# केन्द्रीय विद्यालय संगठन
# लखनऊ संभाग

केन्द्रीय विद्यालय संगठन

# रचनात्मक और समीक्षात्मक चिन्तन कौशल विकास

## CREATIVE AND CRITICAL THINKING SKILL DEVELOPMENT

SUPPORT MATERIAL
SCIENCE DOMAIN
CLASS 12

# रचनात्मक और समीक्षात्मक चिन्तन कौशल विकास

# CREATIVE AND CRITICAL THINKING SKILL DEVELOPMENT



तत् त्वं पूषन् अपावृणु
केन्द्रीय विद्यालय संगठन

## SUPPORT MATERIAL
## SCIENCE DOMAIN
### CLASS 12

# केन्द्रीय विद्यालय संगठन, लखनऊ संभाग
## KENDRIYA VIDYALAYA SANGATHAN, LUCKNOW REGION

# केन्द्रीय विद्यालय संगठन

**KENDRIYA VIDYALAYA SANGATHAN**

(मानव संसाधन विकास मंत्रालय, भारत सरकार के अधीन)

(Under Ministry of HRD, Govt. of India)

**सम्भागीय कार्यालय, लखनऊ / Regional Office, Lucknow**

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# सन्देश

मुझे अत्यंत प्रसन्नता है कि केन्द्रीय विद्यालय संगठन, लखनऊ संभाग सत्र 2022-23 हेतु रचनात्मक एवं समीक्षात्मक कौशल पर आधारित कक्षा 11वीं एवं 12वीं की भौतिक विज्ञान, रसायन विज्ञान, जीव विज्ञान, कम्प्यूटर साइंस एवं इन्फार्मेटिक्स प्रक्टिसेस के प्रश्न बैंक पुस्तिका तैयार करने जा रहा है| यह पुस्तिका विद्यार्थियों की रचनात्मक एवं समीक्षात्मक शक्ति की पहचान करने में सहायक सिद्ध होगी तथा भविष्य की परीक्षाओं एवं प्रतियोगिताओं हेतु मार्गदर्शक के रूप में कार्य करेगी |

केन्द्रीय विद्यालय संगठन अपने बच्चों के सर्वांगीण विकास हेतु कृत संकल्प है | इस प्रश्न बैंक पुस्तिका का उद्देश्य पारम्परिक शैक्षिक एवं अन्य सम्बन्धित गतिविधियों से इतर बच्चों को भविष्य में विभिन्न रूपों में आने वाली समस्याओं एवं चुनौतियों का सामना करने हेतु सशक्त बनाना है |

मुझे विश्वास है कि यह पुस्तिका एक सच्चे पथ प्रदर्शक एवं उत्साहवर्धक का कार्य करके बच्चों के विकास में प्रेरक सिद्ध होगी |

मै केन्द्रीय विद्यालय क्रमांक-1, वायु सेना स्थल चकेरी, कानपुर की प्राचार्य एवं शिक्षक / शिक्षिकाओं को इस सराहनीय प्रयास के लिए शुभकामनाएं देता हूँ|

(डी के द्विवेदी)

उपायुक्त

केन्द्रीय विद्यालय संगठन

लखनऊ संभाग

# Message

It is a matter of pride and immense pleasure that Kendriya Vidyalaya Sangathan, Lucknow Region is preparing the Resource Material for the students of classes XI & XII keeping in mind their critical and creative skills for the session 2022-23.

This will equip the learners with key competencies to meet the upcoming challenges proactively. Our goal is to innovate structural changes focusing on effective and productive learning. This question bank will prove to be the most trusted companion of the students. It will be helpful in recognizing and enhancing their cognitive abilities.

We are resolutely determined to move our learners from conventional to competency-based learning and develop 21st century skills.

I congratulate and appreciate this wonderful effort of the teachers of Lucknow region and KV No.1, Chakeri team as well.

**(Preeti Saxena)**

**Assistant Commissioner,**

**Kendriya Vidyalaya Sangathan**

**Lucknow Region**

# Message

Scientific literacy and Creative and Critical thinking are key components of science education aiming to prepare students to think rationally and to function as responsible citizens in a world increasingly influenced by science and technology. Therefore, students should be given opportunities in their science classes to be engaged in learning experiences that promote Scientific literacy and Creative and Critical thinking, which may trigger the need to build and develop knowledge, attitudes/values, thinking abilities, in an integrated way, resulting in their ability to know how to take responsible action in contexts and situations of personal and social relevance.

With the inspiration of our honourable Deputy Commissioner Shri D. K. Dwivedi for his guidance and inspiration in this endeavour. I would also like to thank our esteemed Assistant Commissioner Mrs Preeti Saxena for her motivation and support.

Furthermore, I highly appreciate all the Science Teachers of Lucknow Region who were instrumental in preparing this question bank. Last but not the least, my acknowledgement goes to the industrious team of Science PGTs and IT teachers of KV No.1, Chakeri for their relentless contribution in reviewing and scrutinising the entire content of this question bank.

(Mini Verma)
Principal
KV No.1, Chakeri, Kanpur

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# TECHNICAL SUPPORT

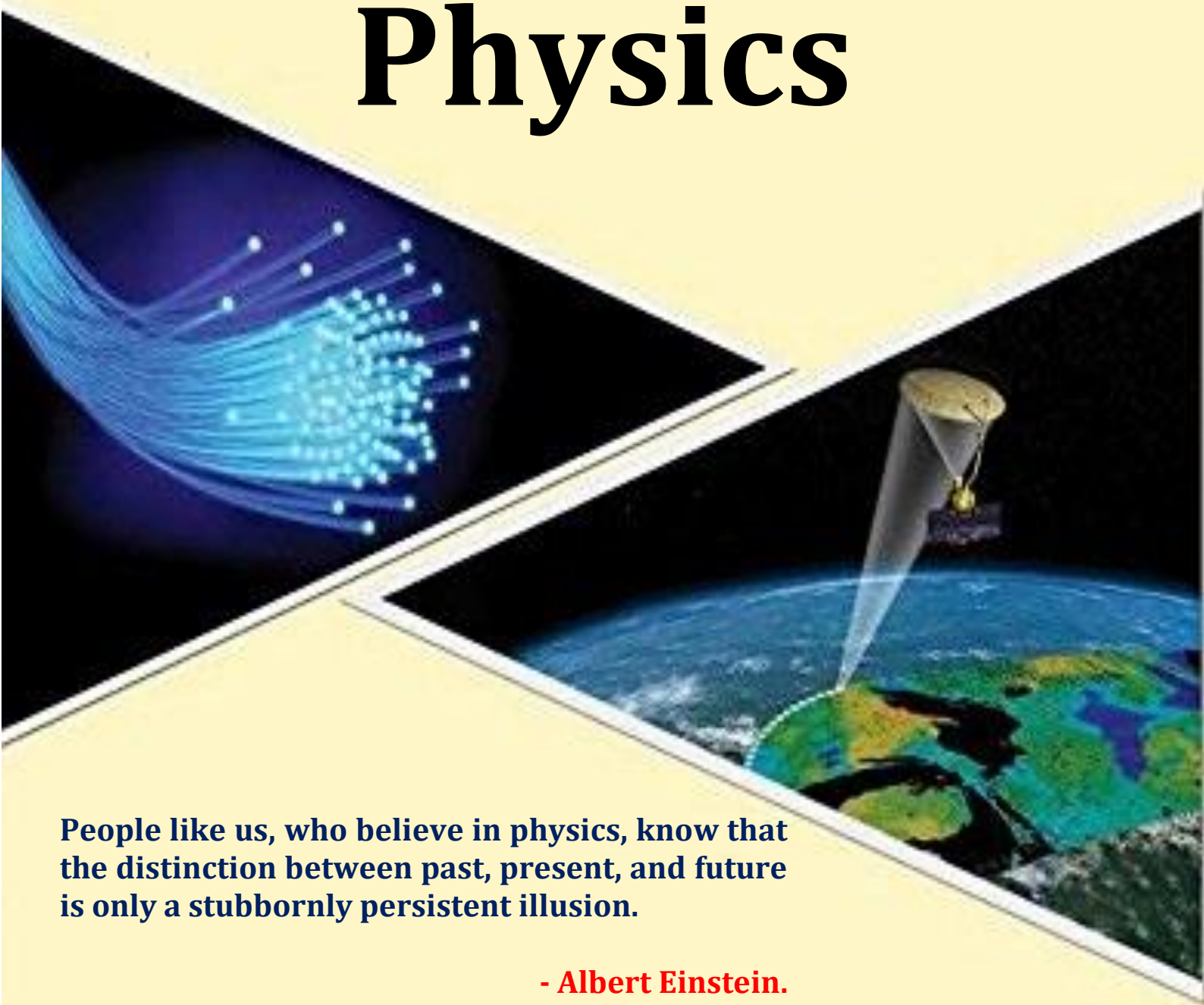| | |
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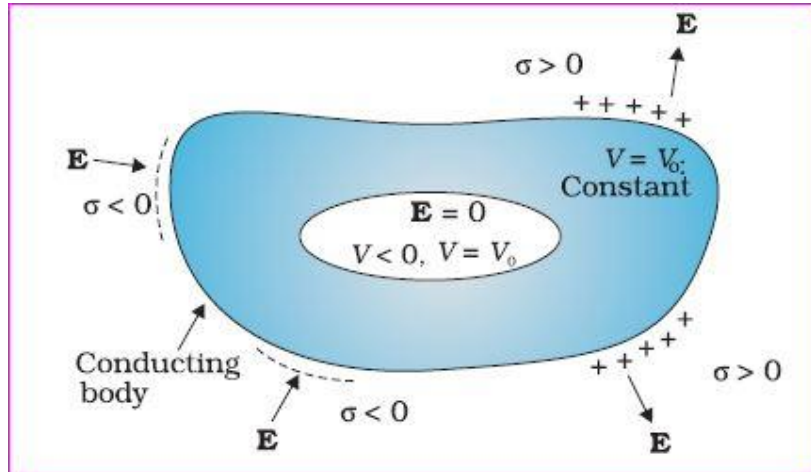# Contents

# CCT Questions

# Class XII

# Physics

People like us, who believe in physics, know that
the distinction between past, present, and future
is only a stubbornly persistent illusion.

**- Albert Einstein.**

**Question 1:**

Whatever be the charge on the conductor and the external fields in which it might be placed. The electric field inside a charged spherical shell is zero. But the vanishing of electric field in the (charge-free) cavity of a conductor is, as mentioned above, a very general result. A related result is that even if the conductor is charged or charges are induced on a neutral conductor by an external field, all charges reside only on the outer surface of a conductor with cavity.

The proofs of the results noted in Fig. are omitted here, but we note their important implication. Whatever be the charge and field configuration outside, any cavity in a conductor remains shielded from outside electric influence: the field inside the cavity is always zero. This is known as electrostatic shielding. The effect can be made use of in protecting sensitive instruments from outside electrical influence.

(i) A metallic shell having inner radius $R_1$ and outer radii $R_2$ has a point charge Q kept inside the cavity. Electric field in the region $R_1 < r < R_2$ where r is the distance from the centre is given by
  (a) depends on the value of r
  (b) Zero
  (c) Constant and nonzero everywhere
  (d) None of the above

(ii) The electric field inside the cavity is depend on
  (a) Size of the cavity
  (b) Shape of the cavity
  (c) Charge on the conductor
  (d) None of the above

(iii) Electrostatic shielding is based on
  (a) electric field inside the cavity of a conductor is less than zero
  (b) electric field inside the cavity of a conductor is zero
  (c) electric field inside the cavity of a conductor is greater than zero
  (d) electric field inside the cavity of a plastic is zero

(iv) During the lightning thunderstorm, it is advised to stay
   (a) inside the car
   (b) under trees
   (c) in the open ground
   (d) on the car

(v) Which of the following material can be used to make a Faraday cage
   (based on electrostatic shielding)
   (a) Plastic
   (b) Glass
   (c) Copper
   (d) Wood

**Question 2:**
When a glass rod is rubbed with silk, the rod acquires one kind of charge and the silk acquires the second kind of charge. This is true for any pair of objects that are rubbed to be electrified. Now if the electrified glass rod is brought in contact with silk, with which it was rubbed, they no longer attract each other. They also do not attract or repel other light objects as they did on being electrified.
Thus, the charges acquired after rubbing are lost when the charged bodies are brought
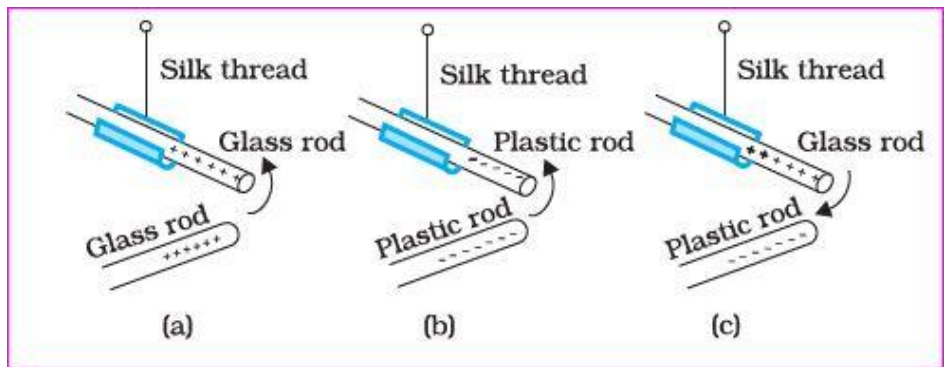


in contact. What can you conclude from these observations? It just tells us that unlike charges acquired by the objects neutralise or nullify each other's effect. Therefore, the charges were named as positive and negative by the American scientist Benjamin Franklin. We know that when we add a positive number to a negative number of the same magnitude, the sum is zero. This might have been the philosophy in naming the charges as positive and negative. By convention, the charge on glass rod or cat's fur is called positive and that on plastic rod or silk is termed negative. If an object possesses an electric charge, it is said to be electrified or charged. When it has no charge, it is said to be electrically neutral.

(i) When you charge a balloon by rubbing it on your hair this is an example of charging by the method of:
  (a) Friction                          (b) Conduction
  (c) Grounding                      (d) Induction

(ii) Neutral atoms contain equal numbers of positive __ and negative __
   (a) Electrons and Protons          (b) Protons and Electrons
   (c) Neutrons and Electrons         (d) Protons and Neutrons

(iii) Which particle in an atom can you physically manipulate?
   (a) protons
   (b) electrons
   (c) neutrons
   (d) you can't manipulate any particle in an atom

(iv) If a negatively charged rod touches a conductor, the conductor will be
      charged by the method of:
   (a) Friction
   (b)Conduction
   (c)Induction
   (d)Convection

(v)A negatively charged rod is touched to the top of an electroscope, which
      one is correct   in the given figure
   (a)  A
   (b)  B
   (c)  C
   (d)  D
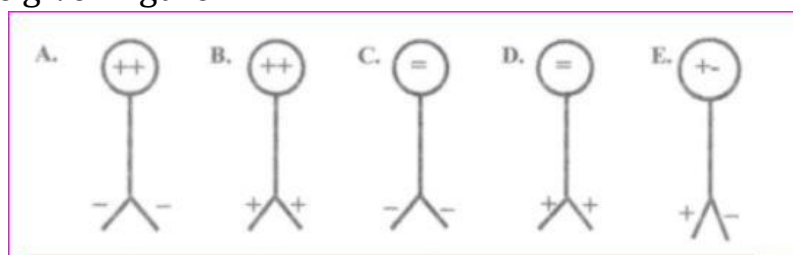


## Question 3:
For electrostatics, the concept of electric field is convenient, but not really necessary. Electric field is an elegant way of characterizing the electrical environment of a system of charges. Electric field at a point in the space around a system of charges tells you the force a unit positive test charge would experience if placed at that point (without disturbing the system). Electric field is a characteristic of the system of charges and is independent of the test charge that you place at a point to determine the field. The term field in physics generally refers to a quantity that is defined at every point in space and may vary from point to point. Electric field is a vector field, since force is a vector quantity.

(i) Which of the following statement is correct? The electric field at a point is
   (a) always continuous.
   (b) continuous if there is a charge at that point.
   (c) discontinuous only if there is a negative charge at that point.
   (d) discontinuous if there is a charge at that point.

(ii) The force per unit charge is known as
 (a) electric flux        (b) electric field
 (c) electric potential      (d) electric current

(iii) The SI unit of electric field is
 (a) N/m          (b) N-m
 (c) N/C          (d) $N/C^2$

(iv) The magnitude of electric field intensity E is such that, an electron placed
  in it would experience an electrical force equal to its weight is given by
 (a) mge          (b) mg/e
 (c) e/mg         (d) $e^2 g/m^2$

 (v) At a particular point, Electric field depends upon
   (a) Source charge Q only
   (b) Test Charge $q_0$ only.
   (c) Both Q and $q_0$
   (d) Neither Q nor $q_0$

**Question 4:**

Dielectric with polar molecules also develops a net dipole moment in an external field, but for a different reason. In the absence of any external field, the different permanent dipoles are oriented randomly due to thermal agitation, so the total dipole moment is zero. When an external field is applied, the individual dipole moments tend to align with the field. When summed overall the molecules, there is then a net dipole moment in the direction of the external field, i.e., the dielectric is polarised. The extent of polarisation depends on the relative strength of two factors: the dipole potential energy in the external field tending to align the dipoles mutually opposite with the field and thermal energy tending to disrupt the alignment. There may be, in addition, the 'induced dipole moment' effect as for non-polar molecules, but generally the alignment effect is more important for polar molecules. Thus, in either case, whether polar or non-polar, a dielectric develops a net dipole moment in the presence of an external field. The dipole moment per unit volume is called polarization.



(a) Non-polar molecules

(b) Polar molecules
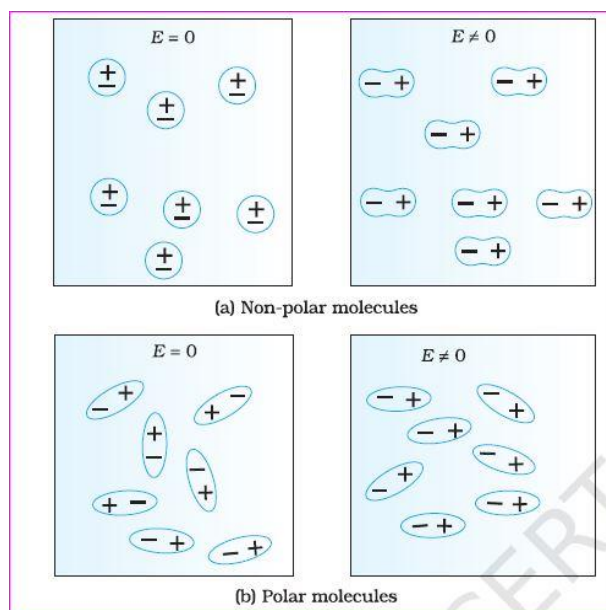
(i) The best definition of polarisation is
   (a) Orientation of dipoles in random direction
   (b) Electric dipole moment per unit volume
   (c) Orientation of dipole moments
   (d)Change in polarity of every dipole

(ii) Calculate the polarisation vector of the material which has 100 dipoles per
    unit volume in a volume of 2 units.
   (a) 200units           (b) 50units
   (c) 0.02units         (d) 100units

(iii) The total polarisation of a material is the
   (a) Product of all types of polarisation
   (b) Sum of all types of polarisation
   (c)Orientation directions of the dipoles
   (d)Total dipole moments in the material

(iv) Dipoles are created when dielectric is placed in _____
   (a) Magnetic Field
   (b) Electric field
   (c) Vacuum
   (d) Inert Environment

(v) Identify which type of polarisation depends on temperature.
   (a)Electronic
   (b)Ionic
   (c)Orientational
   (d) Interfacial

## Question 5:

Figure (a) shows an uncharged metallic sphere on an insulating metal stand. If we bring a negatively charged rod close to the metallic sphere, as shown in Fig. (b). As the rod is brought close to the sphere, the free electrons in the sphere move away due to repulsion and start piling up at the farther end. The near end becomes positively charged due to deficit of electrons. This process of charge distribution stops when the net force on the free electrons inside the metal is zero.
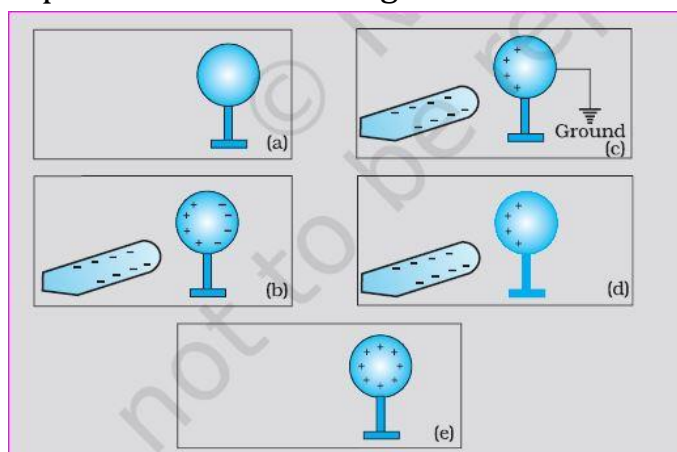
Now if we connect the sphere to the ground by a conducting wire. The electrons will flow to the ground while the positive charges at the near end will remain held there due to the attractive force of the negative charges on the rod, as shown in Fig. (c). Disconnect the sphere from the ground. The positive charge continues to be held at the near end Fig.(d). if we remove the electrified rod. The positive charge will spread uniformly over the sphere as shown in Fig. (e). In this experiment, the metal sphere gets charged by the process of induction and the rod does not lose any of its charge.

(i) What do you call the process of charging a conductor by bringing it near another Charged object?
(a)Induction    (b)Polarisation    (c) neutralization   (d) conduction

(ii) The negatively charged balloon is brought near the two cans. What happens?
(a)The negative charges in Can B move towards the balloon
(b)The negative charges in Can A move away from the balloon
(c)The positive charges in Can B move towards the balloon
(d)The positive charges in Can A move away from the balloon
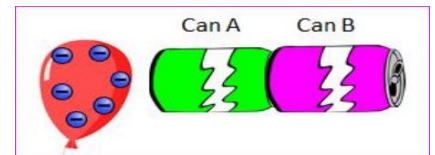


(iii) Transferring a charge without touching is ___
(a)Conduction
(b)Induction
(c)Grounding
(d)Newton's 3rd law

(iv) In an electrostatic induction in aluminium rod due to charged plastic rod, the total charge on the aluminium rod is
(a)Zero
(b)Positive
(c) Negative
(d) Dual

(v) If we bring charged plastic rod near-neutral aluminium rod, then rods will
(a)Repel each other
(b)Attract each other
(c)Remain their position
(d)Exchange charges

**Question 6:**

A Faraday cage or Faraday shield is an enclosure made of a conducting material. The fields within a conductor cancel out with any external fields, so the electric field within the enclosure is zero. These Faraday cages act as big hollow conductors you can put things in to shield them from electrical fields. Any electrical shocks the cage receives, pass harmlessly around the outside of the cage.



(i) Which of the following material can be used to make a Faraday cage?
    (a) Plastic       (b) Glass       (c) Copper       (d) Wood

(ii) Example of a real-world Faraday cage is
    (a) Car       (b) plastic box    (c) lightning rod    (d) metal rod

(iii) What is the electrical force inside a Faraday cage when it is struck by lightning?
    (a) The same as the lightning     (b) Half that of the lightning
    (c) Zero                     (d) A quarter of the lightning

(iv) An isolated point charge +q is placed inside the Faraday cage
    Its surface must have charge equal to
    (a) Zero       (b) +q       (c) –q       (d) +2q

(v) A point charge of 2C is placed at centre of Faraday cage in the shape of cube with surface of 9 cm edge. The number of electric field lines passing through the cube normally will be-
 (a) $1.9 \times 10^5$ Nm²/C entering the surface  (b) $1.9 \times 10^5$ Nm²/C leaving the surface
 (c) $2.26 \times 10^5$ Nm²/C leaving the surface  (d) $2.26 \times 10^5$ Nm²/C entering the surface

**Question 7:**

The parallel plate capacitor consists of two parallel metal plates X and Y each of area A, separated by a distance d, having a surface charge density σ as shown in figure. The medium between the plates is air. A charge +q is given to the plate X. It induces a charge –q on the upper surface of earthed plate Y. When the plates are very close to each other, the field is
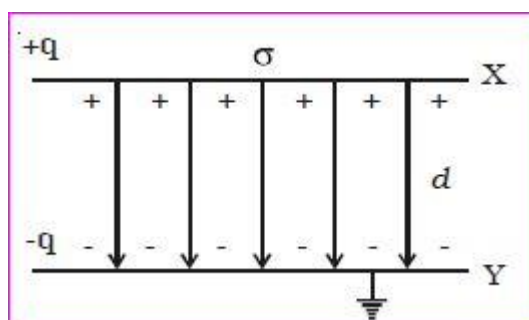
confined to the region between them. The electric lines of force starting from plate X and ending at the plate Y are parallel to each other and perpendicular to the plates. The capacitance is directly proportional to the area (A) of the plates and inversely proportional to their distance of separation (d). The capacitance (C) of the parallel plate capacitor is given by C= $\epsilon_0$A/d. if the region between the two plates is filled with dielectric like mica or oil. Its capacitance increased by $\epsilon_r$ times of the medium.

(i) The potential difference between the two plates of a parallel plate capacitor is Q is magnitude of charge on each plate of area A separated by a distance d
    (a)Qd/($\epsilon_0$A)　　　　(b) d$\epsilon_0$/AQ　　　　　　(c) Ad/($\epsilon_0$Q)　　　(d) QA/d$\epsilon_0$

(ii) A capacitor is charged by a battery and the charging battery is disconnected and a dielectric slab is inserted in it. Then for the capacitor
    (a) Charge remains constant　　　　　　(b) Charge increases
    (c) Potential difference remains constant　(d) Potential difference increases

(iii) A parallel plate capacitor has a capacitance of 10 μF. If the distance between two plates is doubled then the new capacitance will be
    (a) 20 μF　　　　　(b) 15 μF　　　　　　(c) 10 μF　　　　　(d) 5 μF

 (iv) Capacitance of a parallel plate capacitor does not depend on:
    (a) Area of the plates
    (b) Type of metal used for plates
    (c) Separating distance between the plates
    (d) Dielectric constant of the medium between the plates

(v) A parallel plate air capacitor with no dielectric between the plates is connected to a constant voltage source. What happens to the capacitance if a dielectric of dielectric constant k = 2 is inserted between the plates?
    (a) Capacitance decreases　　　　　　(b) Capacitance increases by two times
    (c)Capacitance remains unchanged　　(d) insufficient data

## Question 8:
The Gauss's law relates the flux through any closed surface and the net charge enclosed within the surface. The law states that the total flux of the electric field E over any closed surface is equal to 1/$\epsilon_0$ times the net charge enclosed by the surface.    $\varphi = q/\epsilon_0$
This closed imaginary surface is called Gaussian surface. Gauss's law tells us that the flux of E through a closed surface S depends only on the value of net charge inside the surface and not on the location of the charges and shape of the object in

which the charge is enclosed. Charges outside the surface will not contribute to flux.

(i) A charge q is enclosed by a spherical surface R. If the radius is reduced to half, how would the electric flux through the surface change?
    (a) Became twice              (b) Became half
    (c) No effect                  (d) became zero
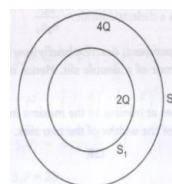
(ii) Consider two hollow concentric spheres, $S_1$ & $S_2$, enclosing charges 2Q & 4Q respectively as shown. The ratio of the electric flux through them is.........
   (a) 1/2            (b) 2/1          (c) 1/3          (d) 3/1

(iii) A charge Q is placed at the centre of a cube, what is the electric flux passing through one of its faces?
   (a) $\phi = \frac{1}{2}\left(\frac{Q}{\epsilon_0}\right)$      (b) $\phi = \left(\frac{Q}{\epsilon_0}\right)$    (c) $\phi = \frac{1}{3}\left(\frac{Q}{\epsilon_0}\right)$      (d) $\phi = \frac{1}{6}\left(\frac{Q}{\epsilon_0}\right)$

(iv) The S.I. unit electric flux is .............
   (a) $Nm^2/C$         (b) $Nm^2/C^2$    (c) $N^2m^2/C$     (d) $Nm^2/C^{-1}$

(v) If there existed only one type of charge q on the Earth, then what is the electric flux related to Earth?
    (a)Zero through any surface of Earth
    (b)Infinite flux on Earth
    (c) Zero if the charge is placed outside Earth and if the charge is placed inside the Earth $\phi = \left(\frac{q}{\epsilon_0}\right)$
    (d) Cannot be defined

## Question 9:

Concept of field lines was introduced by Michael Faraday as an aid in visualizing electric and magnetic fields. Electric line of force is an imaginary straight or curved path along which a unit positive charge tends to move in an electric field. Properties of lines of forces observed by the scientist such as: Lines of force start from positive charge and terminate at negative charge, Lines of force never intersect, the tangent to a line of force at any point gives the direction of the electric field E at that point, the number of lines per unit area, through a plane at right angles to the lines, is proportional to the magnitude of E. This means that, where the lines of force are close together, E is large and where they are far apart, E is small. Each unit positive charge gives rise to 1/ $\varepsilon_0$ lines of force in free space. Hence number of lines of force originating from a point charge q is N = q/$\varepsilon_0$ in free space.

(i) Choose correct statement regarding electric lines of force:
    (a) Emerges from (-ve) charge and meet at (+ve) charge.
    (b) Electric field in a region is strong when the electric lines of force at that region is closely spaced.
    (c) Just as it is shown for a point system in the same way it represents for a solid sphere.
    (d) has a physical nature.

(ii) Two electric field lines due to a point charge:
    (a) Never intersect                    (b) May intersect near the charge
    (c) Always intersect at 2 points       (d) None of these

(iii) The tangent at any point on the electric field line gives:
    (a) The direction of magnetic field at that point
    (b) The direction of electric field at that point
    (c)The direction of acceleration due to gravity
    (d) All of the above

(iv) A metallic sphere is placed in a uniform electric field. The lines of force follow the paths as shown in figure. Identify the correct path of lines of force.
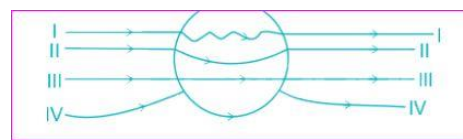


    (a) i           (b) ii      (c) iii         (d) iv

(v) If the direction of the electric field line due to two unlike point charges is from left to right then:
    (a)Positive charge is at left and negative charge is at right
    (b) Negative charge is at left and positive charge is at right
    (c) Both charges are at left
    (d) Both charges are at right

**Question 10:**
There are some basic properties of charge, one is quantization of charge and second is conservation of electric charge and third is Additivity of electric charge. In quantisation of electric charge, the electric charge of any system is always an integral multiple of the least amount of charge. It means that the quantity can take only one of the discrete set of values. The charge, q = ne where n is an integer. The fundamental unit of electric charge (e) is the charge carried by the electron and its unit is coulomb. e has the magnitude $1.6 \times 10^{-19}$ C. In conservation of electric charge, Electric charges can neither be created nor destroyed. According to the law of conservation of electric charge, the total charge in an isolated system always remains constant. But the charges can be transferred from one part of the system

to another, such that the total charge always remains conserved. In additivity of electric charge: The total charge of a system is obtained from the algebraic sum of the constituent charges.

(i) A glass rod rubbed with silk acquires a charge +1.6 X 10 $^{-12}$ C. What is the charge on the silk?
   (a) +1.6 X 10 $^{-12}$ C     (b) - 1.6 X 10 $^{-12}$ C   (c) Zero          (d) +1.6 X 10 $^{-19}$ C

(ii) Which of the following cannot be the magnitude of the charge on a body?
   (a) 5.8X 10$^{-19}$ C        (b) 8.0X 10$^{-19}$ C      (c) 9.6X 10$^{-19}$ C     (d) 11.2X 10$^{-19}$ C

(iii) Two insulated charged copper spheres A and B of identical size have charges $q_A$ and $-3q_A$ respectively. When they are brought in contact with each other and then separated, what are the new charges on them?
   (a) 4$q_A$                (b) $q_A$                  (c) -$q_A$               (d) -4$q_A$

(iv) If the charge on four glass rods are 2q, -q, -5q and 3q respectively, then the total charge stored in the system is:
   (a) 1q                  (b)-1q                  (c) 11q                 (d) -11q

(v) When a body is positively charged, consider the following statements:
   (i) Its atomic number increases
   (ii)Its mass increases
   (iii) Its mass decreases
   Which of the above statement is/are correct?
   (a) All are correct            (b) only (ii) is correct
   (c)  only (iii) is correct     (d) only (i) is correct

## Question 11:

The flow of charge in a particular direction constitutes the electric current. Current is measured in Ampere. Quantitatively, electric current in a conductor across an area held perpendicular to the direction of flow of charge is defined as the amount of charge is flowing across that area per unit time.

Current density at a point in a conductor is the ratio of the current at that point in the conductor to the area of cross section of the conductor of that point.
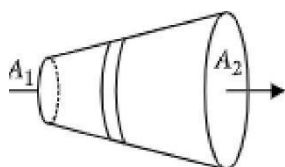
The given figure shows a steady current flow in a metallic conductor of non-uniform cross section. Current density depends inversely on area, so, here $J_1 > J_2$, as $A_1 < A_2$

(i) What is the current flowing through a conductor, if one million electrons are crossing in one millisecond through a cross-section of it?
   (a) 2.5 x $10^{-1}$ A        (b) 1.6 x $10^{-10}$ A
   (c) 7.5 x $10^{-9}$ A        (d) 8.2 x $10^{-1}$ A

(ii) SI unit electric current is
   (a) C s        (b) N $s^{-2}$
   (c) C $s^{-1}$        (d) $C^{-1} s^{-1}$

(iii) A steady current flow in a metallic conductor of non-uniform cross-section. Which of these quantities is constant along the conductor?
   (a) Electric field        (b) Drift velocity
   (c) Current        (d) Current density

(iv) A constant current I is flowing along the length of a conductor of variable cross-section as shown in the figure. The quantity which does not depend upon the area of cross-section is
   (a) electron density        (b) current density
   (c) drift velocity        (d) electric field



(v) When a current of 40 A flows through a conductor of area 10 $m^2$, then the current density is
   (a) 4 A/$m^2$        (b) 1 A/$m^2$
   (c) 2 A/$m^2$        (d) 8 A/ $m^2$
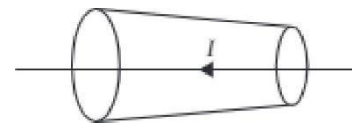
**Question 12:**
According to Ohm's law, the current flowing through a conductor is directly proportional to the potential difference across the ends of the conductor

i.e., $I \propto V \Rightarrow \dfrac{V}{I} = R,$    where R is resistance of the conductor.

Electrical resistance of a conductor is the obstruction posed by the conductor to the flow of electric current through it. It depends upon length, area of cross-section, nature of material and temperature of the conductor.

We can write, where $\rho$ $R \propto \dfrac{l}{A}$ or $R = \rho \dfrac{l}{A}$ is electrical resistivity of the material of the conductor.

(i) Dimensions of electric resistance is
   (a) $[ML^2T^{-2}A^{-2}]$    (b) $[ML^2T^{-3}A^{-2}]$    (c) $[M^{-1}L^{-2}T^{-1}A]$    (d) $[M^{-1}L^2T^2A^{-1}]$

(ii) If 1μA current flows through a conductor when potential difference of 2 V is applied across its ends, then the resistance of the conductor is

    (a) $2 \times 10^6 \, \Omega$     (b) $3 \times 10^5 \, \Omega$     (c) $1.5 \times 10^5 \, \Omega$     (d) $5 \times 10^7 \, \Omega$

(iii) Specific resistance of a wire depends upon

    (a) length     (b) cross-sectional area    (c) mass    (d) none of these

(iv) The slope of the graph between potential difference and current through a conductor is

    (a) a straight line                    (b) curve
    (c) first curve then straight line     (d) first straight line then curve

(v) The resistivity of the material of a wire 1.0 m long, 0.4 mm in diameter and having a resistance of 2.0 ohm is

    (a) $1.57 \times 10^{-6} \Omega m$              (b) $5.25 \times 10^{-7} \, \Omega m$
    (c) $7.12 \times 10^{5} \, \Omega \, m$              (d) $2.55 \times 10^{-7} \, \Omega m$

## Question 13:

The resistance of a conductor at temperature t°C is given by $R_t = R_o (1 + \alpha t)$ where $R_t$ is the resistance at t°C, $R_o$ is the resistance at 0°C and α is the characteristics constant of the material of the conductor.

Over a limited range of temperatures, that is not too large. The resistivity of a metallic conductor is approximately given by $\rho_t = \rho_0 (1 + \alpha t)$.

There α is the temperature coefficient of resistivity Its unit is $K^{-1}$ or $°C^{-1}$. For metals, α is positive i.e., resistance increases with rise in temperature. For insulators and semiconductors, α is negative i.e., resistance decreases with rise in temperature.



Resistivity $\rho_T$ of copper as a function of temperature $T$

Resistivity $\rho_T$ of nichrome as a function of temperature $T$

Temperature dependence of the resistivity of a typical semiconductor
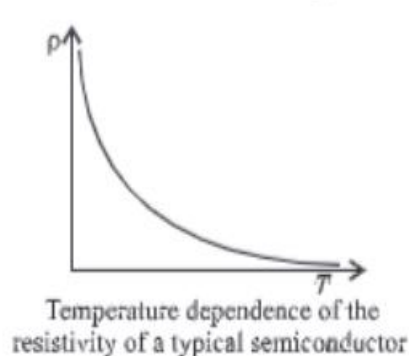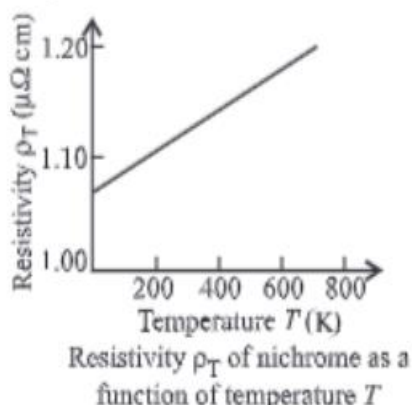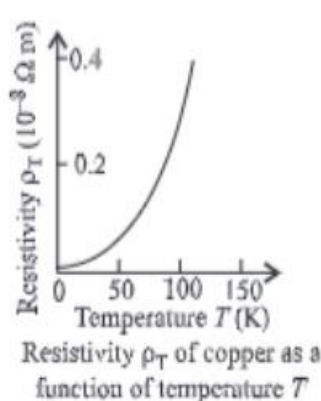
(i) Fractional increase in resistivity per unit increase in temperature is defined as

    (a) resistivity                    (b) temperature coefficient of resistivity
    (c) conductivity                 (d) drift velocity

(ii) The material whose resistivity is insensitive to temperature is
   (a) silicon        (b) copper        (c) silver        (d) nichrome

(iii) The temperature coefficient of the resistance of a wire is 0.00125 per °C. At 300 K its resistance is 1 ohm. The resistance of wire will be 2 ohms at
   (a) 1154 K        (b) 1100 K        (c) 1400 K        (d) 1127 K

(iv) The temperature coefficient of resistance of an alloy used for making resistors is
   (a) small and positive        (b) small and negative
   (c) large and positive        (d) large and negative

(v) For a metallic wire, the ratio V / I (V = applied potential difference and I = current flowing) is
   (a) independent of temperature
   (b) increases as the temperature rises
   (c) decreases as the temperature rises
   (d) increases or decreases as temperature rises depending upon the metal

## Question 14:
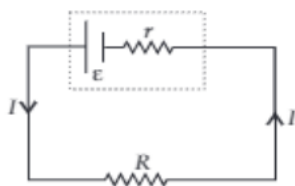


Emf of a cell is the maximum potential difference between two electrodes of the cell when no current is drawn from the cell. Internal resistance is the resistance offered by the electrolyte of a cell when the electric current flows through it. The internal resistance of a cell depends upon the following factors. (A) distance between the electrodes (B) nature and temperature of the electrolyte (C) nature of electrodes (D) area of electrodes. For a freshly prepared cell, the value of internal resistance is generally low and goes on increasing as the cell is put to more and more use. The potential difference between the two electrodes of a cell in a closed circuit is called terminal potential difference and its value is always less than the emf of the cell in a closed circuit. It can be written as $V = \varepsilon - Ir$.

(i) The terminal potential difference of two electrodes of a cell is equal to emf of the cell when
   (a) $V = 0$     (b) $I = 0$     (c) both (a) and (b)     (d) neither (a) nor (b)

(ii) A cell of emf $\varepsilon$ and internal resistance r gives a current of 0.5 A with an external resistance of 12 Ω and a current of 0.25 A with an external resistance of 25 Ω. What is the value of internal resistance of the cell?
   (a) 5 Ω        (b) 1 Ω        (c) 7 Ω        (d) 3Ω

(iii) Choose the wrong statement.
 a) Potential difference across the terminals of a cell in a closed circuit is always less than its emf.
 b) Internal resistance of a cell decreases with the decrease in temperature of the electrolyte.
 c) Potential difference versus current graph for a cell is a straight line with a negative slope.
 d) Terminal potential difference of the cell when it is being charged is given as $V = \varepsilon + Ir$.

(iv) An external resistance R is connected to a cell of internal resistance r, the maximum current flows in the external resistance, when

 (a) $R = r$           (b) $R < r$

 (c) $R > r$           (d) $R = 1/r$

(v) If external resistance connected to a cell has been increased to 5 times, the potential difference across the terminals of the cell increases from 10 V to 30 V. Then, the emf of the cell is

 (a) 30 V             (b) 60 V

 (c) 50 V             (d) 40 V

## Question 15:

Metals have many free electrons nearly $10^{28}$ per cubic metre. In the absence of electric field, average terminal speed of the electrons in random motion at room temperature is of the order of $10^5$ ms$^{-1}$. When a potential difference V is applied across the two ends of a given conductor, the free electrons in the conductor experiences a force and are accelerated towards the positive end of the conductor. On their way, they suffer frequent collisions with the ions/atoms of the conductor and lose their gained kinetic energy. After each collision, the free electrons are again accelerated due to electric field, towards the positive end of the conductor and lose their gained kinetic energy in the next collision with the ions/atoms of the conductor. The average speed of the free electrons with which they drift towards the positive end of the conductor under the effect of applied electric field is called drift speed of the electrons.
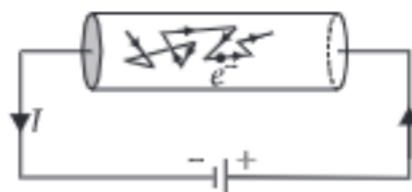
 (i) Magnitude of drift velocity per unit electric field is
     (a) current density              (b) current
     (c) resistivity                   (d) mobility

(ii) The drift speed of the electrons depends on
   (a) Dimensions of the conductor
   (b) Number density of free electrons in the conductor
   (c) Both (a) and (b)
   (d) Neither (a) nor (b)

(iii) We are able to obtain fairly large currents in a conductor because

   (a) The electron drift speed is usually very large

   (b) The number density of free electrons is very high, and this can compensate for the low values of the electron drift speed and the very small magnitude of the electron charge

   (c) The number density of free electrons as well as the electron drift speeds are very large, and these compensate for the very small magnitude of the electron charge

   (d) The very small magnitude of the electron charge has to be divided by the still smaller product of the number density and drift speed to get the electric current.

(iv) Drift speed of electrons in a conductor is very small i.e., x = $10^{-4}$ ms$^{-1}$, The Electric bulb glows immediately. When the switch is closed because
   (a) Drift velocity of electron increases when switch is closed
   (b) Electrons are accelerated towards the negative end of the conductor
   (c) The drifting of electrons takes place at the entire length of the conductor
   (d) The electrons of conductor move towards the positive end and protons of conductor move towards negative end of the conductor.

(v) The number density of free electrons in a copper conductor is 8.5 x $10^{28}$ m$^{-3}$, How long does an electron take to drift from one end of a wire 3.0 m long to its other end? The area of cross-section of the wire is 2.0 x $10^{-6}$ m$^2$ and it is carrying a current of 3.0 A.
   (a) 8.1 x $10^4$ s        (b) 2.7 x $10^4$ s        (c) 9 x $10^3$ s        (d) 3 x $10^3$ s

## Question 16:

A single cell provides a feeble current. In order to get a higher current in a circuit. We often use a combination of cells. A combination of cells is called a battery. Cells can be joined in series, parallel or in a mixed way.
Two cells are said to be connected in series when negative terminal of one cell is connected to positive to of the other cell
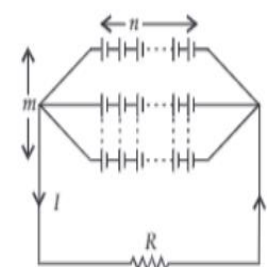
and so on. Two cells are said to be connected in parallel if positive terminal of each cell is connected to one point and negative terminal of each cell connected to the other point. In mixed grouping of cells, a certain number of identical cells are joined in series, and all such rows are then connected in parallel with each other.

(i) To draw the maximum current from a combination of cells, how should the cells be grouped?
    (a) Parallel
    (b) Series
    (c) Mixed Grouping
    (d) Depends upon the relative values of internal and external resistances

(ii) The total emf of the cells when n identical cells each of emf E are connected in parallel is
    (a) $n\,E$        (b) $n^2\,E$        (c) $E$        (d) $E\,/\,n$

(iii) 4 cells each of emf 2 V and Internal resistance of 1 $\Omega$ are connected in parallel to a load resistor of 2 $\Omega$ Then the current through the load resistor is
    (a) 2 A        (b) 1.5 A        (c) 1 A        (d) 0.888 A

(iv) If two cells out of 'n' number of cells each of internal resistance 'r' are wrongly connected in series, then total resistance of the cell is
    (a) 2nr        (b) nr – 4r        (c) nr        (d) r

(v) Two identical non-ideal batteries are connected in parallel. Consider the following statement

(A) The equivalent emf is smaller than either of the two emfs.
(B) The equivalent internal resistance is smaller than either of the two internal resistances.
    (a) Both I and II are correct.        (b) I is correct but II is wrong.
    (c) II is correct but I is wrong        (d) Both I and II are wrong.

## Question 17:

In 1942, a German physicist Kirchhoff extended Ohm's law to complicated circuits and gave two laws, which enable us to determine current in any part of such a circuit. According to Kirchhoff's first rule, the algebraic sum of the currents meeting at a junction in a closed electric circuit is zero. The current flowing in a conductor towards the Junction is taken as positive and the current flowing away from the junction is taken as negative. According to Kirchhoff's second rule, in a closed loop, the algebraic sum of the emf's and algebraic sum of the products of

current and resistance in the various arms of the loop is zero. While traversing a loop, if negative pole of the cell is encountered first, then its emf is negative, otherwise positive.

(i) Kirchhoff's 1st law follows
    (a) law of conservation of energy
    (b) law of conservation of charge and energy
    (c) law of conservation of momentum
    (d) Newton's third law of motion

(ii) The value of current I in the given circuit is
    (a) 4.5 A
    (b) 3.7 A
    (c) 2.0 A
    (d) 2.5 A
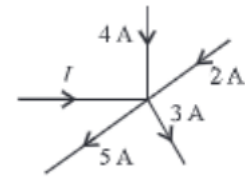
(iii) Kirchhoff 's II law is based on
    (a) law of conservation of momentum of electron
    (b) law of conservation of charge and energy
    (c) law of conservation of energy
    (d) none of these.

(iv) Point out the right statements about the validity of Kirchhoff 's Junction rule.
    (a) The current flowing towards the junction is taken as positive.
    (b) The currents flowing away from the junction are taken as negative.
    (c) Bending or reorienting the wire does not change the validity of Kirchhoff's Junction rule.
    (d) All of the above

(v) Potential difference between A and B in the circuit shown here is
    (a) 4 V
    (b) 5.6 V
    (c) 2.8 V
    (d) 6 V
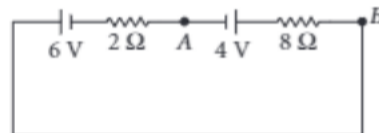
## Question 18:

Wheatstone bridge is an arrangement of four resistances P, Q, P and S connected as shown in the figure. Their values are so adjusted that the galvanometer G shows no deflection. The bridge is then said to be balanced when this condition is

achieved happens. In the setup shown here, the points B and D are at the same potential, and it can be shown that $\frac{P}{Q} = \frac{R}{S}$

This is called the balancing condition. If any three resistances are known, the fourth can be found. The practical form of Wheatstone bridge is slide wire bridge or Meter bridge. Using

$$S = \left(\frac{100 - l}{l}\right) \times R$$

the unknown resistance can be determined as where $l$ is the balancing length of the Meter bridge.
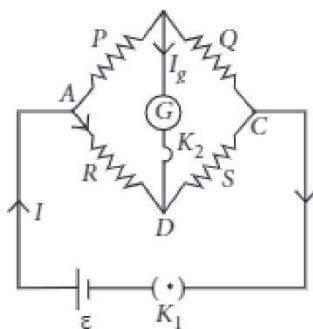


(i) In a Wheatstone bridge circuit, P = 5 Ω, Q = 6 Ω, R = 10 Ω and S = 5 Ω. What is the value of additional resistance to be used in series with S, so that the bridge is balanced?

(a) 9 Ω        (b) 7 Ω        (c) 10 Ω        (d) 5 Ω

(ii) A Wheatstone bridge consisting of four arms of resistances P, Q, R, S is most sensitive when

(a) All the resistances are equal
(b) All the resistances are unequal
(c) The resistances P and Q are equal but R > > P and S >>Q
(d) The resistances P and Q are equal but R << P and S <<Q

(iii) When a metal conductor connected to left gap of a meter bridge is heated, the balancing point
(a) shifts towards right
(b) shifts towards left
(c) remains unchanged
(d) remains at zero

(iv) The percentage error in measuring resistance with a meter bridge can be minimized by adjusting the balancing point close to

(a) 0        (b) 20 cm        (c) 50 cm        (d) 80 cm

(v) In a meter bridge experiment, the ratio of left gap resistance to right gap resistance is 2:3. The balance point from left is

(a) 20 cm       (b) 50 cm       (c) 40 cm       (d) 60 cm

## Question 19:

A cylindrical copper conductor AB of length 'L' and area of cross section 'A' has a large number of free electrons which at room temperature move at random within the body of the conductor, like the molecules of a gas. The average thermal speed of the free electrons in random motion at room temperature is of the order of $10^5$ ms$^{-1}$. When a potential difference 'V' is applied across the two ends of a given conductor, the free electrons in the conductor experience a force and are accelerated towards the positive end of the conductor. On their way they suffer frequent Collisions with the ion/atoms of the conductor and lose their gained kinetic energy. After each collision the free electrons are again accelerated due to electric field towards the positive end of the conductor and lose their gained kinetic energy in the next Collision with the Ion/atom of the conductor. The average speed of free electrons with which they drift towards the positive end of the conductor under the effect of applied electric field is called Drift velocity of the electron.
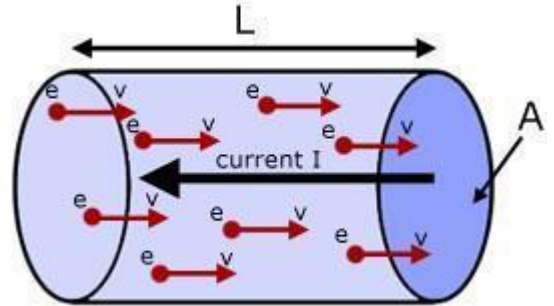


(i) When the potential difference is applied across the two ends of the conductor then electric field exists-
(a) outside the conductor
(b) inside the conductor
(c) both outside and inside the conductor
(d) nowhere.

(ii) The motion of electrons in between two successive collisions with the atoms/ ion follows
(a) Straight path       (b) Circular path
(c) Elliptical path       (d) Curved path

(iii) The drift speed of the electrons does depend on
a) Dimension of conductor
b) Number density of free electron in the conductor
c) Both (a) and (b)
d) None of these above

(iv) The current in the conductor is due to
    (a) Thermal motion of free electrons
    (b) Acceleration of the electrons towards the positive end of the conductor
    (c) Drifting of electrons towards positive end of the conductors
    (d) None of the above

(v) Drift current is due to
    a) Applied electric field over a given distance
    b) Random motion of electrons
    c) Random motion of holes
    d) Recombination of holes and electrons

## Question 20:

Whenever an electric current is passed through a conductor, it becomes hot after some time. The phenomenon of the production of heat in a resistor by the flow of an electric current through it is called heating effect of current or Joule heating. Thus, the electrical energy supplied by the source of emf is converted into heat. In purely resistive circuit, the energy expended by the source entirely appears as heat. But if the circuit has an active element like a motor, then a part of the energy supplied by the source goes to do useful work and the rest appears as heat. Joule's law of heating forms the basis of various electrical appliances such as electric bulb, electric furnace, electric press etc.
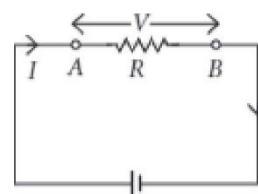
(i) Which of the following is a correct statement?
    (a) Heat produced in a conductor is independent of the current flowing
    (b) Heat produced in a conductor varies Inversely as the current flowing
    (c) Heat produced in a conductor varies directly as the square of the current flowing
    (d) Heat produced in a conductor varies inversely as the square of the current flowing

(ii) If the coil of a heater is cut to half, what would happen to heat produced?
    (a) Doubled                (b) Halved
    (c) Remains same        (d) Becomes four times

(iii) A 25 W and 100 W are joined in series and connected to the mains. Which bulb will glow brighter?
    (a) 100 W               (b) 25 W
    (c) both bulbs will glow brighter     (d) none will glow brighter

(iv) A rigid container with thermally insulated wall contains a coil of resistance 100 Ω, carrying current 1A. Change in its internal energy after 5 min will be
(a) 0 kJ          (b) 10 kJ          (c) 20 kJ          (d) 30 kJ

(v) The heat emitted by a bulb of 100 W in 1 min is
(a) 100 J          (b) 1000 J          (C) 600 J          (d) 6000 J

## Question 21:

The earth's magnetic field extends millions of kilometres into outer space and looks very much like a bar magnet. The earth's south magnetic pole is actually near the North Pole and the magnetic north pole is in Antarctica! This is why a compass magnet's north pole actually points north (north and south poles attract). The Earth's magnetic field extends far and wide but is very weak in terms of field strength.

There are three components that are responsible for the magnitude as well as the direction of the earth's magnetic field:

Magnetic Declination- The magnetic declination is defined as the angle between the true north and the magnetic north. On the horizontal plane, the true north is never at a constant position and keeps varying depending upon the position on the earth's surface and time.

Magnetic Inclination- The magnetic inclination is also known as the angle of dip. It is the angle made the horizontal plane on the earth's surface. At the magnetic equator, the angle of dip is 0° and at the magnetic poles, the angle of dip is 90°.

Horizontal Component of the Earth's Magnetic Field- There are two components to explain the intensity of the earth's magnetic field: Horizontal component (H) and vertical component (v) $\tan\delta = Bv/ B_H$



South magnetic pole
Magneticfield
North magnetic pole
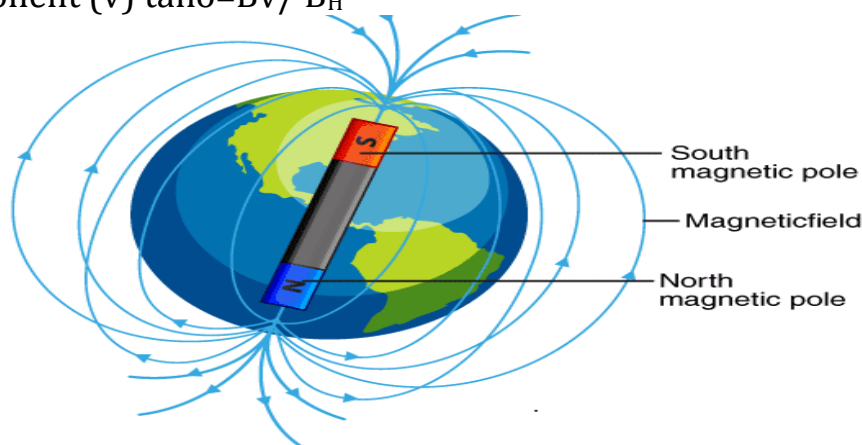
(i) The vertical component of the earth's magnetic field is at a place is √3 times the horizontal component. What is the value of angle of dip at this place?
(a) 60⁰          (b) 45⁰          (c) 90⁰          (d) 30⁰

(ii) A bar magnet is placed with its north pole pointing earth's north. The points of zero magnetic field will be in which direction from the centre of the magnet?
(a) north and south                              (b) east and west
(c) north-east and south-west              (d) north-west and south-east

(iii) Which of the following statements is true about magnetic lines of force?
(a) Magnetic lines of force are always closed.
(b) Magnetic lines of force always intersect each other.
(c) Magnetic lines of force tend to crowd far away from the poles of the magnet
(d) Magnetic lines of force do not pass through the vacuum.

(iv) A long magnet is cut into two parts such that the ratio of their lengths is 2:1. What is the ratio pole strength of both the section?
(a) 1:2                (b) 2:1                (c) 4:1                (d) Equal

(v) If a man is in Antarctica, then what is the angle of dip for the man is
(a) $60^0$            (b) $45^0$            (c) $90^0$            (d) $30^0$

## Question 22:

Bubble Chamber: Trails of bubbles are produced by high-energy charged particles moving through the superheated liquid hydrogen in this artist's rendition of a bubble chamber. There is a strong magnetic field perpendicular to the page that causes the curved paths of the particles. The radius of the path can be used to find the mass, charge, and energy of the particle.
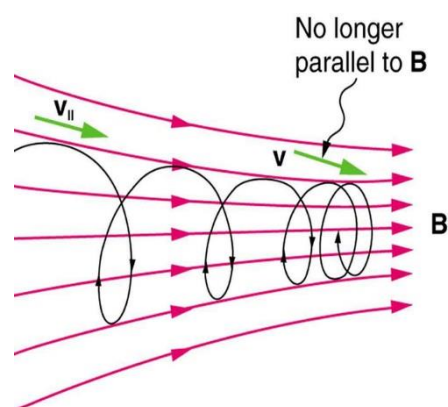


Magnetic forces can cause charged particles to move in circular or spiral paths. Particle accelerators keep protons following circular paths with magnetic force. Cosmic rays will follow spiral paths when encountering the magnetic field of astrophysical objects or planets (one example being Earth's magnetic field). The

bubble chamber photograph in the figure below shows charged particles moving in such curved paths. The curved paths of charged particles in magnetic fields are the basis of a number of phenomena and can even be used analytically, such as in a mass spectrometer. shows the path traced by particles in a bubble chamber.

(i) When a charged particle moves perpendicular to a uniform electric field, it follows-

    (a) circular path                         (b) parabolic path

    (c) translational path               (d) helical path

(ii) A charged particle moving with velocity v in X direction is subjected to a magnetic field B in negative X direction. As a result, the charge will

    (a) retard along X-axis

    (b) start moving in a circular path in YZ plane

    (c) remains unaffected

    (d) move in a helical path around X-axis

(iii) An α- particle and proton having same momentum enter into a region of uniform magnetic field and move in a circular path. The ratio of the radii of curvature of their paths

    (a) 1              (b) ¼             (c) ½              (d) 4

(iv) A neutron, a proton, an electron and an α- particle enter in a region of uniform magnetic field with equal velocities. The magnetic field is perpendicular and directed into the paper. The tracks of the particles are shown in figure. The electron will follow the track-
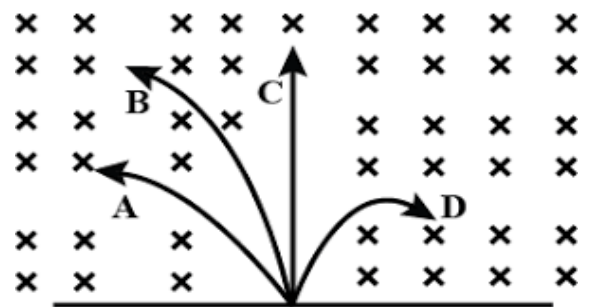
    (a) A        (b) B        (c) C        (d) D

(v) If magnetic force experienced by the charged particle is perpendicular to the velocity of the particle, then work done is-

    (a) zero                      (b) maximum

    (c) minimum              (d) none of these

## Question 23:

Current loop behaves likes a magnetic dipole and has a magnetic field. They behave just like a magnet. Interesting part is, it depends upon the direction of current in loop which decides whether magnetic field line is in outward or inward direction. With the help of this outward and inward direction of magnetic field, North and South poles get decided.
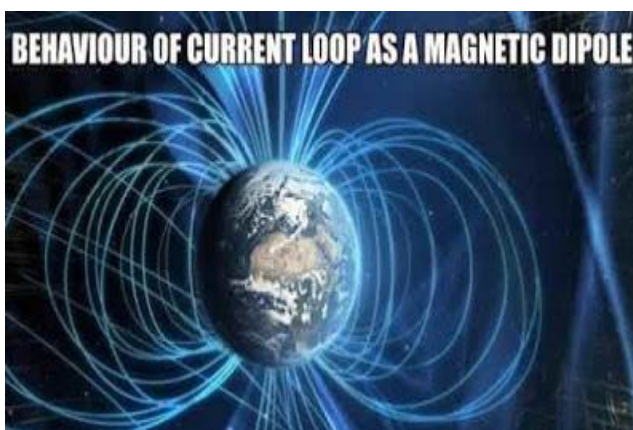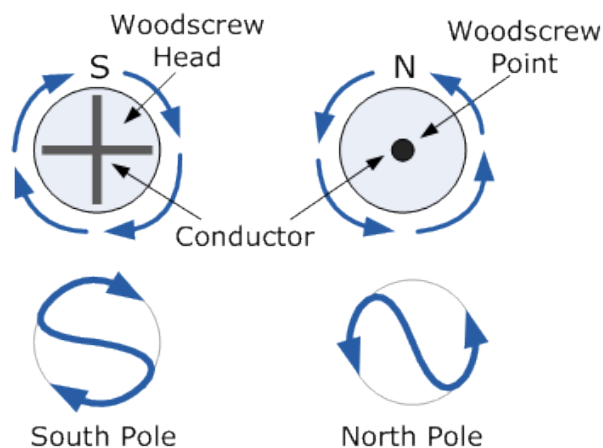


Anticlockwise direction of current creates north pole (outward direction magnetic field) and clockwise direction of current creates a south pole (inward direction magnetic field). Magnetic dipole moment M with the circular current loop carrying a current I and of area A. The magnitude of M is given by

$$|M| = I \times A$$
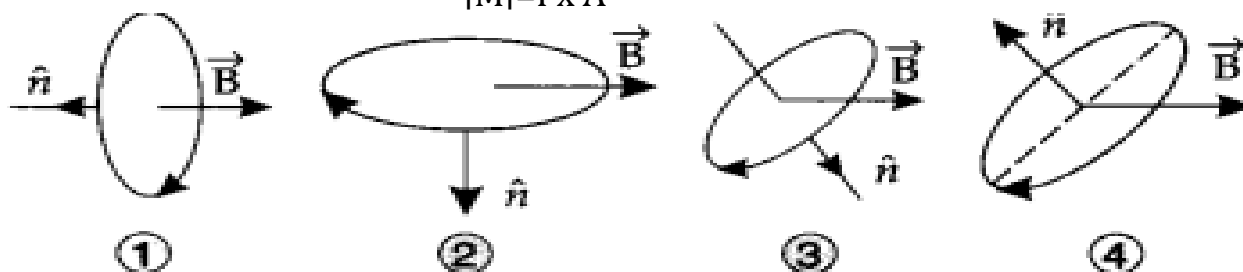


Current in the circular coil produces magnetic field and amperes found out that magnetic field created due to circular coil is similar to the magnetic field due to a bar magnet. Wood screw head sign shows that direction of screw is inward because we are not able to see pointed part of screw and so direction is inward. This inward direction of screw denotes the direction of the magnetic field.

(i) A thin circular wire carrying a current I, has a magnetic moment M. The shape of a wire is changed to a square and it carries the same current. It will have a magnetic moment-

(a) $4M/\pi^2$          (b) M          (c) $4\pi \times M$          (d) $4M/\pi$

(ii) A current carrying loop is placed in a uniform magnetic field in four different orientations as shown in figure. Arrange them in the decreasing order of potential energy.

(a) 4, 2, 3,1                     (b) 1, 4, 2, 3
(c) 4, 3, 2,1                     (d) 1, 2, 3, 4

(iii) Point out the correct direction of magnetic field in the given figures.
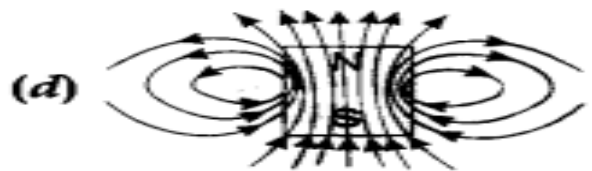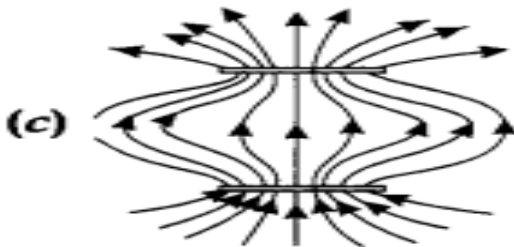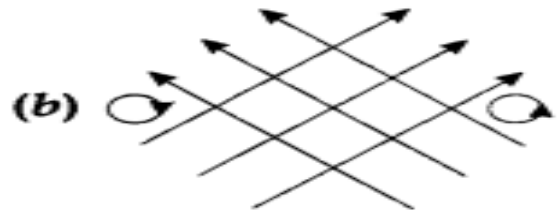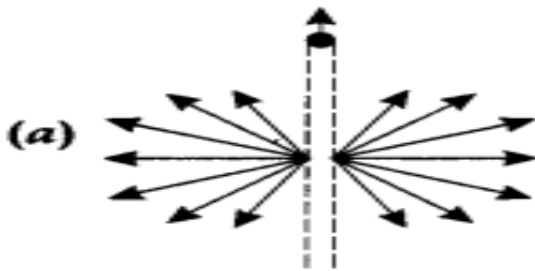


(iv) Two identical bar magnets are fixed with their centres at a distance d apart. A stationary charge Q is placed at P in between the gap of the two magnets at a distance D from the centre O as shown in the figure. The force on the charge Q is
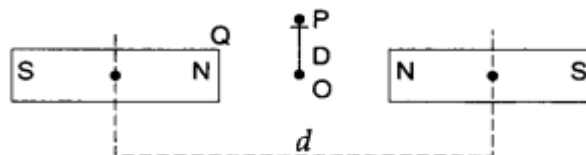


        (a) zero
        (b) directed along OP
        (c) directed along PO
        (d) directed perpendicular to the plane of paper

(v) In a bar magnet, magnetic lines of force-
        (a) are produced only at north pole like rays of light from a bulb
        (b) starts from north pole and ends at the south pole
        (c) emerge in circular paths from the middle of the bar
        (d) run continuously through the bar and outside

**Question 24:**

Moving coil galvanometer operates on Permanent Magnet Moving Coil (PMMC) mechanism and was designed by the scientist Darsonval.
Moving coil galvanometers are of two types

(i) Suspended coil
(ii) Pivoted coil type or tangent galvanometer

Its working is based on the fact that when a current carrying coil is placed in a magnetic field, it experiences a torque. This torque tends to rotate the coil about its axis of suspension in such a way that the magnetic flux passing through the coil is maximum.

(i) A moving coil galvanometer is an instrument which
    (a) is used to measure emf
    (b) is used to measure potential difference
    (c) is used to measure resistance
    (d) is a deflection instrument which gives a deflection when a current flow through its coil

(ii) To make the field radial in a moving coil galvanometer.
    (a) number of turns of coil is kept small
    (b) magnet is taken in the form of horse-shoe
    (c) poles are of very strong magnets
    (d) poles are cylindrically cut

(iii) The deflection in a moving coil galvanometer is
    (a) directly proportional to torsional constant of spring
    (b) directly proportional to the number of turns in the coil
    (c) inversely proportional to the area of the coil
    (d) inversely proportional to the current in the coil

(iv) In a moving coil galvanometer, having a coil of N-turns of area A and carrying current I is placed in a radial field of strength B. The torque acting on the coil is
    (a) $NA^2B^2I$      (b) $NABI^2$      (c) $N^2ABI$      (d) $NABI$

(v) To increase the current sensitivity of a moving coil galvanometer, we should decrease
    (a) strength of magnet
    (b) torsional constant of spring
    (c) number of turns in coil
    (d) area of coil

**Question 25:**

Ram is doing one experiment on Electromagnetic induction. He has a fixed coil of wire AB and he connected the two ends of the coil galvanometer. Now, he observes that when a bar magnet is held stand still inside the hollow coil of wire, then there is no deflection in the galvanometer pointer showing that no electric current is produced in the coil of wire when the magnet is held stationary in it. After that he moved bar magnet quickly into a fixed coil of wire AB. He observes that When a bar magnet is moved quickly into a fixed coil of wire AB, then a current is produced in the coil. This current causes a deflection in the galvanometer pointer Similarly, he observes that when the magnet is moved out quickly from inside the coil, even then a current is produced in the coil This current also causes a deflection in the galvanometer pointer but in the opposite direction (showing that when the direction of movement of magnet changes, then the direction of current produced in the coil also changes). So, he confirms that the current produced in this case is also alternating current or a.c.

(i) The phenomenon of electromagnetic induction is:
    (a) the process of charging a body.
    (b) the process of generating magnetic field due to a current passing through a coil.
    (c) producing induced current in a coil due to relative motion between a magnet and the coil.
    (d) the process of rotating a coil of an electric motor.

(ii) A soft iron bar is inserted inside a current-carrying solenoid. The magnetic field inside the solenoid:
    (a) will decrease          (b) will increase
    (c) will become zero       (d) will remain the same

(iii) The magnetic effect of current was discovered by:
    (a) Maxwell          (b) Fleming          (c) Oersted          (d) Faraday

(iv) The magnetic field inside a long straight solenoid carrying current:
    (a) is zero
    (b) decreases as we move towards its end.
    (c) increases as we move towards its end.
    (d) is the same at all points.

(v) If the direction of electric current in a solenoid when viewed from a particular end is anticlockwise, then this end of solenoid will be:
    (a) west pole          (b) south pole          (c) north pole          (d) east pole

**Question 26:**

A magnetic field can be produced by moving charges or electric currents. The basic equation governing the magnetic field due to a current distribution is the Biot-Savart law.

Finding the magnetic field resulting from a current distribution involves the vector product, and is inherently a calculus problem when the distance from the current to the field point is continuously changing.

According to this law, the magnetic field at a point due to a current element of length $\vec{dl}$ carrying current I, at a distance r from the element is

$$dB = \frac{\mu 0}{4\pi} \frac{I(\vec{dl} \times \vec{r})}{r3}$$

Biot-Savart law has certain similarities as well as difference with Coulomb's law for electrostatic field e. g., there is an angle dependence in Biot-Savart law which is not present in electrostatic case.

(i) The direction of magnetic field $\vec{dB}$ due to a current element $\vec{dl}$ at a point of distance $\vec{r}$ from it, when a current I passes through a long conductor is in the direction:

    a) of position vector $\vec{r}$ of the point
    b) of current element $\vec{dl}$
    c) perpendicular to both $\vec{dl}$ and $\vec{r}$
    d) perpendicular to $\vec{dl}$ only

(ii) The magnetic field due to a current in a straight wire segment of length L at a point on its perpendicular bisector at a distance r (r > > L):

    a) decreases as $1/r$
    b) decreases as $1/r^2$
    c) decreases as $1/r^3$
    d) approaches a finite limit as $r \to \infty$

(iii) Two long straight wires are set parallel to each other. Each carries a current i in the same direction and the separation between them is 2r. The intensity of the magnetic field midway between them is:

    a) $\mu_0 i/r$
    b) $4\mu_0 i/r$
    c) Zero
    d) $\mu_0 i/4r$
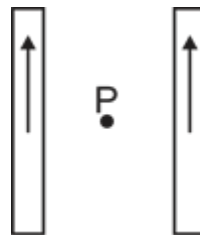
(iv) A long straight wire carries a current along the z-axis for any two points in the x-y plane. Which of the following is always false?

    a) The magnetic fields are equal
    b) The directions of the magnetic fields are the same
    c) The magnitudes of the magnetic fields are equal
    d) The field at one point is opposite to that at the other point

(v) Biot-Savart law can be expressed alternatively as:

    a) Coulomb's Law
    b) Ampere's circuital law
    c) Ohm's Law
    d) Gauss's Law

## Question 27:

Ampere's law gives a method to calculate the magnetic field due to given current distribution. According to it, the circulation $\oint \vec{B} \cdot \vec{dl}$ of the resultant magnetic field along a closed plane curve is equal to $\mu_0$ times the total current crossing the area bounded by the closed curve provided the electric field inside the loop remains constant. Ampere's law is more useful under certain symmetrical conditions. Consider one such case of a long straight wire with circular cross-section (radius R) carrying current I uniformly distributed across this cross-section.
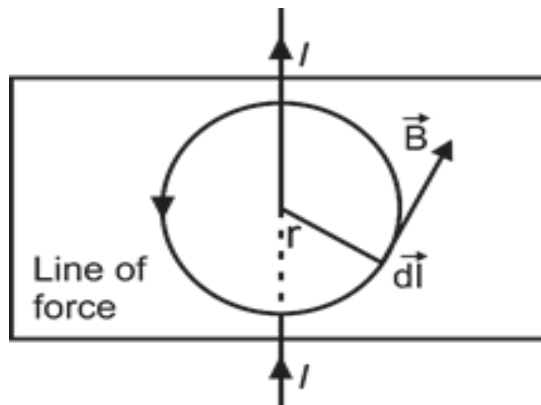


(i) The magnetic field at a radial distance r from the centre of the wire in the region r > R, is:

    a) $\mu_0 I / 2\pi r$
    b) $\mu_0 I / 2\pi R$
    c) $\mu_0 I R^2 / 2\pi r$
    d) $\mu_0 I r^2 / 2\pi R$

(ii) The magnetic field at a distance r in the region r<R is:

    a) $\mu_0 I^2 \pi$
    b) $\mu_0 I r^2 / 2\pi R^2$
    c) $\mu_0 I / 2\pi r$
    d) $\mu_0 I r / 2\pi R^2$

(iii) A long straight wire of a circular cross section (radius a) carries a steady current I and the current I is uniformly distributed across this cross-section. Which of the following plots represents the variation of magnitude of magnetic field B with distance r from the centre of the wire?
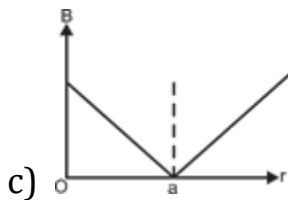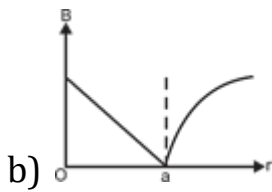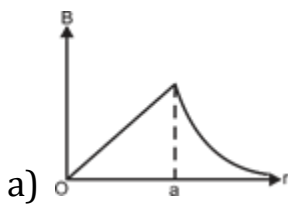


(iv) A long straight wire of radius R carries a steady current I. The current is uniformly distributed across its cross-section. The ratio of magnetic field at R/2 and 2R is:
    a) 1/2
    b) 2
    c) 1/4
    d) 1

(v) A direct current I flows along the length of an infinitely long straight thin walled pipe, then the magnetic field is:

   a) uniform throughout the pipe but not zero
   b) zero only along the axis of the pipe
   c) zero at any point inside the pipe
   d) maximum at the centre and minimum at the edges.

**Question 28:**

A solenoid is a long coil of wire tightly wound in the helical form. Solenoid consists of closely stacked rings electrically insulated from each other wrapped around a non-conducting cylinder.
Figure below shows the magnetic field lines of a solenoid carrying a steady current I. We see that if the turns are closely spaced, the resulting magnetic field inside the solenoid becomes fairly uniform, provided that the length of the solenoid is much greater than its diameter. For an "ideal" solenoid, which is infinitely long with turns tightly packed, the magnetic field inside the solenoid is uniform and parallel to the axis, and vanishes outside the solenoid.
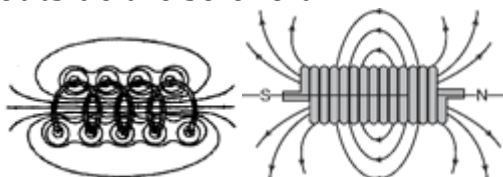


Read the given passage carefully and give the answer of the following questions.

(i) A Long solenoid has 800 turns per metre length of solenoid. A current of 1.6 A flows through it. The magnetic induction at the end of the solenoid on its axis is:
   a) $16 \times 10^{-4}$T
   b) $8 \times 10^{-4}$T
   c) $32 \times 10^{-4}$T
   d) $4 \times 10^{-4}$T

(ii) Choose the correct statement in the following:
   a) The magnetic field inside the solenoid is less than that of outside
   b) The magnetic field inside an ideal solenoid is not at all uniform
   c) The magnetic field at the centre, inside an ideal solenoid is almost twice that at the ends
   d)  The magnetic field at the centre, inside an ideal solenoid is almost half of that at the ends

(iii) The magnetic field (B) inside a Long solenoid having n turns per unit length and carrying current I when iron core is kept in it is ($\mu_0$ = permeability of vacuum, $\chi$ = magnetic susceptibility):

    a) $\mu_0 nI(1-\chi)$
    b) $\mu_0 nI\chi$
    c) $\mu_0 nI^2(1+\chi)$
    d) $\mu_0 nI(1+\chi)$

(iv) A solenoid of length L and having n turns carries a current I is in anticlockwise direction. The magnetic field is not:

    a) $\mu_0 nI$
    b) $\mu_0 nI/2$
    c) along the axis of solenoid
    d) perpendicular to the axis of coil

(v) The magnitude of the magnetic field inside a long solenoid is increased by:

    a) decreasing its radius
    b) decreasing the current through it
    c) increasing its area of cross-section
    d) introducing a medium of higher permeability

## Question 29:

When a rectangular loop PQRS of sides 'a' and 'b' carrying current I is placed in uniform magnetic field $\vec{B}$, such that area vector $\vec{A}$ makes an angle $\theta$ with direction of magnetic field, then forces on the arms QR and SP of loop are equal, opposite
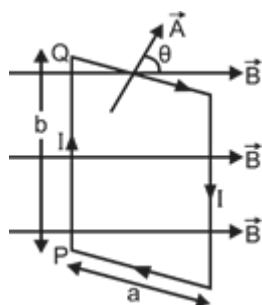


and collinear, thereby perfectly cancel each other, whereas forces on the arms PQ and RS of loop are equal and opposite but not collinear, so they give rise to torque on the loop.

Force on side PQ or RS of loop is F = $lbB\sin90° = lbB$ and perpendicular distance between two non-collinear forces is $r_\perp = a\sin\theta$
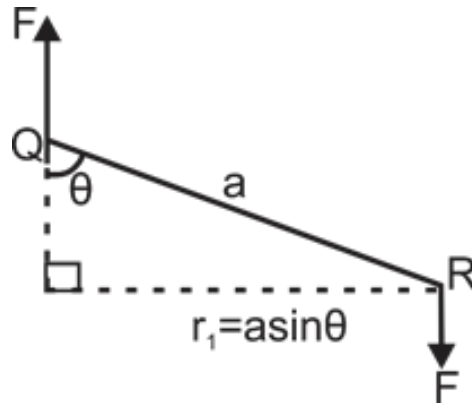
So, torque on the loop, $\tau = IAB\sin\theta$

In vector form, torque $\vec{\tau}=\vec{M}\times\vec{B}$

where $\vec{M}\times\overrightarrow{NIA}$

is called magnetic dipole moment of current loop and is directed in direction of area vector $\vec{A}$ i.e., normal to the plane of loop.

Read the given passage carefully and give the answer of the following questions.

(i) A circular loop of area 1 $cm^2$, carrying a current of 10 A is placed in a magnetic field of 0.1 T perpendicular to the plane of the loop. The torque on the loop due to the magnetic field is:

a) zero
b) $10^{-4}Nm$
c) $10^{-2}Nm$
d) 1 N m

(ii) Relation between magnetic moment and angular velocity is:

a) $M\propto\omega$
b) $M\propto\omega^2$
c) $M\propto\sqrt{\omega}$
d) None of these

(iii) A current Loop in a magnetic field:
  a) can be in equilibrium in two orientations, both the equilibrium states are unstable
  b) can be in equilibrium in two orientations, one stable while the other is unstable
  c) experiences a torque whether the field is uniform or non-uniform in all orientations
  d) can be in equilibrium in one orientation

(iv) The magnetic moment of a current l carrying circular coil of radius r and number of turns N varies as

a) $1/r^2$
b) $1/r$
c) r
d) $r^2$

(v) A rectangular coil carrying current is placed in a non-uniform magnetic field. On that coil the total:

a) force is non-zero
b) force is zero
c) torque is zero
d) None of these

## Question 30:

The path of a charged particle in magnetic field depends upon angle between velocity and magnetic field. If velocity $\vec{v}$ is at angle $\theta$ to $\vec{B}$, component of velocity
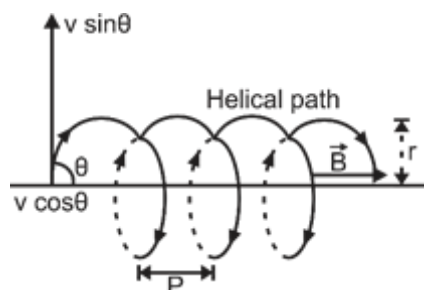


parallel to magnetic field ($vcos\theta$) is responsible for circular motion, thus the charge particle moves in a helical path.

The plane of the circle is perpendicular to the magnetic field and the axis of the helix is parallel to the magnetic field. The charged particle moves along helical path touching the line parallel to the magnetic field passing through the starting point after each rotation.

Radius of circular path is $$r = \frac{mvsin\theta}{qB}$$

Hence the resultant path of the charged particle will be a helix, with its axis along the direction of $\vec{B}$ as shown in figure.

Read the given passage carefully and give the answer of the following questions.

(i) When a positively charged particle enters into a uniform magnetic field with uniform velocity, its trajectory can be (A) a straight line (B) a circle (C) a helix.
   a) (A) only
   b) (A) or (B)
   c) (A) or (C)
   d) any one of (A) (B) and (C)

(ii) Two charged particles A and B having the same charge, mass and speed enter into a magnetic field in such a way that the initial path of A makes an angle of 30° and that of B makes an angle of 90° with the field. Then the trajectory of:

   a) B will have smaller radius of curvature than that of A
   b) both will have the same curvature
   c) A will have smaller radius of curvature than that of B
   d) both will move along the direction of their original velocities

(iii) An electron having momentum $2.4×10^{-23} kg\ m/s$ enters a region of uniform magnetic field of 0.15 T. The field vector makes an angle of $30^0$ with the initial velocity vector of the electron. The radius of the helical path of the electron in the field shall be:

   a) 2mm
   b) 1mm
   c) $3\sqrt{2}mm$
   d) 0.5 mm

(iv) The magnetic field in a certain region of space is given by $\vec{B} = 8.35×10^{-2}\hat{i}\ T$. A proton shot into the field with velocity $\vec{v} = (2×10^5\hat{i} + 4×10^2\hat{j})m/s$. The proton follows a helical path in the field. The distance moved by proton in the x-direction during the period of one revolution in the yz-plane will be (Mass proton $=1.67×10^{-27}kg$):

   a) 0.053 m
   b) 0.136 m
   c) 0.157 m
   d) 0.236 m

(v) The frequency of revolution of the particle is:
   a) mqB
   b) qB/2πm
   c) 2πR/vcosθ
   d) 2πR/vsinθ

## Question 31:

Lenz's law states that the direction of induced current in a circuit is such that it opposes the change which produces it. Thus, if the magnetic flux linked with a closed-circuit increase, the induced current flows in such a direction that magnetic flux is created in the opposite direction of the original magnetic flux. If the magnetic flux linked with the closed-circuit decreases, the induced current flows in such a direction so as to create magnetic flux in the direction of the original flux.



(i) Which of the following statements is false?
(a) The induced e.m.f. is not in the direction opposing the change in magnetic flux.
(b) The relative motion between the coil and magnet produces change in magnetic flux.
(c) Emf is induced only if the magnet is moved towards coil.
(d) Emf is induced only if the coil is moved towards magnet

(ii) The polarity of induced emf is given by
(a) Ampere's circuital law
(b) Biot-Savart law
(c) Lenz's law
(d) Fleming's left-hand rule

(iii) Lenz's law is a consequence of the law of conservation of
(a) Charge                    (b)Momentum
(c) Energy                    (d) Mass

(iv) Near a circular loop of conducting wire as shown in the figure, an electron moves along a direction of the induced current if any in the loop is
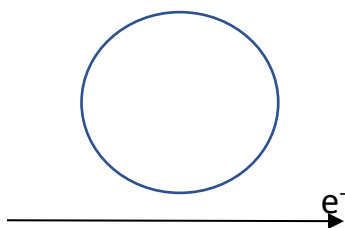


(a) variable
(b) clockwise
(c) zero
(d) anticlockwise

(v) Two identical circular coils A and B are kept in a horizontal tube side by side without touching each other. If the current in coil A increases with time, in response, the coil B.
(a) is attracted by A
(b) is repelled by A
(c) is not effected
(d) rotates

## Question 32:

Mutual inductance is the phenomenon of inducing emf in a coil, due to a change of current in the neighbouring coil. The amount of mutual inductance that links one coil to another depends very much on the relative positioning of the two coils, their geometry and relative separation between them. Mutual inductance between the two coils increases $\mu_r$ times if the coils are wound over an iron core of relative permeability $\mu_r$.
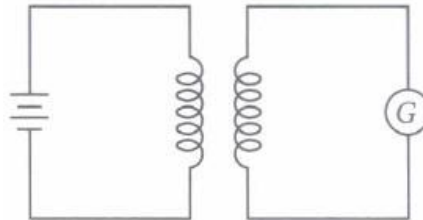


(i) A short solenoid of radius a, number of turns per unit length $n_1$ and length L is kept coaxially inside a very long solenoid of radius b, number of turns per unit length $n_2$. What is the mutual inductance of the system?
(a) $\mu_0\pi b^2 n_1 n_2 L$
(b) $\mu_0\pi a^2 n_1 n_2 L$
(c) $2\mu_0\pi b^2 n_1 n_2 L$
(d) $2\mu_0\pi a^2 n_1 n_2 L$

(ii) If a change in current of 0.01 A in one coil produces a change in magnetic flux of $2 \times 10^{-2}$ weber in another coil, then the mutual inductance between coils is
(a) 0
(b) 1H
(c) 2H
(d) 3H

(iii) Mutual inductance of two coils can be increased by
(a) decreasing the number of turns in the coils
(b) increasing the number of turns in the coils
(c) winding the coils on wooden cores
(d) none of these

(iv) When a sheet of iron is placed in between the two co-axial coils, then the mutual inductance between the coils will
(a) increase                               (b) decrease
(c) remains same                           (d) cannot be predicted

(v) The SI unit of mutual inductance is
(a) Ohm               (b) mho            (c) Henry            (d) none of these

**Question 33:**
Currents can be induced not only in conducting coils, but also in conducting sheets or blocks. Current is induced in solid metallic masses when the magnetic flux threading through them changes. Such currents flow in the form of irregularly shaped loops throughout the body of the metal. These currents look like eddies or whirlpools in water so they are known as eddy currents. Eddy currents have both undesirable effects and practically useful applications. For example, it causes unnecessary heating and wastage of power in electric motors, dynamos and in the cores of transformers.

(i) The working of speedometers of trains is based on
        (a) wattles currents
        (b) eddy currents
        (c) alternating currents
        (d) pulsating currents

(ii) Identify the wrong statement
        (a) Eddy currents are produced in a steady magnetic field
        (b) Induction furnace uses eddy currents to produce heat.
        (c) Eddy currents can be used to produce braking force in moving trains
        (d) Power meters work on the principle of eddy currents.

(iii) Which of the following is the best method to reduce eddy currents?
        (a) Laminating core
        (b) Using thick wires
        (c) By reducing hysteresis loss
        (d) None of these

(iv) The direction of eddy currents is given by
        (a) Ampere's circuital law
        (b) Biot-Savart law
        (c) Lenz's law
        (d) Fleming's left-hand rule

(v) Eddy currents can be used to heat localized tissues of the human body. This branch of medical therapy is called
     (a) Hyperthermia             (b) Diathermy
     (c) Inductothermy          (d) none of these

**Question 34:**
In year 1820 Oersted discovered the magnetic effect of current. Faraday gave the thought that reverse of this phenomenon is also possible i.e., current can also be produced by magnetic field. Faraday showed that when we move a magnet towards the coil which is connected by a sensitive galvanometer. The galvanometer gives instantaneous deflection showing that there is an electric current in the loop.

     Whenever relative motion between coil and magnet takes place an emf induced in coil. If coil is in closed circuit then current is also induced in the circuit. This phenomenon is called electromagnetic induction.
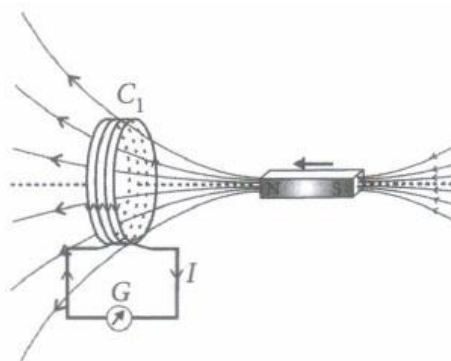


(i) The north pole of a long bar magnet was pushed slowly into a short solenoid connected to a galvanometer. The magnet was held stationary for a few seconds with the north pole in the middle of the solenoid and then withdrawn rapidly. The maximum deflection of the galvanometer was observed when the magnet was
     (a) moving towards the solenoid
     (b) moving into the solenoid
     (c) at rest inside the solenoid
     (d) moving out of the solenoid.

(ii) A closed iron ring is held horizontally and a bar magnet is dropped through the ring with its length along the axis of the ring. The acceleration of the falling magnet is
     (a) equal to g
     (b) less than g
     (c) more than g
     (d) depends on the diameter of the ring and length of magnet

(iii) Whenever there is a relative motion between a coil and a magnet, the magnitude of induced emf set up in the coil does not depend upon the
  (a) relative speed between the coil and magnet
  (b) magnetic moment of the coil
  (c) resistance of the coil
  (d) number of turns in the coil

(iv) A coil of metal wire is kept stationary in a non-uniform magnetic field
  (a) an emf and current both are induced in the coil
  (b) an emf is not induced but current is induced in the coil
  (c) an emf is induced but current is not induced in the coil
  (d) neither emf nor current is induced in the coil

(v) A dead-beat galvanometer is the one in which oscillation of coil stops as soon as the current stops flowing through it. In order to achieve this the coil is wounded over
  (a) Metallic frame
  (b) Plastic frame
  (c) Wooden frame
  (d) Rubber frame

## Question 35:

The emf induced across the ends of a conductor due to its motion in a magnetic field is called motional emf. It is produced due to the magnetic Lorentz force acting on the free electrons of the conductor. For a circuit shown in figure, if a conductor of length I moves with velocity v in a magnetic field B perpendicular to both its length and the direction of the magnetic field, then emf induced across the length of the rod is Bvl. In case the rod is not straight rather in the form of a curve then l will be the shortest distance between the ends of the rod perpendicular to its velocity as well as magnetic field
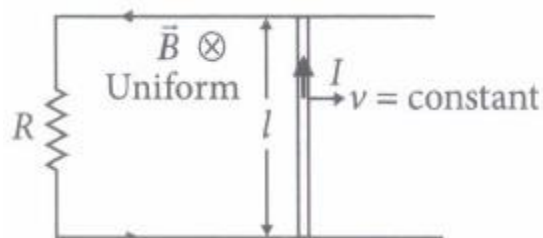


(i) Direction of current induced in a wire moving in a magnetic field is found using
  (a) Fleming's left-hand rule
  (b) Fleming's right-hand rule
  (c) Ampere's rule
  (d) Right hand clasp rule

(ii) A conducting rod of length I is moving in a transverse magnetic field of strength B with velocity v. The resistance of the rod is R. The current in the rod is
    (a) BlvR
    (b) Blv/R
    (c) zero
    (d) Bvl/2R

(iii) A 0.1 m long conductor carrying a current of 50 A is held perpendicular to a magnetic field of 1.25 mT. The mechanical power required to move the conductor with a speed of 1 m s$^{-1}$ is
    (a) 62.5 mW
    (b) 625 mW
    (c) 6.25 mW
    (d) 12.5 mW

(iv) A bicycle generator creates 1.5 V at 15 km/hr. The EMF generated at 10 km/hr is
    (a) 1.5 volts
    (b) 2volts
    (c) 0.5volts
    (d) 1 volt

(v) The dimensional formula for emf E in MKS system will be
    (a) $[ML^2 T^{-3} A^{-1}]$
    (b) $[ML^2 T^{-3} A^{-2}]$
    (c) $[ML T^{-3} A^{-2}]$
    (d) $[ML^2 T^{-2} A^{-2}]$

## Question 36:

When a pure resistance R, pure inductor L and an ideal capacitor of capacitance C is connected in series to a source of alternating e.m.f., then current at any instant through the three elements has the same amplitude and is represented as I = $I_0$sinωt. However, voltage across each element has a different phase relationship with the current as shown in graph. The effective resistance of RLC circuit is called impedance (Z) of the circuit and the voltage leads the current by a phase angle φ.
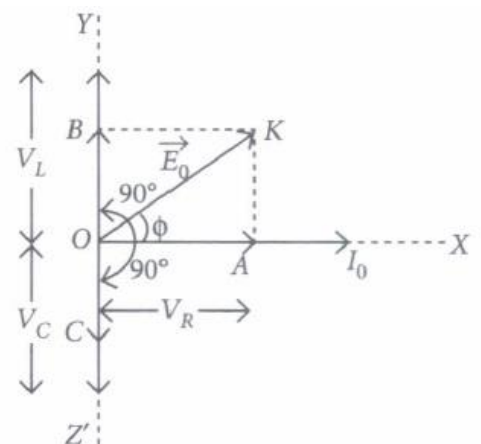
(i) A resistor of 12Ω a capacitor of reactance 14Ω and a pure inductor of inductance 0.1 H are joined in series and placed across 200 V, 50 Hz a.c. supply. The value of inductive reactance is
     (a) 15Ω
     (b) 31.4Ω
     (c) 20Ω
     (d) 30Ω

(ii) The value of impedance is
     (a) 20Ω
     (b) 15Ω
     (c) 30Ω
     (d) 21.13Ω

(iii) What is the value of current in the circuit?
     (a) 5 A
     (b) 15 A
     (c) 10 A
     (d) 9.46 A

(iv) What is the value of the phase angle between current and voltage?
     (a) 53°9′
     (b) 63°9′
     (c) 55°4′
     (d) 50°

(v) From graph, which one is true from following?
     (a) $V_L > V_C$
     (b) $V_L < V_C$
     (c) $V_L > V_C$
     (d) $V_L = V_C$

## Question 37:

A transformer is essentially an a.c. device. It cannot work on d.c. It changes alternating voltages or currents. It does not affect the frequency of a.c. It is based on the phenomenon of mutual induction. A transformer essentially consists of two coils of insulated copper wire having different number of turns and wound on the same soft iron core.

(i) The number of turns in the primary and secondary coils of an ideal transformer are 2000 and 50 respectively. The primary coil is connected to a main supply of 120 V and secondary coil is connected to a bulb of resistance 0.6Ω. The voltage across the secondary coil is
    (a) 5V
    (b) 2V
    (c) 3 V
    (d) 10 V

(ii) The value of current in the bulb is
    (a) 7 A
    (b) 15 A
    (c) 3 A
    (d) 5 A

(iii) The value of current in primary coil is
    (a) 0.125 A
    (b) 2.52 A
    (c) 1.51 A
    (d) 3.52 A

(iv) Power in primary coil is
    (a) 20W
    (b) 5W
    (c) 10W
    (d) 15W

(v) Power in secondary coil is
    (a) 15W
    (b) 20 W
    (c) 7W
    (d) 8 W

## Question 38:

An LC circuit also called a resonant circuit, tank circuit or tuned circuit is an electric circuit consisting of an inductor represented by the letter L and a capacitor, represented by the letter C connected together. An LC circuit is an idealized model since it assumes there is no dissipation of energy due to resistance. An LC circuit contains a 20 mH inductor and a 50μF capacitor with an initial charge of 10 mC the resistance of the circuit is negligible. Let the instant the circuit is closed be t = 0.
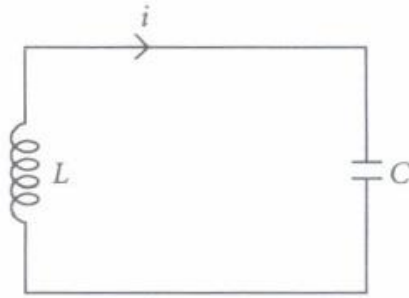
(i) The total energy stored initially is

    (a) 5 J
    (b) 3 J
    (c) 10 J
    (d) 1 J

(ii) The natural frequency of the circuit is

    (a) 159.24 Hz
    (b) 200.12 Hz
    (c) 110.25 Hz
    (d) 95 Hz

(iii) At what time is the energy stored completely electrical?

    (a) T,5T,9T
    (b) T/2,5T/2,9T/2
    (c) 0, T, 2T, 3T
    (d) 0, T/2, T,3T/2

(iv) At what time is the energy stored completely magnetic?

    (a) T/2,3T/2,5T/4
    (b) T/3, T/9, T/12
    (c) 0, 2T, 3T
    (d) T/4,3T/4,5T/4

(v) The value of $X_L$ is
    (a) 20Ω
    (b) 40Ω
    (c) 60Ω
    (d) 50Ω

**Question 39:**

Step-down transformers are used to decrease or step-down voltages. These are used when voltages need to be lowered for use in homes and factories. A small town with a demand of 800 kW of electric power at 220 V is situated 15 km away from an electric plant generating power at 440 V. The resistance of the two-wire line carrying power is 0.5Ω per km. The town gets power from the line through a 4000 - 220 V step-down transformer at a sub-station in the town.
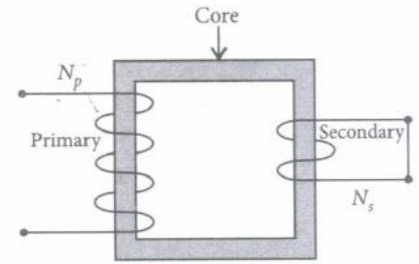
(i) The value of total resistance of the wires is
(a) 25Ω
(b) 30Ω
(c) 35Ω
(d) 15Ω

(ii) The line power loss in the form of heat is
(a) 550 kW
(b) 650 kW
(c) 600 kW
(d) 700 kW

(iii) How much power must the plant supply, assuming there is negligible power loss due to leakage?
(a) 600 kW
(b) 1600 kW
(c) 500 W
(d) 1400 kW

(iv) The voltage drop in the power line is
(a) 1700V
(b) 3000V
(c) 2000V
(d) 2800 V

(v) The total value of voltage transmitted from the plant is
(a) 500 V
(b) 4000 V
(c) 3000 V
(d) 7000 V

**Question 40:**

A transformer is an electrical device which is used for changing the a.c. voltages. It is based on the phenomenon of mutual induction i.e. whenever the amount of magnetic flux linked with a coil changes, an e.m.f is induced in the neighboring coil. For. an ideal transformer, the resistances of the primary and secondary windings are negligible. It can be shown that

$$E_sE_p=I_pI_s=n_sn_p=kE_sE_p=I_pI_s=n_sn_p=k$$

where the symbols have their standard meanings. For a step up transformer

$$E_s>E_p; k>1$$

$$\therefore n_s>n_p;$$

$$\therefore I_s<I_p$$

For a step-down transformer

$$E_s<E_p; k<1$$

$$\therefore n_s>n_p;$$

$$\therefore I_s<I_p$$

The above relations are on the assumptions that efficiency of transformer is 100%.

$$\eta= \text{output power/ intput power} =E_sI_s/E_pI_p$$
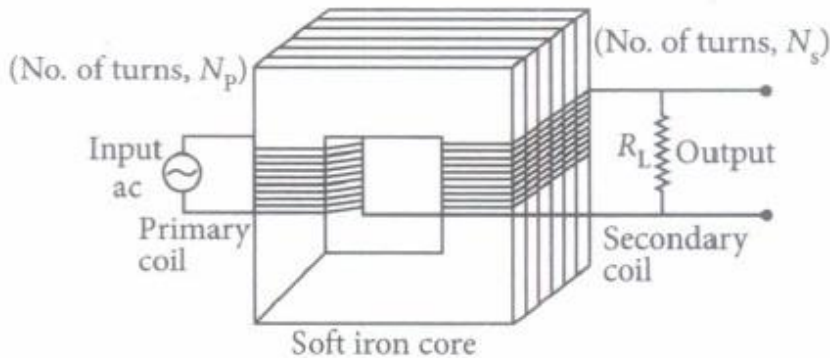


(i) Which of the following quantity remains constant in an ideal transformer?
(a) Current
(b) Voltage
(c) Power
(d) All of these

(ii) Transformer is used to
(a) convert ac to dc voltage
(b) convert dc to ac voltage
(c) obtain desired dc power
(d) obtain desired ac voltage and current

(iii) The number of turns in primary coil of a transformer is 20 and the number of turns in a secondary is 10. If the voltage across the primary is 220 ac V, what is the voltage across the secondary?
(a) 100 ac V
(b) 120 ac V
(c) 110 ac V
(d) 310 ac V

(iv) In a transformer the number of primary turns is four times that of the secondary turns. Its primary is connected to an a.c. source of voltage V. Then
(a) current through its secondary is about four times that of the current through its primary
(b) voltage across its secondary is about four times that of the voltage across its primary.
(c) voltage across its secondary is about two times that of the voltage across its primary.
(d) voltage across its secondary is about √2 times that of the voltage across its primary.

(v) A transformer is used to light 100 W-110 V lamp from 220 V mains. If the main current is 0.5 A, the efficiency of the transformer is
(a) 95%
(b) 99%
(c) 90%
(d) 96%

**Question 41:**
Electric and magnetic fields exhibit a wave-like behaviour. When electric and magnetic fields vary in space and time, they produce an electromagnetic wave. An accelerated charge produces electromagnetic waves. An oscillating charge has oscillating electric and magnetic fields around it and hence it produces electromagnetic waves. Electrons falling from a higher to a lower energy orbit in an atom radiate electromagnetic waves. The motion of electrons in an antenna radiates electromagnetic waves. Electromagnetic waves are transverse in nature. They do not require a material medium for their propagation. The speed of an electromagnetic wave is given by v = 1 me where m is the magnetic permeability and e is the electrical permittivity of the medium. Radiowaves, microwaves, infrared radiations, visible light, ultraviolet rays, X-rays and gamma rays are all electromagnetic waves. They have a very wide range of wavelengths and hence of frequencies. Although they are identical in nature, their method of production and their interaction with matter are different.

(i)     Which of the following electromagnetic waves has the longest wavelength?
        (a) Radiowaves
        (b) Infrared radiation
        (c) Microwaves
        (d) X-rays

(ii)    Which of the following electromagnetic waves has the highest frequency?
        (a) Radiowaves                    (b) Visible light
        (c) Ultraviolet rays              (d) Microwaves

(iii)   Which of the following wave is longitudinal in nature?
        (a) Light emitted from a sodium lamp
        (b) Sound waves travelling in air
        (c) X-rays from an X-ray machine
        (d) Microwaves used in a radar.

(iv)    Which of the following statements is false?
        Electromagnetic waves
          (a) are transverse.
          (b) travel in free space at the same speed.
          (c) travel in all media at the same speed.
          (d) are produced by an accelerating charge.

(v)     An electromagnetic wave is produced by oscillating electric and magnetic
        fields E and B. Choose the only incorrect statement from the following.
          (a) E is perpendicular to B.
          (b) E is perpendicular to the direction of propagation of the wave.
          (c) B is perpendicular to the direction of propagation of the wave.
          (d) E is parallel to B.

## Question 42:

Microwave in aircraft navigation Microwave are used in aircraft navigation. A radar guns out short bursts of microwave and it reflect back from oncoming aircraft and are detected by receiver in gun. The frequency of reflected wave used to compute speed of aircraft.

(i)     How are microwave produced?
        (a) klystron and magnetron valve
        (b) sudden deceleration of electron in x- ray tube
        (c)  accelerated motion of charge in conducting wire
        (d)  hot bodies and molecules

(ii)   Why microwave use for aircraft navigation?
       (a) due to high wavelength     (b) due to low wavelength
       (c) due to low frequency       (d)due to their frequency modulation power

(iii)  Which is use of microwave?
       (a) in treatment of cancer
       (b) to observe changing blood flow
       (c)used to kill microbes
       (d)studying details of atoms and molecule

(iv)   Where do microwave fall in electromagnetic spectrum?
       (a) between UV region and infrared     (b) between gamma and UV
       (c)between infrared and radio wave     (d)between gamma and infrared

**Question 43:**
Gamma rays are used in radiotherapy to treat cancer. They are used to spot tumours. They kill the living cells and damage malignant tumour.

(i)    What is the source of gamma rays?
       (a) radioactive decay of nucleus
       (b) accelerated motion of charges in conducting wire
       (c) hot bodies and molecule
       (d) klystron valve

(ii)   The wavelength of gamma rays is
       (a) low                (b) high
       (c) infinite           (d) zero

(iii)  Choose the one with correct radiation order?
       (a) alpha>beta>gamma        (b) beta>alpha>gamma
       (c) gamma>beta>alpha        (d) gamma>alpha>beta

(iv)   what is other use of gamma rays?
       (a) used to change white topaz to blue topaz
       (b) used in aircraft navigation
       (c) used in kill microbes
       (d) checking fractures of bone

**Question 44:**
X-rays are a form of electromagnetic radiation, similar to visible light. Unlike light, however, x-rays have higher energy and can pass through most objects, including

the body. Medical x-rays are used to generate images of tissues and structures inside the body.

(i) What is the most common method of preparation of X rays?
(a) magnetron valve
(b) vibration of atoms and molecules
(c) bombardment of metal by high energy electrons
(d) radioactive decay of nucleus

(ii) Which of the following set of instrument /equipment can detect X-rays?
(a) Photocells, photographic film
(b) Thermopiles, bolometer
(c) Photographic film, Geiger tube
(d) Geiger tube, human eye

(iii) Where do X rays fall on the electromagnetic spectrum?
(a) Between UV region and infrared region
(b) Between gamma rays and UV region
(c) Between infrared and microwaves
(d) Between microwaves and radio waves

(iv) What is the use of rays lying beyond X ray region in electromagnetic spectrum?
(a) used to kill microbes
(b) used to detect heat loss in insulated systems
(c) used in standard broadcast radio and television
(d) used in oncology, to kill cancerous cells.

## Question 45:

The greenhouse effect is a natural process that warms the Earth's surface. When the Sun's energy reaches the Earth's atmosphere, some of it is reflected back to space and the rest is absorbed and re-radiated by greenhouse gases. The absorbed energy warms the atmosphere and the surface of the Earth.

(i) The one which is not considered as naturally occurring greenhouse gas is
(a) methane                    (b) CFCs
(c) carbon dioxide             (d) nitrous oxide

(ii) Which of the following is not a use of infrared waves?
(a) Used in treatment for certain forms of cancer
(b) in military and civilian applications include target acquisition, surveillance, night vision, homing, and tracking.
(c) to observe changing blood flow in the skin
(d) In imaging cameras, used to detect heat loss in insulated systems

(iii) Which of the following is the best method for production of infrared waves?
(a) bombardment of metal by high energy electrons
(b) radioactive decay of nucleus
(c) magnetron valve
(d) vibration of atoms and molecules

(iv) Wavelength of infrared radiations is
(a) shorter      (b) longer      (c) infinite      (d) zero

## Question 46:

The electromagnetic (EM) spectrum is the range of all types of EM radiation. Radiation is energy that travels and spreads out as it goes – the visible light that comes from a lamp in your house and the radio waves that come from a radio station are two types of electromagnetic radiation. The other types of EM radiation that make up the electromagnetic spectrum are microwaves, infrared light, ultraviolet rays, X- rays and gamma rays.

(i) The classification is roughly based on?
(a) Wavelength and frequency of waves.
(b) Production and detection of waves.
(c) The way of travelling of waves.
(d) Year discovered.

(ii)  Which of the following is NOT an example of EM waves?
(a) Radiotherapy(medicine).
(b) Checking fractures.
(c) Sterilisation.
(d) Explosives.

(iii)    Identify the pair having highest frequency and highest wavelength EM WAVES.

(a) UV rays and X- rays        (b) Gamma rays and Microwaves.

(c) Gamma rays and Radio waves.    (d) Radio waves and UV rays.

(iv) What physical quantity is the same for X rays of wavelength 10-10m, red light of wavelength 6800 A$^0$ and radiowaves of wavelength 500m?

(a) Speed in vacuum        (b) frequency

(c) Scattering        (d) Energy

## Question 47:

Electromagnetic radiation is a natural phenomenon found in almost all areas of daily life, from radio waves to sunlight to x-rays. Laser radiation – like all light – is also a form of electromagnetic radiation. Electromagnetic radiation that has a wavelength between 380 nm and 780 nm is visible to the human eye and is commonly referred to as light. At wavelengths longer than 780 nm, optical radiation is termed infrared (IR) and is invisible to the eye. At wavelengths shorter than 380 nm, optical radiation is termed ultraviolet (UV) and is also invisible to the eye. The term "laser light" refers to a much broader range of the electromagnetic spectrum that just the visible spectrum, anything between 150 nm up to 11000 nm (i.e. from the UV up to the far IR). The term laser is an acronym which stands for "light amplification by stimulated emission of radiation".

Einstein explained the stimulated emission. In an atom, electron may move to higher energy level by absorbing a photon. When the electron comes back to the lower energy level it releases the same photon. This is called spontaneous emission. This may also so happen that the excited electron absorbs another photon, releases two photons and returns to the lower energy state. This is known as stimulated emission. Laser emission is therefore a light emission whose energy is used, in lithotripsy, for targeting and ablating the stone inside human body organ.

Apart from medical usage, laser is used for optical disk drive, printer, barcode reader etc.

(i)    What is the full form of LASER?

(a) Light amplified by stimulated emission of radiation
(b) Light amplification by stimulated emission of radiation
(c) Light amplification by simultaneous emission of radiation
(d) Light amplified by synchronous emission of radiation

(ii)    The "stimulated emission" is the process of:
    (a) release of a photon when electron comes back from higher to lower energy level.
    (b) release of two photons by absorbing one photon when electron comes back from higher to lower energy level.
    (c) absorption of a photon when electron moves from lower to higher energy level.
    (d) None of the above

(iii)   What is the range of amplitude of LASER?
    (a) 150 nm – 400 nm           (b) 700 nm – 11000 nm
    (c) Both the above            (d) None of the above

(iv)    Lithotripsy is:
    (a) an industrial application.      (b) a medical application.
    (c) laboratory application.        (d) process control application.

(v)     LASER is used in:
    (a) optical disk drive.          (b) transmitting satellite signal.
    (c) radio communication.       (d) ionization.

## Question 48:

Maxwell showed that the speed of an electromagnetic wave depends on the permeability and permittivity of the medium through which it travels. The speed of an electromagnetic wave in free space is given by $c = \frac{1}{\sqrt{\mu_0 \epsilon_0}}$. The fact led Maxwell to predict that light is an electromagnetic wave. The emergence of the speed of light from purely electromagnetic considerations is the crowning achievement of Maxwell's electromagnetic theory. The speed of an electromagnetic wave in any medium of permeability μ and permittivity ε will be $= \frac{1}{\sqrt{\mu_r K}}$. where K is the dielectric constant of the medium and $\mu_r$ is the relative permeability.

(i)     The dimensions of $\frac{1}{2} \epsilon_0 E^2$ ($\epsilon_0$ permittivity of free space; E = electric field) is

    (a) $[M\ L\ T^{-1}]$            (b) $[M\ L^2 T^{-2}]$
    (c) $[M\ L^{-1}T^{-2}]$        (d) $[M\ L^2 T^{-1}]$

(ii) Let [ε₀] denote the dimensional formula of the permittivity of the vacuum.
If M = mass, L = length, T = time and A = electric current, then
(a) $[\epsilon_0] = [M^{-1} L^{-3} T^2 A]$
(b) $[\epsilon_0] = [M^{-1} L^{-3} T^4 A^2]$
(c) $[\epsilon_0] = [M L T^{-2} A^{-2}]$
(d) $[\epsilon_0] = [M L^2 T^{-1}]$

(iii) An electromagnetic wave of frequency 3MHz passes from vacuum into a dielectric medium with permittivity ε = 4. Then
(a) Wavelength and frequency both remain unchanged
(b) Wavelength is doubled and the frequency remains unchanged
(c) Wavelength is doubled and the frequency becomes half
(d) Wavelength is halved and the frequency remains unchanged.

(iv) Which of the following are not electromagnetic waves?
(a) Cosmic rays      (b) Υ – rays
(c) $\beta$ – rays      (d) X – rays

## Question 49:

Radio waves are produced by the accelerated motion of charges in conducting wires. Microwaves are produced by special vacuum tubes. Infrared waves are produced by hot bodies and molecules also known as heat waves. UV rays are produced by special lamps and very hot bodies like Sun.
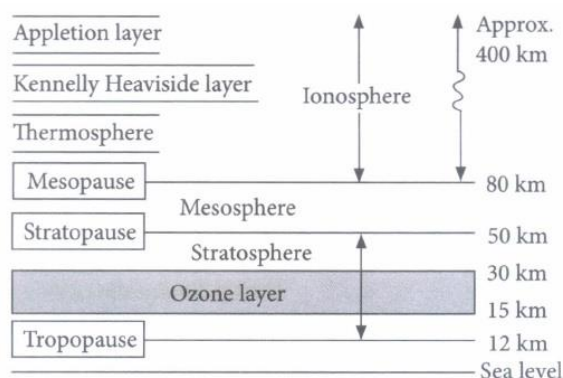


(i) Solar radiation is
(a) Transverse electromagnetic wave
(b) Longitudinal electromagnetic waves
(c) Both longitudinal and transverse electromagnetic waves
(d) None of these.

(ii) What is the cause of greenhouse effect?
(a) Infrared rays
(b) Ultraviolet rays
(c) X-rays
(d) Radio waves

(iii)    Biological importance of ozone layer is
      (a)  It stops ultraviolet light    (b) Its layer reduces greenhouse effect
      (c)  It reflects radio waves    (d)  none of these

(iv)    Ozone is found in
      (a)  Stratosphere        (b) ionosphere
      (c) mesosphere        (d) troposphere

## Question 50:

All the known radiations from a big family of electromagnetic waves which stretch over a large range of wavelengths. Electromagnetic wave includes radio waves, microwaves, visible light waves, infrared rays, UV rays, X-rays and gamma rays. The orderly distribution of the electromagnetic waves in accordance with their wavelength or frequency into distinct groups having widely differing properties is electromagnetic spectrum.

(i) Which wavelength of the Sun is used finally as electric energy?
      (a) Radio waves        (b) infrared waves
      (c) visible light        (d) microwaves

(ii) Which of the following electromagnetic radiations have the longest wavelength?
      (a)  X-rays        (b) $\gamma$-rays
      (c) microwaves        (d) Radio waves

(iii) Which one of the following is not electromagnetic in nature?
      (a)  X-rays        (b) $\gamma$-rays
      (c) cathode rays        (d) infrared rays

(iv) Which of the following has minimum wavelength?
      (a)  X-rays        (b) ultraviolet rays
      (c)  $\gamma$-rays        (d) cosmic rays

(v) The decreasing order of wavelength of infrared, microwave, ultraviolet and gamma rays is
      (a)  microwave, infrared, ultraviolet, gamma rays
      (b)  gamma rays, ultraviolet, infrared, microwave
      (c)  microwave, gamma rays, infrared, ultraviolet
      (d)  infrared, microwave, ultraviolet, gamma rays

**Question 51:**

A compound microscope consists of two lenses. A lens of short aperture and short focal length facing the object is called the object lens and another lens of short focal length but large aperture is called the eye lens. Magnifying power is defined as the ration of angle subtended by the final image at the eye to the angle subtended by the object is seen directly, when both are placed at least distance of distinct vision



(i)    An objective lens consists of
        (a) Short aperture and short focal length
        (b)large aperture and large focal length
        (c)short aperture and large focal length
        (d)large aperture and short focal length

(ii)    An eyepiece consists of
        (a) short aperture and short focal length
        (b) large aperture and large focal length
        (c) short aperture and large focal length
        (d) large aperture and short focal length

(iii)    Formula of magnifying power
        (a) M= (beta/alpha)
        (b) M=(alpha/beta)
        (c) M=(1+(alpha/beta))
        (d) M=(1+(beta/alpha))

(iv)    A compound microscope with an objective of 1.0 cm, focal length and eyepiece 2.0 cm. Focal length of a tube is 20 cm. Calculate the magnifying power of the microscope
        (a) 270      (b) 27      (c)140      (d) 14

(v)    Final image formed by compound microscope
        (a) inverted
        (b) Erect
        (c)virtual
        (d)highly diminished

**Question 52:**

If a beam of white light is made to fall on one face of prism the light emerging from the other face of the prism consist of seven colours violet, indigo, blue, green, yellow, orange, red. The phenomena of splitting of white light into its constituent colours is called dispersion of light.
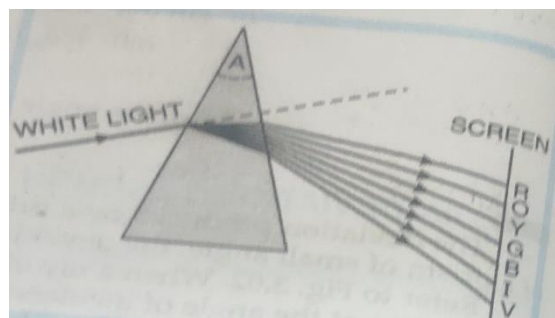


(i) Which one of the following colours will suffer greatest dispersion?
(a) violet (b)indigo
(c) blue (d)red

(ii) The critical angle between an equilateral prism and air is $45^0$. If the incident ray is perpendicular to refracting surface then
(a) it is reflected totally from the second surface and emerges perpendicular from the third surface.
(b) it gets reflected from second and third surface and emerges from the first surface.
(c) it keeps reflecting from all the three side of the prism and never emerges out.
(d) after deviation, it gets refracted from the second surface.

(iii) Which colour is taken as the mean colour (i.e. mean refractive index for a material
(a) yellow (b) red
(c) violet (d) green

(iv) A prism with a refracting angle of 60° gives angle of minimum deviation 53°,51°,52° for blue, red, yellow light respectively. What is the dispersive power of the material of the prism
(a) 385 (b) 0.385
(c) 0.0385 (d) 38.5

(v) The refractive angle of a prism for a monochromatic light is 60° and refractive index is $\sqrt{2}$. For minimum deviation the angle of incidence will be
(a) 60°
(b) 45°
(c) 30°
(d) 75°

**Question 53:**

The lens maker's formula relates the focal length of a lens to the refractive index of its material and the radii of curvature of its two surfaces. This formula is used to manufacture a lens of particular focal length from the glass of a given refractive index. For this reason, it is called the lens maker's formula.
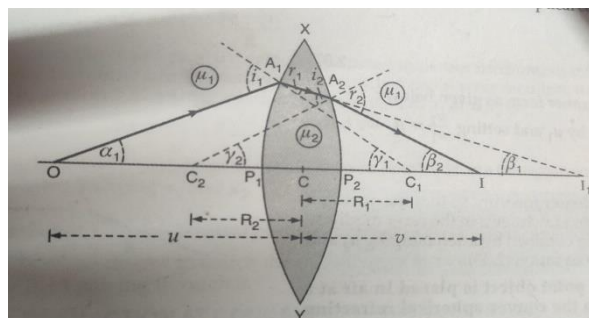


(i) For a plano-convex lens of radius of curvature 10 cm the focal length is 30 cm. If the refractive index of the material of the lens is
(a) 2.0          (b) 1.33
(c) 1.66        (d) 1.5

(ii) An image is formed on the screen by a convex lens when upper half part of lens is covered with black paper then
(a) half image is formed
(b) full image is formed
(c) intensity of image is enhanced
(d) all of the above

(iii) A convex lens of focal length 20 cm is placed in contact with a diverging lens of unknown focal length. The lens combination acts as a converging lens and has a focal length of 30 cm. What is the focal length of diverging lens
(a) -90 cm        (b) -60 cm
(c) -30 cm        (d) -10 cm

(iv) In case of thin lens of focal length f, an object is placed at a distance X from first focus and its image is formed at a distance X from the second focus. Find X.
(a) f              (b) 1/f
(c) f$\sqrt{2}$         (d) f$\sqrt{3}$

(v) Two thin lenses of focal length 60cm and -20 cm in contact have a resultant focal length of
(a) -30 cm        (b) +15 cm
(c) -15 cm        (d) +30 cm

**Question 54:**

The object appears to be raised from its real position to apparent position (i.e. from O to I). The distance through which the position of the object appears to be raised is called normal shift. The normal shift in the position of the objects depends upon the real depth of the object and the refractive index of the refracting medium.
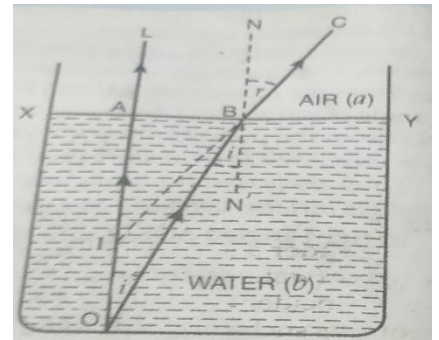


(i) What is the apparent depth of a tank 3 m deep when viewed outside (refractive index of water is 4/3).
   (a) 1.1 m          (b) 2.26 m
   (c) 1.5 m          (d) 0.5 m

(ii) A rectangular block of glass ABCD has a refractive index 1.6. A pin is placed midway on the face AB. When observed from the face AD, the pin shall
   (a) appear to be near A
   (b) appear to be near D
   (c) appear to be at the centre of AD
   (d) not to be seen at all

(iii) A short pulse of white light incident from air to a glass slab at normal incidence after traveling through the slab the first colour to shift is
   (a) blue          (b) green
   (c) violet        (d) red

(iv) A mark at the bottom of a liquid appears to rise by 0.1m. The depth of the liquid is 1m. The refractive index of the liquid is
   (a) 1.33          (b) 9/10
   (c) 10/9          (d) 1.5

(v) A double convex lens of refractive index $u_1$ is immersed in a liquid of refractive index $u_2$. The lens will act as transparent plane sheet when the lens will act as a transparent plane sheet when
   (a) $u_1 < u_2$          (b) $u_1 > u_2$
   (c) $u_1 = u_2$          (d) $u_1 = 1/u_2$

**Question 55:**

A convex or converging lens is thicker at the centre than at the edges. It converges a parallel beam of light on refraction through it. It has a real focus.

Convex lens is of three types:

(A) Double convex lens
(B) Plano-convex lens
(C) Concavo-convex lens. Concave lens is thinner at the centre than at the edges.

It diverges a parallel beam of light on refraction through it. It has a virtual focus.

(i) A point object 0 is placed at a distance of 0.3 m from a convex lens (focal length 0.2 m) cut into two halves each of which is displaced by 0.0005 m as shown in figure. What will be the location of the image?
(a) 30cm right of lens
(b) 60cm right of lens
(c) 70cm left of lens
(d) 40cm left of lens
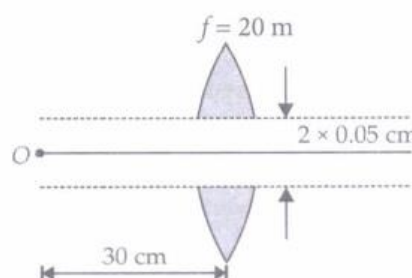


$f = 20$ m

$2 \times 0.05$ cm

O

30 cm

(ii) Two thin lenses are in contact and the focal length of the combination is 80 cm. If the focal length of one lens is 20 cm, the focal length of the other would be
(a) -26.7cm              (b) 60cm
(c) 80cm                 (d) 20cm

(iii) A spherical air bubble is embedded in a piece of glass. For a ray of light passing through the bubble, it behaves like a
(a) converging lens       (b) diverging lens
(c) plano-converging lens (d) plano-diverging lens

(iv) Lens used in magnifying glass is
(a) concave lens
(b) convex lens
(c) both
(d) none of these

(v) The magnification of an image by a convex lens is positive only when the object is placed
(a) at its focus F              (b) between F and 2F
(c) at 2F                       (d) between F and optical centre

**Question 56:**

Refraction of light is the change in the path of light as it passes obliquely from one transparent medium to another medium. According to law of refraction sin i /sin r $=_1\mu_2$ where $_1\mu_2$ is called refractive index of second medium with respect to first medium. From refraction at a convex spherical surface, we have $\frac{\mu_2}{v} - \frac{\mu_1}{u} = (\mu_2 - \mu_1)\frac{1}{R}$. Similarly from refraction at a concave spherical surface when object lies in the rarer medium, we have $\frac{\mu_2}{v} - \frac{\mu_1}{u} = (\mu_2 - \mu_1)\frac{1}{R}$ and when object lies in the denser medium, we have $\frac{\mu_1}{v} - \frac{\mu_2}{u} = (\mu_1 - \mu_2)\frac{1}{R}$

(i) Refractive index of a medium depends upon
(a) nature of the medium
(b) wavelength of the light used
(c) temperature
(d) all of these

(ii) A ray of light of frequency 5 x $10^{14}$ Hz is passed through a liquid. The wavelength of light measured inside the liquid is found to be 450 x $10^{-9}$ m. The refractive index of the liquid is
(a)1.33                (b) 2.52
(c) 2.22                (d) 0.75

(iii) A ray of light is incident at an angle of 60° on one face of a rectangular glass slab of refractive index 1.5. The angle of refraction is
(a) $\sin^{-1}(0.95)$
(b) $\sin^{-1}(0.58)$
(c) $\sin^{-1}(0.79)$
(d) $\sin^{-1}(0.86)$

(iv) A point object is placed at the centre of a glass sphere of radius 6 cm and refractive index 1.5. The distance of the virtual image from the surface of sphere is
(a) 2cm                (b) 4cm
(c) 6cm                (d) 12cm

(v) In refraction, light waves are bent on passing from one medium to the second medium because in the second medium
(a) the frequency is different
(b) the coefficient of elasticity is different
(c) the speed is different
(d) the amplitude is different

**Question 57:**

The lens maker's formula relates the focal length of a lens to the refractive index of the lens material and the radii of curvature of its two surfaces. This formula is called so because it is used by manufacturers to design lenses of required focal length from a glass of given refractive index. If the object is placed at infinity, the image will be formed at focus for both double convex lens and double concave lens

Therefore, lens maker's formula is $\frac{1}{f} = (\mu_2 - \mu_1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$ When lens is placed in air, The lens maker formula takes the form $\frac{1}{f} = (\mu - 1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$

(i)    The radius of curvature of each face of biconcave lens with refractive index 1.5 is 30 cm. The focal length of the lens in air is
(a) 12cm                                    (b) 10cm
(c) 20cm                                    (d) -30cm

(ii)   The radii of curvature of the faces of a double convex lens are 10 cm and 15 cm. If focal length is 12 cm, then refractive index of glass is
(a) 1.5
(b) 1.78
(c) 2.0
(d) 2.52

(iii)  An under-water swimmer cannot see very clearly even in absolutely clear water because of
(a) absorption of light in water
(b) scattering of light in water
(c) reduction of speed of light in water
(d) change in focal length of eye-lens

(iv)   A thin lens of glass ($\mu$ = 1.5) of focal length 10 cm is immersed in water ($\mu$ = 1.33). The new focal length is
(a) 20 cm
(b) 40 cm
(c) 48 cm
(d)12 cm

(v)    An object is immersed in a fluid. In order that the object becomes invisible, it should
(a) behave as a perfect reflector
(b) absorb all light falling on it
(c) have refractive index one
(d) have refractive index exactly matching with that of the surrounding fluid

**Question 58:**

A prism is a portion of a transparent medium bounded by two plane faces inclined to each other at a suitable angle. A ray of light suffers two refractions on passing through a prism and hence deviates through a certain angle from its original path. The angle of deviation of a prism is, $\{(\delta) = \mu - 1\}$ A, through which a ray deviates on passing through a thin prism of small refracting angle A. If $\mu$ is refractive index of the material of the prism, then prism formula is,

$$\mu = \frac{\sin(A + \delta_m)}{\sin \frac{A}{2}}$$

(i) For which colour, angle of deviation is minimum?
         (a) red                 (b) yellow
         (c) violet             (d) blue

(ii) When white light moves through vacuum
         (a) all colours have same speed
         (b) different colours have different speed
         (c) violet has more speed than red
         (d) red has more speed than violet

(iii) The deviation through a prism is maximum when angle of incidence is

         (a) 45°                 (b) 70°
         (c) 90°                 (d) 60°

(iv) What is the deviation produced by a prism of angle 6°? (Refractive index of the material of the prism is 1.644).

         (a) 3.864°
         (b) 4.595°
         (c) 7.259°
         (d) 1.252°

(v) A ray of light falling at an angle of 50° is refracted through a prism and suffers minimum deviation. If the angle of prism is 60°, then the angle of minimum deviation is

         (a) 45°                 (b) 75°
         (c) 50°                 (d) 40°

**Question 59:**
An optical fibre is a thin tube of transparent material that allows light to pass through, without being refracted into the air or another external medium. It makes use of total internal reflection. These fibres are fabricated in such a way that light reflected at one side of the inner surface strikes the other at an angle larger than critical angle. Even, if fibre is bent, light can easily travel along the length.
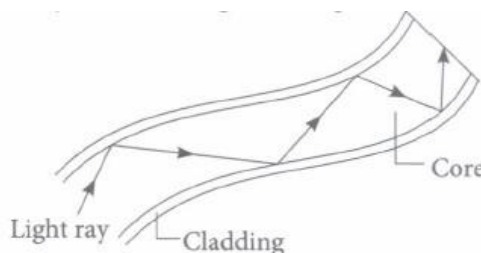
(i) Which of the following is based on the phenomenon of total internal reflection of light?
  (a) sparkling of diamond
  (b) optical fibre
  (c) instrument used by doctors for endoscopy
  (d) all of these

(ii) A ray of light will undergo total internal reflection inside the optical fibre, if it
  (a) goes from rarer medium to denser medium
  (b) is incident at an angle less than critical angle
  (c) strikes the interface normally
  (d) is incident at an angle greater than critical angle

(iii) If in core, angle of incidence is equal to critical angle, then angle of refraction will be
  (a) $0^\circ$   (b) $45^\circ$
  (c) $90^\circ$   (d) $180^\circ$

(iv) In an optical fibre (shown), correct relation for refractive indices of core and cladding is
  (a) $n_1 = n_2$
  (b) $n_1 < n_2$
  (c) $n_1 > n_2$
  (d) $n_1 + n_2 = 2$
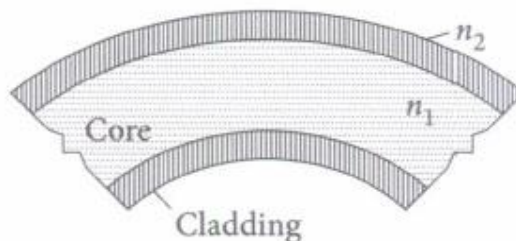
(v) If the value of critical angle is 30° for total internal reflection from given optical fibre, then speed of light in that fibre is
  (a) $3 \times 10^8$ ms$^{-1}$
  (b) $1.5 \times 10^8$ ms$^{-1}$
  (c) $6 \times 10^8$ ms$^{-1}$
  (d) $45 \times 10^8$ ms$^{-1}$

**Question 60:**

Total internal reflection is the phenomenon of reflection of light into denser medium at the interface of denser medium with rarer medium. For this phenomenon to occur necessary condition is that light must move from denser to rarer and angle of incidence in denser medium must be greater than critical angle for the pair of media in contact. Critical angle depends on nature of medium and wavelength of light. We can show that $\mu = 1/\sin C$ (where C is the critical angle).

(i) critical angle for glass air interface, where $\mu$ for glass is 3/2, is
(a)$41.8^0$　　　　　　　　(b) $60^0$
(c)$30^0$　　　　　　　　(d)$15^0$

(ii) Critical angle for water air interface is $48.6^0$, then what is the refractive index of water
(a)1　　　　　　　　(b)3/2
(c)4/3　　　　　　　　(d)3/4

(iii) Critical angle for air water interface for violet colour is $49^0$ its value for red colour will be
(a)$49^0$　　　　　　　　(b)$50^0$
(c)$48^0$　　　　　　　　(d)can't say

(iv) Which of the following is not due to total internal reflection?
(a) working of optical fibre
(b)difference between real depth and apparent depth of a pound.
(c)mirage on hot summer day
(d) brilliance of diamond

(v) critical angle of glass is $\theta_1$ and that of the water is $\theta_2$ critical angle for water and glass surface would be ($\mu_g > \mu_w$)
(a) less than $\theta_2$
(b) between $\theta_1$ and $\theta_2$
(c)greater then $\theta_2$
(d)less than $\theta_1$.

**Question 61:**

Power (P) of a lens is given as the reciprocal of focal length (P=1/f) where f should be in meter and P is in Diopter. for convex power is positive and concave power is –ve. When two or more lenses are kept in contact then power of the combined lens is given as $P = P_1 + P_2 + P_3$ .......

(i) A convex and a concave lens is separated by distance d are then put in contact then the focal length of the combination
   (a) becomes 0
   (b) remain the same
   (c) decreases
   (d) increases.

(ii) The two lenses of power +1.5D and +1.0D are placed in contact then the effective power of the combination will be
   (a) 2.5D
   (b) 1.5 D
   (c) 0.5D
   (d) 3.25D

(iii) If the power of the lens is 5D then what is the focal length of the lens?
   (a) 10cm          (b) 20cm
   (c) 15cm          (d) 5cm

(iv) Two thin lens of focal length +10cm and -5cm are kept in contact, the power of the combination is?
   (a) -10D
   (b) -20D
   (c) 10D
   (d) 15D

(v) A convex lens of focal length 25cm is placed coaxially in contact with a concave lens of focal length 20cm the system will be;
   (a) converging in nature
   (b) diverging in nature
   (c) can be converging or diverging
   (d) None of the above.

## Question 62:
Optical fibres are fabricated with high quality composite glass/quartz fibres which is used for the transmission of optical signal. Each fibre consists of a core and cladding. The refractive index of the material of the core is higher than that of the cladding. As there is difference in the refractive index of core and denser; core acts as a denser medium and cladding act as a rarer medium.
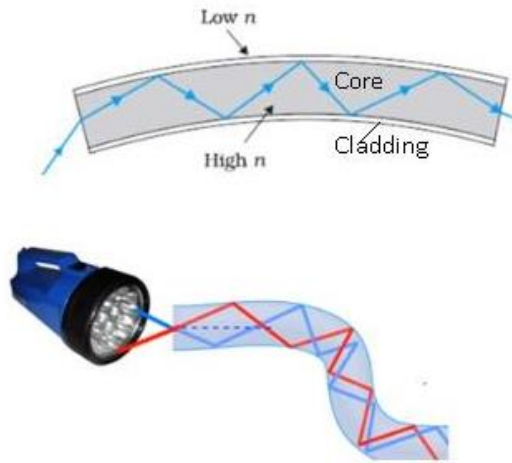
(i)The function of core and cladding in optical fibre
   (a) Core behave as rarer medium and cladding behave as a denser medium
   (b) Core behave as denser medium and cladding behave as a rarer medium
   (c) both have same refractive index
   (d) none of these

(ii)On which principle optical fibre works?
   (a)Refraction of light
   (b) Interference
   (c) Diffraction
   (d) Total internal reflection

(iii)Write the use of optical Fibre.
   (a) Transmission of optical signal
   (b) transmission of electrical signal
   (c) Use to store electrical energy
   (d) all of the above

(iv)How does the refractive index vary in graded index fibre-
   (a) Tangentially            (b) radially
   (c) Longitudinally          (d) Transversely

(v)What causes microscopic bend in optical fibres?
   (a) Uniform pressure        (b) Non-uniform pressure
   (c) Uniform volume          (d) non-uniform volume

**Question 63:**

The whole class was excited as they were on their way to Kavalur in Tamil Nadu, an observatory, housing the largest telescope in India. The teacher was explaining type of telescope, the diameter of the objective (2.34m) and other details. The children were looking forward to see through the telescope.

(i) What type of telescope is the teacher referring to
(a) Binocular
(b) Refracting type telescope
(c) Reflecting type telescope
(d) Compound microscope

(ii) In astronomical compare to eye piece, objective lens has
(a) negative focal length
(b) zero focal length
(c) small focal length
(d) large focal length

(iii) If $f_o$ is the focal length of the objective and $f_e$ is the focal length of the eyepiece, then magnification of a refracting (M) telescope can be determined as
(a) $M = f_o/f_e$
(b) $M = f_o + f_e$
(c) $M = f_o - f_e$
(d) $M = f_e/f_o$

(iv) A telescope can make stars look
(a) bigger
(b) brighter
(c) smaller
(d) all of above

(v) A telescope that uses two converging lenses is called
(a) reflecting telescope
(b) refracting telescope
(c) simple telescope
(d) compound microscope

**Question 64:**

If we drop a small stone on a calm pool of water, waves spread out from the point of impact. Wave propagate in the form of crest and trough. At any instant, a photograph of the surface would show circular rings as shown in diagram below. Clearly, all points on such a circle are oscillating in phase because they are at the same distance from the source. Such a locus of points, which oscillate in phase is called a wavefront; thus, a wavefront is defined as a surface of constant phase.
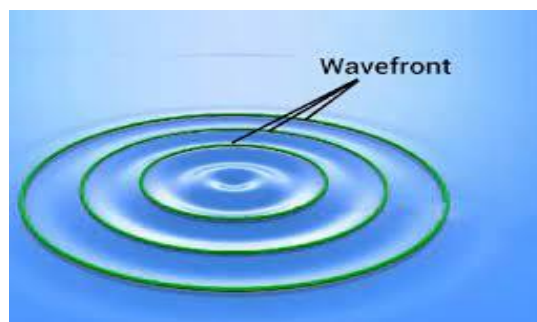
(i) What is the mean of term 'phase'?
    (a)    It indicates the distance of wavefront from source
    (b)    It is the velocity of particles
    (c)    It is the position of a point at a time in a cycle of waveform
    (d)    It is acceleration of point at a time

(ii) Crests are the point of
    (a)    Maximum displacement
    (b)    Minimum displacement
    (c)    Zero displacement
    (d)    Maximum and minimum displacements

(iii) Wavelength is given by
    (a)    Distance between 2 crests
    (b)    Distance between 2 troughs
    (c)    One crest + one trough
    (d)    All of the above

(iv) Here, shape of the wavefront depends upon the
    (a)    Size of source
    (b)    Shape of source
    (c)    Velocity with which source is dropped
    (d)    Size and shape of the source

(v) Similar to the wavefronts in water, an electric bulb and tubelight will give
    (a)    Spherical and cylindrical wavefronts respectively
    (b)    Cylindrical and spherical wavefronts respectively
    (c)    both will give cylindrical wavefront
    (d)    both will give spherical wavefronts

## Question 65:

According to Huygens principle, each point of the wavefront is the source of a secondary disturbance. The wavelets from every point of a wavefront spread out in all directions. These wavelets emanating from the wavefront are called 'secondary wavelets. *If* we wish to determine the shape of the wavefront at time t, we draw spheres of radius ct from each point on the spherical wavefront where c represents the speed of the waves in the medium. If we draw common tangent to all these spheres, we obtain a new position of wavefront. Huygens principle could satisfactorily explain the phenomenon of reflection and refraction. Amplitude of wavelets is given by A$\dot{\alpha}$ (1+cos$\theta$), For wavefront in forward direction $\theta$= $0^0$ For wavefront in backward direction $\theta$ = $180^0$
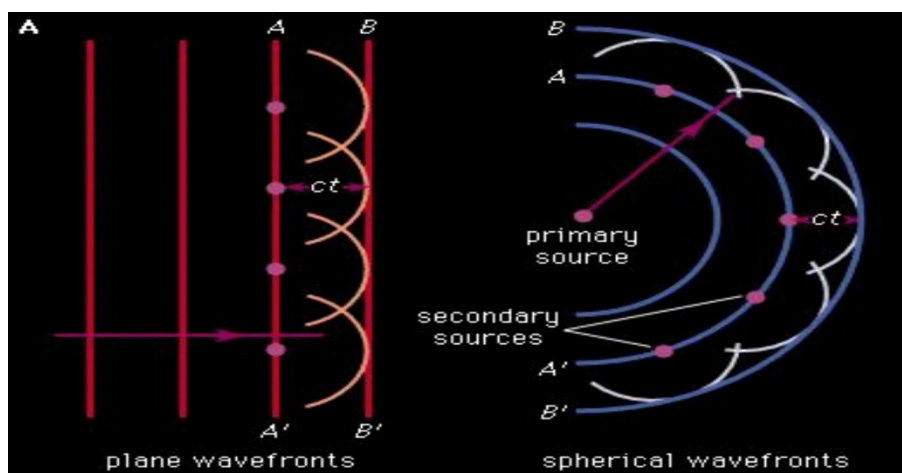
(i) We get spherical wavefront from point source, cylindrical wavefront from line source, similarly plane wavefront from

    (a) source at infinity         (b) a point source

    (c) a plane               (d) a circle

(ii)  If the velocity of light emerging from source is 'v', the velocity of secondary wavelets in that medium will be

    (a)  less than v           (b) greater than v

    (c) equal to v            (d)may increase or decrease

(iii) From a point source light emerges with a velocity of 3 x $10^8$m/s. For getting secondary wavelets after 1x$10^{-3}$s, we apply an arc of radius

    (a) 3 x $10^8$ m         (b) 1.5 x $10^8$ m

    (c) 3 x $10^5$ m         (d)1.5 x $10^5$ m

(iv) According to Huygens we get wavelets in

    (a) forward direction only

    (b) backward direction only

    (c) both forward and backward direction

    (d)none of the above

(v) **ASSERTION**- When a plane wavefront is refracted through a convex lens, the emerging wavefront is spherical.
**REASON-** The central part of the plane wavefront travels through the greatest thickness of convex lens and is, therefore, slowed down the most. The marginal parts of the wavefront travel through a minimum thickness of the lens and are, therefore, slowed down the least.

(a) If both assertion and reason are true and the reason is the correct explanation of assertion
(b) If both assertion and reason are true but the reason is not the correct explanation of assertion
(c) If assertion is true but reason is false
(d) If both the assertion and reason are false

## Question 66:

The incident ray, the refracted ray and the normal to the interface of two media, all lie in the same plane.
Second law of refraction- The ratio of sine of angle of incidence to the angle of refraction is a constant. If i is the angle of incidence in first medium and r is angle of refraction of second medium, then $\sin i / \sin r = n_{21}$, where $n_{21}$ is called refractive index of second medium with respect to first medium.
As frequency is the characteristic of the source, so it does not vary when light goes from one medium to another, but the velocity and wavelength of light changes when light goes from one medium to another. Now the relation becomes
$n_2/n_1 = v_1/v_2$, where $v_2$ and $v_1$ are the velocities of light in medium of refractive index $n_2$ and $n_1$ respectively.

(i) When light goes from rarer medium to a denser medium, its velocity
(a) Decreases                        (b) Increases
(c) Remains same                     (d) Increases then decreases

(ii) A light of wavelength 600nm is incident from air on a glass surface. If refractive index of glass is 1.5, speed of refracted light is
(a) $3x 10^8$ m/s                    (b) $2x 10^8$ m/s
(c) $1x 10^8$ m/s                    (d) $0.5 x 10^8$ m/s

(iii) In question (ii), what will be the frequency of refracted ray
(a)    $5 x 10^{14}$ Hz
(b)    $3.3 x 10^{14}$ Hz
(c)    $2 x 10^{14}$ Hz
(d)    $3.3 x 10^{15}$ Hz

(iv) How much time will the light take to travel normally through a glass plate of thickness 1mm. refractive index of glass is 1.5 and velocity of light is 3 x $10^8$ m/s.
   (a)   2.5 x $10^{-12}$ s
   (b)   5 x $10^{-9}$ s
   (c)   5 x $10^{-12}$ s
   (d)   2.5 x $10^{-9}$ s

(v) Which of the following relations is correct?
   (a)   $n_2/n_1 = \lambda_1/\lambda_2$
   (b)   $n_2/n_1 = \lambda_2/\lambda_1$
   (c)   $n_2/n_1 = v_2\lambda_2/v_1\lambda_1$
   (d)   $n_2/n_1 = v_1\lambda_1/v_2\lambda_2$

## Question 67:

When a number of waves travelling through a medium superpose on each other, the resultant displacement at any point at a given instant is equal to the vector sum of the displacements due to the individual waves at that point.

If $y_1$, $y_2$, $y_3$,....$y_N$ are the displacements due to the different waves acting separately, then according to the principle of superposition, the resultant displacement when all the waves act together is given by the vector sum:

$$y = y_1 + y_2 + y_3 + ... + y_n$$
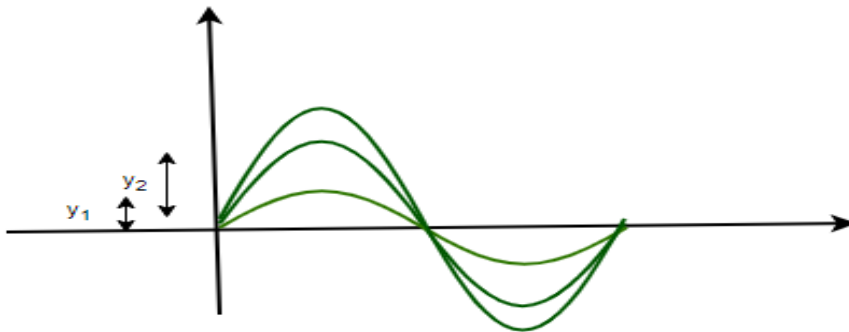


(i) If a particle of the medium is displaced by a wave by 5cm in +y direction and by 3cm in –y direction by another wave, then what will be the resultant displacement of the particle
   (a)  5cm in +y direction
   (b)  2cm in +y direction
   (c)  3cm in –y direction
   (d)  2cm in -y direction

(ii) If a particle of the medium is displaced by a wave by 4cm in +y direction and by 3cm in +x direction by another wave, then what will be the resultant displacement of the particle
    (a)   1cm in +y direction
    (b)   5cm in +y direction
    (c)   5cm in a direction between +x and +y axis
    (d)   7cm in +y direction

(iii) When two light waves through a medium
    (a)   They deflect each- other
    (b)   They attract each- other
    (c)   They travel independent of each- other
    (d)   Only one wave can travel at a time

(iv) Superposition principle is also applicable for
    (a)   Force on a charge due to a multiple charge
    (b)   Electric field at a point due to a number of charges
    (c)   Magnetic field at a point due to a number of charges
    (d)   All of the above

**Question 68:**
When two light waves of the same frequency and having zero or constant phase difference travelling in the same direction superpose each other, the intensity in the region of superposition gets redistributed, becoming maximum at some points and minimum at others. This phenomenon is called interference of light. The two sources of light are said to be coherent only when the phase difference between the light waves produced by them is zero or constant. The point at which two waves are in phase or if trough of one wave coincides with the trough of other or crest of one wave coincides with the crest of other then the resultant intensity produced at that point will be larger and amplitude also maximum. Such points are the points where 'constructive interference' takes place. While there are some points where two light waves are not in phase with each other and crest of one wave coincides with the trough of other and vice versa due to which resultant intensity at that point is minimum and amplitude also get decreased. Such points are the points where 'destructive interference' takes place.

For constructive interference, the path difference is equal to integral multiple of wavelengths and resultant intensity will be maximum at that points. While for destructive interference, the path difference is (n + 1/2) multiple of wavelengths and where resultant intensity is zero.

**Wave Interference**
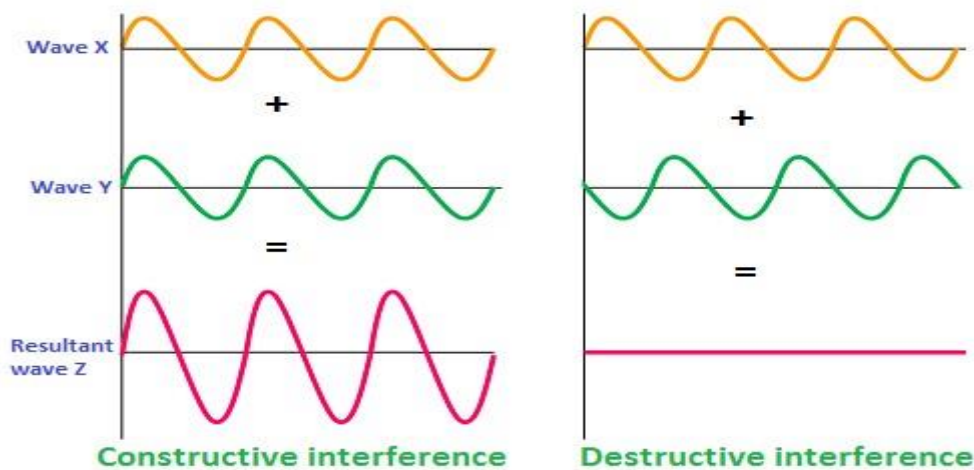


(i) Two waves having a phase difference of 90º between them, will interfere
- (a) Constructively
- (b) Destructively
- (c) Will not interfere
- (d) Both (i) and (ii)

(ii) For two sources to be coherent, path difference between them should be
- (a) Integral multiple of λ
- (b) Even multiple of λ
- (c) Odd multiple of λ
- (d) Zero or constant

(iii) Two coherent sources should have
- (a) Same frequency
- (b) Same wavelength
- (c) Zero or constant phase difference
- (d) All of the above

(iv) A phase difference of 2π is associated with a path difference of
- (a) λ
- (b) 2 λ
- (c) 3 λ
- (d) λ/2

(v) Interference of light follows law of
- (i) Conservation of momentum
- (ii) Conservation of angular momentum
- (iii) Conservation of energy
- (iv) Conservation of mass

**Question 69:**

Displacement of two light waves from two coherent sources $S_1$ and $S_2$ at time t are $Y_1 = a_1\sin\omega t$. $Y_2 = a_2\sin(\omega t + \acute{\alpha})$ Displacement of resultant wave $Y = A\sin(\omega t + \theta)$ Resultant wave is also a harmonic wave of amplitude A

$A = \sqrt{(a_1^2 + a_2^2 + 2a_1a_2 \cos\theta)}$ As we know Intensity $\alpha$ (Amplitude)$^2$

$I_1 = ka_1^2$; $I_2 = ka_2^2$ and $I = kA^2$ (k is a proportionality constant)

Resultant Intensity $I = I_1 + I_2 + 2\sqrt{I_1 I_2} \cos\theta$   for two identical sources, $I_1 = I_2 = I_0 \Rightarrow$ $I = I_0 + I_0 + 2\sqrt{I_0 I_0} \cos\theta = 4 I_0 \cos^2(\theta/2)$.

If interference is constructive interference $\cos\phi = 1$ $\phi$ (Phase Difference) $= 0, \pm 2\pi, \pm 4\pi, \pm 6\pi.....2n\pi$.   $\delta$ (Path Difference) $= 0, \pm\lambda, \pm 2\lambda, \pm 3\lambda, \pm 4\lambda..... \pm\lambda$.

If interference is destructive interference $\cos\phi = -1$, $\phi = \pi, \pm 3\pi, \pm 5\pi, \pm 7\pi .... (2n+1)\pi$. (Path Difference) $= \pm 2\lambda, \pm 23\lambda, \pm 25\lambda, \pm 27\lambda..... \pm 2(2n+1)\lambda$.

(i) When two identical waves from two identical sources interfere, intensity of resultant wave is given by
- (a)    $4I_0 \cos^2(\theta/2)$.
- (b)    $I_0 \cos^2(\theta/2)$.
- (c)    $I_0 \sin^2(\theta/2)$.
- (d)    $2I_0 \sin^2(\theta/2)$

(ii) Four waves are expressed as
- (A) $y_1 = a_1\sin\omega t$
- (B) $y_2 = a_2\sin 2\omega t$
- (C) $y_3 = a_3\cos\omega t$
- (D) $y_4 = a_4\sin(\omega t + \theta)$

Here an observable interference is possible between
- (a)    (A), (C), (D)
- (b)    (A), (B)
- (c)    (B), (D)
- (d)    Not possible

(iii) The resultant intensity for two identical waves of intensity I with a phase difference of $\pi/3$ is
- (a)    R= $2\sqrt{3}$I
- (b)    R= $\sqrt{3}$I
- (c)    R= $4\sqrt{3}$I
- (d)    R= $3\sqrt{3}$I

(iv) Find the ratio of intensities of two points P and Q on the screen in a Young's double slit experiment when waves from sources have path difference of $\pi/3$ and $\pi/2$ respectively

    (a)    1:1

    (b)    1:2

    (c)    3:2

    (d)    2:3

(v) Two coherent monochromatic light beams of intensities I and 4I are superposed. What will be the maximum and possible intensity?

    (a)    I

    (b)    2I

    (c)    5I

    (d)    9I

## Question 70:

Aniruddh woke up in the morning and saw it was raining. He got ready for school. When it stopped raining, he started from his home to school. In his way to school, he observed that on ground there is a rainbow. He looked at that rainbow closely and saw there was kerosene oil split over the wet floor which is reflecting beautiful colours.

He wondered how can this rainbow be formed on the floor because he studied in class 10th that rainbow is formed in the sky when sun rays fall on water droplets. He ran to the school and asked his science teacher about the phenomenon. The teacher took a plastic tub filled with muddy water and poured two drops of kerosene oil in it. The boy got surprised to see beautiful colours were formed in the tub. The teacher explained this is due to the interference between the light waves reflected by the upper and lower surfaces of thin films formed by kerosene oil. As they both originate from the same source, they are coherent waves.
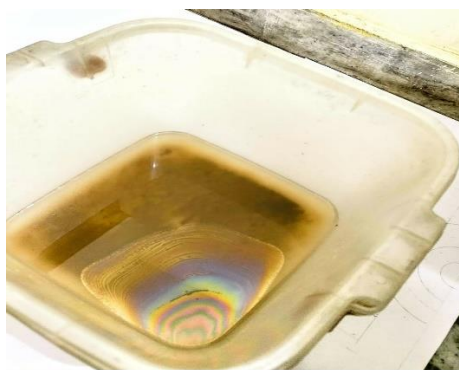
(i) Is there any difference between the colours emerging from a rainbow and the colours from kerosene oil seen in sunlight?
(a) No, both are produced due to same reason
(b) Yes, in rainbow colours are produced due to dispersion, while in kerosene oil, colours are due to interference of light
(c) No, since both are having same pattern of colours
(d) Yes, in rainbow colours are due to reflection of light, but in kerosene oil film reflection does not take place

(ii) If instead of pouring two drops of kerosene oil, half bottle of kerosene oil is poured, shall we see the same colours?
(a) Yes, because we are using the same oil
(b) No, in this case reflection will not take place
(c) No, because now thick film is formed so general illumination will be seen
(d) Yes, because quantity of oil doesn't matter for producing colours

(iii) (A) When two independent tuning forks are struck simultaneously
(B) In prism
(C) In two independent light bulbs
(D) In soap bubbles
In which of the above the phenomenon of interference is observed
(a) In (A), (B), (C), (D)
(b) In (A), (B), (D)
(c) In (A), (D)
(d) In (B), (C), (D)

(iv) Interference pattern can't be seen if
(a) Sources are not coherent
(b) coherent sources are far apart
(c) coherent sources are infinitely close to each –other
(d) all of the above

(v)     **Assertion:** A white source of light during interference forms only white and black fringes.
**Reason:** Width of frindge is inversely proportional to the wavelength of the light used.
(a)     If both assertion and reason are true but the reason is the correct explanation of assertion
(b)     If both assertion and reason are true but the reason is not the correct explanation of assertion
(c)     If assertion is true but reason is false
(d)     If both the assertion and reason are false

## Question 71:
We know that, in Young's double slit experiment,

Position of Bright Frindge
For maximum intensity or bright fringe to be formed at P
Path difference, $\Delta z = n\lambda$ (n = 0, ±1, ±2, . . ..)
i.e., $xd/D = n\lambda$
$x = n\lambda D/d$
The distance of the $n^{th}$ bright frindge from the center is
$x_n = n\lambda D/d$
Frindge width, $\beta = x_n - x_{(n-1)} = n\lambda D/d - (n-1) \lambda D/d = \lambda D/d$
(n = 0, ±1, ±2, . . ..)

Position of Dark Frindge
For minimum intensity or dark frindge to be formed at P,
Path difference, $\Delta z = (2n + 1) (\lambda/2)$ (n = 0, ±1, ±2, . . ..)
i.e., $x = (2n +1) \lambda D/2d$
The distance of the $n^{th}$ dark frindge from the center is
$x_n = (2n+1) \lambda D/2d$
Fringe width, $\beta = x_n - x_{(n-1)} = (2n + 1) \lambda D/2d - (2(n-1) + 1) \lambda D/2d = \lambda D/d$
(n = 0, ±1, ±2, . . ..)

Frindge Width
Distance between two adjacent bright (or dark) frindges is called the frindge width.
$\beta = \lambda D/d$
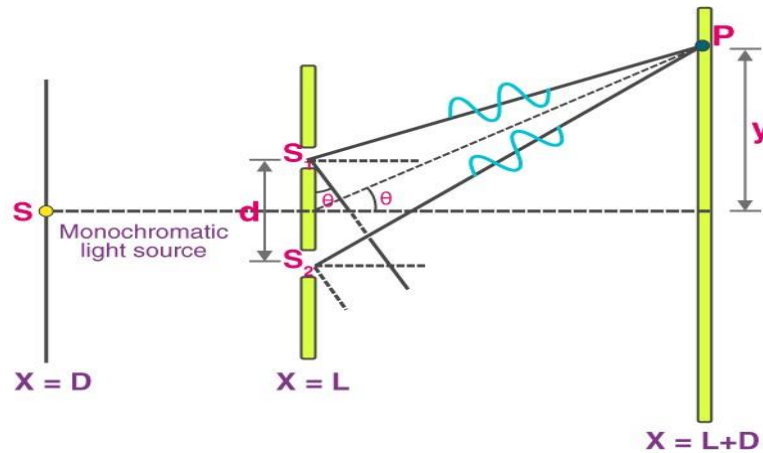
(i) If the apparatus of Young's double slit experiment is immersed in a liquid of refractive index ($\mu$), then frindge width becomes
   (a)  $\beta / \mu$
   (b)  $\beta \mu$
   (c)  $\mu / \beta$
   (d)  $\beta$

(ii) If the linear distance of the $n^{th}$ bright frindge from the center is $x_{n} = n\lambda D/d$, then what will be the angular distance of it from central bright frindge
   (a)  $\Theta_n = n\lambda/d$
   (b)  $\Theta_n = nD/d$
   (c)  $\Theta_n = (n-1) D/d$
   (d)  $\Theta_n = n\lambda D/d$

(iii) If, instead of using one monochromatic source S, we use two different independent sources on $S_1$ and $S_2$, then
   (a)  Position of bright and dark frindges remain same
   (b)  We will not get steady interference pattern
   (c)  Interference pattern does not depend upon wavelength of light used
   (d)  We will get two separate interference patterns

(iv) In a two-slit experiment with monochromatic light, frindges are obtained on a screen placed at some distance from the slits. If screen is moved by $5 \times 10^{-2}$ m towards the slits, then change in frindge width is $3 \times 10^{-5}$ m. If the distance between slits is $10^{-3}$ m then wavelength of the light used will be
   (a) 4000 Å     (b) 6000 Å     (c) 5890 Å     (d) 8000 Å

(v) In a Young's double slit experiment, angular width of a frindge formed on a distant screen is $0.1^{\circ}$. If wavelength of light used is 6000 Å, then distance between the slits will be
   (a) 0.241 mm    (b) 0.344 mm    (c) 0.519 mm     (d) 0.413 mm

**Question 72:**

When a light wave propagates through a slit (or aperture) the result depends upon the physical size of the aperture with respect to the wavelength of the incident beam. This is illustrated in Figure  assuming a coherent, monochromatic wave emitted from point source S, similar to light that would be produced by a laser, passes through aperture d and is diffracted, with the primary incident light beam landing at point P and the first secondary maxima occurring at point Q.



**Diffraction of Coherent Laser Light**
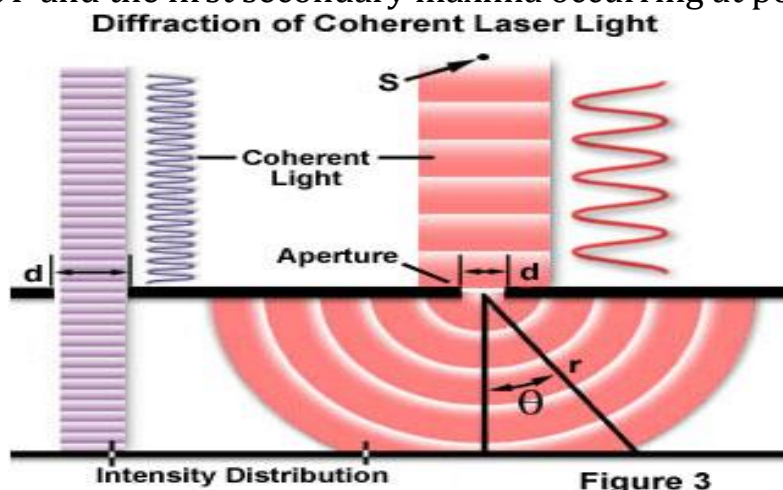
**Figure 3**

As shown in the left side of the figure, when the wavelength ($\lambda$) is much smaller than the aperture width (d), the wave simply travels onward in a straight line, just as it would if it were a particle or no aperture were present. However, when the wavelength exceeds the size of the aperture, we experience diffraction of the light according to the equation:

$$\sin\theta = \lambda/d$$

Where $\theta$ is the angle between the incident central propagation direction and the first minimum of the diffraction pattern.

Give the answer of the following questions;

(i)   State   the   essential   condition   for   diffraction   of   light   to   occur
(a) The size of the aperture must be less when compared to the wavelength of light
(b)The size of the aperture must be more when compared to the wavelength of light
(c)The size of the aperture must be comparable to the wavelength of light
(d)The size of the aperture should not be compared to the wavelength of light

(ii) What is the cause of diffraction?
(a) Interference of primary wavelets
(b)Interference of secondary wavelets
(c)Reflection of primary wavelets
(d) Reflection of secondary wavelets

(iii) What should be the order of the size of an obstacle or aperture for diffraction light?
(a) Order of wavelength of light
(b) Order of wavelength of obstacle
(c) Order in ranges of micrometer
(d) Order in ranges of nanometer

(iv) Single slit diffraction is completely immersed in water without changing any other parameter. How is the width of the central maximum affected?
(a) Insignificant
(b) Increases
(c)Decreases
(d) Becomes zero

(v) Determine the half angular width of the central maximum, if a wavelength of 1000 nm is observed when diffraction occurs from a single slit of 2 μm width.
(a) 100°
(b) 30°
(c) 90°
(d) 150°

**Question 73:**



**Diffracted Light Intensity Distibution**
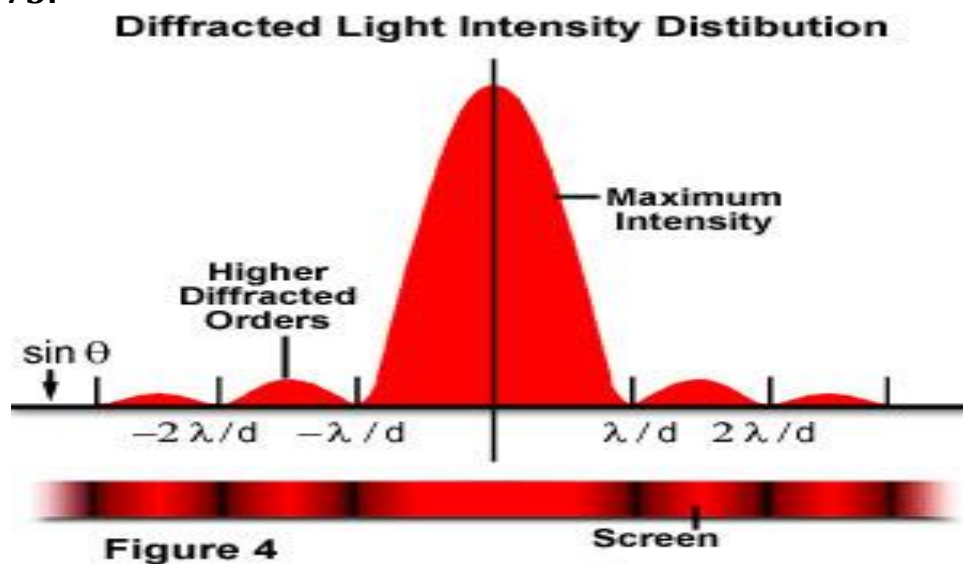
Figure 4

The experiment produces a bright central maximum that is flanked on both sides by secondary maxima, with the intensity of each succeeding secondary maximum decreasing as the distance from the center increases. Figure 4 illustrates this point with a plot of beam intensity versus diffraction radius. Note that the minima occurring between secondary maxima are located in multiples of π.

This experiment was first explained by Augustin Fresnel who, along with Thomas Young, produced important evidence confirming that light travels in waves. From the figures above, we see how a coherent, monochromatic light emitted from point is diffracted by aperture d.

Give the answer of the following questions

(i) Which one of the following is most essential for observing diffraction of light_____
      (a) monochromatic light
      (b) white light
      (c) a very narrow slit or obstacle
      (d) two coherent sources

(ii) A diffraction pattern is obtained using a beam of red light. What happens if red light is replaced by the blue light_____
      (a) bands disappear
      (b) diffraction bands become narrow and crowded together
      (c) diffraction bands become broader and farther apart
      (d) no change in diffraction pattern

(iii) The angular width of the central maxima of a diffraction pattern due to a single slit does not depend upon the_____
      (a) distance between slit and source
      (b) width of the slit
      (c) wavelength of light used
      (d) frequency of light used

(iv) The phenomenon of diffraction may be considered as interference, where the number of coherent sources are_____
      (a) one
      (b) zero
      (c) less than 5
      (d) infinite

(v) Diffraction pattern of a single slit is observed with red light the source is then replaced with that of blue light. If the positions of the diffraction minima on the screen are to remain the same as before_____
      (a) the slit width must be decreased
      (b) the slit width must be increased
      (c) the lens-screen combination must be moved away from the slit
      (d) the lens-source combination must be moved away from the slit

**Question 74:**
According to de-Broglie, a moving material particle sometimes acts as a wave and sometimes as a particle or a wave associated with a moving particle which controls the particle in every respect. The wave associated with moving particle is called matter wave/ de-broglie wave where wavelength called de-broglie wavelength given by $\lambda = h/mv$.

(i)If a proton and an electron have the same de Broglie wavelength, then
    (a) kinetic energy of electron < kinetic energy of proton
    (b) kinetic energy of electron = kinetic energy of proton
    (c) momentum of electron = momentum of proton
    (d) momentum of electron < momentum of proton

(ii) Which of these particles having the same kinetic energy has the largest de Broglie wavelength?

    (a) Electron
    (b) Alpha particle
    (c) Proton
    (d) Neutron

(iii)Two particles $A_1$ and $A_2$ of masses $m_1$, $m_2$ ($m_1 > m_2$) have the same de Broglie wavelength. Then

    (a) their moment are the same.
    (b) their energies are the same.
    (c) momentum of $A_1$ is less than the momentum of $A_2$.
    (d) energy of $A_1$ is more than the energy of $A_2$.

**Question 75:**
Photoelectric effect is the emission of electrons from metal surface, when radiations of suitable frequency fall on them. The emitted electrons are called photoelectrons and the current so produced is called photoelectric current.

(i) With the increase of incident radiations on phototube, the number
of photoelectrons emitted per unit time
    (a)increase
    (b)decrease
    (c)remains same
    (d)none of these

(ii)It is observed that photoelectron emission stops at a certain time t after light source is switched on. The stopping potential can be represented as

(a)2(KEmax/e)

(b)KEmax/e

(c)KEmax/3e

(d)KEmax/2e

(iii)A point source of light power 3.2 X 10$^{-3}$ W emits monoenergetic photons of energy 5.0 eV and work function 3.0eV. The efficiency of photoelectron emission is 1 for every 10$^6$ photons. Assume that the photoelectrons are instantaneously swept away for emission. The max energy of KE of photon

(a)4eV

(b)5eV

(c)2eV

(d)none of these

(iv)Which of these devices is application of Photoelectric effect?

(a)light emitting diode

(b)diode

(c)photocell

(d)none of these

(v)If the frequency of incident light falling on photosensitive metal is doubled, the kinetic energy of the emitted photoelectron is

(a)unchanged           (b)halved

(c)doubled            (d)more than twice its initial value

**Question 76:**

When the light of sufficiently high frequency is incident on metal surface, electrons are emitted from metallic surface. The phenomenon is called photoelectric emission. Kinetic energy of the emitted photoelectrons depends on the wavelength of incident light and is independent of intensity of light. Number of emitted photoelectrons depends on intensity (hf- work function) is the maximum kinetic energy of emitted photoelectrons. Reverse effect of photoemission produces X-rays. X-ray is not deflected by electric and magnetic field. Wavelength of a continuous X-ray depends on potential difference across the tube. Wavelength of characteristic X-ray depends on the potential difference across the tube. Wavelength of characteristic X-ray depend on the atomic number

(i) Energy of photon depends upon

(a)Intensity           (b) Saturation current

(c)frequency          (d)none of the above

(ii)Light of wavelength l which is less than threshold wavelength is incident on a photosensitive metal. If the incident wavelength is decreased so that emitted photoelectrons are moving with the same velocity then stopping potential will be

    (a)increase                    (b)decrease

    (c)zero                        (d)exactly half

(iii)When UV rays incident on metal plate then photoelectric effect does not occur, it occurs by the incident of

    (a)infrared                   (b)x-rays

    (c)radiowave               (d)microwave

(iv)A monochromatic light is used in photoelectric experiment. The stopping potential will

    (a)related to mean wavelength

    (b)related to shortest wavelength

    (c)related to minimum KE of photoelectron

    (d)intensity of incident light

**Question 77:**

To study photoelectric effect, an emitting electrode of a photosensitive material is kept at a negative potential and collecting electrode is kept at positive potential in an evacuated tube. When light of sufficiently high frequency falls on emitting electrode, photoelectrons are emitted which travel directly to collecting electrode and hence an electric current called photoelectric current starts flowing in the circuit, which is directly proportional to the number of photoelectrons emitted by emitting electrode.

While demonstrating the existence of electromagnetic waves. Hertz found that high voltage sparks passed across the metal electrodes of the detector loop more easily when the cathode was illuminated by UV light from an arc lamp. The UV light falling on the metal surface caused the emission of negatively charged particles, which are now known to be electrons, into the surrounding space and hence enhanced the high voltage sparks.

(i) Cathode rays were discovered by

    (a)Maxwell Clerk James       (b)Hertz

    (c)William Crookes           (d)Heinrich Greissle

(ii)Cathode rays consists of

    (a)electrons                 (b)photon

    (c)proton                   (d)alpha particles

(iii)Who discovered the charge on electron for first time?
    (a)Millikan                 (b) J J thomson
    (c)Kelvin                    (d) Coulomb

(iv)The dual nature is exhibited by
    (a)diffraction and photoelectric current
    (b)photoelectric effect
    (c)refraction and interference
    (d)diffraction and reflection

**Question 78:**
The photon picture of electromagnetic radiations and the characteristics properties of photons are as follows:
In the interaction of radiation with matter radiation behave as if it is made of particles like photon. each photon has energy equal to product of plank constant and frequency and momentum equal to ratio of plank constant to wavelength. energy of photon is independent of intensity of radiation. All the photon emitted from source of radiation travel the with speed of light.
The frequency of photon gives the radiation a definite energy (or colour) which does not change when photon travels through different media. The particles are not deflected by electric or magnetic field. This shows photon are electrically neutral.

(i) Which one among the following shows particle nature of light.
    (a) Photo electric effect       (b) Interference
    (c) refraction             (d) polarisation

(ii) Which of the following statement about photon is in in correct.
    (a) photon exerts no pressure
    (b) momentum of photon is $h\nu/c$ ($\nu$ is frequency)
    (c) rest mass of photon is zero
    (d) energy of photon is $h\nu$ ($\nu$ is frequency)

(iii) The rest mass of photon is
    (a) $h\nu/c$                 (b) $h\nu/c^2$
    (c) $h\nu/\lambda$             (d) zero

(iv)In a photon particle collision which of the following may not be conserved
    (a) Total energy
    (b) Number of photons
    (c) Total momentum
    (d) Both a and b

(v)- 'n' photon of wavelength λ is absorbed by a black body of mass 'm'. the momentum gained by the body is

    (a) $h/mc$                         (b) $mnh/λ$

    (c) $nh/mλ$                      (d) $nh/λ$

**Question 79:**

Everything around us which has mass and occupies space is matter. An atom is the basic unit of matter. It cannot be broken down further using any chemical means because it is the basic building block of an element. Every state of matter solid, liquid, gas, and plasma is composed of either atom either it is neutral (unionized), or ionized atoms. An atom is made up of three particles known as protons, neutrons, and electrons. And these particles are also made up from sub-particles. Among these three particles, protons have a positive charge while electrons carry a negative charge and the third particle neutrons have no electrical charge. And the charge of atoms depends on the number of protons and electrons, i.e. an atom is electrically neutral if the number of protons and electrons are equal. If an atom has more or fewer electrons than protons, then it has an overall negative or positive charge, respectively. These atoms are extremely small or you can say their typical sizes are around 100 picometers. So, the dense region consisting of protons and neutrons at the centre of an atom is known as the atomic nucleus of an atom. Every atom is composed of such nucleus and some elections will be surrounding it. Studying these atoms and Nuclei will help us to have a thorough understanding of matter. Studying about the nucleus and its reactions will help us to understand more about nuclear energy, which is a very useful renewable energy. That's why it is very important to study about Atoms and Nuclei.

(i) What is the basic unit of matter?

    (a) Atom          (b) Electron       (c) Proton         (d) Neutron

(ii) Which particle is responsible for the ionization of the atom?

    (a) Positron      (b) Electron     (c) Proton         (d) Neutron

(iii) If number of protons in an atom is equal to number of electrons +2. Then the atom is said to be

    (a) Single ionized positive ion       (b) Single ionized positive atom

    (c) Double ionized positive ion      (d) Double ionized positive atom

(iv) Which is the densest part of an atom?

    (a) The exact central part of the atom.

    (b) The region at the centre of atom containing neutrons and protons.

    (c) Outer edge of the atom

    (d) None of the above

**Question 80:**

To study about atom various scientists, perform various experiments and suggest various models of an atom with some explanation. For example, Thomson gives the "plum pudding" model in which he said that atom consists of a positive material known as "pudding" with some negative materials ("plums") distributed throughout. Later, famous scientist, Rutherford gives Rutherford's model of the atom after performing an Alpha Particle scattering experiment. According to this model, an atom consists of a small, positively-charged nucleus and negatively-charged electrons orbiting around it in an orbital. These orbits can have different sizes, energy, etc. And the energy of the orbit is also related to its size, i.e. the lowest energy is found in the smallest orbit. If the electron is orbiting in $n^{th}$ orbit then we will study about its Velocity in $n^{th}$ orbit, Radius of $n^{th}$ orbital, Energy of electron in $n^{th}$ orbit, etc. Energy is also emitted due to the transition of electrons from one orbit to another orbit. This energy is emitted in the form of photons with different wavelengths. This wavelength is given by the Rydberg formula. When electrons make transitions between two energy levels in an atom various spectral lines are obtained. The emission spectrum of the hydrogen atom has been divided into various spectral series like Lyman series, Balmer series, Paschen series Etc.

(i) The formula which gives the wavelength of emitted photon when electron jumps from higher energy state to lower was given by
    (a) Balmer      (b) Paschen      (c) Lymen      (d) Rydberg

(ii) What is true about Bohr's atomic Model
    (a) His model was unique totally different from other
    (b) His model is a modification of Rutherford atomic model.
    (c) His model is a modification of Thomson atomic model.
    (d) None of the above

(iii) Bohr's atomic model is applicable for
    (a) All types of atoms
    (b) Only for hydrogen atom
    (c) For hydrogen like atoms
    (d) For $H_2$ gas

(iv) The cause of rejection of Rutherford atomic model was
    (a) It was totally wrong
    (b) It could not justify its stability
    (c) Rutherford was unable to explain it
    (d) None of the above

**Question 81:**

Rutherford was the pioneer who postulated and established the existence of the atomic nucleus. At Rutherford's suggestion, Geiger and Marsden performed their classic experiment: on the scattering of α-particles from thin gold foils. Their experiments revealed that the distance of closest approach to a gold nucleus of an α-particle of kinetic energy 5.5 MeV is about $4.0 \times 10^{-14}$ m. The scattering of α-particle by the gold sheet could be understood by Rutherford by assuming that the coulomb repulsive force was solely responsible for scattering. Since the positive charge is confined to the nucleus, the actual size of the nucleus has to be less than $4.0 \times 10^{-14}$ m. If we use α-particles of higher energies than 5.5 MeV, the distance of closest approach to the gold nucleus will be smaller and at some point, the scattering will begin to be affected by the short-range nuclear forces, and differ from Rutherford's calculations. Rutherford's calculations are based on pure coulomb repulsion between the positive charges of the α-particle and the gold nucleus. From the distance at which deviations set in, nuclear sizes can be inferred. By performing scattering experiments in which fast electrons, instead of αparticles, are projectiles that bombard targets made up of various elements, the sizes of nuclei of various elements have been accurately measured. It has been found that a nucleus of mass number A has a radius $R = R_0 A^{1/3}$, where $R_0 = 1.2 \times 10^{-15}$ m. This means the volume of the nucleus, which is proportional to $R^3$ is proportional to A. Thus, the density of nucleus is a constant, independent of A, for all nuclei. The density of nuclear matter is approximately $2.3 \times 10^{17}$ kgm$^{-3}$. This density is very large compared to ordinary matter, say water, which is $10^3$ kg m$^{-3}$. This is understandable, as we have already seen that most of the atom is empty. Ordinary matter consisting of atoms has a large amount of empty space.

(i) Relative density of nucleus with respect to water is
     (a) $2.3 \times 10^{17}$ kgm$^{-3}$
     (b) $2.3 \times 10^{14}$ kgm$^{-3}$
     (c) $23 \times 10^{17}$ kgm$^{-3}$
     (d) $0.23 \times 10^{17}$ kgm$^{-3}$

(ii) From $R = R_0 A^{1/3}$ how can we conclude that density of almost all the nucleus is same
     (a) Volume being proportional to square of R density becomes independent of mass number A
     (b) Volume being proportional to cube of R density becomes independent of mass number A
     (c) Volume being proportional to R density becomes independent of mass number A
     (d) Density has no relation with R

(iii) What is the kinetic energy of α-particles bombarded towards the gold nucleus in Geiger and Marsden classic experiment?

    (a) $8.8 \times 10^{-13}$ Joule         (b) $8.8 \times 10^{-15}$ Joule

    (c) $8.8 \times 10^{-13}$ Joule         (d) $8.5 \times 10^{-13}$ Joule

(iv) What is the range of volume of hydrogen nucleus?

    (a) $10^{-45}$m               (b) $10^{-30}$m

    (c) $10^{-15}$m               (d) $10^{-60}$m

## Question 82:
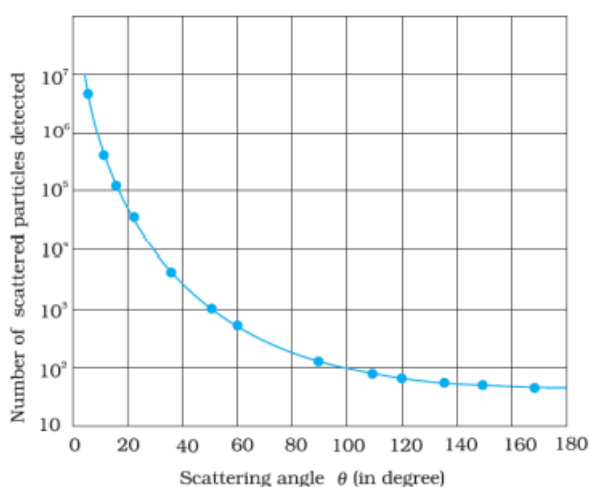


A typical graph of the total number of α particles scattered at different angles, in a given interval of time, is shown in Fig. The dots in this figure represent the data points and the solid curve is the theoretical prediction based on the assumption that the target atom has a small, dense, positively charged nucleus. Many of the α-particles pass through the foil. It means that they do not suffer any collisions. Only about 0.14% of the incident α-particles scatter by more than $1^0$; and about 1 in 8000 deflect by more than $90^0$. Rutherford argued that, to deflect the α-particle backwards, it must experience a large repulsive force. This force could be provided if the greater part of the mass of the atom and its positive charge were concentrated tightly at its centre. Then the incoming α- particle could get very close to the positive charge without penetrating it, and such a close encounter would result in a large deflection. This agreement supported the hypothesis of the nuclear atom. This is why Rutherford is credited with the discovery of the nucleus. In Rutherford's nuclear model of the atom, the entire positive charge and most of the mass of the atom are concentrated in the nucleus with the electrons some distance away. The electrons would be moving in orbits about the nucleus just as the planets do around the sun. Rutherford's experiments suggested the size of the nucleus to be about $10^{-15}$ m to $10^{-14}$ m. From kinetic theory, the size of an atom was

known to be $10^{-10}$ m, about 10,000 to 100,000 times larger than the size of the nucleus. Thus, the electrons would seem to be at a distance from the nucleus of about 10,000 to 100,000 times the size of the nucleus itself. Thus, most of an atom is empty space. With the atom being largely empty space, it is easy to see why most α -particles go right through a thin metal foil. However, when α-particle happens to come near a nucleus, the intense electric field there scatters it through a large angle. The atomic electrons, being so light, do not appreciably affect the α-particles. The scattering data shown in Fig. can be analyzed by employing Rutherford's nuclear model of the atom. As the gold foil is very thin, it can be assumed that α-particles will suffer not more than one scattering during their passage through it. Therefore, computation of the trajectory of an alpha-particle scattered by a single nucleus is enough. Alpha particles are nuclei of helium atoms and, therefore, carry two units,2e, of positive charge and have the mass of the helium atom. The charge of the gold nucleus is Ze, where Z is the atomic number of the atom; for gold Z = 79. Since the nucleus of gold is about 50 times heavier than α-particle, it is reasonable to assume that it remains stationary throughout the scattering process. Under these assumptions, the trajectory of an alpha particle can be computed employing Newton's second law of motion and the Coulomb's law for electrostatic force of repulsion between the alpha-particle and the positively charged nucleus.

(i) What percentage of α particle scattered at an angle more than 90º?
    (a) 0.0125%         (b) 0.125%
    (c) 1.25%            (d) 12.5%

(ii) Why the nucleus of gold is about remains stationary throughout the scattering process?
    (a) Because its mass is 100 times the mass of proton.
    (b) Because its mass is 50 times the mass of proton.
    (c) Because its mass is 150 times the mass of proton.
    (d) Because its mass is 200 times the mass of proton.

(iii) Why electrons around the gold nucleus were unable to deflect α particles?
    (a) Size of α particle is much greater than that of electron.
    (b) Number of electrons around gold nucleus is very small
    (c) α particles is much heavier than electron.
    (d) Electrons are negatively charged.

(iv) What is the ratio of charge on α particle and gold nucleus?
    (a) 0.025         (b) 0.25
    (c) 0.2           (d) 0.5

**Question 83:**
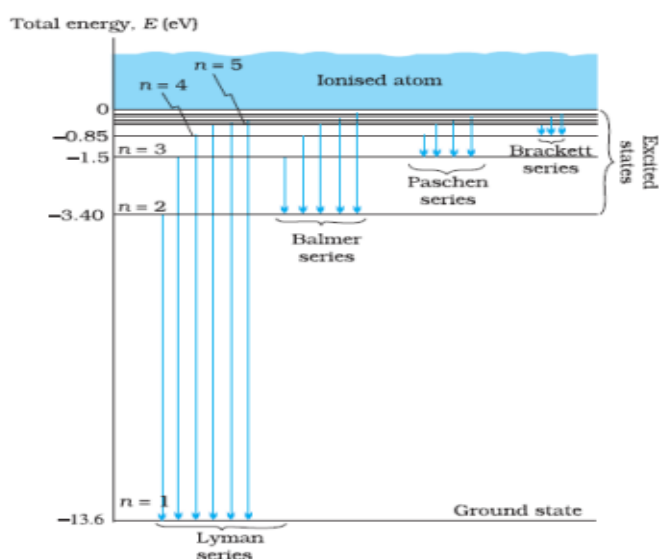


According to the third postulate of Bohr's model, when an atom makes a transition from the higher energy state with quantum number $n_i$ to the lower energy state with quantum number $n_f$ ($n_f < n_i$), the difference of energy is carried away by a photon of frequency $v$ such that $hv = En_i - En_f$. Since both $n_f$ and $n_i$ are integers, this immediately shows that in transitions between different atomic levels, light is radiated in various discrete frequencies. For hydrogen spectrum, the Balmer formula corresponds to $n_f = 2$ and $n_i = 3, 4, 5$ etc. The results of the Bohr's model suggested the presence of other series spectra for hydrogen atom–those corresponding to transitions resulting from $n_f = 1$ and $n_i = 2, 3$, etc; $n_f = 3$ and $n_i = 4, 5$, etc. and so on. Such series were identified in the course of spectroscopic investigations and are known as the Lyman, Balmer, Paschen, Brackett, and Pfund series. The electronic transitions corresponding to these series are shown in Fig. The various lines in the atomic spectra are produced when electrons jump from higher energy state to a lower energy state and photons are emitted. These spectral lines are called emission lines. But when an atom absorbs a photon that has precisely the same energy needed by the electron in a lower energy state to make transitions to a higher energy state, the process is called absorption. Thus, if photons with a continuous range of frequencies pass through a rarefied gas and then are analysed with a spectrometer, a series of dark spectral absorption lines appear in the continuous spectrum. The dark lines indicate the frequencies that have been absorbed by the atoms of the gas. The explanation of the hydrogen atom spectrum provided by Bohr's model was a brilliant achievement, which greatly stimulated progress towards the modern quantum theory.

(i) The series of spectrum when electron jumps from n = 5 to n = 3 is
　　(a) Lymen　　　　(b) Balmer　　　　　　(c) Paschen　　　(d) Bracket

(ii) Balmer series is obtained when electron transits from
      (a) n = 1,2,3, … to n = 5           (b) n = 3,4,5 … to n = 2
      (c) n = 1,2,3, … to n = 4           (d) n = 1,2,3, … to n = 6

(iii) From Fig. shown predict which series has waves of maximum frequency
      (a) Lymen       (b) Balmer       (c) Paschen       (d) Bracket

(iv) What is the maximum energy of photon in emission spectrum of hydrogen atom
      (a) 13.6 eV       (b) 1.36 eV       (c) 1.5 eV       (d) 1eV

**Question 84:**
A pure semiconductor germanium or silicon, free of every impurity is called intrinsic semiconductor. At room temperature, a pure semiconductor has very small number of current carriers (electrons and holes). Hence its conductivity is low.
When the impurity atoms of valance five or three are doped in a pure semiconductor, we get respectively n- type or p- type extrinsic semiconductor. In case of doped semiconductor ne nh=ni². Where ne and nh are the number density of electron and hole charge carriers in a pure semiconductor. The conductivity of extrinsic semiconductor is much higher than that of intrinsic semiconductor.

(i) Which of the following statements is not true?
      (a) The resistance of intrinsic semiconductor decreases with increase of temperature.
      (b) Doping pure Si with trivalent impurities gives p- type semiconductors.
      (c) The majority charges in n- type semiconductors are holes.
      (d) All of the above.

(ii) The impurity atoms with which pure Si should be doped to make a p- type semiconductor is
      (a) Phosphorus           (b) Boron
      (c) Arsenic               (d) Antimony

(iii) Holes are majority charge carriers in
      (a) Intrinsic semiconductors       (b) n – type semiconductor
      (c) p- type semiconductors        (d) Metals

(iv) At absolute zero, Si acts as
      (a) Non- metal           (b) Metal
      (c) Insulator           (d) None of these

**Question 85:**

p-n junction is a semiconductor diode. It is obtained by bringing p-type semiconductor in close contact with n-type semiconductor. A thin layer is developed at the p-n junction which is devoid of any charge carrier but has immobile ions. It is called depletion layer. At the junction a potential barrier appears which does not allow the movement of majority charge carriers across the junction in the absence of any biasing of the junction.

If p-side of p-n junction is connected to positive terminals of external battery and n-side is connected to negative terminal of external battery, then the p-n junction is said to be forward biased. If n-side of p-n junction is connected to positive terminals of external battery and p-side is connected to negative terminal of external battery, then the p-n junction is said to be reverse biased. The p-n junction offers low resistance when forward biased and high resistance when reverse biased.

(i) In the middle of depletion layer of reverse biased p- n junction, the
    (a) Electric field is zero
    (b) Potential is zero
    (c) Potential is maximum
    (d) Electric field is maximum

(ii) The current in the circuit shown in the figure is
    (a) 20 A
    (b) 2 x 10$^{-3}$ A
    (c) 200 A
    (d) 2 x 10$^{-4}$ A
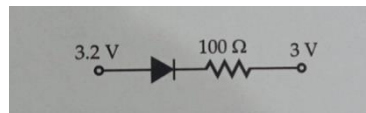


(iii) The number of majority carriers crossing the junction of diode depends
    (a) Concentration of doping impurities
    (b) Magnitude of potential barriers
    (c) Magnitude of the forward bias voltage
    (d) Rate of thermal generation of electron–hole pairs

(iv) In an unbiased p-n junction, holes diffuse from the p- region to the n- region
    (a) Free electron in the n-region attract them
    (b) They move across the junction due to potential difference
    (c) Hole concentration in p-region is more as compared to n-region
    (d) All of the above

**Question 86:**
From the V-I characteristic of a junction diode we see that it allows current to pass only when it is forward biased. So, if an alternating voltage is applied across a diode the current flows only in that part of the cycle when the diode is forward biased. This property is used to rectify alternating voltages and the circuit used for this purpose is called a rectifier. A semiconductor device is used as a rectifier that allows the voltage to flow in positive direction and very small value in the reverse direction.

If an alternating voltage is applied across a diode in series with a load, a pulsating voltage will appear across the load only during the half cycles of the ac input during which the diode is forward biased. Such rectifier circuit is called a half-wave rectifier.

The circuit using two diodes gives output rectified voltage corresponding to both the positive as well as negative half of the ac cycle. Hence, it is known as full-wave rectifier.

(i) The peak voltage in the output of a half wave rectifier fed with a sinusoidal signal without filter is 10 V. The d.c. component of the output voltage is

    (a) $10/\sqrt{2}$ V
    (b) $20/\pi$ V
    (c) 10 V
    (d) $10/\pi$ V

(ii) When a p-n junction diode is reverse biased then

    (a) No Current flows
    (b) The depletion region is increased
    (c) The depletion region is reduced
    (d) Height of potential barrier is reduced

(iii) Which device is used to convert AC into DC

    (a) Condenser
    (b) Amplifier
    (c) Rectifier
    (d) Modulator

(iv) In a full wave rectifier circuit operating from 50 Hz mains frequency, the fundamental frequency in the ripple would be

    (a) 50 Hz                    (b) 100 Hz
    (c) 25 Hz                    (d) 70.7 Hz

**INSTRUCTION**

For question numbers 87 to 91 two statements are given, one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below.
(a) Both A and R is true and R is the correct explanation of A.
(b) Both A and R is true but R is NOT the correct explanation of A.
(c) A is true but R is false.
(d) A is false and R is also false.

**Question 87:**
**(i) Assertion(A):** The Coulomb force between two-point charges depend upon the dielectric constant of the intervening medium.
**Reason(R):** Coulomb's force varies inversely with the dielectric constant of medium.

**(ii) Assertion (A):** Capacitance increase as the effective separation between the plates are increase.
**Reason (R):** Induced dipole moment per unit electric field, is called polarization.

**(iii) Assertion (A):** Electron Mobility defined as the drift velocity per unit electric field.
**Reason (R):** Electron mobility remains constant with change in temperature.

**(iv) Assertion(A):** Earthing provides a safety measure for electrical circuits and appliances.
**Reason(R):** When we bring a charged body in contact with the earth, all the excess charge on the body disappears by causing a momentary current to pass to the ground through the connecting conductor.

**(v) Assertion (A):** Resistance of a conductor increased with the rise in temperature.
**Reason (R):** frequency of collision of electrons with ions/atoms in the conductor increases with increases in temperature.

**Question 88:**
**(i) Assertion:** Photoelectric effect demonstrates the wave nature of light.
**Reason:** The no of photoelectrons is proportional to the frequency of light.

**(ii) Assertion:** When ultraviolet light is incident on a photocell, its stopping potential is $V_0$ and the maximum kinetic energy of the photoelectrons is $K_{max}$. When the ultraviolet light is replaced by X-rays, both $V_0$ and $K_{max}$ increase.
**Reason:** Photoelectrons are emitted with speeds ranging from zero to a maximum value because of the range of frequencies present in the incident light.

**(iii) Assertion:** According to Einstein's photoelectric equation, the plot of the kinetic energy of the emitted photoelectrons from a metal vs the frequency of the incident radiation gives a straight line whose slope is same for all metals and independent of intensity of radiation.
**Reason:** According to Einstein eqn =hf-work function, therefore slope =h. hence slope is same for all metals.

**(iv) Assertion:** In the process of photoelectric emission, all emitted electrons do not have same kinetic energy.
**Reason:** If the radiation falling on photosensitive surface of metal consists of different wavelength then energy acquired by the electrons absorbing photons of different wavelengths shall be different.

**(v) Assertion:** It is not possible to use $^{35}$Cl as the fuel for fusion energy.
**Reason:** The binding energy of $^{35}$Cl is too small.

**Question 89:**
**(i) Assertion:** $^{90}$Sr from the radioactive fall out from a nuclear bomb ends up in the bones of human beings through the milk consumed by them. It causes impairment of the production of red blood cells.
**Reason:** The energetics β -particles emitted in the decay of $^{90}$Sr damage the bone marrow.

**(ii) Assertion:** Neutrons penetrate matter more readily as compared to protons.
**Reason:** Neutrons are slightly more massive than protons.

**(iii) Assertion:** All the radioactive elements are ultimately converted in lead.
**Reason:** All the elements above lead are unstable.

**(iv) Assertion:** The mass of a nucleus less than the sum of the masses of nucleons present in it.
**Reason:** The whole mass of the atom is considered in the nucleus.

**(v) Assertion (A):** A Pure semiconductor has negative temperature coefficient of resistance.
**Reason (R):** On raising the temperature, more charge carriers are released, conductance increases and resistance decreases.

**Question 90:**
**(i) Assertion (A):** At a fix temperature, silicon will have a minimum conductivity when it has a smaller accepter doping.

**Reason (R):** The conductivity of and intrinsic semiconductor is slightly higher than of a lightly doped p-type.

**(ii) Assertion (A):** The electrons in the conduction band have higher energy than those in the valance band of a semi-conductor.
**Reason (R):** The conduction band lies above the energy gap and valance band lies below the energy gap.

**(iii) Assertion (A):** The energy gap between the valance band and conduction band is greater in silicon than a germanium.
**Reason (R):** Thermal energy produces fewer minority carriers in silicon than in germanium.

**(iv) Assertion (A):** Electron has higher mobility than hole in a semiconductor.
**Reason (R):** Mass of electron is less than the mass of hole.

**(v) Assertion (A):** An n type semiconductor has a large number of electrons but still it is electrically neutral.
**Reason (R):** A n type semiconductor is obtained by doping an intrinsic semiconductor with a pentavalent impurity.

**Question 91:**
**(i) Assertion (A):** V-I characteristic of p-n junction diode is same as that of any other conductor.
**Reason (R):** p-n junction diode does not obey Ohm's law.

**(ii) Assertion (A):** Silicon is preferred over germanium for making semiconductors device.
**Reason (R):** The energy gap for germanium is more than the energy gap of silicon.

**(iii) Assertion:** The resolving power of a telescope is more if the diameter of the objective lens is more.
**Reason:** Objective lens of large diameter collects more light.

**(iv) Assertion:** The optical instruments are used to increase the size of the image of the object.
**Reason:** The optical instruments are used to increase the visual angle

**(v) Assertion:** The focal length of an equiconvex lens of radius of curvature R made of material of refractive index $\mu = 1.5$, is R.
**Reason:** The focal length of the lens will be R/2.

# Answer Keys

| QN | (i) | (ii) | (iii) | (iv) | (v) | | QN | (i) | (ii) | (iii) | (iv) | (v) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | b | d | b | a | c | | 47 | b | a | c | b | a |
| 2 | a | b | b | b | a | | 48 | c | b | d | c | ■ |
| 3 | b | b | c | b | a | | 49 | a | a | a | a | ■ |
| 4 | b | a | b | b | c | | 50 | b | d | c | c | c |
| 5 | a | b | b | a | b | | 51 | a | d | a | a | a |
| 6 | c | a | c | c | c | | 52 | a | a | a | c | b |
| 7 | a | a | d | b | b | | 53 | b | b | b | d | a |
| 8 | c | c | d | a | c | | 54 | b | a | d | c | c |
| 9 | b | a | b | d | a | | 55 | b | a | b | b | d |
| 10 | b | a | c | b | c | | 56 | b | a | b | c | c |
| 11 | b | c | c | a | a | | 57 | d | a | b | b | d |
| 12 | b | a | d | a | d | | 58 | a | a | a | a | d |
| 13 | b | d | d | a | b | | 59 | d | b | c | c | b |
| 14 | b | b | b | a | b | | 60 | a | c | d | b | b |
| 15 | d | c | b | c | b | | 61 | c | a | b | a | b |
| 16 | d | c | d | b | c | | 62 | b | d | a | b | b |
| 17 | a | c | c | d | b | | 63 | c | d | a | c | b |
| 18 | b | a | a | c | c | | 64 | c | a | d | b | a |
| 19 | b | a | b | c | a | | 65 | a | c | c | a | a |
| 20 | c | a | b | d | d | | 66 | a | b | a | c | a |
| 21 | a | b | a | d | c | | 67 | b | c | c | d | ■ |
| 22 | b | c | c | d | a | | 68 | b | d | d | a | c |
| 23 | c | b | d | a | b | | 69 | a | a | b | c | d |
| 24 | d | b | c | d | b | | 70 | b | c | c | d | d |
| 25 | c | b | c | d | c | | 71 | a | a | b | b | b |
| 26 | c | b | c | a | b | | 72 | c | b | a | c | b |
| 27 | a | d | a | d | c | | 73 | c | b | a | d | c |
| 28 | b | c | d | c | d | | 74 | a | a | c | ■ | ■ |
| 29 | a | a | b | d | a | | 75 | a | b | c | d | c |
| 30 | d | a | d | c | b | | 76 | c | a | b | b | ■ |
| 31 | a | c | c | d | b | | 77 | d | a | b | a | ■ |
| 32 | b | c | b | a | c | | 78 | a | a | d | b | d |
| 33 | b | a | a | c | b | | 79 | a | b | c | b | ■ |
| 34 | d | b | c | d | a | | 80 | d | b | c | b | ■ |
| 35 | b | b | c | d | a | | 81 | b | b | a | a | ■ |
| 36 | b | d | d | c | c | | 82 | a | d | c | a | ■ |
| 37 | c | d | a | d | a | | 83 | c | b | a | a | ■ |
| 38 | d | a | d | d | a | | 84 | c | b | c | c | ■ |
| 39 | d | c | d | b | d | | 85 | c | c | d | c | ■ |
| 40 | c | d | c | a | c | | 86 | d | b | c | b | ■ |
| 41 | a | c | b | c | d | | 87 | a | d | c | a | a |
| 42 | a | d | b | c | ■ | | 88 | c | c | c | b | c |
| 43 | a | b | c | a | ■ | | 89 | a | b | c | c | a |
| 44 | c | c | b | d | ■ | | 90 | c | a | b | a | b |
| 45 | b | a | d | b | ■ | | 91 | d | c | a | d | c |
| 46 | b | d | c | a | ■ | | | | | | | |

# CCT Questions Class XII Chemistry

Chemistry is necessarily an experimental Science: its conclusions are drawn from data and its principles supported by evidence from facts.

**Michael Faraday**

**Question 1:**

Q1. The properties of the solutions which depend only on the number of solute particles but not on the nature of the solute are called colligative properties. Relative lowering in vapour pressure is also an example of colligative properties. For an experiment, sugar solution is prepared for which lowering in vapour pressure was found to be 0.061 mm of Hg. (vapour pressure of water at $20^0C$ is 17.5 mm of Hg).

Answer the following MCQs by choosing the most appropriate options:

(i) Relative lowering of vapour pressure for the given solution is-
  (a) 0.00348         (b) 0.061        (c) 0.122        (d) 1.75

(ii) Reema found out about a colligative property that depends on molarity not the molality. She asked her friend Seema about it. What would be Seema's answer?
  (a) Elevation of boiling point      (b) Osmotic pressure
  (c) Depression in freezing point   (d)Relative lowering of vapour pressure

(iii) What would happen to the vapour pressure of a solution in which a non-volatile solute is added?
  (a) it will decrease             (b) it will remain same
  (c) first decreases then increases     (d) it will increase

**Question 2:**

According to Henry's law "the mass of a gas dissolved per unit volume of the solvent at constant temperature is directly proportional to the pressure of the gas in equilibrium with the solution". Dalton during the same period also concluded independently that the solubility of a gas in a liquid solution depends upon the partial pressure of the gas. If we use the mole fraction of gas in the solution as a measure of its solubility, then Henry's law can be modified as "the partial pressure of the gas in the vapour phase is directly proportional to the mole fraction of the gas in the solution".

(a) Rohan was told by his teacher that there is a similarity between Raoult's law and Henry's law. What could be the possible explanation given to Rohan by the teacher?

(b) $K_H$ (K bar) values for $Ar(g)$, $CO_2(g)$, $HCHO(g)$ and $CH_4(g)$ are 40.39, 1.67, $1.83 \times 10^5$ and 0.413 respectively.

Arrange these gases in the order of their increasing solubility.

## Question 3:
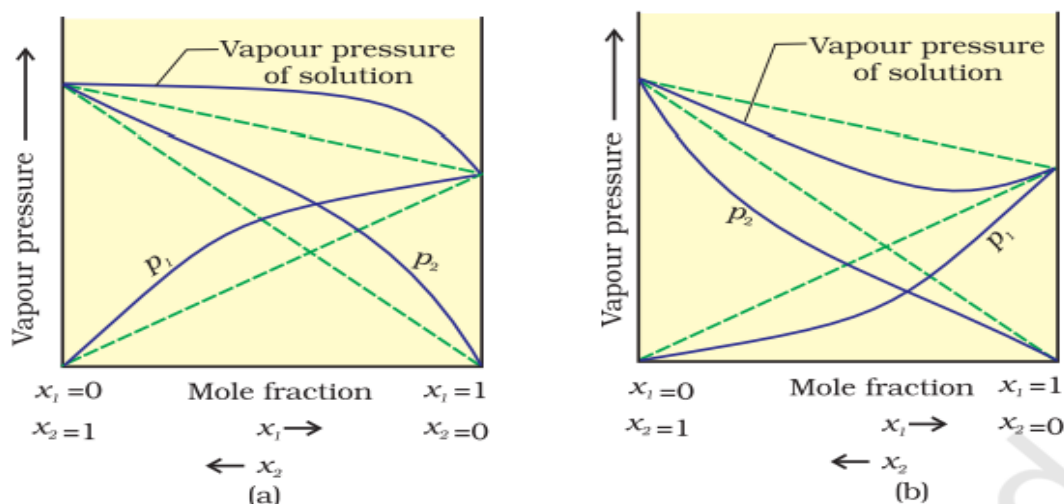


On the basis of above figure answer the questions that follow-

(i) When liquids X and Y are mixed, hydrogen bonding occurs. The solutions will show:

    a) Positive deviation from Raoult's law
    b) Negative deviation from Raoult's law
    c) No deviation from Raoult's law
    d) Slightly increase in volume

(ii) While doing experiments in lab Shyam found that the azeotropic mixture of water and HCl boils at $108.5^0C$ when the mixture is distilled. It is possible for Shyam to obtain:

    a) Pure HCl
    b) Pure water
    c) Pure water as well as pure HCl
    d) Neither HCl nor water in their pure states.

(iii) In a solution formed by adding carbon disulphide to acetone, the dipolar interactions between solute-solvent molecules are weaker than the respective interactions among the solute-solute and solvent-solvent molecules. Mention whether the solution will show positive or negative deviation from Raoult's law.

## Question 4:

According to many researches the decrease in freezing point directly correlated to the concentration of solutes dissolved in the solvent. This phenomenon is expressed as freezing point depression and it is useful for several applications such as freeze concentration of liquid food and to find the molar mass of an unknown solute in the solution.

(i) Assume three samples X, Y and Z have glucose as the only sugar present in them. The concentration of sample X, Y and Z are 0.1 M, 0.5 M and 0.2 M respectively. Freezing point will be highest for the sample-

  (a) X   (b) Y  (c) Z   (d) all have same freezing point

(ii) A solution will freeze when-
  (a) when its vapour pressure is greater than vapour pressure of pure solid
  (b) when its vapour pressure is less than vapour pressure of pure solid
  (c) when its vapour pressure is equal to the vapour pressure of pure solid
  (d) none of the above

(iii) The cryoscopic constant depends on-
  (a) nature of solvent
  (b) nature of solution
  (c) is independent of nature of solvent
  (d) none of the above

## Question 5:

| Solvent | b. p./K | $K_b$/K kg mol$^{-1}$ | f. p./K | $K_f$/K kg mol$^{-1}$ |
|---|---|---|---|---|
| Water | 373.15 | 0.52 | 273.0 | 1.86 |
| Ethanol | 351.5 | 1.20 | 155.7 | 1.99 |
| Cyclohexane | 353.74 | 2.79 | 279.55 | 20.00 |
| Benzene | 353.3 | 2.53 | 278.6 | 5.12 |
| Chloroform | 334.4 | 3.63 | 209.6 | 4.79 |
| Carbon tetrachloride | 350.0 | 5.03 | 250.5 | 31.8 |
| Carbon disulphide | 319.4 | 2.34 | 164.2 | 3.83 |
| Diethyl ether | 307.8 | 2.02 | 156.9 | 1.79 |
| Acetic acid | 391.1 | 2.93 | 290.0 | 3.90 |

Answer the following questions as per the above table-

(a) Mention the solvent which has maximum value for cryoscopic constant.

(b) Mention the solvent which has the minimum value of $K_b$.

(c) From the above table find out the solvent which has cryoscopic constant value less than acetic acid but greater than ethanol.

**Question 6:**

Osmotic pressure is a colligative property as it depends on the number of solute molecules and not on their identity. For dilute solutions, it has been found experimentally that osmotic pressure is proportional to the molarity, C of the solution at a given temperature T.
Consider the figure and mark the correct option.
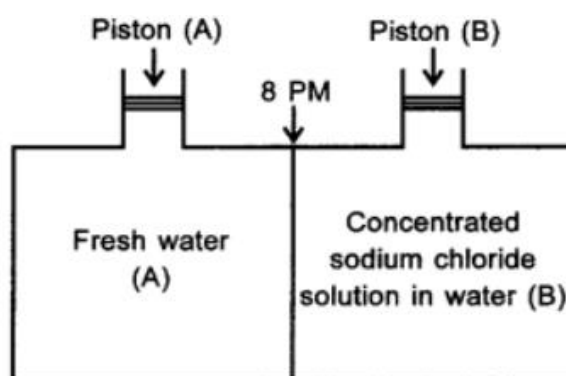


(a) water will move from side (A) to side (B) if a pressure lower than osmotic pressure is applied on piston (B).
(b) water will move from side (B) to side (A) if a pressure greater than osmotic, pressure is applied on piston (B).
(c) water will move from side (B) to side (A) if a pressure equal to osmotic pressure is applied on piston (B).
(d) water will move from side (A) to side (B) if pressure equal to osmotic pressure is applied on piston (A).

**Question 7:**

A raw mango placed in concentrated salt solution loses water via osmosis and shrivel into pickle. Wilted flowers revive when placed in fresh water. A carrot that has become limp because of water loss into the atmosphere can be placed into the water making it firm once again. Water will move into its cells through osmosis. When placed in water containing less than 0.9% (mass/ volume) salt, blood cells swell due to flow of water in them by osmosis.

(a) People taking a lot of salt or salty food suffer from puffiness or oedema. What is the reason behind this?
(b) The preservation of meat by salting and of fruits by adding sugar protects against bacterial action. How?
(c) Why the direction of osmosis gets reversed if a pressure larger than the osmotic pressure is applied to the solution side?

## Question 8:

Molecules of ethanoic acid (acetic acid) dimerise in benzene due to hydrogen bonding. This normally happens in solvents of low dielectric constant. In this case the number of particles is reduced due to dimerization. It can be undoubtedly stated here that if all the molecules of ethanoic acid associate in benzene, then $\Delta T_b$ or $\Delta T_f$ for ethanoic acid will be half of the normal value. Such a molar mass that is either lower or higher than the expected or normal value is called as abnormal molar mass.

(a) In case of association, value of 'i' is less than unity while for dissociation it is greater than unity. What will be the value of i for aqueous KCl?

(b) How can i be calculated when the values of normal and abnormal molar mass is given?

## Question 9:

On the basis of following figures, answer the questions that follow-
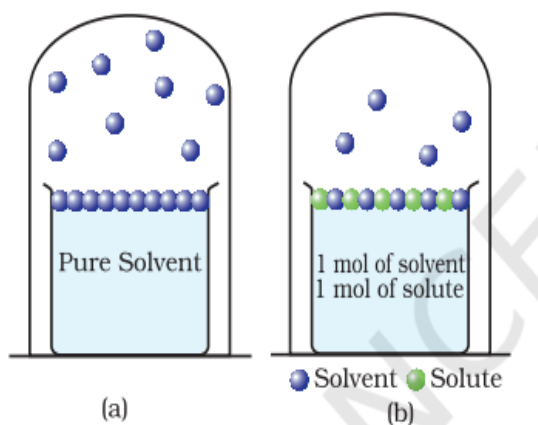


(a) In which case vapour pressure will be more?

(b) Decrease in the vapour pressure of water by adding 1.0 mol of sucrose to one kg of water is nearly similar to that produced by adding 1.0 mol of urea to the same quantity of water at the same temperature. How?

**Question 10:**

On the basis of given figure answer the questions that follow-
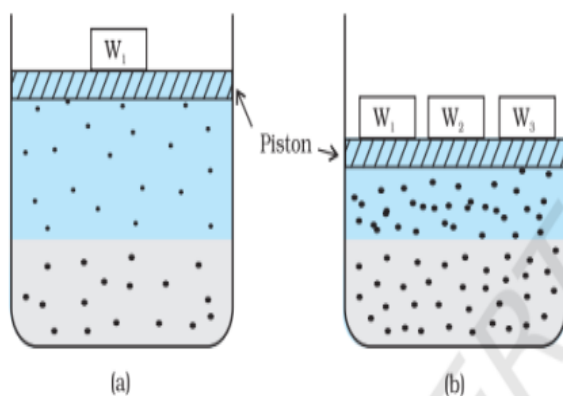


(a) In which of the above two figures, solubility of gas is more and why?
(b) The solubility of a gas in a liquid is directly proportional to the partial pressure of the gas present above the surface of liquid or solution provided the temperature should remain-

    (i) same                      (ii) should increase
    (iii) should decrease         (iv) none of the above

(c) What would happen if the pressure applied is increased on the vessel?

**Question 11:**
Electrolysis is the process by which electric current is passed through a substance to effect a chemical change. The chemical change is one in which the substance loses or gains an electron (oxidation or reduction). The process is carried out in an electrolytic cell, an apparatus consisting of positive and negative electrodes held apart and dipped into a solution containing positively and negatively charged ions. The substance to be transformed may form the electrode, may constitute the solution, or may be dissolved in the solution. Electric current (i.e., electrons) enters through the negatively charged electrode (cathode); positively charged components of the solution travel to this electrode, combine with the electrons, and are transformed to neutral elements or molecules. The negatively charged components of the solution travel to the other electrode (anode), give up their electrons, and are transformed into neutral elements or molecules. If the substance to be transformed is the electrode, the reaction is generally one in which the electrode dissolves by giving up electrons.

Q.1.Faraday's law of electrolysis is related to
    (a) Atomic number of cation           (b) Speed of cation
    (c) Speed of anion.                  (d) Equivalent weight of electrolyte

Q.2.How long would it take to deposit 50 g of Al from an electrolytic cell containing $Al_2O_3$ using a current of 105 ampere
(a) 1.54 h            (b) 1.42 h            (c) 1.32 h            (d) 2.15 h

Q.3.The charge required for reducing 1 mole of $MnO^{-4}$ to $Mn^{2+}$ is ----
(a) $1.93 \times 10^5$ C                    (b) $2.895 \times 10^5$ C
(c) $4.28 \times 10^5$ C                    (d) $4.825 \times 10^5$ C

Q.4.How much electricity in in terms of Faraday is required to produce 100g of Ca from molten $CaCl_2$?
(a) 1F            (b) 2F            (c) 3F            (d) 5F

Q.5.If a current of 1.5 ampere flows through a metallic wire for 3 hours, then how many electrons would flow through the wire?
(a) $2.25 \times 10^{22}$ electrons                (b) $1.13 \times 10^{23}$ electrons
(c) $1.01 \times 10^{23}$ electrons                (d) $4.5 \times 10^{23}$ electrons

Q.6.How many coulombs of electricity is required to reduce 1 mole of $Cr_2O_2^{-7}$ in acidic medium?
(a) $4 \times 96500$ C                    (b) $6 \times 96500$ C
(c) $2 \times 96500$ C                    (d) $1 \times 96500$ C

**Question 12:**
Read the passage given below and answer the following questions
Galvanic cell → A galvanic cell is an electrochemical cell that converts the chemical energy of a spontaneous redox reaction into electrical energy.

Working of galvanic cell →It involves a chemical reaction that makes the electric energy available. During a redox reaction, a galvanic cell utilizes the energy transfer between electrons to convert chemical energy into electric energy.  In a Galvanic cell, the following reaction occurs-
$$Zn(s)  +  Cu^{2+}(aq)  →  Zn^{2+}(aq) + Cu(s)$$
Galvanic cell utilizes the ability to separate the flow of electrons in the process of oxidization and reduction. This flow of electrons is essentially called a current. Such current can be made to flow through a wire to complete a circuit and obtain its output in any device such as a television or a watch.
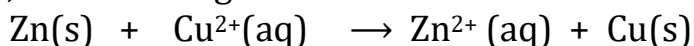
A galvanic cell can be made out of any two metals. These two metals can form the anode and the cathode if left in contact with each other. This combination allows the galvanic corrosion of that metal which is more anodic. A connecting circuit shall be required to allow this corrosion to take place. E.g.- In this cell, there is a container in which a solution of concentrated Copper Sulphate ($CuSO_4$) is kept inside it and a copper rod is inserted inside the solution of $CuSO_4$ which act like cathode. Inside this, the container a porous container is kept in which concentrated

Sulphuric Acid ($H_2SO_4$) is filled in which a zinc rod is inserted in it which acts as an anode. Thus, when a wire is connected through the copper rod and zinc rod an electric current starts to flow.

Q.1. Fused NaCl on electrolysis gives …………. on cathode.
(a) Chlorine.
(b) Sodium.
(c) Sodium amalgam.
(d) Hydrogen

Q.2. The standard electrode potentials for the half cell reactions are:
$Zn \rightarrow Zn^{2+} + 2e^-$  $E° = - 0.76$ V
$Fe \rightarrow Fe^{2+} + 2e^-$  $E° = -0.41$ V
The emf of the cell reaction   $Fe^{2+} + Zn \rightarrow Zn^{2+} + Fe$ is ----
(a) -0.35 V
(b) +0.35 V
(c) -1.17 V
(d) +1.17 V
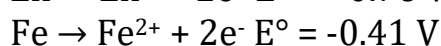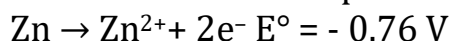
Q.3. Which of the following is a secondary cell?
(a) Leclanche cell
(b) Lead storage battery
(c) Concentration cell
(d) All of these

Q.4. Fo a certain redox reaction, E° is positive. This means that
(a) $\Delta G°$ is positive, K is greater than 1.
(b) $\Delta G°$ is positive, K is less than 1
(c) $\Delta G°$ is negative, K is greater than 1.
(d) $\Delta G°$ is negative, K is less than 1

Q.5. Cell reaction is spontaneous, when
(a) $E^0$ red is negative
(b) $\Delta G°$ is negative
(c) $E^0$ oxidation is Positive
(d) $\Delta G°$ is positive

Q.6. Equilibrium constant K is related to $E^0_{cell}$ and not $E_{cell}$ because
(a) $E^0_{cell}$ is easier to measure than $E_{cell}$
(b) $E_{cell}$ becomes zero at equilibrium point but E0cell remains constant under all conditions
(c) at a given temperature, $E_{cell}$ changes hence value of K can't be measured
(d) any of the terms $E_{cell}$ or $E^0_{cell}$ can be used

**Question 13:**
Read the given passage and answer the questions that follow:
Electrochemistry plays a very important part in our daily life. Primary cells like dry cell is used in torches, wall clock, mercury cell is used in hearing aids, watches. Secondary cells Ni–Cd cell is used in cordless phones, lithium battery is used in mobiles, lead storage battery is used in vehicle and inverter. Fuel cells like $H_2$—$O_2$ cell was used in apollo space programme. A 38% solution of sulphuric and is used in lead storage battery. Its density is 1.30 g $mL^{-1}$. The battery holds 3.5 L of the acid.

During the discharge of the battery, the density of $H_2SO_4$ falls to 1.14 g mL$^{-1}$ (20% solution by mass) (Molar mass of $H_2SO_4$ is 98 g mol$^{-1}$).

(a) Write the chemical reaction taking place at anode when lead storage battery is in use.
(b) How much electricity in Faraday is required to carry out the reduction of one mole of $PbO_2$?
(c) What is molarity of sulphuric acid before discharge?
(d) What is mass of sulphuric acid in solution after discharge?
(e) Write the products of electrolysis when dilute sulphuric acid is electrolysed using platinum electrodes.

## Question 14:

Read the passage given below and answer the following questions 1-5
The Daniell cell is a kind of zinc-copper battery previously widely used in the European telegraph industry. A typical Daniell cell contains a salt bridge connecting the anode electrode of a zinc sulphate solution and an immersed zinc plate, as well as the cathode electrode of a copper sulphate solution and an immersed copper plate. A porous barrier exists between the metals. When discharged, the zinc anode is oxidized according to equation 1.

$$Zn(s) \rightarrow Zn^{2+}(aq) + 2e^-$$
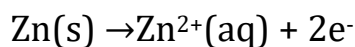
Simultaneously, the copper cathode reduced according to equation 2.

$$Cu^{2+}(aq) + 2e^- \rightarrow Cu(s)$$
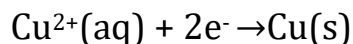
Owing to the serious self-discharge and inability to be recharged, the Daniell cell was replaced by modern rechargeable battery technologies. Modern solutions include the lead-storage battery developed in 1859 and the nickel-cadmium battery developed in 1909. The half-reactions of a discharging lead-storage battery are expressed by equations 3 and 4.

$$Pb_{(s)} + HSO_4^-{}_{(aq)} \rightarrow PbSO_{4(s)} + H^+ + 2e^- \ (E°_{reduction} = -0.36V)$$

$$PbO_{2(s)} + SO_4^{2-}{}_{(aq)} + 4H^+ + 2e^- \rightarrow PbSO_{4(s)} + 2H_2O \ (E°_{reduction} = 1.69\ V)$$
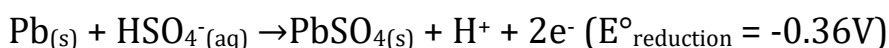
Q.1: What is the net reaction occurring in the Daniell cell as it discharges?

A) $Zn_{(s)} + Cu^{2+}{}_{(aq)} \rightarrow Zn^{2+}{}_{(aq)} + Cu_{(s)}$

B) $Zn^{2+}{}_{(aq)} + Cu_{(s)} \rightarrow Zn_{(s)} + Cu^{2+}{}_{(aq)}$

C) $Zn_{(aq)} + Cu^{2+}{}_{(aq)} \rightarrow Zn^{2+}{}_{(s)} + Cu_{(s)}$

D) $Zn^{2+}{}_{(s)} + Cu_{(s)} \rightarrow Zn_{(s)} + Cu^{2+}{}_{(s)}$

Q.2: What is the reaction quotient for the overall reaction when the Daniell cell is discharging?

A) $Q = [Zn^{2+}][Cu] / [Zn][Cu^{2+}]$

B) $Q = [Zn^{2+}]/[Cu^{2+}]$

C) $Q = [Zn][Cu^{2+}] / [Zn^{2+}][Cu]$

D) $Q = [Zn^{2+}]/[Zn]$

Q.3: Which of the following accurately describes the processes occurring in a lead-storage battery

A) When discharging, both electrodes are identical

B) When discharging, the anode consists of elemental lead and the cathode consists of lead (IV) oxide

C) When discharging, the anode consists of lead (IV) oxide and the cathode consists of elemental lead

D) The electrodes are placed in a solution of potassium hydroxide

Q.4: Which of the following accurately characterizes a nickel-cadmium battery?

A) When completely discharged, the two electrodes are identical

B) When discharging, the anode consists of elemental cadmium and the cathode consists of elemental nickel

C) To recharge the battery, it must function as an electrolytic cell

D) The electrodes are in a solution of sulphuric acid

Q.5: What is the electromotive force of a discharging lead-storage battery?

A) -1.33 V          B) 1.33 V          C) -2.05 V          D) 2.05 V

**Question 15:**
Read the passage given below and answer the following questions

Both conductivity and molar conductivity changes with the concentration. Conductivity always decreases with concentration for both weak and strong electrolytes. This is because the no of ions per unit volume that carry the current in solution decreases on dilution. Molar conductivity decreases with increase in concentration. This is because the total volume V of solution containing one mole of electrolyte also increases. Molar conductivity can be defined as the conductance of the electrolyte solution kept between the electrodes of a conductivity cell at unit distance but having large area of cross section large enough to accommodate sufficient volume of solution that contains one mole of electrolyte. For strong

electrolytes molar conductivity increases slowly and reaches maximum value. For weak electrolytes. it increases sharply with dilution and reaches maximum value.

A statement and reason are given below. Choose the correct answer from the option given below.
 a) Both assertion and reason are correct and reason is the correct explanation of the assertion
 b) Both assertion and reason are correct and reason is not the correct explanation of the assertion
 c) Assertion is correct but reason is incorrect
 d) Assertion is wrong Reason is correct.

**1)Assertion:** conductivity of strong electrolytes decreases with increase in concentrations
**Reasons:** No. of ions per unit volume decreases with dilution
**2) Assertion:** Molar conductance is the conductance offered by one molar solution
**Reason:** Decrease in conductance on dilution of a solution is more than compensated by the increased volume.
**3) Assertion:** Molar conductivity increases with decrease in concentration of the electrolyte.
**Reason:** On decreasing the conc, the ions move faster as inter ionic interaction decreases.
**4) Assertion:** For weak electrolytes molar conductivity increases sharply and reaches a maximum value.
**Reason:** Degree of dissociation increases and more ions are produced.
**5) Assertion:** The molar conductivity of strong electrolyte is high when compared to weak electrolytes. At a particular concentration.
**Reason:** For strong electrolytes almost, complete dissociation takes place in aqueous medium.

## Question 16:

Read the passage given below and answer the following questions
A Galvanic cell is made up of two electrodes anode and cathode, i.e., two half cells. One of these electrodes must have a higher electrode potential (higher tendency to lose electrons) than the other electrode. As a result of this potential difference, the electrons flow from an electrode at a higher potential to the electrode at a lower

potential. There is a difference between electromotive force and potential difference.

Q.1. In a Galvanic cell, the potential difference and emf are respectively measured by
(A) Ammeter and calorimeter          (B) Ammeter and Voltmeter
(C) Voltmeter and potentiometer       (D)Potentiometer and Voltmeter

Q.2. In a galvanic cell
(A) the flow of electron is from anode (negative zinc electrode) towards cathode (positive copper electrode)
(B) the flow of electron is from cathode (positive copper electrode) towards anode (negative zinc electrode)
(C) the electric current flows from anode to cathode.
(D)the electrons are transferred from the oxidizing agent to the reducing agent.

Q.3. In a Galvanic cell
(A)According to IUPAC convention, electrode potentials are expressed as standard oxidation potential.
(B) standard electrode potential can be measured experimentally.
(C) Oxidation potential is the tendency to release electrons.
(D) the electrode potential values represent the standard reduction potential, standard oxidation potential will have the same values but with opposite sign

Q.4. Which of the following is not true about the electrode potential?
(A) Electrode potential depends on the nature of the metal.
(B) Electrode potential is an extensive property.
(C) Electrode potential depends on the concentration of the ions in solution.
(D) Electrode potential depends on the temperature.

**Question 17:**

The standard electrode potentials are very important and we can extract a lot of useful information from them. If the standard electrode potential of an electrode is greater than zero then its reduced form is more stable compared to hydrogen gas. Similarly, if the standard electrode potential is negative then hydrogen gas is more stable than the reduced form of the species. It can be seen that the standard electrode potential for fluorine is the highest in the Table indicating that fluorine gas ($F_2$) has the maximum tendency to get reduced to fluoride ($F^-$) and therefore fluorine gas is the strongest oxidizing agent and fluoride ion is the weaker reducing agent. Lithium has the lowest electrode potential indicating that lithium metal is the most powerful reducing agent in an aqueous solution.

Q.1. A negative $E_0$ means that
(A) the redox couple is a stronger reducing agent.
(B) the redox couple is a stronger oxidizing agent.
(C) the redox couple is a weak reducing agent.
(D) the reaction is spontaneous in the forward direction.

Q.2. Standard Electrode Potential is _____
(A) the reduction potential of a molecule under specific and standard conditions.
(B) extensive property.
(C) measured by calorimeter.
(D) oxidation potential.

Q.3. The standard hydrogen electrode can be represented as
(A) Pt (s) / $Pt^{+2}$ (aq) / $H_2$ (g) / $H^+$ (aq.)
(B) Pt (s) / $H_2$ (g, 1 bar) / $H^+$ (aq, 1M)
(C) Pt (s) / $H_2$ (g, 2 bar) / $H^+$ (aq, 1M)
(D) Pt (s) / $H_2$ (g, 4 bar) / $H^+$ (aq, 2M)

Q.4. $E^0 Mg^{+2}/Mg$ = -2.36 V, $E^0 Ag^+/Ag$ = 0.80 V. The $E^0_{cell}$ is _____
(A) -3.16 V      (B) -1.56 V      (C) 2.3 V      (D) 3.16 V

**Question 18:**
All chemical reaction involved interaction of atoms and molecules. A large number of atoms/ molecules are present in a few grams of any chemical compound varying with their atomic/molecular masses. To handle such large number conveniently, the mole concept was introduced. All electrochemical cell reactions are also based on mole concept. For example, a 4.0 molar aqueous solution of NaCl is prepared and 500 ml of this solution is electrolyzed. This leads to the evolution of chlorine gas at one of the electrodes. The amount of products formed can be calculated by using mole concept.

Q.1. The total number of moles of chlorine gas evolved is
(a)0.5          (b)1.0          (c) 1.5          (d)1.9

Q.2. If cathode is a Hg electrode, then the maximum weight of amalgam formed from this solution is
(a) 300g          (b) 446g          (c) 396g          (d) 256g

Q.3.The total charge (coulomb) required for complete electrolysis is
(a) 186000          (b) 24125          (c) 48296          (d)193000

Q.4. In the electrolytes, the number of moles of electrons involved are
(a) 2                     (b) 1                     (c) 3                     (d) 4

Q.5. In electrolysis of aqueous NaCl solution when Pt electrode is taken, then which gas is liberated at cathode?
(a) $H_2$                 (b) $Cl_2$                (c) $O_2$                 (d) None of these

**Question 19:**
Read the passage given below and answer the following questions
Kohlrausch Law refers to an electrolyte's limiting molar conductivity to its constituent ions. It indicates that an electrolyte's limiting molar conductivity is equal to the sum of the individual limiting molar conductivities of the cations and anions that make up the electrolyte.
The Kohlrausch Law of Independent Migration is another name for this law. The Kohlrausch law and its applications are crucial in the study of dilute liquids as well as electrochemical cells. Among other essential uses, this law is utilised to determine the limiting conductivity of a weak electrolyte.

Q.1. Equivalent conductance of a strong electrolyte increases on dilution due to
        (a) An increase in the number of ions and the ionic mobility of solution
        (b) Complete dilution of the electrolyte at standard dilution
        (c) An increase in the ionic mobility of solution
        (d) None of the above

Q.2. The molar conductivity of an ionic solution depends on
(a) Concentration of electrolytes in solution        (b) Distance between electrodes
(c) Surface area of electrodes                       (d) None of the above

Q.3. The molar conductance of a solution _____ with dilution while its specific conductance _____ with dilution.
(a) Decreases, Increases                             (b) Increases, Decreases
(c) Decreases, Decreases                             (d) Increases, Increases

Q.4. Kohlrausch's law states that at
        (a) Infinite dilution, the equivalent conductivity of an electrolyte is equivalent to the sum of the conductance of the cations and anions
        (b) Finite dilution, the equivalent conductivity of an electrolyte is equivalent to the sum of the conductance of the cations and anions.
        (c) Both (a) and (b)
        (d) None of the above

Q.5. Which of the following statements is correct for an electrolytic solution upon dilution?

     (a) Conductivity increases on dilution

     (b) Conductivity decreases on dilution

     (c) Molar conductance decreases, but equivalent conductance increases on dilution

     (d) Molar conductance increases, but equivalent conductance decreases on dilution

## Question 20:

Read the passage given below and answer the following questions

Metallic conductance involves movement of electrons whereas electrolytic conductance involves movement of ions. Specific conductance increases with increase in concentration where as Λm (molar conductivity) decreases with increase in concentration. Electrochemical cell converts chemical energy of redox reaction into electricity. Mercury cell, Dry cells are primary cells whereas Ni—Cd cell, lead storage battery are secondary cells. Electrochemical series is arrangement of elements in increasing order of their reduction potential. Electrolytic cell converts electrical energy into chemical energy which is used in electrolysis. Amount of products formed are decided with the help of Faraday's laws of Electrolysis. Kohlrausch law helps to determine limiting molar conductivity of weak electrolyte, their degree of ionisation (a) and their dissociation constants. Corrosion is electrochemical phenomenon. Metal undergoing corrosion acts as anode, loses electrons to form ions which combine with substances present in atmosphere to form surface compounds. More reactive metals are coated over less reactive metals to prevent corrosions. $H_2$—$O_2$ fuel cell was used in Apollo space programme.

(a) Out of 0.5 M, 0.01 M, 0.1 M and 1.0 M which solution of KCl will have highest value of specific conductance? Why?

(b) Write the product of electrolysis of aq. NaCl on cathode. Why?

(c) When does electrochemical cell behaves like electrolytic cell?

(d) For an electrochemical cell $Mg(s) + 2Ag^+(aq) \rightarrow 2Ag(s) + Mg^{2+}$. Give the cell representation and write Nernst equation.

(e) Which will have higher conductance, silver wire at 30° or at 60°C?

(f) Calculate maximum work obtained from the cell

     $Ni(s) + 2Ag^+(aq) \rightarrow Ni^{2+}(aq) + 2Ag(s)$     $E°_{cell}$ = 1.05V

(g) Which cell is used in hearing aids and watches?

**Question 21:**

Half-life of a first-order reaction is used to calculate how long the reaction of radioactive decay had been occurring. Because nuclear decay reactions follow first-order kinetics and have a rate constant that is independent of temperature and the chemical or physical environment, we can perform similar calculations using the half-lives of isotopes to estimate the ages of geological and archaeological artefacts. The techniques that have been developed for this application are known as carbon dating techniques. The most common method for measuring the age of ancient objects is *carbon-14 dating*. The carbon-14 isotope, created continuously in the upper regions of Earth's atmosphere, reacts with atmospheric oxygen or ozone to form $^{14}CO_2$. As a result, the $CO_2$ that plants use as a carbon source for synthesizing organic compounds always includes a certain proportion of $^{14}CO_2$ molecules as well as nonradioactive $^{12}CO_2$ and $^{13}CO_2$. Any animal that eats a plant ingests a mixture of organic compounds that contains approximately the same proportions of carbon isotopes as those in the atmosphere. When the animal or plant dies, the carbon-14 nuclei in its tissues decay to nitrogen-14 nuclei by a radioactive process known as *beta decay*, which releases low-energy electrons (β particles) that can be detected and measured.

The half-life of a reaction is the time required for the reactant concentration to decrease to one-half its initial value. The half-life of a first-order reaction is a constant that is related to the rate constant for the reaction.

Given below are two statements labelled as Assertion (A) and Reason (R)

Select the most appropriate answer from the options given below

(a) Both A and R are true and R is the correct explanation of A

(b) Both A and R are true but R is not the correct explanation of A.

(c) A is true but R is false.

(d) A is false but R is true.

Q.**1. Assertion (A):** Half-life period of a reaction of first order is independent of initial concentration.
**Reason (R):** Half-life period for a first order is … $t_{1/2}=0.693/k$

Q.**2. Assertion (A):** The half-life of a radioactive isotope is equal to $0.693/\lambda$.
   **Reason (R):** Radioactivity is a first order reaction.

**Choose the correct option:**

Q.3. After the third half-life, how much sample is left?

(a) ½

(b)1/3

(c)1/16

(d)1/8

Q.4. The rate constant of a reaction depends upon
(a) temperature of the reaction
(b) extent of the reaction
(c) initial concentration of the reactants
(d) the time of completion of reaction

## Question 22:

Molecularity is the number of molecules that come together to react in an elementary(single step) reaction and is equal to the sum of stoichiometric coefficients of reactants in the elementary reaction with effective collision (sufficient energy) and correct orientation. Depending on how many molecules come together, a reaction can be unimolecular, bimolecular or even trimolecular.

The kinetic order of any elementary reaction or reaction step is equal to its molecularity, and the rate equation of an elementary reaction can therefore be determined by inspection, from the molecularity.

The kinetic order of a complex (multistep) reaction, however, is not necessarily equal to the number of molecules involved. The concept of molecularity is only useful to describe elementary reactions or steps. The order of reaction is an emperical quantity determined by experiment from the rate law of the reaction. It is the sum of the exponents in the rate law equation. Molecularity, on the other hand, is deduced from the mechanism of an elementary reaction, and is used only in context of an elementary reaction.

Decomposition reaction of HI gives $H_2$ and $I_2$

$2HI \rightarrow H_2 + I_2$ ; rate = k $[HI]^2$ ; order of reaction = 2

In general, the molecularity of simple reactions is equal to the sum of the number of molecules of reactants involved in the balanced stoichiometric equation. Molecularity of a reaction is always in the whole number. It is never fractional. Molecularity is a theoretical concept. Molecularity cannot be greater than three because more than three molecules may not mutually collide with each other.

Some examples are:
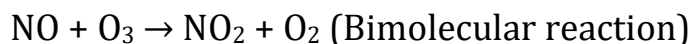
$PCl_5 \rightarrow PCl_3 + Cl_2$ (Unimolecular reaction)

$NO + O_3 \rightarrow NO_2 + O_2$ (Bimolecular reaction)

$2SO_2 + O_2 \rightarrow 2SO_3$ (Trimolecular reaction)

Given below are two statements labelled as Assertion (A) and Reason (R)

Select the most appropriate answer from the options given below

(a) Both A and R are true and R is the correct explanation of A

(b) Both A and R are true but R is not the correct explanation of A.

(c) A is true but R is false.

(d) A is false but R is true.

Q.1. **Assertion (A):** Molecularity has no meaning for a complex reaction.

   **Reason (R):** The overall molecularity of a complex reaction is equal to the molecularity of the slowest step.

Q.2. **Assertion (A):** If in a zero-order reaction, the concentration of the reactant is doubled, the half-life period is also doubled.

   For a zero-order reaction, the rate of reaction is independent of initial concentration.

Q.3. **Assertion (A):** Order and molecularity are same.

   **Reason (R):** Order is determined experimentally and molecularity is the sum of the stoichiometric coefficient of rate determining elementary step.

Q.4. **Assertion (A):** Order of the reaction can be zero or fractional.

   **Reason (R):** We cannot determine order from a balanced chemical equation.

**Question 23:**
The reaction rate or rate of reaction is the speed at which a chemical reaction takes place, defined as proportional to the increase in the concentration of a product per unit time and to the decrease in the concentration of a reactant per unit time. Reaction rates can vary dramatically. For example, the oxidative rusting of iron under Earth's atmosphere is a slow reaction that can take many years, but the combustion of cellulose in a fire is a reaction that takes place in fractions of a second. For most reactions, the rate decreases as the reaction

proceeds. A reaction's rate can be determined by measuring the changes in concentration over time.

The rate of reaction or reaction rate is the speed at which reactants are converted into products. When we talk about chemical reactions, it is a given fact that rate at which they occur varies by a great deal. Some chemical reactions are nearly instantaneous, while others usually take some time to reach the final equilibrium. The average reaction rate remains constant for a given time period so it can certainly not give any idea about the rate of reaction at a particular instant.

This is where the instantaneous rate of reaction comes into the picture. Instantaneous rate of reaction is the rate at which the reaction is proceeding at any given time. The unit of rate of reaction is given by concentration/time that is (mol/L)/sec.

Given below are two statements labelled as Assertion (A) and Reason (R)

Select the most appropriate answer from the options given below

(a) Both A and R are true and R is the correct explanation of A

(b) Both A and R are true but R is not the correct explanation of A.

(c) A is true but R is false.

(d) A is false but R is true.

Q.1. **Assertion (A):** Instantaneous rate of reaction is equal to dx/dt

   **Reason (R):** It is the rate of reaction at any particular instant of time.

Q.2. **Assertion (A):** Instantaneous rate is used to predict the rate of reaction at a particular moment of time.

   **Reason (R):** Average rate is constant for the time interval for which it is calculated.

Q.3. **Assertion (A):** The rate of reaction is the rate of change of concentration of reactant or a product.

   **Reason (R):** The rate of reaction remains constant during the course of reaction.

Q.4. **Assertion (A):** In a chemical reaction the rate of reaction always decreases with time.

   **Reason (R):** In a chemical reaction the amount of reactant remaining always decreases with time.

**Question 24:**

The constant k is the reaction rate constant or rate coefficient of the reaction. Its value may depend on conditions such as temperature, ionic strength, surface area of an adsorbent, or light irradiation.

The integrated rate equations can be fitted with kinetic data to determine the order of a reaction. The integrated rate equations for zero, first and second order reactions are:

Zero order: $[A] = - kt + [A]_0$

First order: $\log [A] = -kt/2.303 + \log [A]_0$

Second order: $1/[A] = kt + 1/[A]_0$

These equations can also be used to calculate the half-life periods of different reactions, which give the time during which the concentration of a reactant is reduced to half of its initial concentration, i.e. at time $t_{1/2}$; $[A] = [A]_0/2$

Q.1 The decomposition of nitrogen pentoxide:

$2N_2O_5 (g) ----\rightarrow 4NO_2 (g) + O_2 (g)$
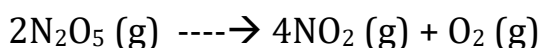
Is a first order reaction. The plot of $\log [N_2O_5]$ vs time (min) has slope = - 0.01389. the rate constant k is

- (a) $1.389 \times 10^{-2}$ min$^{-1}$
- (b) $3.2 \times 10^{-2}$ min$^{-1}$
- (c) $6.03 \times 10^{-3}$ min$^{-1}$
- (d) $71.99$ min$^{-1}$

Q.2 For a second order reaction, the correct plot of $t_{1/2}$ vs $1/[A]_0$ is
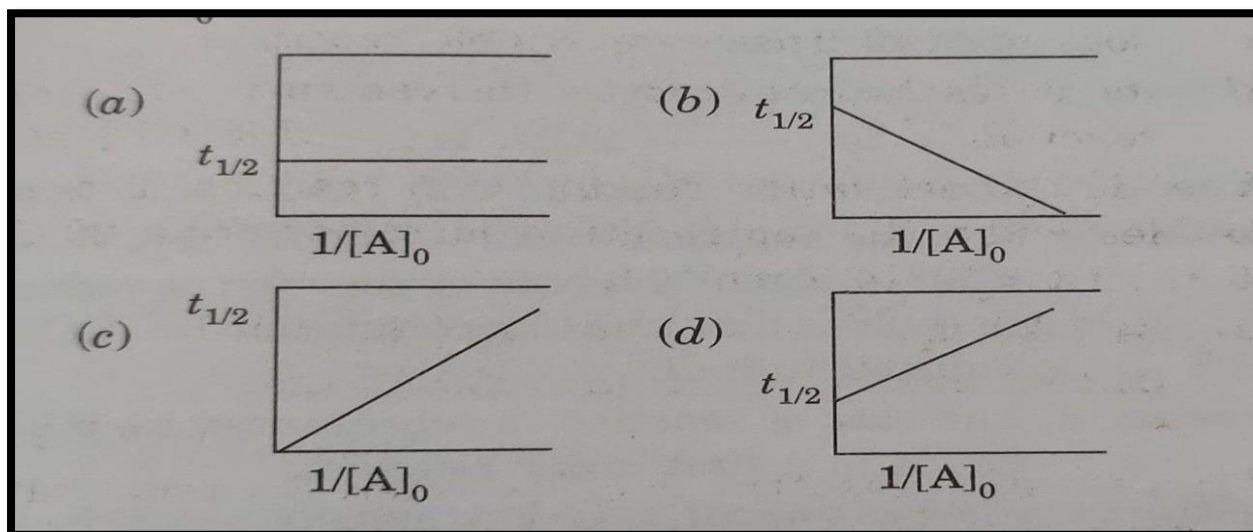
Q.3 For a second order reaction, rate at a particular time is x. If the initial concentration is tripled, the rate will become

(a) $9 x^2$
(b) $27 x$
(c) $9 x$
(d) $3 x$

Q.4 The rate for the first order reaction is 0.0069 mol $L^{-1}min^{-1}$ and the initial concentration is 0.2 mol $L^{-1}$. The half-life period is

(a) 636 s
(b) 0.635 s
(c) 690 s
(d) 1205 s

Q.5 The plot of [A] versus t for zero order reaction gives slope

(a) $- k/2.303$
(b) $k/2.303$
(c) $2.303 k$
(d) $- k$

## Question 25:

**Carbon-14 dating**, also called **radiocarbon dating,** method of age determination that depends upon the decay to nitrogen of radiocarbon (carbon-14). Carbon-14 is continually formed in nature by the interaction of neutrons with nitrogen-14 in the Earth's atmosphere; the neutrons required for this reaction are produced by cosmic rays interacting with the atmosphere.

Radiocarbon present in molecules of atmospheric carbon dioxide enters the biological carbon cycle: it is absorbed from the air by green plants and then passed on to animals through the food chain. Radiocarbon decays slowly in a living organism, and the amount lost is continually replenished as long as the organism takes in air or food. Once the organism dies, however, it ceases to absorb carbon-14, so that the amount of the radiocarbon in its tissues steadily decreases. Carbon-14 has a half-life of 5,730 ± 40 years—*i.e.*, half the amount of the radioisotope present at any given time will undergo spontaneous disintegration during the succeeding 5,730 years. Because carbon-14 decays at this constant rate, an estimate of the date at which an organism died can be made by measuring the amount of its residual radiocarbon.

Q.1 The radioactive disintegration follows

    (a)    Zero order kinetics
    (b)    First order kinetics
    (c)    Second order kinetics
    (d)    Pseudo first order reaction

Q.2 The half-life period of first order reaction is

    (a)    independent of initial concentration of reactant.
    (b)    directly proportional to the initial concentration of reactant.
    (c)    Inversely proportional to the initial concentration of reactant.
    (d)    depending on final concentration of reactant.

Q.3 The half-life period for radioactive decay of $^{14}C$ is 5730 year. The rate constant is

    (a)    $1.209 \times 10^{-5}$ year$^{-1}$
    (b)    $12.09 \times 10^{-5}$ year$^{-1}$
    (c)    $1.209 \times 10^{-4}$ year$^{-1}$
    (d)    $12.09 \times 10^{-4}$ year$^{-1}$

Q.4 An archaeological artefact contained wood had only 80% the $^{14}C$ found in a living tree. Estimate the age of the sample.

    (a)    1945 year
    (b)    1840 year
    (c)    2036 year
    (d)    1846 year

Q.5 Which of the following graphs correspond to first order reaction?
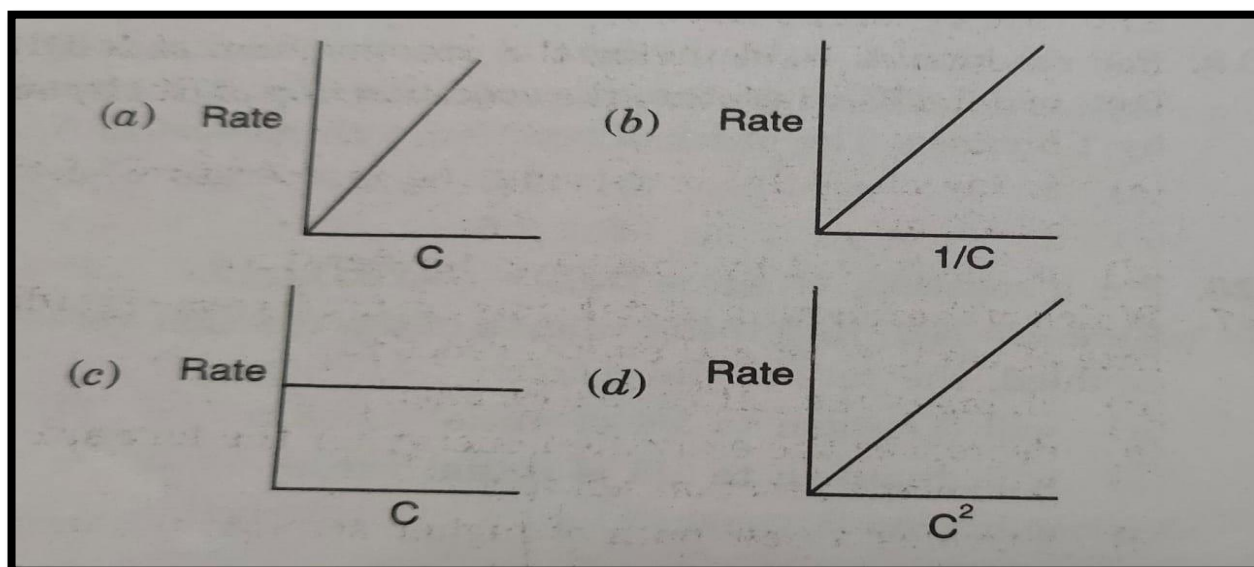
**Question 26:**

Reaction rate, in chemistry, the speed at which a chemical reaction proceeds. It is often expressed in terms of either the concentration (amount per unit volume) of a product that is formed in a unit of time or the concentration of a reactant that is consumed in a unit of time. Alternatively, it may be defined in terms of the amounts of the reactants consumed or products formed in a unit of time. For example, suppose that the balanced chemical equation for a reaction is of the form

$A + 3B \rightarrow 2Z$.

The rate of above reaction could be expressed in the following alternative ways:
$+d[Z]/2dt$, $-d[A]/dt$, $-d[B]/3dt$,
where t is the time, [A], [B], and [Z] are the concentrations of the substances, and a, b, and z are their coefficients. Note that these six expressions are all different from one another but are simply related.

Chemical reactions proceed at vastly different speeds depending on the nature of the reacting substances, the type of chemical transformation, the temperature, and other factors. In general, reactions in which atoms or ions (electrically charged particles) combine occur very rapidly, while those in which covalent bonds (bonds in which atoms share electrons) are broken are much slower. For a given reaction, the speed of the reaction will vary with the temperature, the pressure, and the amounts of reactants present. Reactions usually slow down as time goes on because of the depletion of the reactants. In some cases, the addition of a substance that is not itself a reactant, called a catalyst, accelerates a reaction. The rate constant, or the specific rate constant, is the proportionality constant in the equation that expresses the relationship between the rate of a chemical reaction and the concentrations of the reacting substances. The measurement and interpretation of reactions constitute the branch of chemistry known as chemical kinetics.

Q.1 For the single step reaction of the type

$A + 2B ---\rightarrow E + 2F$
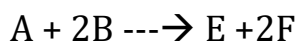
The rate law is:

    (a)    Rate = k[A] [B[
    (b)    Rate = k $[E][F]^2/[A][B]$
    (c)    Rate = k[A] [2B]
    (d)    Rate = k [A] $[B]^2$

Q.2 For the chemical reaction:

$2NO_2Cl \longrightarrow 2NO_2 + Cl_2$

The rate equation is: rate = $k[NO_2Cl]$
The rate determining step is:

(a) $2NO_2Cl \longrightarrow 2NO_2 + Cl_2$
(b) $NO_2 + Cl_2 \longrightarrow NO_2Cl + Cl$
(c) $NO_2Cl + Cl \longrightarrow NO_2 + Cl_2$
(d) $NO_2Cl \longrightarrow NO_2 + Cl$

Q.3 The rate equation for the reaction:

$1A + B \longrightarrow C$ is found to be rate = $k[A][B]$. The correct statement in relation to this reaction is that the

(a) Units of k must be $s^{-1}$
(b) $t_{1/2}$ is constant
(c) value of k is independent of the initial concentration of A and B
(d) rate of formation of C is twice the rate of disappearance of A

Q.4 For a reaction: $1/2 A \longrightarrow 2B$, rate of disappearance of 'A' is related to the rate of appearance of B by the expression:

(a) $-d[A]/dt = d[B]/dt$
(b) $-d[A]/dt = 1/4 d[B]/dt$
(c) $-d[A]/dt = 4 d[B]/dt$
(d) $-d[A]/dt = 1/2 d[B]/dt$

Q.5 In a reaction, $2A + B \longrightarrow A_2B$, the reactant B will disappear at

(a) Half the rate as A will decrease
(b) The same rate as A will decrease
(c) Twice the rate as A will decrease
(d) Half the rate as $A_2B$ will form

## Question 27:

The Molecularity of a whole reaction has no importance and overall kinetics of the reaction depends upon the rate determining step. The slowest step is rate-determining step. This was given by Van't Hoff.

Example:

$NH_4NO_2 \rightarrow N_2 + 2H_2O$ *(Unimolecular)*

$NO + O_3 \rightarrow NO_2 + O_2$ *(Bimolecular)*

$2NO + O_2 \rightarrow 2NO_2$ *(Trimolecular)*

Total number of the molecules or atoms whose concentration determines the rate of reaction is called as order of reaction.

The Order of reaction = Sum of the exponents of the concentration terms in rate law

For the reaction $xA+yB\rightarrow$Products

The rate law is Rate = $[A]^x[B]^y$

Then the overall order of the reaction. $n=x+y$

Here x and y are orders with respect to the individual reactants.

If the reaction is in form of reaction mechanism then the order is determined by slowest step of mechanism.

$$2A + 3B \rightarrow A_2B_3$$

$$A + B \rightarrow AB \text{(fast)}$$

$$AB + B_2 \rightarrow AB_3 \text{(slow)} \qquad (Rate\ determining\ step)$$

$$AB_3 + A \rightarrow A_2B_3 \text{(fast)}$$
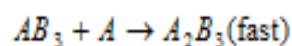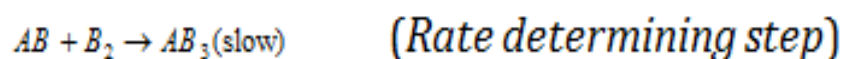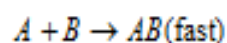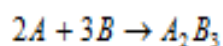
(Here, the overall order of the reaction is equal to two.)

Q.1 Which of the following statement is not correct about order of a reaction?
The order of a reaction can be a fractional number.

(a) The order of a reaction can be a fractional number.
(b) Order of reaction is experimentally determined quantity.
(c) The order of a reaction is always equal to the sum of the stoichiometric coefficients of reactants in the balanced chemical equation for a reaction.
(d) The order of a reaction is the sum of the powers of molar concentration of the reactants in the rate law expression.

Q.2 For the reaction; A ---→ C, it is found that the rate of the reaction quadruples when the concentration of A is doubled. The rate for the reaction is, Rate = $[A]^n$ where the value of n is :

   (a) 1      (b)2      (c) Zero      (d) 3

Q.3 For a reaction having rate law expression:
Rate = k $[A]^{3/2} [B]^{1/2}$
If the concentration of both A and B become four times, the rate of reaction
   (a) Becomes four times      (b) Becomes 16 times
   (c) Decrease four times      (d)Remains same

Q.4 Which one of the following statements for the order of a reaction is incorrect?

(a)    Order can be determined only experimentally.
(b)    Order is not influenced by stoichiometric coefficient of the reactants.
(c)    Order of a reaction is sum of powers to the concentration terms of reactants to express the rate of reaction
(d)    Order of reaction is always a whole number.

Q.5 The sum of the number of molecules of reactants involved in the balanced chemical equation is

(a)    Order of reaction
(b)    Rate of reaction
(c)    Molecularity of the reaction
(d)    None of the above

**Question 28:**

Consider a typical chemical reaction:
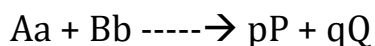
   Aa + Bb -----→ pP + qQ
The lowercase letters ($a$, $b$, $p$, and $q$) represent stoichiometric coefficients, while the capital letters represent the reactants (A and B) and the products (P and Q). Reaction rate thus defined has the units of $molL^{-1}s^{-1}$. The rate of a reaction is always positive. A negative sign is present to indicate that the reactant concentration is decreasing.
Various factors that can affect the rate of a chemical reaction are the physical state of reactants, number of reactants, complexity of reaction and other factors highly influence the reaction rate as well, the rate of reaction is generally slower in liquids when compared to gases and slower in solids when compared to liquids. Size of the reactant also matters a lot. The smaller the size of reactant, the faster the reaction. According to the collision theory, the rate of reaction increases with the increase in the concentration of the reactants. As per the law of mass action. The chemical reaction rate is directly proportional to the concentration of reactants. This implies that the chemical reaction rate increases with the increase in concentration and decreases with the decrease in the concentration of reactant.

Choose the correct option:

Q.1. A reaction in which reactants (R) are converted into products (P) follows second order kinetics. If concentration of R is increased by four times, what will be the increase in the rate of formation of P
(a) 9 times          (b) 4 times          (c) 16 times          (d) 8 times

Q.2. The rate of a chemical reaction is NOT affected by which of the following:
(a) Temperature
(b) Concentration
(c) Particle size
(d) All of these

Q.3. Which of the following laws state that the rate of a chemical reaction is directly proportional to the concentration of reactants?
a) Henry's law
b) Law of conservation of mass
c) Law of mass action
d) Dalton's law

Q.4. Which of the following will lead to an increase in the rate of the reaction?
a) Decrease in temperature
b) Decreasing concentration of reactants
c) Addition of catalyst
d) Addition of inhibitor

## Question 29:

The Arrhenius equation is a formula for the temperature dependence of reaction rates. This equation has a vast and important application in determining the rate of chemical reactions and for calculation of energy of activation. Arrhenius provided a physical justification and interpretation for the formula. Arrhenius argued that for reactants to transform into products, they must first acquire a minimum amount of energy, called the activation energy $E_a$. At an absolute temperature $T$, the fraction of molecules that have a kinetic energy greater than $E_a$ can be calculated from statistical mechanics. The concept of activation energy explains the exponential nature of the relationship, and in one way or another, it is present in all kinetic theories. The collision angle, the relative translational energy, the internal (particularly vibrational) energy will all determine the chance that the collision will produce a product molecule AB.

Select the most appropriate answer from the options given below
(a) Both A and R are true and R is the correct explanation of A
(b) Both A and R are true but R is not the correct explanation of A.
(c) A is true but R is false.
(d) A is false but R is true.

Q.1. **Assertion (A):** All collisions of reactant molecules lead to product formation.
**Reason (R):** Only those collisions in which molecules have correct orientation and sufficient kinetic energy lead to the compound formation.

Q.2. **Assertion (A):** Rate constants determined from Arrhenius equation are fairly accurate for simple as well as complex molecules.
**Reason (R):** Reactant molecules undergo chemical change irrespective of their orientation during collision.

Choose the correct option:

Q.3. Which of the following is a drawback of collision theory?
a) Proper orientation
b) High activation energy
c) Hard spheres
d) Have energy equal to or greater than the threshold energy

Q.4. What are the factors that determine an effective collision?
a) Translational collision and energy of activation
b) Threshold energy and proper orientation
c) Proper orientation and steric bulk of the molecule
d) Collision frequency, threshold energy and proper orientation

**Question 30:**

If the concentration of a reactant remains constant (because it is a catalyst, or because it is in great excess with respect to the other reactants), its concentration can be included in the rate constant, leading to a pseudo–first-order (or occasionally pseudo–second-order) rate equation. For a typical second-order reaction with rate equation $v_0 = k[A][B]$, if the concentration of reactant B is constant then $v_{0=k[A]}$, where the pseudo–first-order rate constant $k' = k[B]$. The second-order rate equation has been reduced to a pseudo–first-order rate equation, which makes the treatment to obtain an integrated rate equation much easier.

One way to obtain a pseudo-first order reaction is to use a large excess of one reactant (say, $[B] \gg [A]$) so that, as the reaction progresses, only a small fraction of the reactant in excess (B) is consumed, and its concentration can be considered to stay constant. For example, the hydrolysis of esters by dilute mineral acids follows pseudo-first order kinetics, where the concentration of water is constant because it is present in large excess:

$$CH_3COOCH_3 + H_2O \rightarrow CH_3COOH + CH_3OH$$
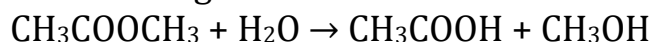
Choose the correct option:

Q.1. Which of the following is not an example of a pseudo first-order reaction?
a) $CH_3COOC_2H_5 + NaOH \rightarrow CH_3COOH + H_2O$
b) $CH_3COOC_2H_5 + H_2O \rightarrow CH_3COOH + C_2H_5OH$
c) $C_2H_5COOC_2H_5 + H_2O \rightarrow C_2H_5COOH + C_2H_5OH$
d) $C_{12}H_{22}O_{11} + H_2O \rightarrow$ glucose + fructose

Q.2. For a pseudo first-order reaction, what is the unit of the rate of the reaction?
a) $s^{-1}$
b) mol $L^{-1}s^{-1}$
c) $mol^{-1}$ L $s^{-1}$
d) $mol^{-2}$ $L^2$ $s^{-1}$

Q.3. What is the rate law for acid hydrolysis of an ester such as $CH_3COOC_2H_5$ in aqueous solution?
a) k $[CH_3COOC_2H_5]$
b) k $[CH_3COOC_2H_5]$ $[H_2O]$
c) k $[CH_3COOC_2H_5]^2$
d) k

Q.4. Which of the following is not true for a pseudo first-order reaction?
a) The reaction follows first order kinetics
b) Molecularity of the reaction should be one
c) The reactants such as water are present in excess and are assumed to be constant throughout the reaction
d) Unit of the rate constant is $s^{-1}$

## Question 31:

Read the passage given below and answer the following questions:

Within the 3d series, manganese exhibits oxidation states in aqueous solution from +2 to +7, ranging from $Mn^{2+}$(aq) to $MnO_4^-$ (aq). Likewise, iron forms both $Fe^{2+}$(aq) and $Fe^{3+}$(aq) as well as the $FeO_2^{-4}$ ion. Cr and Mn form oxyions $CrO_4^{2-}$ , $MnO_4^-$ , owing to their willingness to form multiple bonds. The pattern with the early transition metals—in the 3d series up to Mn, and for the 4d, 5d metals up to Ru and Os—is that the maximum oxidation state corresponds to the number of "outer shell" electrons. The highest oxidation states of the 3d metals may depend upon complex formation (e.g., the stabilization of $Co^{3+}$ by ammonia) or upon the pH (thus

$MnO_4{}^{2-}$ (aq) is prone to disproportionation in acidic solution). Within the 3d series, there is considerable variation in relative stability of oxidation states, sometimes on moving from one metal to a neighbour; thus, for iron, $Fe^{3+}$ is more stable than $Fe^{2+}$, especially in alkaline conditions, while the reverse is true for cobalt. The ability of transition metals to exhibit a wide range of oxidation states is marked with metals such as vanadium, where the standard potentials can be rather small, making a switch between states relatively easy.

In the following questions, a statement of assertion followed by a statement of reason is given.
Choose the correct answer out of the following choices on the basis of the above passage.

A. Assertion and reason both are correct statements and reason is correct explanation for assertion.
B. Assertion and reason both are correct statements but reason is not correct explanation for assertion.
C. Assertion is correct statement but reason is wrong statement.
D. Assertion is wrong statement but reason is correct statement.

1.**Assertion:** Highest oxidation state is exhibited by transition metal lying in the middle of the Series.
   **Reason:** The highest oxidation state exhibited corresponds to number of (n-1) d electrons.

2. **Assertion:** $Fe^{3+}$ is more stable than $Fe^{2+}$
   **Reason:** $Fe^{3+}$ has $3d^5$ configuration while $Fe^{2+}$ has $3d^6$ configuration.

3. **Assertion:** Vanadium had the ability to exhibit a wide range of oxidation states.
   **Reason:** The standard potentials of Vanadium are rather small, making a switch between oxidation states relatively easy.

4. **Assertion:** Transition metals like Fe, Cr and Mn form oxyions
   **Reason:** Oxygen is highly electronegative and has a tendency to form multiple bonds.

5. **Assertion:** The highest oxidation states of the 3d metals depends only on electronic configuration of the metal.
   **Reason:** The number of electrons in the (n-1) d and ns subshells determine the oxidation states exhibited by the metal.

**Question 32:**

Read the passage given below and answer the following questions:

The transition metals when exposed to oxygen at low and intermediate temperatures form thin, protective oxide films of up to some thousands of Angstroms in thickness. Transition metal oxides lie between the extremes of ionic and covalent binary compounds formed by elements from the left or right side of the periodic table. They range from metallic to semiconducting and deviate by both large and small degrees from stoichiometry. Since d electron bonding levels are involved, the cations exist in various valence states and hence give rise to a large number of oxides. The crystal structures are often classified by considering a cubic or hexagonal close-packed lattice of one set of ions with the other set of ions filling the octahedral or tetrahedral interstices. The actual oxide structures, however, generally show departures from such regular arrays due in part to distortions caused by packing of ions of different size and to ligand field effects. These distortions depend not only on the number of d-electrons but also on the valence and the position of the transition metal in a period or group.

In the following questions, a statement of assertion followed by a statement of reason is given.

Choose the correct answer out of the following choices on the basis of the above passage.

A) Assertion and reason both are correct statements and reason is correct explanation for assertion.

B) Assertion and reason both are correct statements but reason is not correct explanation for assertion.

C) Assertion is correct statement but reason is wrong statement.

D) Assertion is wrong statement but reason is correct statement.

1. **Assertion:** Cations of transition elements occur in various valence states
   **Reason:** Large number of oxides of transition elements are possible.
2. **Assertion:** Crystal structure of oxides of transition metals often show defects.
    Reason: Ligand field effect cause distortions in crystal structures.
3. **Assertion:** Transition metals form protective oxide films.
   **Reason:** Oxides of transition metals are always stoichiometric.
4. **Assertion:** CrO crystallises in a hexagonal close-packed array of oxide ions with two out of every three octahedral holes occupied by chromium ions.
   **Reason:** Transition metal oxide may be hexagonal close-packed lattice of oxide ions with metals ions filling the octahedral voids.

**Question 33:**

Read the passage given below and answer the following questions:

One of the notable features of a transition element is the great variety of oxidation states it may show in its compounds. The elements which give the greatest number of oxidation states occur in or near the middle of the series. Manganese, for example, exhibits all the oxidation states from +2 to +7. The lesser number of oxidation states at the extreme ends stems from either too few electrons to lose or share (Sc, Ti) or too many d electrons (hence fewer orbitals available in which to share electrons with others) for higher valence (Cu, Zn). Thus, early in the series scandium (II) is virtually unknown and titanium (IV) is more stable than Ti(III) or Ti(II). At the other end, the only oxidation state of zinc is +2 (no d electrons are involved). The maximum oxidation states of reasonable stability correspond in value to the sum of the s and d electrons up to manganese. The variability of oxidation states, a characteristic of transition elements, arises out of incomplete filling of d orbitals in such a way that their oxidation states differ from each other by unity. An interesting feature in the variability of oxidation states of the d–block elements is noticed among the groups (groups 4 through 10). Although in the p–block the lower oxidation states are favoured by the heavier members (due to inert pair effect), the opposite is true in the groups of d-block. For example, in group 6, Mo(VI) and W(VI) are found to be more stable than Cr(VI). Thus Cr(VI) in the form of dichromate in acidic medium is a strong oxidising agent, whereas $MoO_3$ and $WO_3$ are not.

The following questions are multiple choice questions. Choose the most appropriate answer:

1. Electronic configuration of a transition element X in +3 oxidation state is $[Ar]3d^5$. What is its atomic number?
   (a) 25        (b) 26        (c) 27        (d) 24

2. The electronic configuration of Cu(II) is $3d^9$ whereas that of Cu(I) is $3d^{10}$. Which of the following is correct?
   a. Cu(II) is less stable
   b. Cu(I) and Cu(II) are equally stable
   c. Stability of Cu(I) and Cu(II) depends on nature of copper salts
   d. Cu(II) is more stable

3. Which of the following statements is not correct?
   a. Copper liberates hydrogen from acids.
   b. In its higher oxidation states, manganese forms stable compounds with oxygen and fluorine.
   c. $Mn^{3+}$ and $Co^{3+}$ are oxidizing agents in aqueous solution.
   d. $Ti^{2+}$ and $Cr^{2+}$ are reducing agents in aqueous solution.

4. Highest oxidation state of manganese in fluoride is +4 ($MnF_4$) but highest oxidation state in Oxides is +7 ($Mn_2O_7$) because _____
   a. fluorine is more electronegative than oxygen.
   b. fluorine does not possess d-orbitals.
   c. fluorine stabilizes lower oxidation state.
   d. in covalent compounds fluorine can form single bond only while oxygen forms double bond.

## Question 34:

Read the passage given below and answer the following questions:

All the metals except scandium form MO oxides which are ionic. The highest oxidation number in the oxides, coincides with the group number and is attained in $Sc_2O_3$ to$Mn_2O_7$. Beyond group 7, no higher oxides of iron above $Fe_2O_3$ are known. Besides the oxides, the oxocations stabilize $V^V$ as $VO_2^+$, $V^{IV}$ as $VO^{2+}$ and $Ti^{IV}$ as $TiO^{2+}$. As the oxidation number of a metal increases, ionic character decreases. In the case of Mn, $Mn_2O_7$ is a covalent green oil. In these higher oxides, the acidic character is predominant. Thus, $Mn_2O_7$ gives $HMnO_4$ and $CrO_3$ gives $H_2CrO4$ and $H_2Cr_2O_7$. $V_2O_5$ is, however, amphoteric though mainly acidic and it gives $VO_4^{3-}$ as well as $VO_2^+$ salts. In vanadium there is gradual change from the basic $V_2O_3$ to less basic $V_2O_4$ and to amphoteric $V_2O_5$. $V_2O_4$ dissolves in acids to give $VO^{2+}$ salts. Similarly, $V_2O_5$ reacts with alkalies as well as acids to give $VO_4^{3-}$ and $VO_4^+$ respectively. The well characterised CrO is basic but $Cr_2O_3$ is amphoteric.

The following questions are multiple choice questions. Choose the most appropriate answer:

1. Which of the following is amphoteric oxide?
   $Mn_2O_7$, $CrO_3$, $Cr_2O_3$, CrO, $V_2O_5$, $V_2O_4$
   (a) $V_2O_5$, $Cr_2O_3$    (b) $Mn_2O_7$, $CrO_3$   (c) CrO, $V_2O_5$       (d) $V_2O_5$, $V_2O$

2. Which of the following will not act as oxidising agents?
   (a) $CrO_3$              (b) $Mn_2O_7$            (c) $WO_3$               (d) $CrO_4^{2-}$

3. Which of the following is most covalent in nature
   (a) $V_2O_3$             (b) $V_2O_4$             (c) $V_2O_5$              (d) None of them

4. Which of the following statement is incorrect.
   a. As the oxidation number of a metal increases, ionic character decreases.
   b. $V_2O_5$ is amphoteric but mostly acidic in nature.
   c. $Mn_2O_7$ is least covalent among oxides of Mn.
   d. $V_2O_5$ reacts with acids and give $VO_4$

**Question 35:**

The d block elements are the 40 elements contained in the four rows of ten columns (3-12) in the periodic table. As all the d block elements are metallic, the term d-block metals is synonymous. This set of d-block elements is also often identified as the transition metals, but sometimes the group 12 elements (zinc, cadmium, mercury) are excluded from the transition metals as the transition elements are defined as those with partly filled d or f shells in their compounds. Inclusion of the elements zinc, cadmium and mercury is necessary as some properties of the group 12 elements are appropriate logically to include with a discussion of transition metal chemistry. The term transition element or transition metal appeared to derive from early studies of periodicity such as the Mendeleev periodic table of the elements. His horizontal table of the elements was an attempt to group the elements together so that the chemistry of elements might be explained and predicted. In this table there are eight groups labelled I-VIII with each subdivided into A and B subgroups. Mendeleev recognized that certain properties of elements in Group VIII are related to those of some of the elements in Group VII and those at the start of the next row Group I. In that sense, these elements might be described as possessing properties transitional from one row of the table to the next.

In the following questions, a statement of assertion followed by a statement of reason is given. Choose the correct answer out of the following choices on the basis of the above passage.

A. Assertion and reason both are correct statements and reason is correct explanation for assertion.

B. Assertion and reason both are correct statements but reason is not correct explanation for Assertion.

C. Assertion is correct statement but reason is wrong statement.

D. Assertion is wrong statement but reason is correct statement.

1. **Assertion:** Group 12 elements are not considered as transition metals.
   **Reason:** Transition metals are those which have incompletely filled d shell in their compounds.

2. **Assertion:** All d block elements are metallic in nature.
   **Reason:** The d –block elements belong to Group3 -12 of the periodic table.

3. **Assertion:** Group VII elements of Mendeleev periodic table are transition elements.
   **Reason:** Group I –VIII in Mendeleev periodic table is divided into two subgroups, A and B.

4. **Assertion:** Nickel is a transition element that belongs to group 10 and period 4 of the modern Periodic table.
   **Reason:** Electronic configuration of Nickel is $[Ar]3d^84s^2$

## Question 36:

Read the paragraph carefully and answer the Questions given below

The transition elements are those elements having a partially filled d subshell in any common oxidations state. The term "transition elements" most commonly refers to the d-block elements. The elements zinc, cadmium & mercury do not strictly meet the defining properties but are usually included with the transition elements because their similar properties. The general properties of transitions elements are

- They are high melting point metals
- They have several oxidation states
- They usually from coloured compounds
- They are often paramagnetic

The transition elements include the important metals iron, copper and silver. Iron & titanium are the most abundant transition elements. Many catalysts for industrial reactions involve transition elements.

Q.1.Iron is a transition element
   a. Iron has fully filled d orbitals
   b. Iron shows +2 and +3 oxidation states
   c. Iron has partially filled d subshell in metallic state
   d. None of the above.

Q.2.  $Zn^{2+}$ salts are colourless due to
   a. d-d transition of electrons
   b. Fully filled d orbitals
   c. No d-d transition of electrons
   d. Fully filled d orbitals and no d-d transition of electrons

Q.3. Out of $Sc^{3+}$, $Cr^{3+}$, $Zn^{2+}$ and $Mn^{2+}$ which is highly paramagnetic
   a.  $Sc^{3+}$     b.  $Cr^{3+}$     c. $Zn^{2+}$   d. $Mn^{2+}$

Q.4. Transition metals are known to form complexes
   a.  They have vacant d orbitals
   b.  They hey high nuclear charge
   c.  They can accept electrons from ligands
   d.  All of above

**Question 37:**

Potassium permanganate is produced industrially from manganese dioxide, which also occurs as the mineral pyrolusite. In 2000, worldwide production was estimated at 30,000 tonnes. The $MnO_2$ is fused with potassium hydroxide and heated in air or with another source of oxygen, like potassium nitrate or potassium chlorate. This process gives potassium manganate:

$2\ MnO_2 + 4\ KOH + O_2 \rightarrow 2\ K_2MnO_4 + 2\ H_2O$
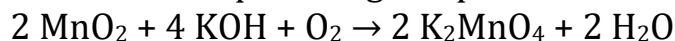
(With sodium hydroxide, the end product is not sodium manganate but an Mn(V) compound, which is one reason why the potassium permanganate is more commonly used than sodium permanganate. Furthermore, the potassium salt crystallizes better.)

The potassium manganate is then converted into permanganate by electrolytic oxidation in alkaline media:

$2\ K_2MnO_4 + 2\ H_2O \rightarrow 2\ KMnO_4 + 2\ KOH + H_2$
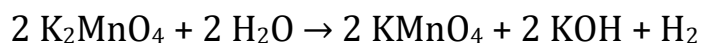
1. When pyrolusite is fused with KOH and $KClO_3$, we get
   a. Potassium permanganate
   b. Potassium manganate
   c. Both potassium permanganate and Potassium manganate
   d. None of these

2. The purple colour of Potassium Permanganate is due to
   a. Incomplete d sub shell
   b. Ionic nature of $KMnO_4$
   c. Charge transfer
   d. Resonance in $MnO_4^-$ ion

3. $MnO_4^-$ reacts with $Br^-$ in alkaline pH to give:
   a. $BrO_3^-$, $MnO_2$
   b. $Br_2$, $MnO_4^{2-}$
   c. $Br_2$, $MnO_2$
   d. $BrO^-$, $MnO_4^{2-}$

4. Amount of oxalic acid in a solution can be determined by its titration with $KMnO_4$ solution with $H_2SO_4$. The titration gives unsatisfactory result with HCl because:
   a. Oxidises oxalic acid to $CO_2$ and $H_2O$
   b. Gets oxidised by oxalic acid to chlorine
   c. Reduces permanganate to $Mn^{2+}$
   d. Furnishes $H^+$ ions in addition to those from oxalic acid

**Question 38:**

Lanthanoid contraction, also called lanthanide contraction, in chemistry, the steady decrease in the size of the atoms and ions of the rare earth elements with increasing atomic number from lanthanum (atomic number 57) through lutetium (atomic number 71).

For each consecutive atom the nuclear charge is more positive by one unit, accompanied by a corresponding increase in the number of electrons present in the $4f$ orbitals surrounding the nucleus. The $4f$ electrons very imperfectly shield each other from the increased positive charge of the nucleus, so that the effective nuclear charge attracting each electron steadily increases through the lanthanoid elements, resulting in successive reductions of the atomic and ionic radii. The lanthanum ion, $La^{3+}$, has a radius of 1.061 angstroms, whereas the heavier lutetium ion, $Lu^{3+}$, has a radius of 0.850 angstrom. Because the lanthanoid contraction keeps these rare earth ions about the same size and because they all generally exhibit the +3 oxidation state, their chemical properties are very similar, with the result that at least small amounts of each one are usually present in every rare earth mineral. The lanthanoid contraction also is a very significant factor in the extremely close chemical similarity of zirconium (atomic number 40) and hafnium (atomic number 72) of the IVb group of the periodic table. Because of the lanthanoid contraction, heavier hafnium, which immediately follows the lanthanoids, possesses a radius nearly identical to the on, $La^{3+}$, has a radius of 1.061 angstroms, whereas the heavier lutetium ion, $Lu^{3+}$, has a radius of 0.850 angstrom. Because the lanthanoid contraction keeps these rare earth ions about the same size and because they all generally exhibit the +3 oxidation state, their chemical properties are very similar, with the result that at least small amounts of each one are usually present in every rare earth mineral. The lanthanoid contraction also is a very significant factor in the extremely close chemical similarity of zirconium (atomic number 40) and hafnium (atomic number 72) of the IVb group of the periodic table. Because of the lanthanoid contraction, heavier hafnium, which immediately follows the lanthanoids, possesses a radius nearly identical to the lighter zirconium.

1. Due to lanthanide contraction:

    a. All f- block ions have unequal size
    b. All iso electronic ions have equal size.
    c. Zr and Hf have equal size.
    d. Fe, Co and Ni have equal size.

2. Which of the following statements is not correct:
   a. $La(OH)_3$ is less basic than $Lu(OH)_3$
   b. Atomic radius of Zr and Hf are same because of lanthanide contraction.
   c. In lanthanide series ionic radius of $Ln^{3+}$ ion decreases.
   d. La is actually an element of transition series rather than lanthanide.

3. Cerium (Z= 58) is an important member of lanthanides. Which of the following statements about cerium is incorrect:
   a. Cerium IV acts as an oxidising agent.
   b. The +4oxidation state of cerium is not known in solution.
   c. The +3oxidation state is more stable than the +4 state.
   d.  The common oxidation states of cerium are +3 and +4.

4. The main cause of Lanthanide Contraction is:

   a. decreasing nuclear charge.
   b. increasing nuclear charge
   c. decreasing screening effect
   d. negligible screening effect of f orbitals

## Question 39:

Read the passage given below and answer the following questions:

The d- block of the periodic table contains the elements of the groups 3-12 and are known as transition elements. In general, the electronic configuration of these elements is (n-1) $d^{1-10}ns^{1-2}$. The d orbitals of the penultimate energy level in their atoms receive electrons giving rise to the three rows of the transition metals i.e. 3d, 4d and 5d series. However, Zn, Cd and Hg are not regarded as transition elements. Transition elements exhibit certain characteristic properties like variable oxidation states, complex formation, formation of coloured ions and alloys, catalytic activity etc. Transition metals are hard (except Zn, Cd and Hg) and have a high melting point. The following questions are multiple choice questions.

Choose the most appropriate answer:

1.  Which transition metal of 3d series does not show variable oxidation states?

    (a) Cr            (b) Ti            (c) Sc            (d) Fe

 2.  Which of the following statement about transition element is not correct?

    (a) They show variable oxidation states.
    (b) They exhibit diamagnetic and paramagnetic properties.

(c) All the ions are coloured.
(d) They exhibit catalytic properties.

3. The magnetic moment is associated with its spin angular momentum and orbital angular momentum. Spin only magnetic moment of $Cr^{3+}$ ion is

   (a) 2.87 BM    (b) 3.87 BM    (c) 3.47 BM    (d) 3.57 BM

4. Which of the following has maximum number of unpaired d- electrons?

   (a) $Mg^{2+}$    (b) $Ti^{3+}$    (c) $V^{3+}$    (d) $Fe^{3+}$

**Question 40:**

**Read the passage given below and answer the following questions:**

Coordination compounds are formulated and named according to the IUPAC system.
Few rules for naming coordination compounds are:

(I) In ionic complex, the cation is named first and then the anion.
(II) In the coordination entity, the ligands are named first and then the central metal ion.
(III) When more than one type of ligands are present, they are named in alphabetical order of preference with any consideration of charge
The following questions are multiple choice question. Choose the most appropriate answer:

(i) The IUPAC name of $[Ni(CO)_4]$ is
   (a) tetracarbonylnickel(II)
   (b) tetracarbonylnickel(0)
   (c) tetracarbonylnickelate(II)
   (d) tetracarbonylnickelate(0)

(ii) The IUPAC name of the complex $[Pt(NH_3)_3Br(NO_2)Cl]Cl$ is
   (a) triamminechlorobromonitroplatinum(IV) chloride
   (b) triamminebromonitrochloroplatinum(IV) chloride
   (c) triamminebromidochloronitroplatinum(IV) chloride
   (d) triamminenitrochlorobromoplatinum(IV) chloride

(iii) As per IUPAC nomenclature, the name of the complex $[Co(H_2O)_4(NH_3)_2]Cl_3$ is
    (a) tetraaquadiamminecobalt(II) chloride
    (b) tetraaquadiamminecobalt(III) chloride
    (c) diamminetetraaquacobalt(II) chloride
    (d) diamminetetraaquacobalt(III) chloride

(iv) Which of the following represents correct formula of dichloridobis(ethane-1,2-diamine)cobalt(III) ion?
    (a) $[CoCl_2(en)]^{2+}$
    (b) $[CoCl_2(en)_2]^{2+}$
    (c) $[CoCl_2(en)]^+$
    (d) $[CoCl_2(en)_2]^+$
OR
    Correct formula of pentaamminenitro-O-cobalt(III) sulphate is
    (a) $[Co(NO_2)(NH_3)_5]SO_4$
    (b) $[Co(ONO)(NH_3)_5]SO_4$
    (c) $[Co(NO2)(NH_3)_4](SO_4)_2$
    (d) $[Co(ONO)(NH_3)_4](SO_4)_2$

**Question 41:**

Read the passage given below and answer the following questions:

Metal carbonyl is an example of coordination compounds in which carbon monoxide (CO) acts as ligand. These are also called homoleptic carbonyls. These compounds contain both σσ and ππ character. Some carbonyls have metal-metal bonds. The reactivity of metal carbonyls is due to (i) the metal centre and (ii) the CO ligands. CO is capable of accepting an appreciable amount of electron density from the metal atom into their empty ππ or ππ* orbitals. These types ofligands are called ππ-accepter or ππ-acid ligands. These interactions increases the Δo value.

The following questions are multiple choice questions. Choose the most appropriate answer:
(i) What is the oxidation state of metal in $[Mn_2(CO)_{10}]$ ?
    (a) +1            (b) -1            (c) +2            (d) 0

(ii) Among the following metal carbonyls, the C - O bond order is lowest in

(a) $[Mn(CO)_6]$　　　　(b) $[Fe(CO)_5]$　　　(c) $[Cr(CO)_6]$　　　(d) $[V(CO)_6]^-$

(iii) The oxidation state of cobalt in $K[Co(CO)_4]$ is

(a) +1　　　　　　　(b) +3　　　　　　(c) -1　　　　　　(d) 0

(iv) Structure of decacarbonyl manganese is

(a) trigonal bipyramidial　　　　　　　(b) octahedral

(c) tetrahedral　　　　　　　　　　　　(d) square pyramidal

## Question 42:

Read the passage given below and answer the following questions:

Werner, a Swiss chemist in 1892 prepared and characterised a large number of coordination compounds and studied their physical and chemical behaviour. He proposed that, in coordination compounds, metals possess two types of valencies, viz. primary; valencies, which are normally ionisable and secondary valencies which are non-ionisable. In a series of compounds of cobalt (III) chloride with ammonia, it was found that some of the chloride ions could be precipitated as AgCI on adding excess of $AgNO_3$ solution in cold, but some remained in solution. The number of ions furnished by a complex in a solution can be determined by precipitation reactions. The measurement of molar conductance of solutions of coordination compounds helps to estimate the number of ions furnished by the compound in solution.

In these questions (i-iv), a statement of assertion followed by a statement of reason is given.
Choose the correct answer out of the following choices.

(a) Assertion and reason both are correct statements and reason is correct explanation for assertion.
(b) Assertion and reason both are correct statements but reason is not correct explanation for assertion.
(c) Assertion is correct statement but reason is wrong statement.
(d) Assertion is wrong statement but reason is correct statement.

The following questions are multiple choice questions. Choose the most appropriate answer:

(i) Assertion: The complex $[Co(NH_3)_3Cl_3]$ does not give precipitate with silver nitrate solution.
Reason: The given complex is non-ionisable.

(ii) Assertion: The complex $[Co(NH_3)_4Cl_2]Cl$ gives precipitate corresponding to 2 mol of AgCl with $AgNO_3$ solution.
Reason: It ionises as $[Co(NH_3)_4Cl_2]^+ + Cl^-$

(iii) Assertion: 1 mol of $[CrCl_2CH_2O)_4]Cl \cdot 2H_2O$ will give 1mol of AgCl on treating with $AgNO_3$.
Reason: $Cl^-$ ions satisfying secondary vacancies will not be precipitated.

(iv) Assertion: $CoCl_3 \cdot 3NH_3$ is not conducting while $CoCl_3 \cdot 5NH_3$ is conducting.
Reason: The complex of $CoCl_3 \cdot 3NH_3$ is $[CoCl_3(3NH_3)_3]$ while that of $CoCl_3 \cdot 5NH_3$ is $[CoCl_3(3NH_3)_5]Cl_2$.

## Question 43:

Read the passage given below and answer the following questions:

Arrangement of ligands in order of their ability to cause splitting Δ is called spectrochemical series. Ligands which cause large splitting (large Δ) are called strong field ligands while those which cause small splitting (small Δ) are called weak field ligands. When strong field ligands approach metal atomlion, the value of Δo is large, so that electrons are forced to get paired up in lower energy t2g orbitals. Hence, a low-spin complex is resulted from strong field ligand. When weak field ligands approach metal atom/ion, the value of Δo is small, so that electrons enter high energy eg orbitals rather than pairing in low energy t2g orbitals. Hence, a high-spin complex is resulted from weak field ligands. Strong field ligands have tendency to form inner orbital complexes by forcing the electrons to pair up. Whereas weak field ligands have tendency to form outer orbital complex because inner electrons generally do not pair up.

In these questions (i-iv), a statement of assertion followed by a statement of reason is given.

Choose the correct answer out of the following choices.

(a) Assertion and reason both are correct statements and reason is correct explanation for assertion.
(b) Assertion and reason both are correct statements but reason is not correct explanation for assertion.
(c) Assertion is correct statement but reason is wrong statement.
(d) Assertion is wrong statement but reason is correct statement.

(i) Assertion: In tetrahedral coordination entity formation, the d orbital splitting is inverted and is smaller as compared to the octahedral field splitting. Reason: Spectrochemical series is based on the absorption of light by complexes with different ligands.

(ii) Assertion: $F^-$ ion is a weak field ligand and forms outer orbital complex. Reason: $F^-$ ion cannot force the electrons of $d_z^2$ and $d_{x^2-y^2}$ orbitals of the inner shell to occupy $d_{xy}$, $d_{yz}$ and $d_{zx}$ orbitals of the same shell.

(iii) Assertion: The crystal field model is successful in explaining the formation, structures, colour and magnetic properties of coordination compounds. Reason: In spectrochemical series, ligands are arranged in a series of increasing field strength.

(iv) Assertion: $NF_3$ is a weaker ligand than $N(CH_3)_3$.
Reason: $NF_3$ ionizes to give $F^-$ ions in aqueous solution.

## Question 44:

Read the passage given below and answer the following questions:

Ligands are atoms or ions which can donate electrons to the central atoms. Ligands can be monodentate, bidentate or polydentate as well. Few ligands can coordinate with the central atom through more than one site, these are called ambidentate ligands. When a di- or polydentate ligand uses its two or more donor atoms to bind a single metal ion, it is said to be a chelating ligand.

In these questions (i-iv), a statement of assertion followed by a statement of reason is given.
Choose the correct answer out of the following choices.

(a) Assertion and reason both are correct statements and reason is correct explanation for assertion.
(b) Assertion and reason both are correct statements but reason is not correct explanation for assertion.
(c) Assertion is correct statement but reason is wrong statement.
(d) Assertion is wrong statement but reason is correct statement.

(i)   Assertion: Glycinate ion is an example of mono dentate ligand.
      Reason: Glycinate contains N and O as donor atoms
(ii)  Assertion: Oxalate ion is a bidentate ligand.
      Reason: Oxalate ion has two donor atoms
(iii) Assertion: A chelating ligand must possess two or more lone pairs at such a distance that it may form suitable strain free 5 and 6 membered rings with the metal ion.
      Reason: $H_2N$- $NH_2$ is a chelating ligand.
(iv)  Assertion: In Zeise's salt coordination number of Pt is five.
      Reason: Ethene is a monodentate ligand.

**Question 45:**

Read the passage given below and answer the following questions:

For understanding the structure and bonding in transition metal complexes, the magnetic properties are very helpful. Low spin complexes are generally diamagnetic because of pairing of electrons, whereas high spin complexes are usually paramagnetic because of presence of unpaired electrons. Larger the number of unpaired electrons, stronger will be the paramagnetism. However magnetic behaviour of a complex can be confirmed from magnetic moment measurement. Magnetic moment $\mu = \sqrt{n(n+2)}$ B.M. $\mu = n(n+2)$ B.M. where n = number of unpaired electrons. Greater the number of unpaired electrons, more will be the magnetic moment.

In these questions (i-iv), a statement of assertion followed by a statement of reason is given.

Choose the correct answer out of the following choices.

(a) Assertion and reason both are correct statements and reason is correct explanation for assertion.

(b) Assertion and reason both are correct statements but reason is not correct explanation for assertion.

(c) Assertion is correct statement but reason is wrong statement.

(d) Assertion is wrong statement but reason is correct statement.

(i) Assertion: Both $[Cr(H_2O)_6]^{2+}$ and $[FeH_2O)_6]^{2+}$ have same magnetic moment.
    Reason: Number of unpaired electrons in $Cr^{2+}$ and $Fe^{2+}$ are same.

(ii) Assertion: $[Fe(H_2O)_5NO]SO_4$ is paramagnetic.
    Reason: The Fe in $[Fe(H_2O)_5NO]SO_4$ has three unpaired electrons.

(iii) Assertion: $[Co(en)_3]^{3+}$ is paramagnetic.
    Reason: It is an inner orbital complex.

(iv) Assertion: $[Ni(CN)_4]^{2-}$ is diamagnetic complex.
    Reason: It involves dsl hybridisation and there is no unpaired electron.

In the following questions, two statements are given one is Assertion and other is reason. Select the correct answer for these questions from a, b, c and d as given below;

a) Both assertion and reason are correct statements and reason is correct explanation of assertion.

b) Both assertion and reason are correct statements and reason is not correct explanation of assertion.

c) Assertion is correct but reason is incorrect statement.

d) Assertion is incorrect but reason is correct statement.

## Question 46:

   **Assertion :** Hydrogen halides (HX) are preferred over thionyl chloride for the preparation of alkyl halides from alcohols .
   **Reason  :** Gaseous side products are formed in case of thionyl chloride.

## Question 47:

   **Assertion :** Tertiary alkyl halides are least reactive towards $S_N1$ reaction .
   **Reason :** In $S_N1$ reaction , the rate of reaction depends only on concentration of alkyl halide.

**Question 48:**

**Assertion :** AgCN reacts with ethyl chloride to give ethyl isocyanide .
**Reason :** $CN^-$ is a bidentate ligand .

**Question 49:**

**Assertion :** Haloalkanes are sparingly soluble in water.
**Reason :** As haloalkanes do not form hydrogen bonds with water .

**Question 50:**

**Assertion :** Propene reacts with HBr to form 2-bromo propene .
**Reason :** As intermediate formed carbcation is secondary which is more stable than primary .

**Question 51 :**

**Assertion :** $S_N2$ mechanism leads to inversion of configuration .
**Reason :** As in this mechanism optical activity is lost .

**Multiple choice questions**

**Question 52:** What is 3-bromopropene's common name?

a) Allyl bromide
b) Vinyl bromide
c) tert butyl bromide
d) properzyl bromide

**Question 53:** Which of the following substances has the highest melting point?

a) chloromethane
b) tetrachloromethane
c) trichloromethane
d) dichloromethane

**Question 54:** In which sequence should isomeric dichlorobenzenes be boiled in?

a) ortho>meta>para
b) meta>ortho>para
c) para>ortho>meta
d) para>meta>ortho

**Question 55:** A monohaloarene is an example of?

a) aliphatic halogen compound
b) vinylic halogen compound
c) side chain substituted aryl halide
d) aromatic halogen compound

## CASE STUDY - A

The substitution reaction of alkyl halides occurs in Sn1 and Sn2 mechanism, whatever mechanism alkyl halide follow for substitution reaction to occur, the polarity of the carbon halogen bond is responsible for the substitution reaction. The rate of Sn1 reactions are governed by stability of carbocation whereas for Sn2 reactions steric factor is a deciding factor. If the starting material is a chiral compound, we may end up with an inverted product or racemic mixture depending upon the type of mechanism followed by alkyl halide.

**Question 56:** Among 1-bromo propane and 2-methyl-2-bromo propane, which will follow Sn1 mechanism and why?

**Question 57:** Among following in which inversion of configuration will occur on reaction with aq alkali 1-bromo propane and 2-methyl-2-bromo propane

**Question 58:** What is the role of polar protic solvent in Sn1 reaction?

**Question 59:** Write example of an alkyl halide having chiral carbon atom.

## CASE STUDY - B

An organic compound X which is manufactured by heating a mixture of chloral and chlorobenzene in the presence of concentrated $H_2SO_4$ is used as an insecticide. The use of compound X is banned in many countries. The compound is very effective against mosquitoes which spread malaria.

Answer the following questions based on the information:

**Question 60:** Name the compound X.

**Question 61:** Give its structural formula.

**Question 62:** Write the IUPAC name of compound X.

**Question 63:** Why is the use of compound X banned in many countries? Should we also advocate the ban of this compound though it is banned in many countries?

(I) ASSERTION AND REASONING TYPE QUESTIONS:

(A) Both assertion and reason are correct statements, and reason is the correct explanation of the assertion.
(B) Both assertion and reason are correct statements, but reason is not the correct explanation of the assertion.
(C) Assertion is correct, but reason is wrong statement.
(D) Assertion is wrong, but reason is correct statement.

**Question 64:**
**Assertion:** Phenols are more acidic than aliphatic alcohols.
**Reason:** The phenoxide ion is more resonance stabilised than alkoxide ion.

**Question 65:**
**Assertion:** Phenol is more reactive than benzene towards electrophilic substitution reaction.
**Reason:** In case of phenol, the intermediate carbocation is more stabilized by resonance.

**Question 66:**

**Assertion:** Tertiary alcohols gets converted into an alkene instead of a carbonyl compounds in the presence of heated metallic copper.
**Reason:** Tertiary alcohols prefer to undergo dehydrogenation instead of dehydration in the presence of heated copper.

**Question 67:**

**Assertion:** Bond angle in ethers is slightly more than the tetrahedral angle.
**Reason:** There is greater repulsion between the two bulky alkyl groups.

**Question 68:**

**Assertion:** n-Butanol has higher boiling point than 2-methyl propan-2-ol.
**Reason:** Branching increases the strength of Vander Waals forces.

**Question 69:**

**Assertion:** 2-Pentanol and 3-Pentanol cannot be distinguished by iodoform test.
**Reason:** 2-Pentanol and 3-Pentanol both are secondary alcohols.

**Question 70:**
**Assertion:**     p-Nitrophenol     is     stronger     acid     than     phenol.
**Reason:** The electron withdrawing nature of the nitro group further stabilises the phenoxide ion formed.

**Question 71:**
**Assertion:** Phenetole on cleavage with HI yields phenol and ethyl iodide.
**Reason:** Phenetole is a mixed aromatic ether.

**Question 72:**
**Assertion:** It is not possible to purify ethanol beyond 95% purity by simple distillation.
**Reason:** The intermolecular hydrogen bond in ethanol increases the boiling point of 95% ethanol.

**Question 73:**
**Assertion:** Ethanol can be distinguished from methanol using iodoform test.
**Reason:** Ethanol has a methyl group attached to a carbon containing hydroxyl groups.

**Question 74:** Alcohols and phenols behave as weak acids due to the presence of polar -OH group in them. Phenols are, however, stronger acids than alcohols because the phenoxide ion is stabilized by resonance. Presence of electron withdrawing groups on the ring further increases the acidic strength of phenol.
(a) Out of Phenol & Benzyl alcohol, which has lower value of pKa and why?
(b) Out of o-Cresol and o-Nitrophenol, which has higher value of pKa?
(c) Which compound has shorter bond length- Phenol or Cyclohexanol? Give reason.
(d) Which species out of ethoxide ion and phenoxide ion, is stronger base?

**Question 75:** Bromomethane reacts with sodium phenoxide to give compound "A". Compound "A" on reaction with HI gives compounds- "B" & "C". Compound "B" on reaction with $Br_2$ in the presence of $CS_2$ as solvent at 273 K gives "D" and "E", where "D" is the major product.
(a) Give structure and the name of the compound.
(b) Give chemical equation for the formation of "A". What is this reaction known as?
(c) Write structure of compounds- "B" and "C".
(d) Write chemical equation for the reaction of "B" with aqueous $Br_2$.

**Question 76:**

When an aldehyde with no a-hydrogen reacts with concentrated aqueous NaOH, half the aldehyde is converted to carboxylic acid salt and other half is converted to an alcohol. In other words, half of the reactant is oxidized and another half is reduced. This reaction is known as Cannizzaro reaction.

The following questions are multiple choice questions. Choose the most appropriate answer:

(i) A mixture of benzaldehyde and formaldehyde on heating with aqueous NaOH solution gives
   a) benzyl alcohol and sodium formate
   b) sodium benzoate and methyl alcohol
   c) sodium benzoate and sodium formate
   d) benzyl alcohol and methyl alcohol.

(ii) Which of the following compounds will undergo Cannizzaro reaction?
   a)    $CH_3CHO$
   b)    $CH_3COCH_3$
   c)    $C_6H_5CHO$
   d)    $C_6H_5CH_2CHO$

(iii) Trichloroacetaldehyde is subjected to Cannizzaro's reaction by using NaOH. The mixture of the products contains sodium trichloroacetate ion and another compound. The other compound is
   a)    2, 2, 2-trichloroethanol
   b)    Trichloromethanol
   c)    2, 2, 2-trichloropropanol
   d)    chloroform

(iv) Two compounds benzyl alcohol and benzoic acid are formed from this compound, when this compound is heated in the presence of conc. NaOH, this compound is.
   a)    Benzaldehyde
   b)    Benzylalcohol
   c)    Acetophenone
   d)    Benzophenone

(v) Cannizzaro reaction is given by
   a)    HCHO
   b)    $CH_3COCH_2CH_3$
   c)    $CH_3CHO$
   d)    $CH_3CH_2OH$

**Question 77:**
When and aldehyde or ketone is present in a molecule which also contains an alcohol functional group the carbonyl is given nomenclature priority by the IUPAC system. This means that the carbonyl is given the lowest possible location number and the appropriate nomenclature suffix is included. Carboxylic acids are given the highest nomenclature priority by the IUPAC system.
The following questions are multiple choice questions. Choose the most appropriate answer:

(i) What is the common name of the compound which has a CHO group attached to the sp2 hybridised carbon of a benzene ring?
    a) Benzanal                        b) Benzaldehyde
    c) Benzenecarbaldehyde       d) Phthaldehyde

(ii) What is the correct IUPAC naming of the compound shown?



    a) Benzenecarbaldehyde
    b) Cyclohexanal
    c) Cyclohexyl aldehyde
    d) Cyclohexanecarbaldehyde

(iii) Identify the correct IUPAC name of CH3-CH=CH-CHO.
    a) But-2-enal                  b) 2-Butenal
    c) Buten-2-al                  d) Butenal

(iv) What is the correct IUPAC name of the compound CH3CH=CHCH=CHCOOH?
    a) Hexenedioc acid
    b) Hexa-2,4-dienoic acid
    c) Penta-1,3-dienioc acid
    d) Pentenedioc acid

(v) What is the IUPAC name of terephthalic acid?
    a) 2-Phenylethanoic acid
    b) Benzene-1,2-dicarboxylic acid
    c) Benzene-1,3-dicarboxylic acid
    d) Benzene-1,4-dicarboxylic acid

**Question 78:**

Aldol Condensation can be defined as an organic reaction in which enolate ion reacts with a carbonyl compound to form β-hydroxy ketone or β-hydroxy aldehyde, followed by dehydration to give a conjugated enone. Aldol Condensation plays a vital role in organic synthesis, creating a path to form carbon-carbon bonds. The following questions are multiple choice questions. Choose the most appropriate answer:

(i) Which of the following compounds would be the main product of an aldol condensation of acetaldehyde and acetone?
(a) $CH_3CH=CHCHO$      (b) $CH_3CH=CHCOCH_3$
(c) $(CH_3)_2C=CHCHO$      (d) $(CH_3)_2C=CHCOCH_3$

(ii) Which combination of carbonyl compounds gives phenyl vinyl ketone by an aldol condensation?
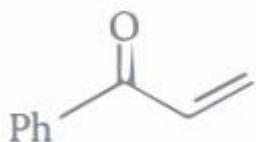


(a) Acetophenone and Formaldehyde
(b) Acetophenone and acetaldehyde
(c) Benzaldehyde and acetaldehyde
(d) Benzaldehyde and acetone

(iii) Which of the following will undergo aldol condensation?
(a) HCHO                  (b) $CH_3CH_2OH$
(c) $C_6H_5CHO$            (d) $CH_3CH_2CHO$

(iv) Which of the following acts as a nucleophile in the aldol condensation of ethanal?
(i)$OH^-$          (ii) $H_2O$          (iii) $^-CH_2CHO$
a) Only (i)
b) (i) and (ii)
c) (i) and (iii)
d) All the three

(v) When ethanal reacts with propanal in the presence of a base, the number of products formed is
(a) 2              (b) 3
(c) 4              (d) 5

**Question 79:**

Carboxylic acids dissociate in water to give carboxylate ion and hydronium ion.

$RCOOH + H_2O \longrightarrow RCOO^- + H_3O^+$
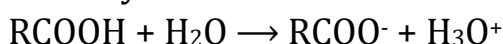
The acidity of carboxyl group is due to the presence of positive charge on oxygen which liberates proton. The carboxylate ion formed is resonance stabilised.
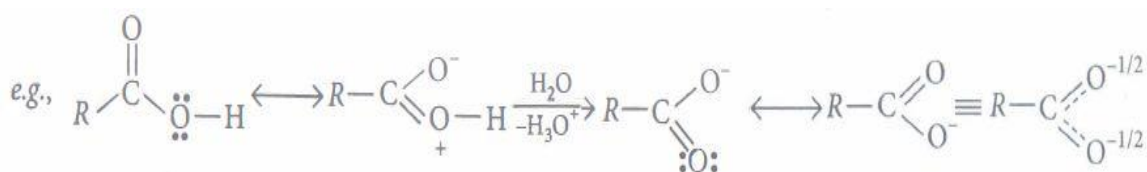


Carboxylic acids are stronger acids than phenols. Electron withdrawing groups (EWG) increase the acidity of carboxylic acids by stabilising the conjugate base through delocalisation of negative charge by inductive and/ or resonance effects. Electron donating group (EDG) decrease the acidity by destabilising the conjugate base.

The following are multiple choice questions. Choose the most appropriate answer:

(i) Which of the following has the maximum acidic strength?
   a) o- nitrobenzoic acid
   b) m-nitrobenzoic acid
   c) p-nitrobenzoic acid
   d) p-nitrophenol

(ii) Which one of the following is the correct order of acidic strength?
   a) $CF_3COOH > CHCl_2COOH > HCOOH > C_6H_5CH_2COOH > CH_3COOH$
   b) $CH_3COOH > HCOOH > CF_3COOH > CHCl_2COOH > C_6H_5CH_2COOH$
   c) $HCOOH > C_6H_5CH_2COOH > CF_3COOH > CHCl_2COOH > CH_3COOH$
   d) $CF_3COOH > CH_3COOH > HCOOH > CHCl_2COOH > C_6H_5CH_2COOH$

(iii) Which of the following acids has the smallest dissociation constant?
   a) $CH_3CHFCOOH$
   b) $FCH_2CH_2COOH$
   c) $BrCH_2CH_2COOH$
   d) $CH_3CHBrCOOH$

(iv) Carboxylic acids are more acidic than phenol and alcohol because of
   a) intermolecular hydrogen bonding
   b) formation of dimers
   c) highly acidic hydrogen
   d) resonance stabilization of their conjugate base

(v)  Among the following acids which has the lowest pKa value?
    a) $CH_3CH_2COOH$
    b) $(CH_3)_2CHCOOH$
    c) $HCOOH$
    d) $CH_3COOH$

**Question 80:**

Aldehydes have a hydrogen attached to the carbonyl carbon which can be abstracted, allowing them to be easily oxidized to form carboxylic acids even with mild oxidizing agents like Tollen's reagent and Fehling solutions. The lack of this hydrogen, makes ketones generally inert to these oxidation conditions. Nevertheless, ketones can be oxidized but only under extreme conditions. Because ketones do not have that particular hydrogen atom, they are resistant to oxidation, and only very strong oxidizing agents like potassium manganate (VII) solution (potassium permanganate solution) oxidize ketones. However, they do it in a destructive way, breaking carbon-carbon bonds. Provided you avoid using these powerful oxidizing agents, you can easily tell the difference between an aldehyde and a ketone. Aldehydes are easily oxidized by all sorts of different oxidizing agents: ketones are not.

(i)  Which of the following compounds will give butanone on oxidation with alkaline $KMnO_4$ solution?
    a) Butan-1-ol
    b) Butan-2-ol
    c) Both of these
    d) None of these

(ii)  A compound $C_5H_{10}O$ forms orange–red precipitate upon reaction with 2,4–DNP, but does not give positive Tollen's test
    a) 2, 2–dimethylpropanal
    b) 3–methylbutan–2–one
    c) Pentan–3–one
    d) None of the above

(iii)  In the oxidation of ketone which of the following is not possible.
    a) breaking of C-C bond
    b) formation of carboxylic acid
    c) breaking of C-O bond
    d) formation of carboxylic acids containing less number of carbon atoms.

(iv) When ethyl benzene is oxidised by alkaline $KMnO_4$ it gives
    a) benzoic acid
    b) pthalic acid
    c) ethanoic acid
    d) benzaldehyde

(v) Compound A of formula $C_3H_{10}O$ forms oxime and give negative silver mirror test and iodoform test. the compound A is
    a) 2-pentanone
    b) Pentanal
    c) 3-pentanone
    d) 2-methyl butanal

## Question 81:

Aldehyde and Ketone preparation is possible by oxidation of primary and secondary alcohol by agents such as PCC (pyridinium chlorochromate), Collins reagents (Chromium trioxide-pyridine complex). Alcohols undergo dehydrogenation when vapours of primary alcohol or secondary alcohol pass through copper gauze at a temperature of 573 K. Formation of aldehyde and ketone is possible by ozonolysis of alkenes. In Ozonolysis, addition of ozone ($O_3$) to an alkene compound leads to the formation of ozonide. Reduction of the ozonide compound with the help of zinc dust and water produces the smaller molecules, which in this case will be the respective aldehydes and ketones. Alkynes undergo hydration according to Markovnikov's rule in the presence of a proper catalyst to produce aldehydes and ketones.

Identify and name the reagents that help in carrying out the following reactions
    a) Cyclohexanol to cyclohexanone
    b) Hexan-1-ol to hexanal
    c) But-2-ene to ethanol
    d) Allyl alcohol to propenal
    e) acetyl chloride to produce ethanal

## Question 82:

Aldehydes and ketones undergo a variety of reactions that lead to many different products. The most common reactions are nucleophilic addition reactions. The main reactions of the carbonyl group are nucleophilic additions to the carbon-oxygen double bond. Due to differences in electronegativities, the carbonyl group

is polarized. The carbon atom has a partial positive charge, and the oxygen atom has a partially negative charge. Aldehydes are usually more reactive toward nucleophilic substitutions than ketones because of both steric and electronic effects. In aldehydes, the relatively small hydrogen atom is attached to one side of the carbonyl group, while a larger R group is affixed to the other side. In ketones, however, R groups are attached to both sides of the carbonyl group. Thus, steric hindrance is less in aldehydes than in ketones.

(i) Imine derivatives of aldehyde and ketone is called as
    a) Schiff's reagent
    b) Fehling's reagent
    c) Schiff's base
    d) Schiff's acid

(ii) The compound that neither forms semicarbazone nor oxime is
    a) HCHO
    b) $CH_3COCH_2Cl$
    c) $CH_3CHO$
    d) $CH_3CONHCH_3$

(iii) Addition of hydrogen cyanide to aldehydes and ketones occurs in presence of a base. The role of base is to
    (i) catalyse the reaction
    (ii) generate $CN^-$ ion
    (iii) slow down the reaction
    (iv) to stabilize the cyanohydrins
    a) (i) and (iii)
    b) (i) and (ii)
    c) (i) and (iv)
    d) (ii) and (iv)

(iv) An organic compound of formula, $C_3H_6O$ forms phenyl hydrazone, but gives negative Tollen's test. The compound is
    a) $CH_3CH_2COCH_3$
    b) $CH_3CH_2CHO$
    c) $CH_3COCH_3$
    d) Both (a) and (c)

(v) The reagent which does not react with both, acetone and benzaldehyde.
   a) Sodium hydrogensulphite
   b) Phenyl hydrazine
   c) Fehling's solution
   d) Grignard reagent

## Question 83:

The haloform reaction is the reaction of a methyl ketone with chlorine, bromine, or iodine in the presence of hydroxide ions to give a carboxylate ion and a haloform. There is one aldehyde that undergoes the haloform reaction, which is acetaldehyde. When the halogen used is iodine, the haloform reaction can be used to identify methyl ketones because iodoform is a yellow solid with a characteristic odour. The test is known as the iodoform test. Alcohols that have the general structural formula 1 also give a positive iodoform test because, under the reaction conditions, they are oxidized to the corresponding methyl ketone, or, in the case of ethanol to acetaldehyde, which is the only aldehyde that undergoes haloform reaction.

(i) Which of the following undergoes haloform reaction?
   a) $CH_3CH_2COCH_2Cl$
   b) $C_6 H_5COCH_3$
   c) $C_6H_5COCHCl_2$
   d) $CH_3CH_2COCCl_3$

(ii) Which of the choices below represents what's known as a haloform?
   a) $CHX_3$
   b) $CH_2 X_2$
   c) $CH_3 X_2$
   d) $CX_4$

(iii) Idoform test is not given by-
   a) Pentan-2-one
   b) Ethanol
   c) Ethanal
   d) Pentan-3-one

(iv) Two isomeric forms Pentan-2-one and Pentan-3-one can be distinguished by
  a) $I_2/NaOH$
  b) $NaHSO_3$
  c) Both a & b
  d) $NaCN/HCl$

(v) The only primary alcohol that provides the triiodomethane (iodoform) reaction is
  a) Methanol
  b) Ethanol
  c) Propanol
  d) Butanol

## Question 84:

The reduction of carbonyl compounds is an example of nucleophilic addition. The carbon-oxygen double bond is highly polar, and the slightly positive carbon atom is attacked by the hydride ion. The most common sources of the hydride nucleophile are lithium aluminum hydride ($LiAlH_4$) and sodium borohydride ($NaBH_4$). These reagents serve as a source of hydride due to the presence of a polar metal-hydrogen bond. Because aluminum is less electronegative than boron, the Al-H bond in $LiAlH_4$ is more polar, thereby, making $LiAlH_4$ a stronger reducing agent. Addition of a hydride anion ($H:^-$) to an aldehyde or ketone gives an alkoxide anion, which upon protonation yields the corresponding alcohol. Aldehydes produce $1^0$-alcohols and ketones produce $2^0$-alcohols. However, catalytic hydrogenation under specified conditions leads to the formation of alkanes viz like Clemmensen reduction and Wolff- Kishner reduction.

(i) Which aldehyde cannot be obtained by Rosenmund's reaction?
  a) $CH_3CHO$
  b) $HCHO$
  c) $CH_3CH_2CHO$
  d) All of these

(ii) In which reaction, $> C = O$ can be reduced to $> CH_2$?
  a) Wolf-Kishner reaction
  b) Reimer-Tiemann reaction
  c) Wurtz reaction
  d) None of these

(iii) Clemmensen reduction of a ketone is carried out in the presence of which of the following?
   a) Glycol with KOH
   b) Zn-Hg with HCl
   c) $LiAlH_4$
   d) $H_2$ and Pt as catalyst

(iv) Iso-butane is the complete reduction product of
   a) methyl sec-propyl ketone
   b) 2-methyl propanal
   c) 2-methyl propan-2-ol
   d) Butan-2-one

(v) Ketones on catalytic hydrogenation forms
   a) pri. Alcohol
   b) monohydric alcohol in which -OH group is attached to two carbon atoms
   c) monohydric alcohol containing -OH group on tert. carbon atoms
   d) monohydric alcohol in which -OH group is linked to sec, carbon

**Question 85:**
Directions: These questions consist of two statements, each printed as Assertion and Reason. While answering these questions, you are required to choose any one of the following four responses.
(a)   If both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.
(b)   If both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.
(c)   If the Assertion is correct but Reason is incorrect.
(d)   If both the Assertion and Reason are incorrect.

(i)
**Assertion :** The boiling points of aldehydes and ketones are higher than hydrocarbons and ethers of comparable molecular masses.
**Reason :** There is a weak molecular association in aldehydes and ketones arising out of the dipole-dipole interactions.

(ii)
**Assertion :** Formaldehyde is a planar molecule.
**Reason :** It contains $sp^2$ hybridised carbon atom.

(iii)
**Assertion:** Compounds containing –CHO group are easily oxidised to corresponding carboxylic acids.
**Reason:** Carboxylic acids can be reduced to alcohols by treatment with $LiAlH_4$

(iv)
**Assertion :** The a-hydrogen atom in carbonyl compounds is less acidic.
**Reason :** The anion formed after the loss of a-hydrogen atom in carbonyl compounds is more acidic.

(v)
**Assertion :** Aromatic aldehydes and formaldehyde undergo Cannizzaro's reaction.
**Reason :** Aromatic aldehydes are almost as reactive as formaldehyde.

(vi)
**Assertion :** Carboxylic acids do not show the properties of a carbonyl group.
**Reason :** The -C=O in the carboxyl group is in resonance with the -OH group.

(vii)
**Assertion :** Lower aldehyde and ketones are soluble in water but the solubility decreases as molecular mass increases.
**Reason :** Aldehydes and ketones can be distinguished by Tollen's reagent.

(viii)
**Assertion:** Benzaldehyde resists nucleophilic addition in comparison with Ethanal
**Reason:** The Phenyl group in benzaldehyde is too bulky and therefore prevents the attack of Nucleophile.

(ix)
**Assertion:** Acetophenone and benzophenone can be distinguished by the iodoform test.
**Reason:** Acetophenone and benzophenone both are carbonyl compounds.

(x)
**Assertion:** Even though there are two $NH_2$ groups in semicarbazide, only one reacts with carbonyl compounds
**Reason:** Semicarbazide has two $NH_2$ groups out of which one is in resonance with the carbonyl group.

**Question 86:**

Amines are derivatives of ammonia in which one or more of the hydrogens has been replaced by an alkyl or aryl group. For the naming of Amines in the IUPAC system: the "e" ending of the alkane name for the longest chain is replaced with – amine. The amine group is located by the position number. Groups that are attached to the nitrogen atom are located using "N" as the position number. More complex primary amines are named with —$NH_2$ as the amino substituent. Aromatic amines: named as derivatives of the parent compound aniline. Substituents attached to the nitrogen are indicated by using "N-" as the location number.

(i) Which of the following is the correct IUPAC name of $(CH_3)_3N$?
   a) Trimethylamine
   b) N-Methylethanamine
   c) N,N-Dimethylmethanamine
   d) N,N,N-Trimethylamine

(ii) What is the correct IUPAC name of $H_2N\text{-}(CH_2)_5\text{-}NH_2$?
   a) Pentan-1,5-diamine
   b) 1,5-Diaminopentane
   c) Pentamethylenediamine
   d) Pentane-1,5-diamine

(iii) Identify the correct IUPAC name
   a) $(CH_3CH_2)_2NCH_3$ = N-Ethyl-N-methylethanamine
   b) $(CH_3)_3CNH_2$ = 2-methylpropan-2-amine
   c) $CH_3NHCH\,(CH_3)_2$ = N-Methylpropan-2-amine
   d) $(CH_3)_2CHNH_2$ = 2, 2-Dimethyl-N-propanamine

(iv) IUPAC name of product formed by reaction of methyl amine with two moles of ethyl chloride
   a) N,N-Dimethylethanamine
   b) N,N-Diethylmethanamine
   c) N-Methyl ethanamine
   d) N-Ethyl – N-methylethanamine
   e)

(v) How many structural isomers are possible for $C_3H_9N$?
   a) 4
   b) 2
   c) 5
   d) 3

**Question 87:**

A mixture of two aromatic compounds (A) and (B) was separated by dissolving in chloroform followed by extraction with aqueous KOH solution. The organic layer containing compound (A), when heated with alcoholic solution of KOH produce $C_7H_5N$ (C) associated with unpleasant odour.

The following questions are multiple choice question. Choose the most appropriate answer:

(i) What is A?
(a) $C_6H_5NH_2$
(b) $C_6H_5CH_3$
(c) $C_6H_5CHO$
(d) None of these

(ii) The reaction of (A) with alcoholic solution of KOH to produce (C) of unpleasant odour is called

(a) Sandmeyer reaction
(b) Carbylamine reaction
(c) Ullmann reaction
(d) Reimer-Tiemann reaction.

(iii) The alkaline aqueous layer (B) when heated with chloroform and then acidified give a mixture of isomeric compounds of molecular formula $C_7H_6O_2$. (B)is

(a) $C_6H_5CHO$
(b) $C_6H_5COOH$
(c) $C_6H_5CH_3$
(d) $C_6H_5OH$

(iv) In the chemical reaction, $CH_3CH_2NH_2 + CHCl_3 + 3KOH \rightarrow$ (A) + (B) + $3H_2O$, the compounds (A) and (B) are respectively

(a) $C_2H_5NC$ and $KCl$
(b) $C_2H_5CN$ and $KCl$
(c) $CH_3CH_2CONH_2$ and $KCl$
(d) $C_2H_5NC$ and $K_2CO_3$

(v) Among the following:

I. $CH_3NH_5$
II. $(CH_3)_2NH$
III. $(CH_3)_3N$
IV. $C_6H_5NH_2$

Which will give the positive carbylamine test?

(a) I and II
(b) I and IV
(c) II and IV
(d) II and III

## Question 88:

Lower members of the aliphatic amines are gases at ordinary temperature and have smelled like ammonia. The higher members with three or more C atoms are mostly liquid has a fishy smell. Most of the amines have an unpleasant odour. Aromatic amines are toxic. Most of the amines in pure form are colourless but they are easily oxidised and they become coloured due to impurities. Amines have higher boiling points than hydrocarbons of comparable molecular mass because amines are polar compounds and with the exception of tertiary amines form associate molecules due to intermolecular hydrogen bonding between nitrogen of one and hydrogen of another molecule. Amines have lower boiling points than those of alcohols or carboxylic acids because the electronegativity of nitrogen is lower than that of oxygen and hence O-H bonds present in alcohols and carboxylic acids are more polar than N-H bonds in amines. The hydrogen bonds in alcohols and carboxylic acids are stronger and have higher boiling points. The lower aliphatic amines are soluble in water because they are capable of forming hydrogen bonds with water. However, Solubility decreases with increases in the molar mass of amines due to an increase in the size of the hydrophobic alkyl part. The higher amines containing six or more carbon atoms are insoluble because of weaker hydrogen bonds the solubility of amines in water is less than that of alcohols.

(i) Aniline is less soluble in water than ethyl amine due to
(a) resonance stablization of benzene ring
(b) resonance stabilization of anilium ion
(c) more hydrophobic nature of $C_6H_5$ group than $C_2H_5$ group
(d) less hydrophobic nature of $C_6H_5$ group than $C_2H_5$ group

(ii) Which of the following amines are insoluble in water

(a) Methanamine
(b) Ethanamine
(c) Propanamine
(d) Benzenamine

(iii) What is the correct order of boiling points of isomeric amines where A= Ethylmethyl amine, B= Propyl amine and C= Trimethyl amine

(a) A>B>C
(b) C>B>A
(c) B>C>A
(d) B>A>C

(iv) Which of the following has lower boiling point than ethanamine

(a) Propane
(b) Ethanal
(c) Ethanol
(d) Methanoic acid

(v) Which of the following amine has highest boiling point?

a) Butyl amine
b) Diethylamine
c) Triethylamine
d) Dipropylamine

**Question 89:**
Amines are alkyl or aryl derivatives of ammonia. All amines are basic compounds. They act as Lewis base due to the presence of lone pair of electron on nitrogen. Basic character of amines depends on the· factors like inductive effect; steric hindrance and resonance. Alkyl groups and electron releasing groups hence these groups increase the electron density at nitrogen as well as the basic character of amines. Basic, character of tertiary amines is reduced due to the steric hindrance of three alkyl groups. Experimentally it is observed that stronger bases have smaller values of $pK_b$ (greater values of $K_b$).

(i)   Which among the following is the most basic in gas phase?

(a) $NH_3$
(b) $CH_3$-$NH_2$
(c) $(CH_3)_2NH$
(d) $(CH_3)_3N$

(ii)  Which among the following is the most basic in aqueous medium?

(a) $NH_3$
(b) $CH_3$-$NH_2$
(c) $(CH_3)_2\ NH$
(d) $(CH_3)_3\ N$

(iii) Which among the following factors influence the basicity of amines?
I-the inductive effect of alkyl group
II-the polar effect
lII-the resonance

(a) I, II
(b) I, 1lI
(c) II, III
(d) I, II, III

(iv)  Arrange the following compounds in increasing order of basicity:
$CH_3NH_2$, $(CH_3)_2\ NH$, $NH_3$, $C_6H_5NH_2$
(a) $C_6H_5NH_2 < NH_3 < (CH_3)_2\ NH < CH_3NH_2$
(b) $CH_3NH_2 < (CH_3)_2\ NH < NH_3 < C_6H_5NH_2$
(c) $C_6H_5NH_2 < NH_3 < CH_3NH_2< (CH_3)_2\ NH$
(d) $(CH_3)_2\ NH < CH_3NH_2 < NH_3 < C_6H_5NH_2$

(v)   Which of the following has lowest $pK_b$ value?
(a) $(CH_3)_3CNH_2$
(b) $NH_3$
(c) $(CH_3)_2NH$
(d) $CH_3NH_2$

**Question 90:**

The process of conversion of a primary aromatic amino compound into a diazonium salt is known as diazotization. This process is carried out by adding an aqueous solution of sodium nitrite to a solution of primary aromatic amine (e.g., aniline) in excess of HCl at a temperature below 5°C. Nitrous acid reacts with all classes of amines; The products obtained from these reactions depend on whether the amine is primary, secondary or tertiary and whether the amine is aliphatic or aromatic. Aliphatic Primary amines react with nitrous acid ($NaNO_2$ + HCI) to form alcohol as major product.

(i) Which of the following compounds reacts with $NaNO_2$ and HCl at 0-4°C to give alcohol/phenol?
(a) $C_6H_5NH_2$
(b) $C_2H_5NH_2$
(c) $CH_3NHCH_3$
(d) $C_6H_5NHCH_3$

(ii) The end product Z of the reaction
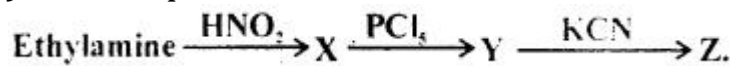
Ethylamine $\xrightarrow{HNO_2}$ X $\xrightarrow{PCl_5}$ Y $\xrightarrow{KCN}$ Z.
(a) propanenitrile
(b) triethylamine
(c) diethylamine
(d) propylamine

(iii)    Identify 'Z' in the sequence?
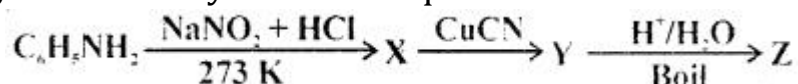
$C_6H_5NH_2 \xrightarrow[\text{273 K}]{NaNO_2 + HCl}$ X $\xrightarrow{CuCN}$ Y $\xrightarrow[\text{Boil}]{H^+/H_2O}$ Z
(a) $C_6H_5CN$
(b) $C_6H_5CONH_2$
(c) $C_6H_5COOH$
(d) $C_6H_5CH_2NH_2$

(iv) Why is the reason for the stability of aromatic diazonium salts?
a) Dispersal of negative charge over the benzene ring
b) Dispersal of positive charge over benzene ring
c) Bond between diazonium group and anion
d) High electronegativity of anion compared to the N atom

(v) The preparation of diazonium salts from primary aromatic amines is known as

a) acylation  b) alkylation

c) benzonation  d) diazotisation

## Question 91:

The replacement of an atom or group of atoms through an electrophile is known as an electrophilic substitution reaction. For example, bromination, nitration, sulphonation etc. of anilines comes under electrophilic substitution reaction. In anilines, the maximum electron density is found at ortho- and para- positions of the –NH$_2$ group. The -NH$_2$ group is ortho and para directing and is a powerful activating group.

(i) When aniline is heated with cone. H$_2$SO$_4$ at 455-475 K, it forms
   (a) aniline hydrogensulphate
   (b) sulphanilic acid
   (c) amino benzene sulphonic acid
   (d) benzenesulphonic acid

(ii) Electrophilic substitution of aniline with bromine water at room temperature gives
   (a) 2-bromoaniline
   (b) 3-bromoaniline
   (c) 2, 4, 6-tribromoaniline
   (d) 3, 5, 6-tribromoaniline

(iii) Which of the following can exist as zwitter ion?
   (a) p-Aminoacetophenone
   (b) Sulphanilic acid
   (c) p-Nitroaminobenzene
   (d) p-Methoxyphenol

(iv) Direct nitration of an aromatic compounds (A) is not feasible because
   (a) the reaction cannot be stopped at the mononitration stage
   (b) a mixture of o, m and p-nitroaniline is always obtained
   (c) nitric acid oxidises most of the aromatic compounds to give oxidation products along with only a small amount of nitrated products
   (d) all of the above

(v) Tertiary amines have lowest boiling points amongst isomeric amines because
(a) they have highest molecular mass
(b) they do not form hydrogen bonds
(c) they are more polar in nature
(d) they are most basic in nature

## Question 92:

The alkylation of ammonia, Gabriel synthesis, reduction of nitriles, reduction of amides, reduction of nitro compounds, and reductive amination of aldehydes and ketones are methods commonly used for preparing amines.

(i) Reduction of aromatic nitro-compounds using Sn and HCl gives
(a) aromatic primary amines
(b) aromatic secondary amines
(c) aromatic tertiary amines
(d) aromatic amides

(ii) Which one of the following reducing agents is likely to be most effective in bringing about the following change?

$$R - \overset{\overset{\textstyle O}{\|}}{C} - NH_2 \rightarrow RCH_2NH_2$$
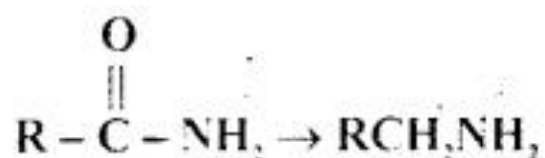
(a) $H_2$-Ni
(b) $NaBH_4$
(c) $LiAlH_4$ ether
(d) Na-AIcohol

(iii) Benzoic acid is treated with $SOCl_2$ and the product (X) formed is reacted with ammonia to give (Y). (Y) on reaction with $Br_2$ and KOH gives (Z). (Z) in the reaction is

(a) aniline
(b) chlorobenzene
(c) benzamide
(d) benzoyl chloride

(iv) Secondary amines can be prepared by

(a) reduction of nitro compounds
(b) oxidation of N-substituted amides
(c) reduction of isonitriles
(d) reduction of nitriles

(v) The most convenient method to prepare primary (i Amine) amine containing one carbon atom less is
(a) Gabriel phthalmidie synthesis
(b) Reductive amination of aldehydes
(c) Hofmann bromamide reaction
(d) Reduction of isonitriles

## Question 93:

Read the passage given below and answer the following questions:

Aniline activates the benzene ring by increasing electron density at ortho- and para-positions. Hence, it is o-, p-directing. $-NH_2$ group strongly activates the ring therefore it is difficult to stop the reaction at mono substitution stage. Among electrophilic substitution reaction, direct nitration of aniline is not done to get o- and p-nitroaniline because lone pair of electrons present at nitrogen atom will accept proton from nitrating mixture to give anilinium ion which is meta-directing. Aniline with $NaNO_2$ and HCl forms benzene diazonium chloride at very low temperature. Aromatic amines react with nitrous acid to form a yellow oily liquid known as N-nitroso amines.

In these questions (i-iv), a statement of assertion followed by a statement of reason is given. Choose the correct answer out of the following choices.

(a) Assertion and reason both are correct statements and reason is correct explanation for assertion.
(b) Assertion and reason both are correct statements but reason is not correct explanation for assertion.
(c) Assertion is correct statement but reason is wrong statement.
(d) Assertion is wrong statement but reason is correct statement.

(i) **Assertion:** Nitrating mixture used for carrying out nitration of benzene consists of cone. conc. $HNO_3$ +conc. $H_2SO_4$.
**Reason:** In presence of $H_2SO_4$, $HNO_3$ acts as a base and produces $NO_2^+$ ions.

(ii) **Assertion:** Anilinium chloride is more acidic than ammonium chloride.
**Reason:** Anilinium ion is not resonance-stabilised.

(iii) **Assertion:** Nitrobenzene can be prepared from benzene by using mixture of conc. $HNO_3$ and conc. $H_2SO_4$.
**Reason:** In the mixture, $H_2SO_4$ act as an acid.

(iv) **Assertion:** In strongly acidic solution, aniline becomes less reactive towards electrophilic reagents.
**Reason:** The amino group being completely protonated in strongly acidic solution, the lone pair of electrons on the nitrogen is no longer available for resonance.

## Question 94:

Amines are produced when an alcoholic solution of ammonia and an alkyl or a benzyl halide is heated in a sealed tube at 373 K. This reaction is called ammonolysis and usually gives a mixture of primary, secondary and tertiary amines along with some quaternary ammonium salts. This reaction is an example of nucleophilic substitution reaction in which ammonia acts as a nucleophile due to the presence of a lone pair of electrons on the nitrogen atom. However, this method cannot be used for the preparation of aryl amines. One of the most convenient methods for the preparation of aryl amines is reduction of nitro compounds. Aryl amines can also be prepared by reduction of nitrites or Gabriel phthalimide synthesis.

In these questions (i-iv), a statement of assertion followed by a statement of reason is given. Choose the correct answer out of the following choices.
(a) Assertion and reason both are correct statements and reason is correct explanation for assertion.
(b) Assertion and reason both are correct statements but reason is not correct explanation for assertion.
(c) Assertion is correct statement but reason is wrong statement.
(d) Assertion is wrong statement but reason is correct statement.

i. **Assertion:** Ammonolysis of alkyl halides only produces $2^o$ amines.
**Reason:** Ammonolysis of alkyl halides involves the reaction between alkyl halides and alcoholic ammonia.

ii.    **Assertion:** Ammonolysis method cannot be used for the preparation of aryl amines.
**Reason:** Aryl halides are much less reactive than alkyl halides towards nucleophilic substitution reaction.

iii.    **Assertion:** Ammonolysis can be used to prepare pure primary amines.
**Reason:** Ammonolysis of haloalkanes lead to multiple ammonium salts.

iv.    **Assertion:** Aromatic 1ᵖ amines cannot be prepared by Gabriel phthalimide synthesis.
**Reason:** Aryl halides do not undergo nucleophilic substitution with anion formed by phthalimide.

## Question 95:

**Directions:** These questions consist of two statements, each printed as Assertion and Reason. While answering these questions, you are required to choose any one of the following four responses.

(a) If both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.

(b) If both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.

(c) If the Assertion is correct but Reason is incorrect.

(d) If both the Assertion and Reason are incorrect.

(i) **Assertion:** Only a small amount of HCl is required in the reduction of nitro compounds with iron scrap and HCl in the presence of steam.
**Reason:** $FeCl_2$ formed gets hydrolysed to release HCl during the reaction. A

(ii) **Assertion:** Acetanilide is less basic than aniline.
**Reason:** Acetylation of aniline results in decrease of electron density on nitrogen.

(iii) **Assertion:** Nitration of aniline can be conveniently done by protecting the amino group by acetylation.
**Reason:** Acetylation increases the electron-density in the benzene ring.

(iv) **Assertion:** Aniline does not undergo Friedel-Crafts reaction.
**Reason:** –NH2 group of aniline reacts with AlCl3 (Lewis acid) to give acid-base reaction.

(v) **Assertion:** N-Ethylbenzene sulphonamide is soluble in alkali.
**Reason:** Hydrogen attached to nitrogen in sulphonamide is strongly acidic.

**Question 96:**

Carbohydrates are primarily produced by plants and form a very large group of naturally occurring organic compounds. Some common examples are cane sugar, glucose, starch, etc. Most of them have a general formula, $C_x(H_2O)_y$ , and were considered as hydrates of carbon from where the name carbohydrate was derived. For example, the molecular formula of glucose ($C_6H_{12}O_6$ ) fits into this general formula, $C_6(H_2O)_6$ . But all the compounds which fit into this formula may not be classified as carbohydrates. Acetic acid ($CH_3COOH$) fits into this general formula, $C_2(H_2O)_2$ but is not a carbohydrate. Similarly, rhamnose, $C_6H_{12}O_5$ is a carbohydrate but does not fit in this definition. A large number of their reactions have shown that they contain specific functional groups. Chemically, the carbohydrates may be defined as optically active polyhydroxy aldehydes or ketones or the compounds which produce such units on hydrolysis. Some of the carbohydrates, which are sweet in taste, are also called sugars. The most common sugar, used in our homes is named as sucrose whereas the sugar present in milk is known as lactose. Carbohydrates are also called saccharides (Greek: sakcharon means sugar).

Carbohydrates are classified on the basis of their behaviour on hydrolysis. They have been broadly divided into following three groups. (i) Monosaccharides: A carbohydrate that cannot be hydrolysed further to give simpler unit of polyhydroxy aldehyde or ketone is called a monosaccharide. About 20 monosaccharides are known to occur in nature. Some common examples are glucose, fructose, ribose, etc. (ii) Oligosaccharides: Carbohydrates that yield two to ten monosaccharide units, on hydrolysis, are called oligosaccharides. They are further classified as disaccharides, trisaccharides, tetrasaccharides, etc., depending upon the number of monosaccharides, they provide on hydrolysis. Amongst these the most common are disaccharides. The two monosaccharide units obtained on hydrolysis of a disaccharide may be same or different. For example, sucrose on hydrolysis gives one molecule each of glucose and fructose whereas maltose gives two molecules of glucose only. (iii) Polysaccharides: Carbohydrates which yield a large number of monosaccharide units on hydrolysis are called polysaccharides. Some common examples are starch, cellulose, glycogen, gums, etc. Polysaccharides are not sweet in taste, hence they are also called non-sugars. The carbohydrates may also be classified as either reducing or non reducing sugars. All those carbohydrates which reduce Fehling's solution and Tollens' reagent are referred to as reducing sugars. All monosaccharides whether aldose or ketose are reducing sugars. In disaccharides, if the reducing groups of monosaccharides i.e., aldehydic or ketonic groups are bonded, these are non-reducing sugars e.g. sucrose. On the other hand, sugars in which these functional groups are free, are called reducing sugars, for example, maltose and lactose.

(i)    Which of the following is a non-reducing sugar?
       (a) Glucose
       (b) Sucrose
       (c) Maltose
       (d) Lactose

(ii)   What are the hydrolysis products of sucrose?
       (a) Fructose + Fructose
       (b) Glucose + Glucose
       (c) Glucose + Galactose
       (d) D-Glucose + D-Fructose

(iii)  Carbohydrates are stored in human body as the polysaccharide
       (a) starch
       (b) glycogen
       (c) cellulose
       (d) amylose

(iv)   Which of the following is an example of an aldopentose?
       (a) D-Ribose
       (b) Glyceraldehyde
       (c) Fructose
       (d) Erythrose

(v)    Which of the following carbohydrates does not satisfy the formula
       $C_x(H_2O)_y$?
       a) Fructose
       b) Glucose
       c) Deoxyribose
       d) Lactose

**Question 97:**

Glucose is an aldohexose and is also known as dextrose. It is the monomer of many of the larger carbohydrates, namely starch, cellulose. It is probably the most abundant organic compound on earth.

1. Its molecular formula was found to be $C_6H_{12}O_6$.
2. On prolonged heating with HI, it forms n-hexane, suggesting that all the six carbon atoms are linked in a straight chain.
3. Glucose reacts with hydroxylamine to form an oxime and adds a molecule of hydrogen cyanide to give cyanohydrin. These reactions confirm the presence of a carbonyl group (>C = 0) in glucose.
4. Glucose gets oxidised to six carbon carboxylic acid (gluconic acid) on reaction with a mild oxidising agent like bromine water. This indicates that the carbonyl group is present as an aldehydic group.
5. Acetylation of glucose with acetic anhydride gives glucose pentaacetate which confirms the presence of five –OH groups. Since it exists as a stable compound, five –OH groups should be attached to different carbon atoms.
6. On oxidation with nitric acid, glucose as well as gluconic acid both yield a dicarboxylic acid, saccharic acid. This indicates the presence of a primary alcoholic (–OH) group in glucose.

Glucose is correctly named as D(+)-glucose. 'D' before the name of glucose represents the configuration whereas '(+)' represents dextrorotatory nature of the molecule. It may be remembered that 'D' and 'L' have no relation with the optical activity of the compound. The meaning of D– and L– notations is given as follows. The letters 'D' or 'L' before the name of any compound indicate the relative configuration of a particular stereoisomer. This refers to their relation with a particular isomer of glyceraldehyde. Glyceraldehyde contains one asymmetric carbon atom and exists in two enantiomeric forms.

The questions given (i) to (v) consist of an assertion (A) reason (R). Choose the correct option.

a) A and R both are correct and R is the correct explanation of A.

b) A and R both are correct but R is not the correct explanation of A.

c) A is true but R is false.

d) A is false but R is true.

**(i) Assertion:** D(+)– Glucose is dextrorotatory in nature.
   **Reason:** 'D' represents its dextrorotatory nature.

**(ii) Assertion:** Glucose reacts with hydroxylamine to form an oxime and also adds a molecule of hydrogen cyanide to give cyanohydrin.
   **Reason:** The carbonyl group is present in the open chain structure of glucose.

**(iii) Assertion:** Sucrose is called invert sugar.
   **Reason:** During hydrolysis of sucrose, the optical rotation of the reaction mixture changes from dextro to levo.

**(iv) Assertion:** Acetic acid is a carbohydrate.
   **Reason:** Acetic acid fits into this general formula of carbohydrate, $C_x(H_2O)_y$.

**(v) Assertion:** Glucose on acetylation gives pentaacetate.
   **Reason:** It contains five –OH group.

**Question 98:**
Disaccharides on hydrolysis with dilute acids or enzymes yield two molecules of either the same or different monosaccharides. The two monosaccharides are joined together by an oxide linkage formed by the loss of a water molecule. Such a linkage between two monosaccharide units through oxygen atom is called glycosidic linkage.

Sucrose: One of the common disaccharides is sucrose which on hydrolysis gives equimolar mixture of D-(+)-glucose and D-(-) fructose. These two monosaccharides are held together by a glycosidic linkage between C1 of α - glucose and C2 of β -fructose. Since the reducing groups of glucose and fructose are involved in glycosidic bond formation, sucrose is a non- reducing sugar. Disaccharides Sucrose is dextrorotatory but after hydrolysis gives dextrorotatory glucose and laevorotatory fructose. Since the laevorotation of fructose (–92.4 ) is more than dextrorotation of glucose (+ 52.5 ), the mixture is laevorotatory. Thus, hydrolysis of sucrose brings about a change in the sign of rotation, from dextro (+) to laevo (–) and the product is named as invert sugar.

(i) Which of the following is an example of monosaccharide?
   a) Galactose          b) Sucrose
   c) Lactose            d) Maltose

(ii) Which of the following is an example of disaccharide?
   a) Glucose            b) Fructose
   c) Galactose          d) Maltose

(iii)   Lactose is a disaccharide of which of the following sugar units?
   a) Glucose and fructose
   b) Glucose and galactose
   c) Glucose and sucrose
   d) Glucose and ribose

(iv)   Which of the following carbohydrates is a triose?
   a) Glucose
   b) Ribose
   c) Ribulose
   d) Glyceraldehyde

(v)   **Sucrose is non-reducing sugar due to**
   a) presence of α-hydroxy keto group
   b) its conversion to invert sugar
   c) the linkage between both the anomeric carbon atoms
   d) equal amount of D(+) glucose and D(−) fructose

**Question 99:**
Polysaccharides contain a large number of monosaccharide units joined together by glycosidic linkages. These are the most commonly encountered carbohydrates in nature. They mainly act as the food storage or structural materials.

(i) Starch: Starch is the main storage polysaccharide of plants. It is the most important dietary source for human beings. High content of starch is found in cereals, roots, tubers and some vegetables. It is a polymer of α -glucose and consists of two components— Amylose and Amylopectin. Amylose is water soluble component which constitutes about 15-20% of starch. Chemically amylose is a long unbranched chain with 200-1000 α-D-(+)-glucose units held by C1– C4 glycosidic linkage. Amylopectin is insoluble in water and constitutes about 80-85% of starch. It is a branched chain polymer of α-D-glucose units in which chain is formed by C1–C4 glycosidic linkage whereas branching occurs by C1–C6 glycosidic linkage.

(ii) Cellulose: Cellulose occurs exclusively in plants and it is the most abundant organic substance in plant kingdom. It is a predominant constituent of cell wall of plant cells. Cellulose is a straight chain polysaccharide composed only of β-D-glucose units which are joined by glycosidic linkage between C1 of one glucose unit and C4 of the next glucose unit. (iii) Glycogen: The carbohydrates are stored in

animal body as glycogen. It is also known as animal starch because its structure is similar to amylopectin and is rather more highly branched. It is present in liver, muscles and brain. When the body needs glucose, enzymes break the glycogen down to glucose. Glycogen is also found in yeast and fungi.

i) In which of the following, glucose residues are linked by β-1, 4-glycosidic bonds?
   a) Amylose
   b) Starch
   c) Cellulose
   d) Glycogen

ii) When all the monosaccharides in a polysaccharide are same type, such type of a polysaccharide is called a _____

   a) Glycogen
   b) Homoglycan
   c) Heteroglycan
   d) Oligosaccharide

iii) Polysaccharide chains are made of _____

   a) disaccharides
   b) glucose
   c) sugars
   d) fructose

## Question 100:

Proteins are the most abundant biomolecules of the living system. Chief sources of proteins are milk, cheese, pulses, peanuts, fish, meat, etc. They occur in every part of the body and form the fundamental basis of structure and functions of life. They are also required for growth and maintenance of body. The word protein is derived from Greek word, "proteios" which means primary or of prime importance. All proteins are polymers of α-amino acids. Amino acids contain amino (–NH₂ ) and carboxyl (–COOH) functional groups. Depending upon the relative position of amino group with respect to carboxyl group, the amino acids can be classified as α, β, γ, δ and so on. Only α-amino acids are obtained on hydrolysis of proteins. They

may contain other functional groups also. All α-amino acids have trivial names, which usually reflect the property of that compound or its source. Glycine is so named since it has sweet taste (in Greek glykos means sweet) and tyrosine was first obtained from cheese (in Greek, tyros means cheese.) Amino acids are generally represented by a three letter symbol, sometimes one letter symbol is also used.

The questions given (i) to (v) consist of an assertion (A) reason (R). Choose the correct option.

a) A and R both are correct and R is the correct explanation of A.
b) A and R both are correct but R is not the correct explanation of A.
c) A is true but R is false.
d) A is false but R is true.

i)   **Assertion :** Proteins are organic components.
    **Reason :** Amino acids are the basic units of proteins formed by hydrolysis.

ii)  **Assertion:** All naturally occurring α-amino acids except glycine are optically active.
    **Reason:** Most naturally occurring amino acids have L-configuration.

iii) **Assertion:** α-amino acids exists as dipolar ion or zwitter ions.
    **Reason:** α-amino acids are building blocks of proteins.

iv)  **Assertion:** Valine is non-essential amino acid
    **Reason:** The lack of essential amino acid in the diet causes kwashiorkor.

## Question 101 :

Amino acids are classified as acidic, basic or neutral depending upon the relative number of amino and carboxyl groups in their molecule. Equal number of amino and carboxyl groups makes it neutral; more number of amino than carboxyl groups makes it basic and more carboxyl groups as compared to amino groups makes it acidic. The amino acids, which can be synthesised in the body, are known as nonessential amino acids. On the other hand, those which cannot be synthesised in the body and must be obtained through diet, are known as essential amino acids Amino acids are usually colourless, crystalline solids. These are water-soluble, high melting solids and behave like salts rather than simple amines or carboxylic

acids. This behaviour is due to the presence of both acidic (carboxyl group) and basic (amino group) groups in the same molecule. In aqueous solution, the carboxyl group can lose a proton and amino group can accept a proton, giving rise to a dipolar ion known as zwitter ion. This is neutral but contains both positive and negative charges. In zwitter ionic form, amino acids show amphoteric behaviour as they react both with acids and bases. Except glycine, all other naturally occurring α-amino acids are optically active, since the α -carbon atom is asymmetric. These exist both in 'D' and 'L' forms. Most naturally occurring amino acids have L-configuration. L-Amino acids are represented by writing the $-NH_2$ group on left hand side.

i)The simplest amino acid is
(a) Glycine                          (b) Alanine
(c) Asparagine                       (d) Tyrosine

ii)Amino acids are mostly synthesised from
(a) fatty acids                      (b) mineral salts
(c) $\alpha$-ketoglutaric acid        (d) volatile acids

iii)The naturally occurring proteins consist of
(a) D-amino acids                    (b) L-amino acids
(c) both (a) and (b)                 (d) none of these

iv) Which of the following is true regarding the solubility of amino acids?
a)      Mostly soluble in water and insoluble in organic solvents
b)      They are only water-soluble
c)      They are only soluble in organic solvents
d)      Mostly soluble in organic solvents and insoluble in water

## Question 102:

Proteins are the polymers of α-amino acids and they are connected to each other by peptide bond or peptide linkage. Chemically, peptide linkage is an amide formed between –COOH group and $-NH_2$ group. The reaction between two molecules of similar or different amino acids, proceeds through the combination of the amino group of one molecule with the carboxyl group of the other. This results in the elimination of a water molecule and formation of a peptide bond –CO–NH–. The product of the reaction is called a dipeptide because it is made up of two amino acids. For example, when carboxyl group of glycine combines with the amino group of alanine we get a dipeptide, glycylalanine. If a third amino acid combines to a dipeptide, the product is called a tripeptide. A tripeptide contains three amino

acids linked by two peptide linkages. Similarly, when four, five or six amino acids are linked, the respective products are known as tetrapeptide, pentapeptide or hexapeptide, respectively. When the number of such amino acids is more than ten, then the products are called polypeptides. A polypeptide with more than hundred amino acid residues, having molecular mass higher than 10,000u is called a protein. However, the distinction between a polypeptide and a protein is not very sharp. Polypeptides with fewer amino acids are likely to be called proteins if they ordinarily have a well-defined conformation of a protein such as insulin which contains 51 amino acids. Proteins can be classified into two types on the basis of their molecular shape.

(a) Fibrous proteins

(b) Globular proteins

i)    Peptide bond is a _____
      a) Covalent bond               b) Ionic bond
      c) Metallic bond               d) Hydrogen bond

ii)   Which of the following information is responsible to specify the three-dimensional shape of a protein?
      a) The protein's peptide bond
      b) The protein's amino acid sequence
      c) The protein's interaction with other polypeptides
      d) The protein's interaction with molecular chaperons

iii)  Unfolding of a protein can be termed as _____
      a) Renaturation                b) Denaturation
      c) Oxidation                   d) Reduction

iv)    Which one is a fibrous protein?
      a)Collagen                     b)Haemoglobin
      c)Globulin                     d)Hordein

**Question 103:**

Life is possible due to the coordination of various chemical reactions in living organisms. An example is the digestion of food, absorption of appropriate molecules and ultimately production of energy. This process involves a sequence of reactions and all these reactions occur in the body under very mild conditions. This occurs with the help of certain biocatalysts called enzymes. Almost all the enzymes are globular proteins. Enzymes are very specific for a particular reaction and for a particular substrate. They are generally named after the compound or

class of compounds upon which they work. For example, the enzyme that catalyses hydrolysis of maltose into glucose is named as maltase. Sometimes enzymes are also named after the reaction, where they are used. For example, the enzymes which catalyse the oxidation of one substrate with simultaneous reduction of another substrate are named as oxidoreductase enzymes. The ending of the name of an enzyme is -ase.

i) The nature of an enzyme is

(a) Lipid
(b) Vitamin
(c) Carbohydrate
(d) Protein


ii) This statement about enzymes is true

(a) enzymes accelerate reactions by lowering the activation energy
(b) enzymes are proteins whose three-dimensional form is key to their function
(c) enzymes do not alter the overall change in free energy for a reaction
(d) all of these


iii) Name the enzyme which catalyzes the oxidation-reduction reaction?
a) Transaminase
b) Glutamine synthetase
c) Phosphofructokinase
d) Oxidoreductase

iv) Mark the CORRECT function of enzyme, Peptidase?
a) Cleave phosphodiester bond
b) Cleave amino bonds
c) Remove phosphate from a substrate
d) Removal of $H_2O$

## Question 104:

It has been observed that certain organic compounds are required in small amounts in our diet but their deficiency causes specific diseases. These compounds are called vitamins. Most of the vitamins cannot be synthesised in our body but plants can synthesise almost all of them, so they are considered as essential food factors. However, the bacteria of the gut can produce some of the vitamins required by us. All the vitamins are generally available in our diet. Different vitamins belong to various chemical classes and it is difficult to define them on the basis of structure. They are generally regarded as organic compounds required in the diet in small amounts to perform specific biological functions for normal maintenance

of optimum growth and health of the organism. Vitamins are designated by alphabets A, B, C, D, etc. Some of them are further named as sub-groups e.g. $B_1$, $B_2$, $B_6$, $B_{12}$, etc. Excess of vitamins is also harmful and vitamin pills should not be taken without the advice of doctor. The term "Vitamin" was coined from the word vital + amine since the earlier identified compounds had amino groups. Later work showed that most of them did not contain amino groups, so the letter 'e' was dropped and the term vitamin is used these days. Vitamins are classified into two groups depending upon their solubility in water or fat. (i) Fat soluble vitamins: Vitamins which are soluble in fat and oils but insoluble in water are kept in this group. These are vitamins A, D, E and K. They are stored in liver and adipose (fat storing) tissues. (ii) Water soluble vitamins: B group vitamins and vitamin C are soluble in water so they are grouped together. Water soluble vitamins must be supplied regularly in diet because they are readily excreted in urine and cannot be stored (except vitamin B12) in our body.

i) Which of the following vitamin helps in blood clotting?

    (a) Vitamin A                  (b) Vitamin C
    (c) Vitamin D                  (d) Vitamin K

ii) Which of the following vitamin deficiency causes Beriberi?

    (a) Vitamin B1                (b) Vitamin B2
    (c) Vitamin B6                (d) Vitamin B12

iii) Which of the following vitamins is also known as cobalamin?

    (a) Vitamin B11              (b) Vitamin B2
    (c) Vitamin B6                (d) Vitamin B12

iv) Which of the following is a fat-soluble vitamin?

    (a) Vitamin B                 (b) Vitamin C
    (c) Vitamin $B_{12}$             (d) Vitamin K

## Question 105:

Every generation of each and every species resembles its ancestors in many ways. How are these characteristics transmitted from one generation to the next? It has been observed that nucleus of a living cell is responsible for this transmission of inherent characters, also called heredity. The particles in nucleus of the cell, responsible for heredity, are called chromosomes which are made up of proteins and another type of biomolecules called nucleic acids. These are mainly of two

types, the deoxyribonucleic acid (DNA) and ribonucleic acid (RNA). Since nucleic acids are long chain polymers of nucleotides, so they are also called polynucleotides.

DNA Fingerprinting-- It is known that every individual has unique fingerprints. These occur at the tips of the fingers and have been used for identification for a long time but these can be altered by surgery. A sequence of bases on DNA is also unique for a person and information regarding this is called DNA fingerprinting. It is same for every cell and cannot be altered by any known treatment. DNA fingerprinting is now used (i) in forensic laboratories for identification of criminals. (ii) to determine paternity of an individual. (iii) to identify the dead bodies in any accident by comparing the DNA's of parents or children. (iv) to identify racial groups to rewrite biological evolution.

i)  In double helix of DNA, the two DNA strands show which type of characteristics?

   a) coiled around a common axis
   b) coiled around each other
   c) coiled differently
   d) coiled over protein sheath

ii)  Which of the following nitrogenous base is not present in RNA?
   a) adenine                       b) thymine
   c) cytosine                      d) guanine

iii)  A nucleotide is formed of which of the following units?

   a) nitrogen base and phosphate
   b) nitrogen base, sugar and phosphate
   c) nitrogen base and sugar
   d) sugar and phosphate

iv)  Which tissue samples are used for DNA fingerprinting?

   a) Hair              b) Skin
   c) blood             d) All of the above

## Chemistry - Answer Keys

Answer 1: (i) a          (ii) b          (iii) a

Answer 2: (a) If we compare the equations for Raoult's law and Henry's law, it can be seen that the partial pressure of the volatile component or gas is directly proportional to its mole fraction in solution. Only the proportionality constant KH differs from $p_1^0$. Thus, Raoult's law becomes a special case of Henry's law in which KH becomes equal to $p_1^0$.

(b) $Ar < CO_2 < CH_4 < HCHO$

Answer 3: (i) b          (ii) d          (iii) Positive deviation from Raoult's law.

Answer 4: (i) a          (ii) c          (iii) a

Answer 5: (a) Carbon tetrachloride          (b) water     (c) carbon disulphide

Answer 6: (b)

Answer 7:

(a) People experience water retention in tissue cells and intercellular spaces due to osmosis.

(b) Through the process of osmosis, a bacterium on salted meat or candid fruit loses water, shrivels and dies.

(c) The pure solvent flows out of the solution through the semi permeable membrane due to reverse osmosis.

Answer 8:

(a) 2

(b) i= Nomal molar mass/Abnormal molar mass

Answer 9:

(a) In first case i. e. (a)

(b) The decrease in the vapour pressure of solvent depends on the quantity of non-volatile solute present in the solution, irrespective of its nature.

Answer 10:

(a) in figure b          (b) (i)          (c) the solubility of gas will increase

Answer 11:

    (1) d      (2) b      (3) d      (4) d      (5) c      (6) b

Answer 12:

    (1) b      (2) b      (3) b      (4) c      (5) b      (6) b

Answer 13:

(a) $Pb + SO_4^{2-} \rightarrow PbSO_4 + 2e^-$    (At anode)

(b) $PbO_2 + 4H^+ + 2e^- + SO_4^{2-} \rightarrow PbSO_4 + 2H_2O$.        2 Faraday is required.
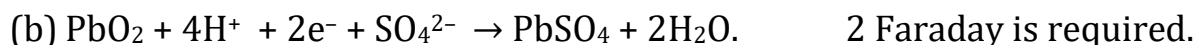
(c) M = % by mass ×10 × d/ molar mass. = 38 × 1.30× 10/ 98 = 494 /98 = 5.041 M

(d) Mass of solution after discharge = 3500 mL × 1.14 g mL$^{-1}$ = 3990 g

    Mass of $H_2SO_4$ present in solution (20%) = 20/100 × 3990 g = 798 g

(e)   $H_2SO_4$ (dil) $\rightarrow 2H^+ + SO_4^{2-}$

    $H_2O \rightarrow H^+ + OH^-$

    At cathode: $2H^+ + 2e^- \rightarrow H_2(g)$

    At anode: $2H_2O \rightarrow 4H^+ + 4e^- + O_2(g)$
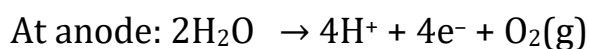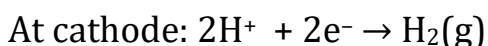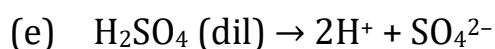
    $H_2$ gas is liberated at cathode and $O_2$ gas is formed at anode.

Answer 14:

    (1) a      (2) b      (3) b      (4) c      (5) d

Answer 15:

    (1) a      (2) d      (3) b      (4) a      (5) a

Answer 16:

    (1) c      (2) a      (3) d      (4) b

Answer 17:

    (1) a      (2) a      (3) b      (4) d

Answer 18:

    (1) b      (2) b      (3) d      (4) a      (5) a

Answer 19:

    (1) c      (2) a      (3) b      (4) a      (5) b

Answer 20:

(a) 1.0 M KCl solution because it will have more number of ions per unit volume of solution.

(b) $2H^+ + 2e^- \rightarrow H_2(g)$    [Q $E°H^+/H_2 = 0$, is higher than $E°Na^+/Na = -2.71$ V]

(c) When Eexternal > E°cell

(d) $Mg_{(s)} | Mg^{2+}(aq) || Ag^+_{(aq)} | Ag_{(s)}$

    $E_{cell} = E°_{cell} - .0591/2 \log[Mg^{2+}] / [Ag^+]^2$

(e) Silver wire at 30°C. Metallic conductance decreases with increase in temperature.

(f) $\Delta G° = -nE°F = -2 \times 1.05$ V $\times 96500$ C $= -202.65$ kJ

    Wmax = –. $\Delta G°$ = –(–202.65 kJ) = +202.65 kJ

(g) Mercury cell

Answer 21:

    (1) a      (2) a      (3) c      (4) d

Answer 22:

    (1) b      (2) b      (3) d      (4) b

Answer 23:

    (1) b      (2) b      (3) c      (4) d

Answer 24:

    (1) b      (2) c      (3) c      (4) c      (5) d

Answer 25:

    (1) b      (2) a      (3) c      (4) d      (5) a

Answer 26:

    (1) d      (2) d      (3) c      (4) b      (5) a

Answer 27:

    (1) c      (2) b      (3) a      (4) d      (5) c

Answer 28:

    (1) c      (2) c      (3) c      (4) c

Answer 29:

    (1) d      (2) c      (3) c      (4) d

Answer 30:

    (1) a      (2) a      (3) a      (4) b

Answer 31:

    (1) c      (2) a      (3) a      (4) b      (5) d

Answer 32:

    (1) b      (2) a      (3) c      (4) d

Answer 33:

    (1) b      (2) a      (3) a      (4) d

Answer 34:

    (1) a      (2) c      (3) c      (4) c

Answer 35:

    (1) a      (2) b      (3) d      (4) a

Answer 36:

    (1) c      (2) d      (3) d      (4) d

Answer 37:

    (1) b      (2) c      (3) a      (4) c

Answer 38:

    (1) c      (2) a      (3) b      (4) d

Answer 39:

    (1) c      (2) c      (3) b      (4) d

Answer 40:

    (1) b      (2) c      (3) d      (4) d  [OR Part b]

Answer 41:

(i) (d): Oxidation state of Mn in $[Mn_2(CO)_{10}]$ is zero.

(ii) (d): In $[V(CO)_6]^-$, the anionic carbonyl complex can delocalise more electron density to antibonding $\pi\pi$-orbital ($d\pi\pi$-$p\pi\pi$ back bonding) of CO and thus lowers the bond order.

(iii) (c): $K[C_0(CO)_4]$

$+ 1 + (x) + 4(0) = 0$ or $x = -1$

(iv) (d): $Mn_2(CO)_{10}$ is made up of two square pyramidal $Mn(CO)_5$ units joined by Mn - Mn bond.


Answer 42:

(i) (a)

(ii) (d): $[Co(NH_3)_4Cl_2]Cl + AgNO_3 \rightarrow [Co(NH_3)_4Cl_2]^+ + AgCl \downarrow$

Thus it gives precipitate of 1 mol of AgCl.

(iii) (a) : The Cl ions outside the coordination sphere can only be precipitated.

(iv) (a)

Answer 43:

(i) (b)
(ii) (a)
(iii) (b)
(iv) (c): Due to high electronegativity of $F^-$ atoms, the lone pair of N-atom in $NF_3$ molecule cannot be ligated easily. Whereas in $N(CH_3)_{3'}$ $CH_3$ group is a electron releasing group, thus lone pair of N-atom in $N(CH_3)_3$ molecule can be ligated easily.
Except, nitrogen fluoride, all other halides hydrolyse in water.

Answer 44:

(i) (d): Glycinate ion is an example of bidentate ligand. It contains N and O as donor atoms.
(ii) (a)

(iii) (c) : $H_2N$ - $NH_2$ does not act as chelating ligand.
The coordination by hydrazine leads to a three member highly unstable strained ring and thus it does not act as chelating agent.
(iv) (d): In Zeises salt, coordination no. of Pt is 4. Ethylene is a mono dentate ligand.

Answer 45:

(i) (a): Spin only magnetic moment, $\mu=n(n+2)\text{------}\sqrt{}$ B.M. $\mu=n(n+2)$ B.M. where n = number of unpaired electrons.

As the number of unpaired electrons in $Cr^{2+}$ ([Ar ]$3d^4$) and $Fe^{2+}$([Ar]$3d^6$) are same, hence $[Cr(H_2O)_6]^{2+}$ and $[Fe(H_2O)_6]^{2+}$ will have same magnetic moment.
(ii) (a): $Fe^+$ : [Ar] $3d^6$ $4s^1$

When the weak field ligand $H_2O$ and strong field ligand $NO^+$ attack, the configuration changes as follows: Fe+ : [Ar] $3d^7$ $4s°$

∴ $Fe^+$ has 3 unpaired electrons.



In presence of strong ethylenediamine ligand the electrons get paired.
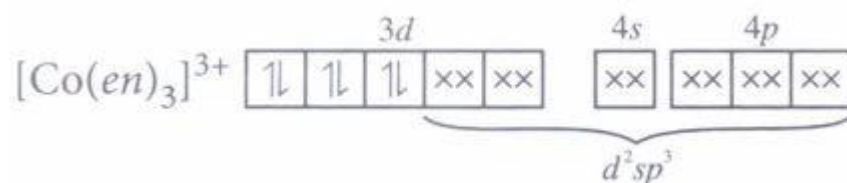


Thus inner orbital complex with no unpaired electrons.
(iv) (a)

Answer 46: d

Answer 47: d

Answer 48: c

Answer 49: b

Answer 50: a

Answer 51: c

Answer 52: a

Answer 53: b

Answer 54: c

Answer 55: d

Answer 56: 2-methyl-2-bromo propane

Answer 57: 1-bromo propane

Answer 58: to facilitate breaking of C-X bond

Answer 59: any example

Answer 60: DDT

Answer 61:
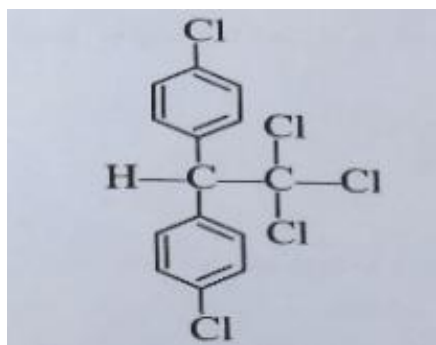


Answer 62: IUPAC NAME: 2,2-Bis(p-chlorophenyl)-1,1,1-trichloroethane

Answer 63: It is banned in many countries as it has harmful effects on microorganisms and vegetation. Yes, we should advocate the ban of DDT

Answer 64: A

Answer 65: A

Answer 66: C

Answer 67: A

Answer 68: C

Answer 69: D

Answer 70: A

Answer 71: B

Answer 72: C

Answer 73: A

Answer 74:

(a) Phenol, because the phenoxide ion is stabilized by resonance.

(b) o-Cresol

(c) Phenol has shorter bond length due to partial double bond character attributed to resonance.

(d) Ethoxide ion.

Answer 75:

(a) Methoxy benzene ($C_6H_5 OCH_3$)

(b) $C_6H_5 O^- Na^+ + CH_3Br \rightarrow C_6H_5 OCH_3 + NaBr$; It is named as Williamson's Synthesis.

(c) B = $C_6H_5 OH$, C= $CH_3I$

(d) Chemical equation for the reaction of "B" with aqueous $Br_2$ is as follows:
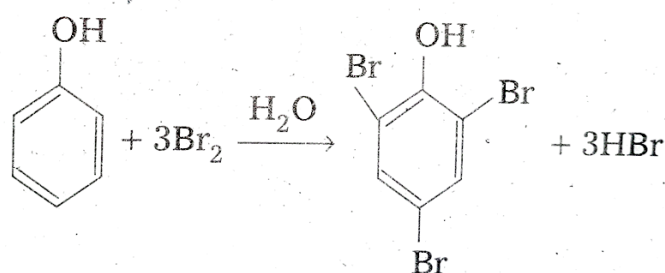


2, 4, 6, – tribromophenol

Answer 76: i) a        ii) c        iii) a        iv) a        v) a

Answer 77: i) b        ii) d        iii) a        iv) b        v) b

Answer 78: i) b        ii) a        iii) d        iv) c        v) c

Answer 79: i) a        ii) a        iii) c        iv) d        v) c

Answer 80: i) b        ii) c        iii) c        iv) a        v) c

Answer 81:

i) Anhydrous $CrO_3$

ii) $C_5H_5NH+CrO_3Cl$ (PCC)

iii) $O_3/H_2O$-Zn dust

iv) PCC

v) Pd over $BaSO_4$

Answer 82: i) c        ii) d        iii) b        iv) d        v) c

Answer 83: i) b        ii) a        iii) d        iv) a        v) b

| Answer 84: i) b | ii) a | iii) b | iv) b | v) d |
|---|---|---|---|---|
| Answer 85: i) a | ii) a | iii) b | iv) d | v) c |
| vi) a | vii) b | viii) c | ix) b | x) a |
| Answer 86: i) c | ii) d | iii) a | iv) b | v) a |
| Answer 87: i) a | ii) b | iii) d | iv) a | v) b |
| Answer 88: i) c | ii) d | iii) d | iv) a | v) d |
| Answer 89: i) d | ii) c | iii) d | iv) c | v) c |
| Answer 90: i) b | ii) a | iii) c | iv) b | v) d |
| Answer 91: i) b | ii) c | iii) b | iv) d | v) b |
| Answer 92: i) a | ii) c | iii) a | iv) c | v) c |
| Answer 93: i) a | ii) c | iii) b | iv) a | |
| Answer 94: i) d | ii) a | iii) d | iv) a | |
| Answer 95: i) a | ii) c | iii) a | iv) a | v) d |
| Answer 96: i) c | ii) a | iii) a | iv) d | v) a |
| Answer 97: i) c | ii) a | iii) a | iv) d | v) a |
| Answer 98: i) a | ii) d | iii) b | iv) d | v) c |
| Answer 99: i) c | ii) b | iii) c | | |
| Answer 100: i) a | ii) b | iii) b | iv) d | |
| Answer 101: i) a | ii) c | iii) b | iv) a | |
| Answer 102: i) a | ii) b | iii) b | iv) a | |
| Answer 103: i) d | ii) d | iii) d | iv) b | |
| Answer 104: i) d | ii) a | iii) d | iv) d | |
| Answer 105: i) a | ii) b | iii) b | iv) d | |

# CCT Questions
# Class XII
# Biology

Everything that human beings or living animals do is done by protein molecules. And therefore, the kind of proteins that one has and therefore the ability one has is determined by the genes that one has.

Har Gobind Khorana
1922-2011

## SEXUAL REPRODUCTION IN FLOWERING PLANTS

**Question 1:**
Why can we not use the term seed for maize grain?

**Question 2:**
How many meiotic divisions are required to produce 76 seeds in a guava fruit?

**Question 3:**
Case study-based questions: Read the given passage and answer Q3 i, ii, iii, iv & v

Pollen grains are generally spherical shaped and each is surrounded by two layers-exine and intine. Exine is made up of sporopollenin which is resistant to high temperatures and strong acids and alkali. Sporopollenin remains absent at germ pores. Pollen grains are well preserved as fossils because of the presence of sporopollenin. The inner wall of pollen grain is intine. The pollen grains are mainly shed at 2-celled stage-vegetative cell and generative cell when they are matured. Pollen grains of many species cause severe allergies and bronchial afflictions, leading to chronic respiratory disorders. It is mentioned that Parthenium or carrot grass that came into India as contaminant with imported wheat, has become ubiquitous in occurrence and causes pollen allergy. However, pollen grains are rich in nutrients which are used pollen tablets as food supplements. In western countries, large number of pollen products in the form of tablets and syrups are available in the market which are claimed to increase the performance of athletes and race horses.

(i) **Assertion**. Sporopollenin is an oxidative polymer of carotenoids which helps in fossilization.
**Reason.** Sporopollenin is a tough substance that provides resistant to biological decomposition, high temperature and alkali.

(a) Both assertion and reason are true, and reason is the correct explanation of assertion.
(b) Both assertion and reason are true, but reason is not the correct explanation of the assertion.
(c) Assertion is true but reason is false.
(d) Both assertion and reason are false.

(ii) Which of the following statements is not appropriate for pollen grains:
(a) Pollen grains can be stored for years in liquid nitrogen and can used in crop breeding programmes.
(b) Pollen grains are rich in nutrients and can be used as pollen tablets as food supplements.

(c) Bee pollen are available in western countries in the form of tablets.
(d) Pollen consumption has potential inhibitory action which results in decreased energy in athletes and race horses.

(iii) Pollen allergy is common in many people during spring, summer and fall as plants release tiny pollen grains in tremendous quantity. Which of the following is not associated with pollen allergy?
(a) Sneezing, stuffy nose and watery eyes
(b) Asthma, bronchitis
(c) Cough, itchy nose, roof of mouth or throat
(d) Fever, diarrhoea and vomiting

(iv) Which of the following set does not cause allergy?
(a) Ragweed parthenium
(b) Sagebrush
(c) Amaranth (pigweed)
(d) Acacia

(v) The function of germ pore in pollen grain is
(a) Emergence of radicle
(c) Initiation of pollen tube
(b) Absorption of water for seed germination
(d) All of these

## Question 4:

Read the following and answer questions given below from (i) to (v)
A flower of tomato plant following the process of sexual reproduction produces 240 viable seeds. The viable seeds are those which have the ability to remain alive and may develop into plants and reproduce themselves in the given appropriate conditions. This happens when one of the pollen grain reaches to the stigma by any agency at 2-celled stage vegetative cell and generative cell. The generative cell divides mitotically and forms two male gametes which enters into ovule after passing through pollen tube and undergoes the process of double fertilization in the ovule. The ovule is a large parenchymatous body formed in the ovary by megasporogenesis. The megaspore mother cell in an ovule is a diploid structure which undergoes meiotic division and forms one functional megaspore. The megaspore undergoes three subsequent divisions and forms 8 nuclei arranging themselves in 3 groups. After fertilization, the ovule converts into the seed and whole ovary develops into a complete fruit.

(i) The minimum number of pollen grains that must have been involved in the pollination of its pistil are
(a) 60
(b) 120
(c) 180
(d) 240

(ii) The minimum number of microspore mother cells must have undergone reductional division prior to dehiscence of anther are:
(a) 60
(b) 90
(c) 180
(d) 240

(iii) The male gametes that might have involved in this case are :
(a) 120
(b) 240
(c) 360
(d) 480

(iv) The minimal number of ovules present in the ovary would be:
(a) 60
(b) 120
(c) 180
(d) 240

(v) Megaspore mother cells involved in this process are:
(a) 120
(b) 180
(c) 240
(d) 360

## Question 5:
Read the following and answer questions given below from i to iv

In major approaches of crop improvement programme as in crossing experiments, it is important to make sure that only the desired pollen grains are used for pollination and the stigma is protected from contamination from unwanted pollens. So, if the female parent bears bisexual flowers, removal of anthers from the flower bud before the anther dehisces is necessary (Emasculation). Emasculated flowers have to be covered with bags of suitable size to prevent contamination of their stigma with unwanted pollen-bagging When the stigma of

bagged flower attains receptivity, mature pollen grains collected from anthers of the male parent are dusted on the stigma and the flowers are rebagged and the fruits are allowed to develop. If the female parent produces unisexual flowers, there is no need for emasculation.

(i) While planning for an artificial hybridisation involving dioecious plants, which of the following steps would not be relevant?
    (a) Bagging of female flower
    (b) Dusting of pollen on stigma
    (c) Emasculation
    (d) Collection of pollen

(ii) **Assertion.** If the female parent produces unisexual flowers, there is no need of emasculation.
**Reason.** Emasculation is the removal of anthers from the flower bud before the anther dehisces.
(a) Both assertion and reason are true, and reason is the correct explanation of assertion.
(b) Both assertion and reason are true, but reason is not the correct explanation of the assertion.
(c) Assertion is true but reason is false.
(d) Both assertion and reason are false.

(iii) Artificial hybridization denotes to:
    (a) production of seedless fruits
    (b) evolve seeds without fertilization
    (c) crop improvement programme
    (d) occurrence of more than one embryo in a seed.

(iv) The correct sequence to perform artificial hybridization is
(a) Bagging → Emasculation → Rebagging → Cross pollination
(b) Emasculation → Bagging → Cross pollination → Rebagging
(c) Cross pollination → Emasculation - Bagging → Rebagging
(d) Bagging → Rebagging → Cross pollination → Emasculation

## Question 6:

Enlist the chromosome no. in ovum, first polar body and second polar body of human body.

**Question 7:**

Select the correct sequence for transport of sperm cells in male reproductive system:

(a) Seminiferous tubules → Vasa efferentia → Epididymis → Inguinal canal → Urethra

(b) Testis → Epididymis → Vasa efferentia →Vas deferens → Ejaculatory duct → Inguinal canal →→ Urethra → Urethral meatus.

(c) Testis → Epididymis → Vasa efferentia → Rete testis → Inguinal canal → Urethra

(d) Seminiferous tubules → Rete testis → Vasa efferentia → Epididymis → Vas deferens → Ejaculatory duct → Urethra → Urethral meatus

**Question 8:**

Directions: In the following questions A, B, C, D, E & F, a statement of Assertion is followed by a statement of Reason.

Mark the correct choice as:

(a) If both Assertion and Reason are true and Reason is the correct explanation of Assertion.

(b) If both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

(c) If Assertion is true but Reason is false.

(d) If both Assertion and Reason are false.

A. **Assertion.** Only a single functional female gamete is formed from each primary oocyte cell.
   **Reason.** Meiosis in each primary oocyte gives rise to only one cell, which function as ovum.

B. **Assertion.** Placenta, in addition to, provides connection with mother and foetus to ductless gland.
   **Reason.** It releases human gonodotropins.

C. **Assertion.** A chemical substance fertilizing is found in the egg of animals.
   **Reason.** It helps in the maturation of embryo after fertilization.

D. **Assertion.** The shape of the uterus is like an inverted pear.
   **Reason.** The inner glandular layer that lines the uterine cavity is called endometrium.

E. **Assertion.** The opening of the vagina is often covered partially by a membrane called hymen.
   **Reason.** The hymen is often torn during the first coitus-intercourse.

F. **Assertion.** Luteinising hormone (LH) acts at the sertoli cells and stimulates the synthesis and secretion of androgens.
**Reason.** Androgens stimulate the process of oogenesis.

**Question 9:**
Read the following and answer questions given below from (i) to (v)

Each month during the years between puberty and menopause, a woman's body goes through a number of changes to get it ready for possible pregnancy. During each menstrual cycle, an egg develops and is released from the ovaries. The lining of the uterus builds up. If a pregnancy does not happen, the uterine lining sheds during a menstrual period. A woman's menstrual cycle is divided into four phases: menstrual phase, follicular phase, ovulation phase and luteal phase and each phase is controlled by hormones. The ovulation phase lasts about 6 hours during which woman can get pregnant. During ovulation, a slight rise in basal body temperature and thicker discharge that has the texture of egg whites held. Ovulation happens at around 14 day of menstrual cycle. After a day, the egg will die or dissolve if it is not fertilized. Sperm can live up to 5 days and if a woman has sex as much as five days prior to ovulation, pregnancy can occur.

(i) The process of ovulation takes place on _____ day of menstrual cycle
    (a) 10
    (b) 12
    (c) 14
    (d) 16

(ii) **Assertion.** Ruptured Graafian follicles form the corpus luteum.
**Reason.** Ovulation takes place under the influence of hormone LH secreted by anterior pituitary.
(a) Both assertion and reason are true, and reason is the correct explanation of assertion.
(b) Both assertion and reason are true but reason is not the correct explanation.
(c) Assertion is true but reason is false.
(d) Both assertion and reason are false.

(iii) Which of the following statement is not appropriate for ovulation?
    (a) Ovulation phase lasts for 6 hours
    (b) A slight rise in basal body temperature occurs during ovulation
    (c) The ovum in primary oocyte stage is released by the rupture of Graafian follicle under the influence of LH hormone
    (d) No conspicuous changes occurs in the uterine endometrium.

(iv) The membranous cover of the ovum at ovulation is
  (a) Corona radiata
  (b) Zona pellucida
  (c) Zona radiata
  (d) Chorion

(v) Corpus luteum in pregnancy has _____ life.
  (a) 10-12 days
  (b) long
  (c) 14-28 days
  (d) negligible

**Question 10:**
Read the following and answer questions given below from (i) to (v)
 The average duration of human pregnancy is about 9 months. Vigorous contractions of uterus occurs at the end of pregnancy due to foetal ejection reflex originated from fully developed foetus and placenta by releasing oxytocin from maternal pituitary. Oxytocin acts on the uterine muscle and causes strong uterine contractions leading to expulsion of the baby out of the uterus through birth canal-parturition. After parturition, lactation starts and umbilical cord and placenta comes out with the baby. The cord blood contains cells called hematopoietic stem cells. These cells can turn into any kind of blood cells and can be used for transplant that can cure diseases such as blood disorders, immune deficiencies, metabolic diseases and some kinds of cancers. Research is revealing more and more ways it can save lives. It is precious-almost magical and absolutely worth to preserve it for the family use or to donate it in blood bank, to be needed by another family.
(i) An umbilical cord is:
  (a) a large artery in the womb
  (b) a large vein in the womb
  (c) the wall that surrounds the developing foetus
  (d) a structure that connects a foetus to the mother placenta

(ii) **Assertion.** An umbilical cord is stored in developed countries as a source for Future stem cell.
**Reason.** An umbilical cord contains hematopoietic' stem cells and can be used for curing various acute diseases.
  (a) Both assertion and reason are true, and reason is the correct explanation of assertion
  (b) Both assertion and reason are true but reason is not the correct explanation.
  (c) Assertion is true but reason is false.
  (d) Both assertion and reason are false.

(iii) Blood flowing in umbilical cord is:
        (a) 50% maternal and 50% foetal
        (b) 100% foetal
        (c) 100% maternal
        (d) 75% maternal and 25% foetal

(iv) The main hormone involved in parturition is:
        (a) Oxytocin
        (b) Prolactin
        (c) hCG
        (d) Progesterone

(v) Which of the following disease cannot be treated with cord blood?
        (a) Lymphomas
        (b) Bone marrow cancer
        (c) Sickle cell disease
        (d) Kwashiorkor

## Question 11:

The technique called Gamete Intra Fallopian Transfer (GIFT) is recommended for those females
 a) who cannot retain the foetus inside uterus
 b) who cannot produce an ovum
 c) whose cervical canal is too narrow to allow passage for the sperms
 d) who cannot provide suitable environment for fertilization

## Question 12:

Choose the correct statement regarding the ZIFT procedure:
a) ova collected from a female donor are transferred into the fallopian tube to facilitate zygote formation.
b) The zygote or early embryo up to 8 blastomeres is transferred into the fallopian tube.
c) zygote is collected from a female donor and transferred to the uterus
d) ova collected from a female donor and transferred to the uterus

## Question 13:

Medical termination of pregnancy (MTP) is considered safe up to how many weeks of pregnancy?
a) 18 weeks       b) 6 weeks       c) 8 weeks         d) 12 weeks

**Question 14:**

The prenatal technique to determine the genetic disorders in a foetus is called
a) Laparoscopy   b) abstinence    c) Coitus interruptus   d) Amniocentesis

**Question 15:**

Progestogens in the contraceptive pills
a) prevents attachment of zygote to endometrium
b) alter the quality of cervical mucus to prevent entry of sperms.
c) inhibits ovulation
d) All the above

**ASSERTION AND REASONING TYPE OF QUESTIONS -**
These questions consist of two statements each, printed as Assertion and Reason. While answering these questions you are required to choose any one of the following four responses.

A. If both Assertion and Reason are true and the Reason is correct explanation of the Assertion.
B. If both Assertion and Reason are true but the Reason is not a correct explanation of the Assertion.
C. If Assertion is true but the Reason is false.
D. If both Assertion and Reason are false

**Question 16:**

**Assertion:** Use of condom is a safeguard against AIDS and sexual diseases besides checking pregnancy.
**Reason:** Certain contraceptives are planted under the skin of the upper arm to prevent pregnancy.

**Question 17:**

**Assertion:** Amniocentesis is often misused.
**Reason:** Amniocentesis is meant for determining the genetic disorders in the foetus, but is being used to determine the sex of the foetus so that female foetus may be aborted.
**Question 18:**

**Assertion:** Zero population growth should be achieved as early as possible to control human population.
**Reason:** This requires not two children per couple but a little more.

**Question 19:**

**Assertion:** Mother should not be blamed for the birth of girls in the family.
**Reason:** Father is responsible for the sex of the child.

**SEXUALLY TRANSMITTED DISEASES** - STDs constitute a major public health problem for both developing and developed countries. The emergence of HIV infection has increased the importance of measures aimed at control of STDs. A proper understanding of the patterns of STDs prevailing in different geographic regions of a country is necessary for proper planning and implementation of STD control strategies. It is with this aim that the authors have reviewed the relevant published literature from India over the past 25 years. To sum up, bacterial STDs like chancroid and Gonorrhoea are showing a declining trend, but the viral STDs like herpes genitalis and condylomata acuminata are showing upward trend. There is a decline in the number of patients with STDs attending the hospital. Whether this is due to an actual decrease in the incidence of STDs or due to other factors is uncertain. The increased availability of facilities for treatment of STDs at peripheral centres might be a factor leading to a decline in the number of patients with STDs approaching higher centres like the teaching hospital where this study was undertaken. The emphasis on the syndromic approach to the management of STDs might have increased the accessibility to healthcare for these patients with STDs. Awareness about HIV and fear of STDs are factors of reducing infection with STDs. Another factor to be considered is the widespread use of antibacterials, including quinolones and the new macrolides, for the treatment of other diseases. This can result in partial treatment or modified course of the bacterial STDs, thereby leading to apparent reduction in the total number of cases of STDs attending STD clinics as well as a decrease in the proportion of bacterial to viral STDs.

**Question 20:**
(i) Which of the following is not a bacterial STD?
     A) Syphilis     B) Gonorrhoea     C) Herpes genitalis     D) Chlamydiasis

(ii) Choose the odd one out-
     A) Genital herpes   B) Genital warts   C) Trichomoniasis    D) Hepatitis B

(iii) Which of the following symptoms is not seen in case of an STD?
     A) Slight pain in genitals
     B) Swelling in the genitals
     C) Itching and fluid discharge from the genitals
     D) Redness/discoloration in the genitals

(iv) Which of the following is not a complication which arises when STDs are not treated on time?

    A) PID      B) Infertility    C) Cancer of the rectum    D) Still births

## Question 21:

Gynaecomastia is a symptom of
a) Turner's syndrome        b) SARS
c) Klinefelter's syndrome     d) Down's syndrome

## Question 22:

In a monohybrid cross involving incomplete dominance, the phenotypic ratio equals the genotypic ratio in F2 generation. The ratio is

    a) 3:1          b) 1:2:1        c) 1:1:1:1        d) 9:7

## Question 23:

A human male produces sperms with the genotypes AB, Ab, aB and ab pertaining to the diallelic characters in equal proportions. What is the corresponding genotype of this person?

    a) AaBB        b) AABb        c) AABB        d) AaBb

## Question 24:

Which of the following conditions is called monosomic?

    a) 2n+1        b) 2n+2        c) n+1        d) 2n-1

## Question 25:

A pea plant parent having violet colour flowers with unknown genotype was crossed with a plant having white colour flowers, in the progeny 50% flowers were violet and 50% were white. The genotypic constitution of the parent having violet colour flower was

    a) Homozygous   b) Merozygous    c) Heterozygous   d) Hemizygous

## ASSERTION AND REASONING TYPE OF QUESTIONS –

These questions consist of two statements each, printed as Assertion and Reason. While answering these questions you are required to choose any one of the following four responses.

A. If both Assertion and Reason are true and the Reason is correct explanation of the Assertion.

B. If both Assertion and Reason are true but the Reason is not a correct explanation of the Assertion.

C. If Assertion is true but the Reason is false.

D. If both Assertion and Reason are false

## Question 26:

**Assertion:** In four o'clock plant or Snap dragon plant, a cross between homozygous white flowered individual and a homozygous red flowered one, produces pink flowered plants.
**Reason:** In these plants, the flower colour is determined by three alleles.

## Question 27:

**Assertion:** It is not possible for human parents heterozygous for skin colour to have children darker or lighter than themselves.
**Reason:** Human skin colour is controlled by a single pair of alleles.

## Question 28:

**Assertion:** The person heterozygous for sickle-cell trait produces both normal (HbA) and abnormal haemoglobin (Hbs)
**Reason:** Heterozygous individuals appear apparently unaffected but they are carrier of the disease as there is 50% chance of transmission of the mutant gene.

## Question 29:

**Assertion:** Haemophilia shows criss-cross inheritance
**Reason:** The gene that causes haemophilia is recessive and lies in the sex (X) chromosome.

## Question 30:

**MENDELIAN DISORDERS** - Broadly, genetic disorders may be grouped into two categories – Mendelian disorders and Chromosomal disorders. Mendelian disorders are mainly determined by alteration or mutation in the single gene. These disorders are transmitted to the offspring on the same lines as we have studied in the principles of inheritance. Most common and prevalent Mendelian disorders are Haemophilia, Cystic fibrosis, Sickle cell anaemia, Colour blindness, Phenylketonuria, Thalassemia. The Mendelian disorders may be recessive or dominant. Similarly, the trait may also be linked to the case of sex chromosome like haemophilia. It is evident that this X – linked recessive trait shows transmission from carrier female to male progeny. A Mendelian disorder occurs if the mutated

gene is found either in homozygous or in heterozygous forms. A recessive disease only expressed in the homozygous genotype, whereas the dominant diseases expressed in heterozygous genotype also. The defected/mutated gene may be found on to the autosome, like in thalassemia, the alpha type, gene is found on chromosome number 16 and beta type gene is found on chromosome number 11. On the other hand, when the defected gene is on X chromosome, then it will be considered as X linked diseases. Father never transmit X linked diseases to the son, because son inherits Y chromosome from his father (not the X-chromosome) and this chromosome does not has any gene of the diseases.

(i) Which two colours cannot be identified in the colour blindness:
    a. Blue & green
    b. Red & green
    c. Violet & blue
    d. Red & blue

(ii) A female with gene of colour blindness may be normal, because: -
    a. One X chromosome has the defected /mutated gene while other X-chromosome is normal
    b. Both X chromosomes have defected/mutated gene.
    c. Y chromosome has the defected/muted gene.
    d. Both A & B

(iii) A son does not inherit X linked Mendelian disease from affected father because: -
    a. The gene is located on X chromosome.
    b. Father transmits Y chromosome to his son, not the X-chromosome.
    c. Father's X chromosome is transmitted to the daughter.
    d. All of the above

(iv) Sickle cell Anaemia and thalassemia are different from each other: -
    a. They created by autosomal genes.
    b. They are related to the disorder of blood.
    c. They are autosomal recessive diseases.
    d. Sickle cell anaemia is qualitative and thalassemia is quantitative diseases.

## Question 31:

While reading newspaper, Jack read that corona virus has mutated and the new variant of corona virus has been discovered in some countries. Jack became curious and wanted to know how corona virus is getting mutated quickly, so he asked his brother who is a doctorate in microbiology about the virus.

a) Which of the following virus is responsible for causing COVID-19?
   (i) SARS-CoV-2   (ii) COVID   (iii) SARS-CoV-19   (iv) Omicron

b) Mutation occurs when
   (i) When one or more nucleotides are added in the DNA segment
   (ii) When one or more nucleotides are removed from DNA segment
   (iii) When one base pair is incorrectly added during replication
   (iv) All of the above

c) Out of 64 codons how many codons can code for amino acids?
   (i)64   (ii) 63   (iii) 62   (iv) 61

d) Which codon codes for the amino acid methionine and also acts as an initiator codon?
   (i) AUU   (ii) AUA   (iii) AUG   (iv) ACG

e) What are the structures in the cell that make the process of translation possible?
   (i) mRNA, tRNA and Ribosomes
   (ii) DNA, Codons and Ribosomes
   (iii)RNA, Protein and tRNA
   (iv)Amino acids, mRNA and tRNA

**Question 32:**
Directions (Q no-1 to 5): Each of the following question consist of two statements, one is Assertion (A) and the other is reason (R). Select the correct answers to these questions from the codes a, b, c and d as given below:
   a) Both Assertion and Reason are true and reason is the correct explanation of the Assertion
   b) Both Assertion and Reason are true but reason is not the correct explanation of the Assertion
   c) Assertion is true but reason is false
   d) Both Assertion and Reason are false.

Q1. **Assertion (A):** Sequences of bases in one polynucleotide chain of DNA can determine the sequence of bases in the other chain.
**Reason (R):** In a DNA, amount of adenine equals that of thymine and the amount of Guanine equals that of Cytosine, i.e. A=T and C=G.

Q2. **Assertion (A):** tRNA acts an adapter molecule.
**Reason (R):** tRNA recognizes codon sequence of mRNA during translation.

**Q3. Assertion (A):** same tRNA can recognize more than one codon differing only at the third position.
**Reason (R):** The specificity of a codon is particularly determined by the first two bases.

**Q4. Assertion (A):** UAA, UAG and UGA terminate protein synthesis.
**Reason (R):** They are not recognized by t RNA.

**Q5. Assertion (A):** Ribosomes attached to endoplasmic reticulum release proteins into lumen of ER.
**Reason (R):** Such proteins are used for formation of hydrolytic enzymes or are modified.

## Question 33:

According to Hardy Weinberg principle, the allele frequencies in a population are stable and remain constant through generations. When the frequency differs from the expected values, the difference indicates the extent (direction) of evolutionary change. Disturbance in the genetic equilibrium or Hardy Weinberg equilibrium in a population can be interpreted as resulting in evolution.

1. Which is correct formula of Hardy –Weinberg 's law?
    (a)    $p^2 + pq + q^2 = 0$        (b)    $p^2 + pq + q^2 = 1$
    (c)    $p^2 + pq + q^2 = infinity$    (d)    $p^2 + 2pq + q^2 = 1$

2. Which of the following would lead to deviation from Hardy –Weinberg equilibrium?
    (a)    Random mating
    (b)    Lack of mutation
    (c)    No gene flow of gene mutation
    (d)    Natural selection

3. In a population of 1000 individuals, 360 belong to genotype AA, 480 to Aa and the remaining 160 to aa. Based on this data, the frequency of allele A in the population is
    (a)    0.4        (b) 0.5        (c) 0.6        (d) 0.7

4. Random genetic drift in a population probably results from-
    (a)    Large population size
    (b)    Highly genetically variable individuals
    (c)    Interbreeding within small isolated population
    (d)    Constant low mutation rate

5. Genetic drift is change of
   - (a)    Gene frequency in same generation
   - (b)    Appearance of recessive genes
   - (c)    Gene frequency from one generation to next
   - (d)    None of the above

**Question 34:**

About 15 million years ago (mya), primates called Dryopithecus and Ramapithecus were existing. They were hairy and walked like gorillas and chimpanzees. Few fossils of man –like bones have been discovered in Ethiopia and Tanzania. These revealed hominid features leading to the belief that about 3 -4 mya, man – like primates walked in eastern Africa. Two mya, Australopithecus probably lived in East African grasslands. Evidence shows they hunted with stone weapons but essentially ate fruit.  This creature was called the first human –like being the hominid and was called Homo habilis. Fossils discovered in Java in 1891 revealed the next stage, i.e., Home erectus. The Neanderthal man with a brain size of 1400 cc lived in near east and central Asia between 1,00,000- 40,000 years back. Homo sapiens arose in Africa and moved across continents and developed into distinct races.
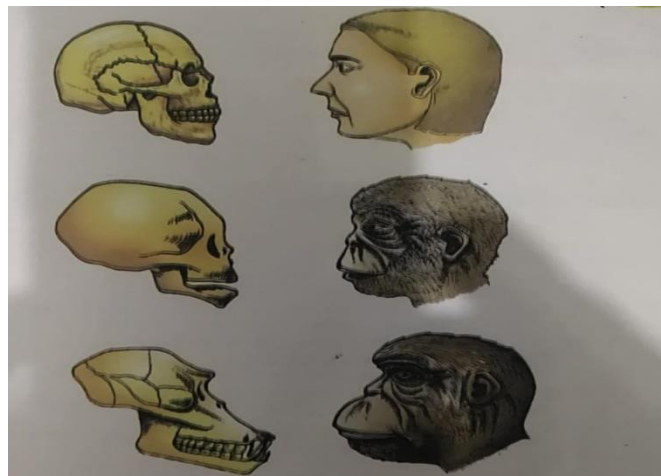


1. Which one is irrelevant to evolution of man?
   - (a)    Perfection of hand for tool making
   - (b)    Change of diet from hard nuts / roots to soft food
   - (c)    Increased ability to communicate or develop community behaviour
   - (d)    Loss of tail

2. The extinct human who lives 100000 to 40000 years ago, in Europe, Asia and parts of Africa, with short stature, heavy eye brows, retreating foreheads, large jaws with heavy teeth, stocky bodies, a lumbering gait and stooped posture was-
   - (a)    Homo habilis
   - (b)    Neanderthal human

(c)     Cro –magnan human
(d)     Ramapithecus

3. What was the most significant trend in the evolution of modern man (Homo sapiens) from his ancestors?
(a)     Shortening of jaws
(b)     Binocular vision
(c)     Increasing brain capacity
(d)     Upright posture

4. Homo sapiens evolved during
(a)     Pleistocene          (b)     Oligocene
(c)     Pliocene             (d)     Miocene

5. Which one of the following is regarded as the direct ancestor of modern man?
(a)     Homo erectus    (b)     Ramapithecus
(c)     Homo habilis    (d)     Cro –magnan man

**Question 35:**
Riya studies in class 2 in a government school. She belongs to a backward family and her parents did not get her properly vaccinated according to the immunization program. once while playing on a school playground she fell down due to weakness and developed a high fever, headache, and stiffness in her back. Identify the illness she could be suffering from and answer the following questions.

1. The microbe responsible for Riya's illness could be:
a.     Vibrio cholerae
b.     Enterovirus
c.     Plasmodium
d.     Mycobacterium

2. Which vaccine, if administered earlier, would have saved Riya from the illness she unfortunately contracted?
a.     Salk vaccine
b.     MMR vaccine
c.     BCG vaccine
d.     Varicella vaccine

3. The disease that Riya has contracted spreads through
a.     Bite of infected mosquito
b.     Bite of infected dog
c.     Faecal oral root
d.     Direct contact with the infected person.

4. Riya can spread her illness to other children through
    a.    Her faeces
    b.    Direct contact
    c.    Coughing and sneezing in open
    d.    Vectors

5. **Assertion:** Polio produces inflammation of the nervous system.
**Reason:** Stiffness of the neck, and paralysis of particular skeletal muscle is an important symptom of polio.
    (a)    If both A and R are true and R is the correct explanation of A.
    (b)    If Both A and R are true but R is not the correct explanation of A
    (c)    If A is true but R is false
    (d)    If both A and R are false.

**Question 36:**
Rajesh Ravi and Rohit are roommates. They are doing their graduation. Few months back Ravi fell ill. It took him around three weeks to recover. Both his friends were absolutely healthy at that time. After sometime Rajesh also fell ill from some other disease. This time Ravi and Rohit both contracted the same illness. Based on the above information, answer the following questions:

1. Which of the following holds true for Ravi's illness?
    a. Ravi was suffering from a communicable disease that is transmitted through a vector.
    b. Ravi was suffering from a communicable disease that is transmitted through the fecal-oral route.
    c. Ravi was suffering from a noncommunicable disease like anemia.
    d. Ravi is suffering from a noncommunicable disease like Down's syndrome.

2. Select the correct statement:
    a. Ravi contracted a disease caused by air borne microbes.
    b. Ravi could have suffered a nutritional disorder.
    c.  Ravi suffered a non- contagious disease.
    d.  Both (b) and (c).

3. Which could be correctly said for Rajesh's illness?
    a. Rajesh's illness was due to microbial infection.
    b. Rajesh's illness could be contagious or noncontagious.
    c. Rajesh's illness could be cured by antibodies.
    d. All of the above.

4. Which of the following may depict Ravi's and Rajesh's illness?

| Ravi | Rajesh |
| --- | --- |
| a. Sickle cell anemia | Myocardial infarction |
| b. Whooping cough | Tetanus |
| c. Gastritis | Rhinitis |
| d. Hypertension | Thyroid |

5. **ASSERTION:** Diabetes mellitus is a non-communicable disease that can be completely cured.
**REASON:** Diabetes mellitus is caused by a deficiency of the aldosterone hormone.
 (a) If both A and R are true and R is the correct explanation of A.
 (b) If Both A and R are true but R is not the correct explanation of A
 (c) If A is true but R is false
 (d) If both A and R are false.

## Question 37:

The given graph shows fluctuations in blood sugar of person X and Y during 24 hrs of time period.
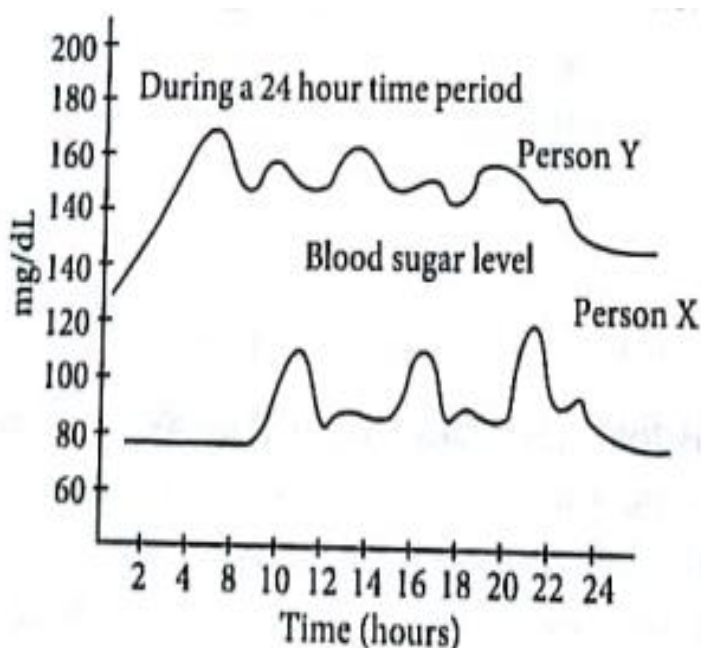


Based on the above information, answer the following questions.

1. Which of the following holds true for person X.
 a. Person X is suffering from type 1 diabetes.
 b. Person X shows severe insulin deficiency and beta cell depletion.

c. Blood sugar level never exceeds the normal limit, and sufficient insulin that converts extra glucose to glycogen

d. Person X is subjected to excessive urination and abnormal thirst.

2. The given graph indicates that person Y is suffering from
   a. Diabetes
   b. Hypertension
   c. Atherosclerosis
   d. Rheumatic heart disease.

3. Which of the following conditions are common in person Y?
   a. Excretion of glucose in urine and excessive urination
   b. Polydipsia and mild beta cells depletion
   c. The progressive erosion of articular cartilage at the synovial joint.
   d. Both a and b.

4. A person suffering from diabetes mellitus becomes weak because.
   a. The cells are unable to utilize glucose and other carbohydrates for energy production.
   b. Degradation of fat increases the production of toxic ketone bodies.
   c. Cells utilize proteins for obtaining energy.
   d. All of these.

5. **ASSERTION**: Type I diabetes involves the failure of insulin to facilitate the movement of glucose into the cells.
   **REASON**: Type II diabetes is caused by the failure of B cells to produce insulin.
   a) If both A and R are true and R is the correct explanation of A.
   b) If Both A and R are true but R is not the correct explanation of A
   c) If A is true but R is false
   d) If both A and R are false.

## Question 38:

Siddharth is a chain smoker He got into this habit in early adolescence due to peer pressure and gradually got addicted to this habit. It's now almost 20 years he is into the habit of smoking. Since few months he is experiencing pain in the chest, shortness of breath, wheezing and chronic cough with phlegm. He sought advice from the doctor.

Based on the above information answer the following questions:

1. What do you think is the possible carcinogen for Siddharths's lung cancer?
   a. Nitrosamines
   b. Benzopyrenes
   c. Hydrazine
   d. All of the above.

2. From which type of cancer is Siddharth suffering from?
   a. Sarcoma
   b. Carcinoma
   c. Lymphoma
   d. Leukaemia

3. Select the correct statement:
   (a) Surgery, radiotherapy, and chemotherapy can be used to treat lung cancer.
   (b) Chemotherapy involves the exposure of cancerous parts to X rays which destroy rapidly growing cancer cells.
   (c) Surgical removal of lung cancer tissue is suggested at advanced stage 4.
   (d) Monoclonal antibodies can effectively treat lung cancer and cure it completely.

4. How is lung cancer diagnosed?
   a. CT scan
   b. Sputum Cytology
   c. Biopsy of lung Tissue
   d. All of these

5. **ASSERTION**: Lung cancer if not treated at an early stage can spread to other initial organs of the body.
   **REASON**: Cancer cell have uncontrolled proliferation and ability to invade new sites. (Metastasis)
   a) If both A and R are true and R is the correct explanation of A.
   b) If Both A and R are true but R is not the correct explanation of A
   c) If A is true but R is false
   d) If both A and R are false.

**Question 39:**
Aditya went to his hometown located in the countryside along with his parents during his summer vacations. His grandparents' house is surrounded by farmland from all

sides. Lots of crops were growing nearby and Aditya was very excited to visit the crop fields. He seeked permission from his mother to play in the farmland along with his friends and then went to play in the fields. On returning home he had running nose, watering eyes and based on the above information answer the following questions:

1. What could be the possible reason for Aditya's condition?
   a. Allergy
   b. Infection
   c. Malnutrition
   d. Genetic disorder

2. How can allergy be diagnosed in a person?
   a. Presence of large amount of IgE antibodies in the blood.
   b. Presence of large number of bacteria in blood.
   c. Presence of bilirubin and biliverdin pigments in the blood.
   d. Presence of sickle shaped RBC's in blood.

3. The symptoms which Aditya developed on account of being allergic are consequence of:
   a. Inflammation of membrane lining the nose and conjunctiva.
   b. Swelling up of tissue surrounding bronchioles in lungs.
   c. Dilation of arteries so that large amount of fluid passes from blood to tissues.
   d. All of these.

4. Name the type of allergy that Aditya developed.
   a. Asthma
   b. Anaphylaxis
   c. Hay fever
   d. Utricaria

5. **ASSERTION**: hay fever is the form of allergy due to pollen of grasses and other plants.
   **REASON**: Hay fever symptoms are due to release of histamines and often respond well to treatment with antihistamines.
   a) If both A and R are true and R is the correct explanation of A.
   b) If Both A and R are true but R is not the correct explanation of A
   c) If A is true but R is false
   d) If both A and R are false.

**Question 40:**

**ASSERTION REASON TYPE OF QUESTIONS**

In each of the questions, a statement of assertion (A) is given and a corresponding statement of Reason (R) is given just below it. Of the statements, mark the correct answer as:

a) If both A and R are true and R is the correct explanation of A.
b) If Both A and R are true but R is not the correct explanation of A
c) If A is true but R is false
d) If both A and R are false.

1) **ASSERTION:** Addicts often take Alcohol and Barbiturates together.
   **REASON:** The combination of these two substances is less harmful to the body.

2) **ASSERTION:** Interferons are a type of antibodies produced by body cells infected by bacteria.
   **REASON:** Interferons stimulate inflammation at the site of injury.

3) **ASSERTION:** Mucus membrane immobilizes the micro- organism in the body.
   **REASON:** Microorganisms and dust particles entering the respiratory tract are trapped in the mucus.

4) **ASSERTION:** Subsequent encounter with the same pathogen elicits a highly intensified anamnestic response.
   **REASON:** This is based on the fact that our body appears to have memory of the first encounter.

5) **ASSERTION:** Smoking causes oxygen deficiency in the body.
   **REASON:** Carbon monoxide when inhaled while smoking combines with haemoglobin to form chemically stable compound.

**Question 41:**
The gut of ruminants contains
   a) Halophiles
   b) Acidophiles
   c) Methanogens
   d) All above

**Question 42:**
Bacillus thuringiensis is used as
   a) Fermentation of beer
   b) Bio pesticide
   c) Antibiotic
   d) Pesticide

**Question 43:**
Which of the following is a non-symbiotic biofertiliser?
   a) VAM
   b) Azotobacter
   c) Anabaena
   d) Rhizobium

**Question 44:**
Integrated Pest Management (IPM) discourages the excessive use of
   a) Biological methods
   b) Chemical pesticides
   c) Mechanical methods
   d) All

**Question 45:**
**Assertion:** Besides curdling of milk, LAB also improve its nutritional quality by increasing vitamin-B12.
**Reason:** LAB, when present in human stomach, check disease causing microbes.
   a) Both assertion and reason are true, and reason is the correct explanation of assertion.
   b) Both assertion and reason are true, but reason is not the correct explanation of assertion.
   c) Assertion is true but reason is false.
   d) Both assertion and reason are false

**Question 46:**
**Assertion:** Yeasts such as Saccharomyces cerevisiae are used in baking industry.
**Reason:** Carbon dioxide produced during fermentation causes bread dough to rise by thermal expansion.
   a) Both assertion and reason are true, and reason is the correct explanation of assertion.
   b) Both assertion and reason are true, but reason is not the correct explanation of assertion.
   c) Assertion is true but reason is false.
   d) Both assertion and reason are true

**Question 47:**
**Assertion:** All microbes cause diseases
Reason: All microbes are harmful
  a) Both assertion and reason are true, and reason is the correct explanation of Assertion.
  b) Both assertion and reason are true, but reason is not the correct explanation of assertion.
  c) Assertion is true but reason is false.
  d) Both assertion and reason are false.

**Question 48:**
**Assertion:** Vitamins B2 is found in cereals, green vegetables, brewer's yeast, egg white, milk and liver.
**Reason:** It can be commercially produced by some yeasts.
  a) Both assertion and reason are true, and reason is the correct explanation of assertion.
  b) Both assertion and reason are true, but reason is not the correct explanation of assertion.
  c) Assertion is true but reason is false
  d) Both assertion and reason are false

**Question 49:**
Mycorrhiza does not help the host plant in
  a) Enhancing its phosphorus uptake capacity
  b) Increasing its tolerance to drought
  c) Enhancing its resistance to root pathogens
  d) Increasing its resistance to insects

**Question 50:**
Example of a natural insect repellant
  a) Citronella oil
  b) Coconut oil
  c) Linseed oil
  d) Rapeseed oil

**Question 51:**
Fate of a piece of DNA, which is somehow transferred into an alien organism, would not be able to multiply itself in the progeny cells of the organism. But, when it gets integrated into the genome of the recipient, it may multiply and be inherited along with the host DNA. This is because the alien piece of DNA has become part of a chromosome, which has the ability to replicate. An alien DNA is linked with the origin of replication, so that, this alien piece of DNA can replicate and multiply itself

in the host organism. This can also be called as cloning or making multiple identical copies of any template DNA. Vectors used at present, are engineered in such a way that they help easy linking of foreign DNA and selection of recombinants from non-recombinants.



E.coli cloning vector pBR322
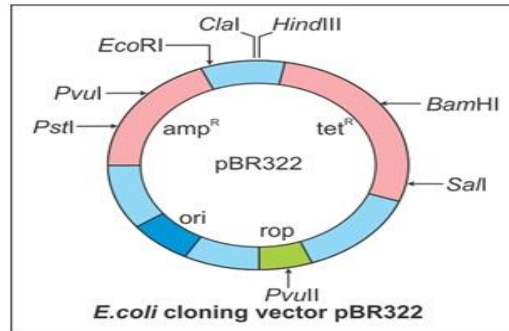
(1) In pBR322, BR stands for:
   a. The initials of two scientist who constructed it.
   b. The resistance of BamH1
   c. For its discovery in Berlin
   d. None of the above

(2) The 'rop' segment codes for:
   a. Resistance Protein
   b. Protein for replication
   c. Protein for translation
   d. Cloning site

(3) The gene which helps in selection of recombinants and non-recombinants are:
   a. EcoR1
   b. $amp^R$
   c. $tet^R$
   d. Both b and c

(4) What will happen if the foreign gene is inserted at the BamH1 site?
   a. The recombinant plasmids will lose tetracycline resistance
   b. The recombinant plasmids will not grow in tetracycline containing medium.
   c. The recombinant plasmids will grow in ampicillin containing medium.
   d. All of the above

(5) Choose the correct statement about 'ori' region.
   a. It is a sequence from where translation starts.
   b. Foreign gene replicates when linked to this sequence.
   c. It does not control the copy number of foreign genes
   d. None of the above.

**Question 52:**
Observe the given fig. and answer the following Questions:



(1) Identify the restriction enzyme which identifies the above sequence:
    A.    BamHI
    B.    EcoRI
    C.    SalI
    D.    PvuI

(2) Identify the nature of enzyme and the type of fragments which are generated?
    A.    Endonuclease, Blunt end
    B.    Exonuclease, Sticky end
    C.    Endonuclease, sticky end
    D.    Exonuclease, Blunt end

(3) This was the first restriction endonuclease that was discovered:
    A.    BamHI
    B.    EcoRI
    C.    HindIII
    D.    HindII

(4) How many bases does the sequence has which are identified by the restriction enzymes?
    A.    1    B.    4        C.    6    D.    12

**Question 53:**

(1) Identify the process depicted in above diagram?
    A.    DNA Spooling
    B.    DNA Isolation
    C.    DNA fingerprinting
    D.    Electrophoresis

(2) Name the enzyme used to isolate DNA from fungal Cells.
    A.    Cellulase
    B.    Chitinase
    C.    Lysozyme
    D.    Endonuclease

(3) In which chemical DNA is precipitated?
    A.    Chilled methanol
    B.    Chilled acetic acid
    C.    Chilled Ethanol
    D.    Both A and B

(4) DNA is made up of:
    A.    Nucleoside
    B.    Nucleotides
    C.    Nitrogen bases
    D.    None of the above

(5) The bases are held together in a DNA double helix by hydrogen bonds. These bonds are:
    A.    Ionic bonds
    B.    Covalent bonds
    C.    Non-covalent bonds
    D.    Van der Waals forces

**Question 54:**

Observe the given fig. and name Enzymes A and B. Also write their functions.
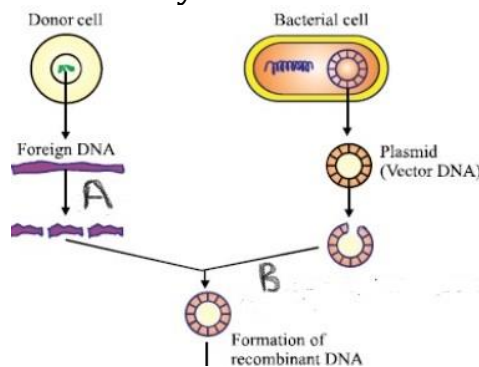
**Question 55:**
In the given process of separation and isolation of DNA fragments, some of the steps are missing, complete the missing steps.

A: Cutting of DNA fragments using restriction endonucleases
B: ………………………………………
C: Visualization in U.V. light
D: ………………………………………………
E: Purification of DNA fragments.

**Question 56:**
Its human nature, it seems, to resist change and fear the unknown. So, it is no surprise that genetic engineering of food and feed crops raised many doubts in the minds of many consumers.
Farmers and agricultural scientists have been genetically engineering the foods we eat for centuries through breeding programs. In addition to traditional crossbreeding, agricultural scientists have used radiation and chemicals to induce gene mutations in edible crops in attempts to achieve desired characteristics.
The fears of G.M.O.s are still theoretical, like the possibility that insertion of one or a few genes could have a negative impact on other desirable genes naturally present in the crop. But many positive instances of GMO have also been reported. Golden Rice, Iron rich Spinach, Bt-cotton are such examples.
Ethical standards are required to evaluate the morality of all such genetic modification activities. GEAC makes all the decisions regarding the validity of GM research and the safety of introducing GMO's for public services.

1.    Farmers and agriculture Scientists are using:
   a.    Conventional breeding methods
   b.    Use of radiations and chemicals to induce gene mutations
   c.    Both (i) and (ii)
   d.    Recombinant DNA Techniques

2.    Golden Rice is enriched in:
   a.    Carbs      b.    B-carotene
   c.    Fats       d.    Minerals

3.    GEAC stands for:
   a.    Genetic Engineering Approval Committee
   b.    Genetic Environment Approval Committee
   c.    Genetic Engineering Action Committee
   d.    Genome Engineering Action Committee

4.   Cultivation of Bt cotton has been much in the news. The prefix "Bt" means
   a.   Barium treated cotton seeds
   b.   Carrying an endotoxin gene from Bacillus thuringiensis.
   c.   Produced by biotechnology method
   d.   Bigger thread variety of cotton with tensile strength.

5. **ASSERTION:** GMO'S have been useful in making crops tolerant to abiotic stresses, reduced reliance on chemical pesticides and to enhance nutritional value of food.
**REASON:** Genetic modification has been used to create tailor-made plants.
   a.  Both assertion and reason are true, and reason is the correct explanation of assertion.
   b.  Both assertion and reason are true, but reason is not the correct explanation of assertion.
   c.  Assertion is true but reason is false.
   d.  Both assertion and reason are false

**Question 57:**



1 Cell with non-functioning gene | 2 Adding DNA containing a functional version of the lost gene | 3 Cell functioning normally
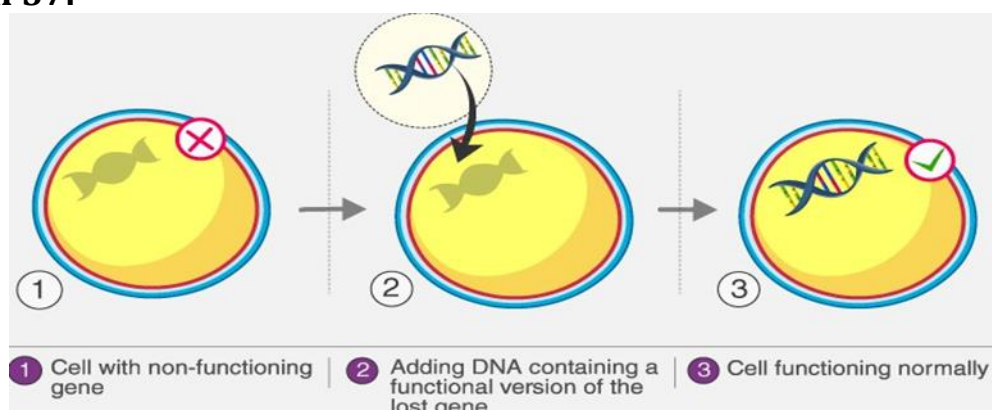
(1) Identify the process depicted in the above diagram.
   A.   DNA Extraction   B.   Cloning
   C.   Gene Therapy     D.   Sequencing

(2) Which enzyme is crucial for the immune system to function?
   A.   ZDA          B.   YDA
   C.   AAD          D.   ADA

(3)  What are the other methods for the treatment of ADA Deficiency?
   A.   Bone Marrow Transplantation
   B.   Enzyme Replacement Therapy
   C.   Both A and B
   D.   Medicines

(4) In gene therapy, the gene defects are cured in a child or in ____ stage.
    A.    Adult      B.    Teenage
    C.    Old         D.    Embryo

(5) A functional ADA cDNA is introduced into the patient's lymphocytes using _____ vector.
    A.    Jumping
    B.    Retroviral
    C.    Infectious
    D.    bacterial

## Question 58:

Fig. A depicts a diseased tobacco plant whereas Fig. B shows disease free plant.



(i)     Name the process through which the above plant is made disease free:
    A.    RNAi
    B.    Antigen Antibody interaction
    C.    Gene therapy
    D.    None

(ii)    In this process, vector used is:
    A.    Retrovirus
    B.    Plasmid
    C.    Bacteriophage
    D.    Agrobacterium

(iii)   This method is a type of _____ mechanism found in all _____.
    A.    Defence, prokaryotes
    B.    Cellular defence, Eukaryotes
    C.    Artificially induced, Eukaryotes
    D.    Artificially induced, Prokaryotes

(iv)    The causative agent of the disease is:
     A.    Bacteria
     B.    Virus
     C.    Nematode
     D.    Prion

(v)    How is the pathogen specific gene silenced in this mechanism?
     A.    Through ds DNA
     B.    Through ss DNA
     C.    Through ds RNA
     D.    Through ss RNA

**Question 59:**
What would be the effect on the PCR reaction if there are no primers in the reaction?
     A. PCR will proceed normally
     B. Non-specific PCR of random templates will occur
     C. the reaction will cease after a few cycles
     D. the PCR reaction will not commence

**Question 60:**
Cry I Ab and cry I AC produce toxins that control:
     A.    Cotton bollworms and corn borer respectively
     B.    Corn borer and cotton bollworms respectively
     C.    Tobacco budworms and nematodes respectively
     D.    Nematodes and tobacco budworms respectively

**Question 61:**
A group of populations of two or more species occupying the same geographical area at the same time is called
     a) Ecosystem
     b) Commensalism
     c) Interaction
     d) Community

**Question 62:**
Biotic factors include
     a) Plants and animals
     b) Water temperature, fish
     c) Plants, animals and physical environment
     d) None of the above

**Question 63:**
An organism that lives in or on another organism and derives nutrients for itself at the expense of the host organism is called _____
    a) Scavenger
    b) Prey
    c) Predator
    d) Parasite

**Question 64:**
A population that exhibits birth rates that are identical to the death rate implies
    a) Initial growth
    b) Plateau phase
    c) Acceleration Phase
    d) None of the above

**Question 65:**
Antifreeze proteins or AFPs enable organisms that possess it to
    a) Survive high temperatures
    b) Survive extreme pressure
    c) Survive subzero temperatures
    d) None of the above

**Question 66:**
A group of individuals from different species living in the same habitat and exhibiting functional interactions is called
    a) Biotic community        b) Population
    c) Ecosystem           d) None of the above

**Question 67:**
Xerocoles are
    a) Animals adapted to live in the tundra
    b) Animals adapted to live in deserts
    c) Animals adapted to live in the deep sea
    d) Animals adapted to a nocturnal lifestyle

**Question 68:**
Fossorial refers to
    a) Animals that turned into fossils
    b) Animals that are adapted to burrowing
    c) Animals that are adapted to climbing
    d) None of the above

**Question 69:**

_____ is the unrestricted growth of populations, which will result in the maximum growth of that population
   a) Biotic Potential
   b) Nutritive potential
   c) Uricotelism
   d) None of the above

**Question 70:**

Crassulacean acid metabolism in plants helps to _____
   a) Reproduction
   b) Conserving water
   c) Increase resistance to disease
   d) Secondary Growth

**ASSERTION AND REASONING TYPE OF QUESTIONS**

These questions consist of two statements each, printed as Assertion and Reason. While answering these questions you are required to choose any one of the following four responses.
   a) If both Assertion and Reason are true and the Reason is correct explanation of the Assertion.
   b) If both Assertion and Reason are true but the Reason is not a correct explanation of the Assertion.
   c) If Assertion is true but the Reason is false.
   d) If both Assertion and Reason are false

**Question 71:**
**ASSERTION:** many freshwater animals cannot live for long in sea water
**REASON:** because of osmotic problems they would face.

**Question 72:**
**ASSERTION:** Predators in nature are 'prudent'.
**REASON:** If a predator is too efficient and overexploits its prey, then the prey might become extinct and following it, the predator will also become extinct for lack of food

**Question 73:**
**ASSERTION:** Mammals from colder climates generally have shorter ears and limbs
**REASON:** This adaptation helps them to minimise heat loss

**Question 74:**
**ASSERTION:** Predators also help in maintaining species diversity in a community,
**REASON:** they do so by reducing the intensity of competition among competing prey species.

**Question 75:**
Decomposers like fungi and bacteria are:
    i. autotrophs
    ii. heterotrophs
    iii. saprotrophs
    iv. chemo-autotrophs.
Choose the correct answer:
    (a) i and iii,        (b) i and iv
    (c) ii and iii,        (d) i and ii

**Question 76:**
The process of mineralisation by micro-organisms helps in the release of:
    a. inorganic nutrients from humus
    b. both organic and inorganic nutrients from detritus
    c. organic nutrients from humus
    d. inorganic nutrients from detritus and formation of humus.

**Question 77:**
Productivity is the rate of production of biomass expressed in terms of:
    i. $(kcal\ m^{-3})\ yr^{-1}$
    ii. $g\ m^{-2}\ y^{-1}$
    iii. $g^{-1}\ yr^{-1}$
    iv. $(kcal\ m{-2})\ yr^{-1}$

    (a) ii,
    (b) iii,
    (c) ii and iv,
    (d) i and iii

**Question 78:**
An inverted pyramid of biomass can be found in which ecosystem?
    a. Forest
    b. Marine
    c. Grass land
    d. Tundra

**Question 79:**
Which of the following is not a producer?
        a. Spirogyra
        b. Agaricus
        c. Volvox
        d. Nostoc

**Question 80:**
Which of the following ecosystems is most productive in terms of net primary production?
        a. Deserts          b. Tropical rain forests
        c. Oceans           d. Estuaries

**Question 81:**
Pyramid of numbers is:
        a. Always upright                b. Always inverted
        c. Ether upright or inverted     d. Neither upright nor inverted

**Question 82:**
Approximately how much of the solar energy that falls on the leaves of a plant is converted to chemical energy by photosynthesis?
        a. Less than 1%          b. 2-10%
        c. 30%                   d. 50%

**Question 83:**
Among the following, where do you think the process of decomposition would be the fastest?
        a. Tropical rain forest    b. Antarctic
        c. Dry arid region         d. Alpine region

**Question 84:**
How much of the net primary productivity of a terrestrial ecosystem is eaten and digested by herbivores?
        a. 1%            b. 10%            c. 40%            d. 90%

**Question 85:**
During the process of ecological succession, the changes that take place in communities are:
        a. Orderly and sequential      b. Random
        c. Very quick                  d. Not influenced by the physical environment

**Question 86:**
Climax community is in a state of:
     a. non-equilibrium
     b. equilibrium
     c. disorder
     d. constant change.

**Question 87:**
Among the following bio-geo-chemical cycles which one does not have losses due to respiration?
     a. Phosphorus
     b. Nitrogen
     c. Sulphur
     d. All of the above

**Question 88:**
The sequence of communities of primary succession in water is:
   a. phytoplankton, sedges, free-floating hydrophytes, rooted hydrophytes, grasses and trees.
   b. phytoplankton, free-floating hydrophytes, rooted hydrophytes, sedges, grasses and trees.
   c. free-floating hydrophytes, sedges, phytoplankton, rooted hydrophytes, grasses and trees.
   d. phytoplankton, rooted submerged hydrophytes, floating hydrophytes, reed swamp, sedges, meadow and trees.

**Question 89:**
The reservoir for the gaseous type of bio-geo chemical cycle exists in
     a. stratosphere
     b. atmosphere
     c. ionosphere
     d. lithosphere

**Question 90:**
If the carbon atoms fixed by producers already have passed through three species, the trophic level of the last species would be.
     a. scavenger
     b. tertiary producer
     c. tertiary consumer
     d. secondary consumer

**Question 91:**
Which of the following type of ecosystem is expected in an area where evaporation exceeds precipitation, and mean annual rainfall is below 100mm
     (a) Grassland
     (b) Shrubby forest
     (c) Desert
     (d) Mangrove

**Question 92:**
The zone at the edge of a lake or ocean which is alternatively exposed to air and immersed in water is called:
     a. Pelagic zone
     b. Benthic zone
     c. Lentic one
     d. Littoral zone

**Question 93:**
Edaphic factor refers to:
     a. Water
     b. Soil
     c. Relative humidity
     d. Altitude

**Question 94:**
Which of the following is an ecosystem service provided by a natural ecosystem?
     a. Cycling of nutrients
     b. Prevention of soil erosion
     c. Pollutant absorption and reduction of the threat of global warming
     d. All of the above

**Question 95:**
Non-native or alien species are often introduced inadvertently for their economic and other uses. They often become invasive and drive away the local species. Exotic species have proved harmful to both aquatic and terrestrial ecosystems. For example, water hyacinth (Eichhornia crassipes) was introduced in Indian waters to reduce pollution. It clogged water bodies including wetlands at many places resulting in death of several aquatic plants and animals.

Island water ecosystem is the most vulnerable due to:
     (a) small size                  (b) small number of species
     (c) increased reproductive capacity (d) both a and b

**Question 96:**
Which of the following is not an alien species?

(a) Lantana camara

(b) Periplaneta americana

(c) Nile Perch

(d) Yucca moth

**Question 97:**
Second major cause of species extinction is

(a) habitat loss and fragmentation

(b) over exploitation

(c) alien species invasion

(d) co-extinction

**Question 98:**
**Assertion (A):** Eichhornia crassipes drains off oxygen from water and can be seen growing in standing water
**Reason (R):** Eichhornia crassipes is an indigenous species of India.

a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
c) Assertion is true but Reason is false.
d) Both Assertion and Reason are false.

**Question 99:**
The population of species P in a certain community was constant until a population species Q from a distant land was subsequently introduced into that community. The interaction between the two populations is reflected in the graph below:
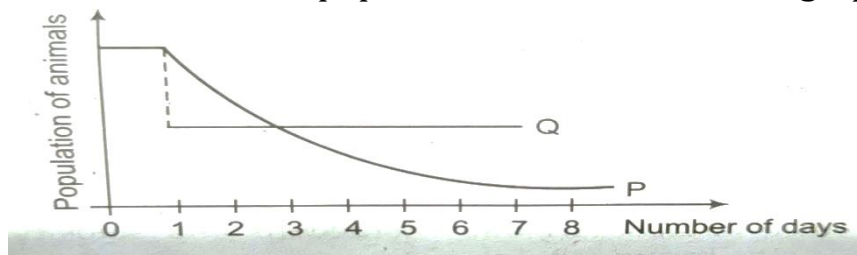


What could be the possible reason for the decrease in the populations of species P over a number of days?

(a) Species Q is a predator of species P.

(b) Species Q is a prey species which wiped out the population of species P.

(c) Species P and Q compete for space but feeds on different food

(d) None of the above

**ASSERTION AND REASONING TYPE OF QUESTIONS**

Each of the following questions consists of two statements, one is Assertion (A) and the other is Reason (R). Select the correct answer to these questions from the codes a, b, c and d as given below.

a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
c) Assertion is true but Reason is false.
d) Both Assertion and Reason are false.

**Question 100:**
**Assertion (A):** The rate of extinction of organisms has increased in recent years.
**Reason (R):** Human activities like deforestation, industrialization, etc. have destroyed the natural habitat of plants and animals.

**Question 101:**
**Assertion (A):** Species diversity decreases as we ascend towards high mountains.
**Reason (R):** Due to drop in temperature, no seasonal variability occurs in high mountains.

**Question 102:**
**Assertion (A):** Communities with more species tend to be more stable than those with less species.
**Reason (R):** Communities with more species is not able to resist occasional disturbances.

**Question 103:**
**Assertion (A):** Dodo, Passenger pigeon, Steller's sea cow has become extinct due to over exploitation.
**Reason (R):** Excessive exploitation of a species, whether animal or plant reduces size of its population so that it becomes vulnerable to extinction.

**Question 104:**
**Assertion (A):** Coral reefs are found in temperate forests.
**Reason (R):** Minimum diversity of biota are found in the reefs.

## Biology - Answer Keys

**Answer 1:**
Maize is a single- seeded fruit because its pericarp (fruit wall) is fused with the seed coat. So, it cannot be called a seed.

**Answer 2:**
To produce 76 seeds in a guava: 76 pollen grains and 76 egg cells are required
As one meiotic division of PMC leads to formation of 4 pollen grains
Therefore no. of meiotic divisions for 76 pollen grains = 76/4=19
Whereas one meiotic division of MMC leads to formation of one megaspore (monosporic development) which later forms an embryo sac with one egg cell so 76 meiotic divisions are required to produce 76 egg cells.
Hence total no. meiotic divisions are =19 + 76 = 95

**Answer 3:** (i) a      (ii) d      (iii) d      (iv) d      (v) c

**Answer 4:** (i) d      (ii) a      (iii) d      (iv) d      (v) c

**Answer 5:** (i) c      (ii) b      (iii) c      (iv) b

**Answer 6:** ovum =23, first polar body = 23, second polar body = 23

**Answer 7:** (d)

**Answer 8:** (A) c      (B) a      (C) c      (D) b      (E) b      (F) d

**Answer 9:** (i) c      (ii) a      (iii) c      (iv) a      (v) b

**Answer 10:** (i) d      (ii) a      (iii) b      (iv) a      (v) d

**Answer 11:** (b)

**Answer 12:** (b)

**Answer 13:** (d)

**Answer 14:** (d)

**Answer 15:** (d)

**Answer 16:** (b)

**Answer 17:** (a)

**Answer 18:** (a)

**Answer 19:** (b)

**Answer 20:** (i) c        (ii) c        (iii) d        (iv) c

**Answer 21:** (c)

**Answer 22:** (b)

**Answer 23:** (d)

**Answer 24:** (d)

**Answer 25:** (c)

**Answer 26:** (c)

**Answer 27:** (d)

**Answer 28:** (a)

**Answer 29:** (a)

**Answer 30:**

(i) b        (ii) a        (iii) d        (iv) d

**Answer 31:**

a) (i)SARS-CoV-2
b) (iv)All of the above
c) (iv) 61
d) (iii) AUG
e) (i) mRNA, tRNA and Ribosomes

**Answer 32:** (1) (b)    (2) (b)        (3) (a)    (4) (a)        (5) (b)

**Answer 33:** (1) (d)    (2) (d)        (3) (c)    (4) (c)        (5) (c)

**Answer 34:** (1) (d)    (2) (b)        (3) (c)    (4) (a)        (5) (d)

**Answer 35:** (1) (b)    (2) (a)        (3) (c)    (4) (a)        (5) (b)

**Answer 36:** (1) (c)    (2) (d)        (3) (d)    (4) (c)        (5) (d)

**Answer 37:** (1) (c)    (2) (a)        (3) (d)    (4) (d)        (5) (d)

**Answer 38:** (1) (d)    (2) (b)        (3) (a)    (4) (d)        (5) (a)

**Answer 39:** (1) (a)    (2) (a)        (3) (a)    (4) (c)        (5) (b)

**Answer 40:** (1) (c )    (2) (d)        (3) (a)    (4) (a)        (5) (a)

**Answer 41:** (c)

**Answer 42:** (b)

**Answer 43:** (a)

**Answer 44:** (b)

**Answer 45:** (b)

**Answer 46:** (a)

**Answer 47:** (d)

**Answer 48:** (a)

**Answer 49:** (d)

**Answer 50:** (a)

**Answer 51:** (1) (a)     (2) (b)          (3) (d)          (4) (d)          (5) (b)

**Answer 52:** (1) (b)     (2) (c)          (3) (d)          (4) (c)

**Answer 53:** (1) (a)     (2) (b)          (3) (c)          (4) (b)          (5) (b)

**Answer 54:**

A - Restriction Enzyme – cuts DNA at specific positions

B - DNA Ligase - joins the two fragments of DNA

**Answer 55:**

B- Staining with Ethidium Bromide

D-Elution

**Answer 56:** (1) (c)     (2) (b)          (3) (a)          (4) (b)          (5) (b)

**Answer 57:** (1) (c)     (2) (d)          (3) (c)          (4) (d)          (5) (b)

**Answer 58:** (1) (a)     (2) (d)          (3) (b)          (4) (c)          (5) (c)

**Answer 59:** (d)

**Answer 60:** (b)

**Answer 61:** (d) - Community

**Answer 62:** (a) - Plants and animals

**Answer 63:** (d) - Parasite

**Answer 64:** (b) - Plateau phase

**Answer 65:** (c) - Survive sub-zero temperatures

**Answer 66:** (a) - Biotic community

**Answer 67:** (b) - Animals adapted to live in deserts

**Answer 68:** (b) - Animals that are adapted to burrowing

**Answer 69:** (a) - Biotic Potential

**Answer 70:** (b) - Conserving water

**Answer 71:** (a)

**Answer 72:** (a)

**Answer 73:** (a)

**Answer 74:** (a)

**Answer 75:** (c)

**Answer 76:** (a)

**Answer 77:** (c)

**Answer 78:** (b)

**Answer 79:** (b)

**Answer 80:** (b)

**Answer 81:** (c)

**Answer 82:** (b)

**Answer 83:** (a)

**Answer 84:** (b)

**Answer 85:** (a)

**Answer 86:** (b)

**Answer 87:** (d)

**Answer 88:** (b)

**Answer 89:** (b)

**Answer 90:** (c)

**Answer 91:** (c)

**Answer 92:** (d)

**Answer 93:** (b)

**Answer 94:** (d)

**Answer 95:** (d)

**Answer 96:** (d)

**Answer 97:** (c)

**Answer 98:** (c)

**Answer 99:** (a)

**Answer 100:** (a)

**Answer 101:** (a)

**Answer 102:** (c)

**Answer 103:** (a)
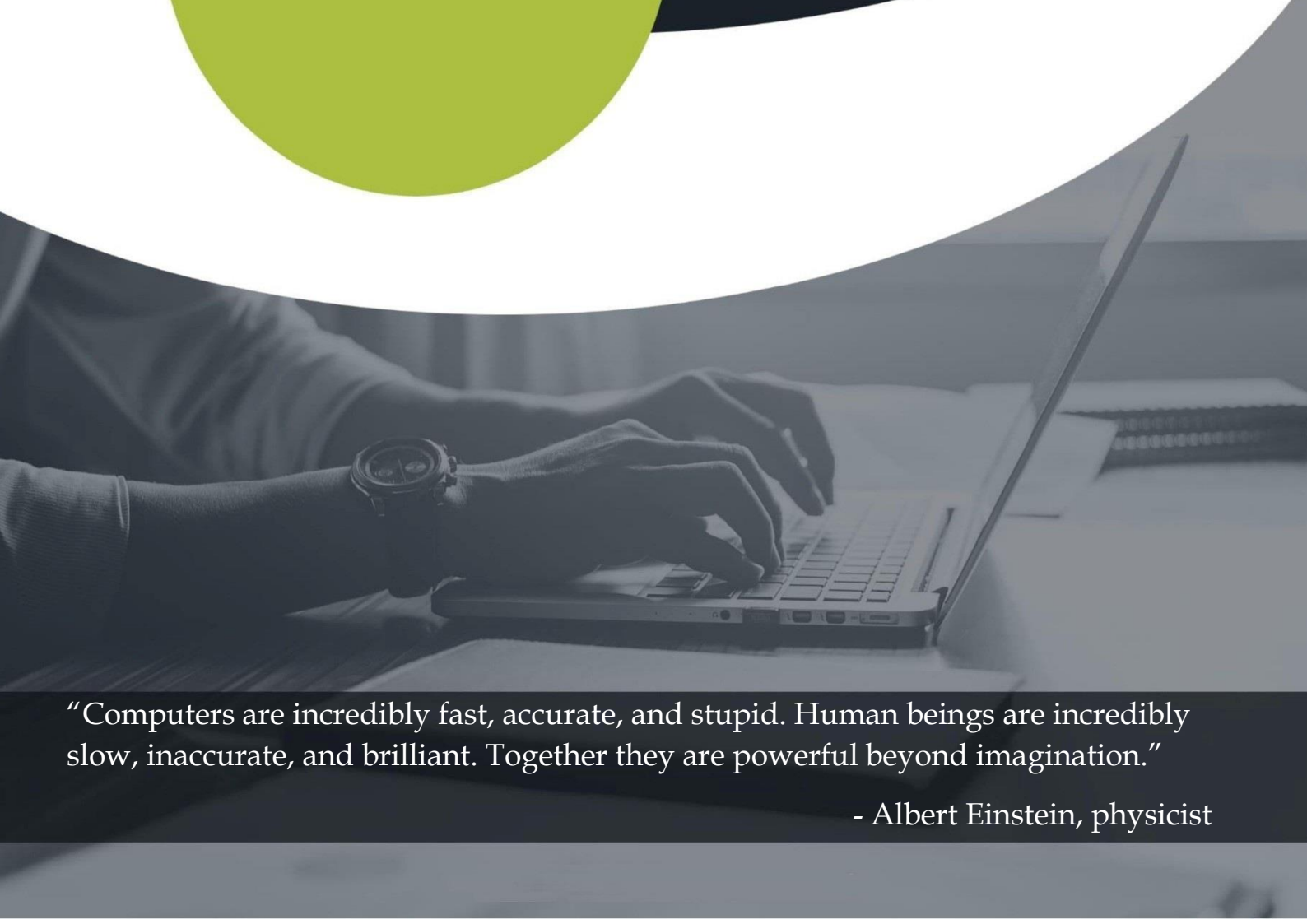
**Answer 104:** (d)

# COMPUTER SCIENCE

## CCT QUESTIONS
## Class XII

**Question 1:**

Consider the following dictionary

Book= {1:2, 2:3, 3:4, 4:5}

Rahul executes statement: 2 in Book

**Assertion**(A): For the above dictionary Book, output of the expression 2 in Book is True.

**Reason**(R): For Dictionary, the in and not in operators return True or False according to whether the specified operand occurs as a Value in the dictionary.

Based on above discussion, choose the appropriate option:

(a)    A is True but R is False.

(b)    A is False but R is True.

(c)    Both A and R are True and R is the correct explanation of A.

(d)    Both A and R are True but R is not the correct reason of A.

(e)    Both A and R are False.

**Question 2:**

For a given list L= [11, 12, 13, 14, 15, 16], the index of element 13 will be:

**Assertion**(A): the index of element 13 will be either 2 or -4.

**Reason**(R): Python List supports forward and backward indexing: forward indexing starts with index 0 given to leftmost element and backward indexing starts with index -1 given to rightmost element.

Based on above discussion, choose the appropriate option:

(a)    A is True but R is False.

(b)    A is False but R is True.

(c)    Both A and R are True and R is the correct explanation of A.

(d)    Both A and R are True but R is not the correct reason of A.

(e)    Both A and R are False.

**Question 3:**

**Assertion**(A): A data structure that contains the value sequentially or linearly is known as linear data structure.

**Reason**(R): Lists and tuples are linear data structures.

Based on above discussion, choose the appropriate option:

(a)    A is True but R is False.

(b)    A is False but R is True.

(c)    Both A and R are True and R is the correct explanation of A.

(d)    Both A and R are True but R is not the correct reason of A.

(e)    Both A and R are False.

**Question 4:**

Isha and Raja are studying computer science. While writing python programs, Isha always starts a variable name with a capital letter while Raja use all lower-case letters. Raja also suggested Isha to use lowercase as using first capital may generate errors in program.

Consider the above scenario and choose the appropriate option:

a) Raja is correct, we must use lower case letters.
b) Writing variable names with upper or lower case or a mix is not wrong and it will not generate any error, if same case is maintained throughout the programs.
c) In Python statement, Case of letters doesn't matter.
d) Starting variable names with capital letters is not allowed in identifier naming rules.

**Question 5:**

Consider the following while keeping iterative constructs or loop statements in mind:

**Assertion**(A): The nested loop can also be designed using while loops.

**Reason**(R): In this situation, a while loop is placed inside another while loop and the inner loop repeats a no. of times for each iteration of outer loop.

Based on above discussion, choose the appropriate option:

(a)    A is True but R is False.

(b)    A is False but R is True.

(c)    Both A and R are True and R is the correct explanation of A.

(d)    Both A and R are True but R is not the correct reason of A.

(e)    Both A and R are False.

## Question 6:

Consider Push and Pop operation of Stack. Push operation is used to insert an element into stack and Pop is used to delete the element from the top of the stack.

**Assertion**(A): Program should check for Overflow condition, before executing Push operation on stack and similarly check for Underflow before executing Pop operation.

**Reason**(R): In stack underflow, means there is no element available in the stack, while Overflow means no further element can be pushed into stack.

Based on above discussion, choose the appropriate option:

(a)    A is True but R is False.

(b)    A is False but R is True.

(c)    Both A and R are True and R is the correct explanation of A.

(d)    Both A and R are True but R is not the correct reason of A.

(e)    Both A and R are False.

## Question 7:

Data Structure is a logical structure created in the memory so that data can be stored and retrieved efficiently. A specific structure is created in the memory that has only one end open for entry and exit of data. It uses a pointer that points the topmost element of the structure.

Choose the possible data structure discussed in above paragraph:

(a)    Tuple        (b)    List            (c)    Stack        (d)    LIFO

**Question 8:**

**Assertion**(A): Stack is a linear data structure that works on the principle of FIFO (First In First Out).

**Reason**(R): The stack is created with the help of a list with some restrictions. It manages a pointer called Stack Pointer (SP) that will increase or decrease by 1, if an element is entered or removed from the stack respectively.

Based on above discussion, choose the appropriate option:

(a) A is True but R is False.

(b) A is False but R is True.

(c) Both A and R are True and R is the correct explanation of A.

(d) Both A and R are True but R is not the correct reason of A.

(e) Both A and R are False.

**Question 9:**

Consider the statements given below with respect to stack data structure.

i. In stack, we cannot insert an element in between the elements that are already inserted (True/False)
ii. Only insertion and deletion, is performed from top of stack, while one can access any element of stack directly using peek() function. (True/False)
iii. Overflow condition never arises in stack as it is implemented using list and new elements can be added using append () function and increasing the length of list. (True/False)

choose the correct option:

(a) i-False, ii-False, iii- False

(b) i-False, ii-True, iii-True

(c) i-True, ii-False, iii-True

(d) i-True, ii-True, iii-False

(e) i-True, ii-True, iii-True

**Question 10:**

Consider the following Push and Pop functions:

```
def PushBook(Book):
        bno = input("enter book no : ")
        btitle = input("enter book title:")
        rec = bno + " " + btitle
        Book.append(rec)
        print (Book)


def PopBook(Book) :
        # If stack is empty
        if len(Book)==0:
                print("Underflow")
        else:
                print ("Deleted entry:", Book.pop())
```

Analyze above functions and choose the appropriate option:

a) The objective of above functions is to insert or delete book number from the stack name Book.
b) The Push Function inserts the sum of book number and the length of book title as an element into the stack.
c) The Pop function returns a string having book no. and book title separated by single space.
d) The objective of above functions is to insert or delete a string having book no. and book title separated by single space from the stack name Book.

**Question 11:**

Ankit, is working on a project where he wants to display heading and line below the heading, he wants line to draw will be dynamic i.e. character to display and number of times to display that character to make a line should be dynamically passed as per requirement. Most of the line will be using '*' character and number of times to print will be 50. For this Ankit has written the following function:

```
def drawline(ch='*',times=50):
    print(ch*times)
```

Answer the following question based on the given function definition:

a.    If function is called as:

drawline('%')

What will be the output?

b.    If function is called as:

drawline(20)

What will be the output?

c.    If the default value of times is removed, what will be output of?

drawline('#',40)

**Question 12:**

Based on the given Python code of function, answer the following questions:

```
def Alpha(x):
    Beta(x+1)
    print(x)


def Beta(x):
    Gamma(x+1)
    print(x)


def Gamma(x):
    print(x)

Alpha(10)
```

a.    What will be the output of following code?

b.    Which function will finish its execution as last?

c.    Which function will first print the value of x?

## Question 13:
## Online status

The aim of this challenge is, given a dictionary of people's online status, to count the number of people who are online.

For example, consider the following dictionary:

statuses = {

  "Alice": "online",

  "Bob": "offline",

  "Eve": "online",

}

In this case, the number of people online is 2.

Raj, accepted the challenge and written the following python code, some part of the code is replaced with ___n___, where n is (a) to (e). Give the code to fill in place of (a) to (e) to execute code correctly.

def online_status(statuses):

     count=0

     for __(a)__ in statuses.___(b)___:

         if __(c)__ =="online":

            ____(d)____

     __(e)__ count

## Question 14:
## Counter Problem

Mohit, is working on a project where he wants to keep track of how many transaction() function is called, to achieve this task he has written the following code as:

count=0

def transaction(amount,balance,type):

     count+=1

     if type=="Debit":

         balance-=amount

     else:

         balance+=amount

     return count

But his code is not working, whenever transaction function is called, it is returning error. Give answer to the following questions based on the above case study:

a. What could be the possible reason of an error?

b. How this error can be removed?

**Question 15:**

Shraddha, a Python programmer working on a project of ABC Corporation where she wants to find out the highest sale done by salesman. Sale amount of the salesman is passed to function in the form of list. She has written the following code, some of the part of the program is missing labelled as (a) to (e), You have to give the correct code to fill in given place to execute the code correctly.

```
def Highest_Sale(Sales):
        high = _____ #(a) Statement 1
        for A in range(___,len(Sales)): #(b) Statement 2
        if _____: #(c) Statement 3
            _____ #(d) Statement 4
    return _____ #(e) Statement 5
```

Write the **#Statement 1** to **#Statement 5** to complete the above code so that program execute successfully.

**Question 16:**

Based on the given below Python code answer the question (a) to (c)

```
def Increment(Val1, Val2, Val3):
    Val1+=10
    Val2+=Val1
    Val3+=Val2
    return Val1, Val2, Val3    #Statement (a)
result = Increment(100,200,300)
_____ = Increment(50,60,70)        #Statement (b)
```

a. What will be the datatype of result variable?
b. Write code for Statement (b) to fill in blanks to store returned value in separate variables
c. If we remove #Statment (a) from the above code, what value will be stored by result variable?

## Question 17:

Write the output of Statement (a), (b) & (c) the given Python code:

```
def Total(Number=10):

    Sum=0

    for C in range(1,Number+1):

        if C%2==0:

            continue

        Sum += C**2

    return Sum

print(Total(4))              # (a)

print(Total(5))              # (b)

print(Total())               # (c)
```

## Question 18:

Ravi, a Python programmer working on a project in which he wants to write a function to find out factorial of any numbers, He has written the following code but his code is not producing the correct output. Help Ravi to correct his code so that program execute successfully.

Code written by Ravi:

```
def Fact(Num):

        f=0                      # Line 1

        for i in range(2,Num):   # Line 2

            f = f * Num          # Line 3

        return f                 # Line 4
```

Write down the correct code after making changes in **#Line 1** to **#Line 4** if required

**Question 19:**

Observe the following Python code and write on What value of X this program will end.

```
def Fun1(X):
    X+=1
    if X % 7!=0:
        Fun2(X)

def Fun2(Y):
    Y+=1
    input()
    Fun1(Y)
Fun1(10)
```

**Question 20:**

The Python function below takes as a parameter a Nested List of integers and computes and return the sum of minimum value from each sub list. For example, if the original Nested List Marks and has 2 sub list of seven elements each populated as:

Marks = [[7,-3,81,9,71,-6,12],[42,81,10,12,106,41,37]]

The function will return 4, which is result of adding the minimum values -6 from first sub list and 10 from second sublist.

The implementation is missing several items (a) to (d). Fill them in for the corresponding locations. Use the minimum spacing possible. For example x<y instead of x  <  y

```
def row_min_sum(Marks):

    total = 0

    for r in range(len(Marks)):

        cur_min =  (a)

        for c in range : (b)

            if          (c)        < cur_min:

                cur_min = (d)

        total = total + cur_min

    return total
```

**Question 21:**

Given below are two statements one labelled as Assertion (A) and other is labelled as a Reason (R).

**Assertion** (A): The tell method will stores/get the current location of the file pointer.

**Reason** (R): Python seek method returns the current position of the file read/write pointer within the file.

Consider the above statement and choose the correct answer from the options given below:

A.      Both (A) and (R) are true, and (R) is the correct explanation of (A).

B.      Both (A) and (R) are true, but (R) is not the correct explanation of (A).

C.      (A) Is true but (R) is false.

D.      (A) is false but (R) is true.


**Question 22:**

Given below are two statements one labelled as Assertion (A) and other is labelled as a Reason (R).

**Assertion** (A): To preserve the data for future purpose in Python is called pickling.

**Reason** (R): Unpickling is a technique that returns the byte stream produced by pickling back into Python objects.

Consider the above statement and choose the correct answer from the options given below:

A.      Both (A) and (R) are true, and (R) is the correct explanation of (A).

B.      Both (A) and (R) are true, but (R) is not the correct explanation of (A).

C.      (A) Is true but (R) is false.

D.      (A) is false but (R) is true.

**Question 23:**

CSV files are the plain text files that include tabular data in the form of number and text. In such files each line in the file represents a record. Each record has one or more fields which are separated by comma, thus these files are known as comma separated value files. CSV format file is one of the simplest and widely used method of storing tabular data such as a spreadsheet or database.

A CSV file must be saved with the extension .csv to be recognised by the operating system. In Python we use a built-in module csv to manipulate the file operations in CSV file. To perform these operations on a csv files we need to import the csv module in the user program.

Most of the popular spreadsheet programs support the csv file and directly opens it in a tabular format. There is a csv reader() module that is used to read the data from csv file.

We can also write any new and existing CSV files in Python by using the csv writer() module. It is similar to the csv reader( ) module and also has two methods, i.e., writer function or the DictWriter class.

It presents two functions, i.e., writerow() and writerows( ). The writerow( ) function only writes one row, and the writerows( ) function writes more than one row.

(i) What is the default extension of the comma separated values file?
(a) .py          (b) .exe          (c) .csv          (d) .comma

(ii) Which module is required to import to handle csv files.
(a) csv_files      (b) CSV          (c) csvFile        (d) csv

(iii) Choose the csv method that is used to read the csv file.
(a) readcsv()      (b) reader( )     (c) read_csv( )    (d) read( )

(iv) Reena opened a csv file 'alpha.csv' to write a record but she stuck in fourth line, now help her to choose the correct statement to write the record in csv file. Consider all necessary modules are already included by the import statement.

  record = [101, 'Saatwik', 'Science', 87.6 ]
  fp= open('alpha.csv','w')
  cw=csv.writer(fp)
  _____   # line 4

(a)  fp.writerow(record)   (b)  cw.writerow(record)

(c)  cw.writerow(record,fp)  (d)  fp.writerows(record)

**Question 24:**

Kartik has written a Python program to handle the binary file. He wants to write some data in the binary file. Observe the following code written by Kartik.

1.          import pickle
2.          data = {'name' :  'Kartik', 'age' : 16, 'game' : 'Chess' }
3.          fp  = open('MyFile.dat', 'w')
4.          pickle.load(data , fp)

 Find the errors if any in the above code by choose the correct from options given below:

(a) Error in line 1, 2, 4          (b) Error in line 2, 3
(c) Error in line 3, 4          (d) Error in line 2, 3, 4

**Question 25:**

Given below are two statements one labelled as **Assertion** (A) and other is labelled as a **Reason** (R).

**Assertion** (A): The file access mode 'a' is used to append the data in the file.

**Reason** (R): In the access mode 'a' the text will be appended at the end of the existing file.  If the file does not exist Python will create a new file and write data into it.

Consider the above statement and choose the correct answer from the options given below:

A.      Both (A) and (R) are true, and (R) is the correct explanation of (A).

B.      Both (A) and (R) are true, but (R) is not the correct explanation of (A).

C.      (A) Is true but (R) is false.

D.      (A) is false but (R) is true.

**Question 26:**

Given below are two statements one labelled as Assertion (A) and other is labelled as a Reason (R).

**Assertion** (A):  The key function for working with files in Python is the open() function.

**Reason** (R):  The open() function takes two parameters; filename, and access mode.  There are four different methods (access modes) for opening a file:

"r" - Read - Default value. Opens a file for reading, error if the file does not exist.

"a" - Append - Opens a file for appending, creates the file if it does not exist

"w" - Write - Opens a file for writing, creates the file if it does not exist

"x" - Create - Creates the specified file, returns an error if the file exists

Consider the above statement and choose the correct answer from the options given below:

A.     Both (A) and (R) are true, and (R) is the correct explanation of (A).

B.     Both (A) and (R) are true, but (R) is not the correct explanation of (A).

C.     (A) Is true but (R) is false.

D.     (A) is false but (R) is true.

**Question 27:**

There are three functions that are used to read the Python text file content. These functions are read( ) readline( ) and readlines( ).  Observe the following user defined function readWord( ) that reads a text file 'article.txt' and counts all those words that are starting from alphabet 'T' or 't'.

def  readWord( ):

count= _____            #blank 1

fp= open('article.txt' , 'r')

data=fp.read( )

for  word in ____:            #blank 2

if _____ in 'tT':        #blank 3

count=count+1

fp.close( )

return    _____            #blank 4

Choose the correct option from the options given below to fill blank 1, blank 2, blank 3 and blank 4.

A.     0, data, word, data

B.     0, data, word[0], count

C.     1, data, word[0], count

D.     0, len(data), range(0,len(word)) , count

**Question 28:**

Given below are two statements one labelled as Assertion (A) and other is labelled as a Reason (R).

**Assertion** (A): The close( ) method is used to close the file.

**Reason** (R): While closing a file, the system frees up all the resources like processor and memory allocated to it.

Consider the above statement and choose the correct answer from the options given below:
A.    Both (A) and (R) are true, and (R) is the correct explanation of (A).
B.    Both (A) and (R) are true, but (R) is not the correct explanation of (A).
C.    (A) Is true but (R) is false.
D.    (A) is false but (R) is true.

**Question 29:**
Read the following text about the seek( ) method:

The seek( ) method:   This method is used to position the file object at a particular position in a file.

The syntax of seek( ) is:

file_object.seek(offset [, reference_point])

In the above syntax, offset is the number of bytes by which the file object is to be moved. reference_point indicates the starting position of the file object. That is, with reference to which position, the offset has to be counted. It can have any of the following values:

        0 - beginning of the file
        1 - current position of the file
        2 - end of file

By default, the value of reference_point is 0, i.e. the offset is counted from the beginning of the file.

Answer the following questions based on the above text.

(i)   The statement fileObject.seek(5,0) will position the file object at ___ byte __.
        A.    5th byte from current position of the file
        B.    5th byte from the beginning of the file
        C.    After the 5th byte
        D.    None of the above

(ii)    If the reference point parameter is not mentioned in the seek( ) method then the default value of reference point will be _____.

A. Current position        B. 1st Byte
C.  Beginning of the file      D.  None

**Question 30:**
Given below are two statements one labelled as **Assertion** (A) and other is labelled as a **Reason** (R).

**Assertion** (A):   The readline([n]) method reads one complete line from a text file.

**Reason** (R):  The readline( ) method reads one line at a time ending with a newline (\n). It can also be used to read a specified number (n) of bytes of data from a file but maximum up to the newline character (\n).

Consider the above statement and choose the correct answer from the options given below:

A.      Both (A) and (R) are true, and (R) is the correct explanation of (A).
B.      Both (A) and (R) are true, but (R) is not the correct explanation of (A).
C.      (A) Is true but (R) is false.
D.      (A) is false but (R) is true.

**Question 31:**
In mid 80's another federal agency, the NSF created a new high capacity network called NSFnet, which was more capable than ARPANET. The only drawback of NSFnet was that it allowed only academic research on its network and not any kind of private business on it. Now, several private organisations and people started working to build their own networks, named private networks, which were later (in 1990's) connected with ARPANET and NSFnet to form the Internet. The Internet really became popular in 1990's after the development of World Wide Web.

(i). NSFnet stand for _____

(ii). ARPANET stand for _____

(iii). An interconnection of different networks is called _____

(iv). To join the internet, the computer has to be connected to a _____

(v). Internet access by transmitting digital data over the wires of a local telephone network is provided by_____

(vi). A piece of icon or image on a web page associated with another webpage is called _____

## Question 32:

TCP/IP, or the Transmission Control Protocol/Internet Protocol, is a suite of communication protocols used to interconnect network devices on the internet. TCP/IP can also be used as a communications protocol in a private computer network (an intranet or an extranet).

TCP defines how applications can create channels of communication across a network. It also manages how a message is assembled into smaller packets before they are then transmitted over the internet and reassembled in the right order at the destination address.

IP defines how to address and route each packet to make sure it reaches the right destination. Each gateway computer on the network checks this IP address to determine where to forward the message. TCP/IP uses the client-server model of communication in which a user or machine (a client) is provided a service (like sending a webpage) by another computer (a server) in the network. Collectively, the TCP/IP suite of protocols is classified as stateless, which means each client request is considered new because it is unrelated to previous requests. Being stateless frees up network paths so they can be used continuously.

(i). Which of the following protocols is used in the internet?

  a. HTTP     b. DHCP      c. DNS      d. All of the above

(ii). Which protocol assigns IP address to the client connected to the internet?

  a. DHCP     b. IP       c. RPC      d. RSVP

(iii). Several protocols for upper layers in Bluetooth use:

  a. UDP      b. HSP      c. ITC      d. L2CAP

(iv). Internet protocols are a set of rules to govern:

  a. communication between computers on a network    b. bandwidth

  c. standard communication       d. metropolitan communication

(v). Network layer at source is responsible for creating a packet from data coming from another _____

  a. station      b. link      c. node      d. protocol

**Question 33:**

Web server is a special computer system running on HTTP through web pages. The web page is a medium to carry data from one computer system to another. The working of the webserver starts from the client or user. The client sends their request through the web browser to the webserver. Web server takes this request, processes it and then sends back processed data to the client. The server gathers all of our web page information and sends it to the user, which we see on our computer system in the form of a web page. When the client sends a request for processing to the web server, a domain name and IP address are important to the webserver. The domain name and IP address are used to identify the user on a large network.

(i). Web servers are:

    a. IP addresses         b. Computer systems         c. Webpages of a site

    d. A medium to carry data from one computer to another


(ii). What does the webserver need to send back information to the user?

     a. Home address     b. Domain name     c. IP address     d. Both b and c

(iii). What is the full form of HTTP?

    a. Hypertext Transfer Protocol         b. Hypertext Transfer Procedure

    c. Hyperlink Transfer Protocol         d. Hyperlink Transfer Procedure

(iv) The ____ translates internet domain and host names to IP address

    a. Domain name system         b. Routing information protocol

    c. Google         d. Network time protocol

(v). Computer that requests the resources or data from other computer is called as ___ computer

    a. Server         b. Client         c. None of the above         d. a and b


(vi). DNS stands for:

     a. Domain Name Security         b. Domain Number System

c. Document Name System          d. Domain Name System

(vii). What is the format of IP address?

a. 34 bit          b. 32 bit          c. 16 bit          d. 64 bit

## Question 34:

Gyan Deep International School is planning to connect all computers, each spread over a distance within 40 m. Suggest an economical cable type having high-speed data transfer, which can be used to connect these computers

## Question 35:

Mr. Taufiq Ahmad wants to prevent unauthorised access to/from his company's local area network. Write the name of system (software/hardware), which he should install.

## Question 36:

Beauty Lines Fashion Inc. is a fashion company with design unit and market unit 135 m away from each other. The company recently connected their LANs using Ethernet cable to share the stock related information. But after joining their LANs, they are not able to share the information due to loss of signal in between. Which device out of the following should you suggest to be installed for a smooth communication?

**UPS /  Modem     / Repeater**

## Question 37:

Identify the following devices:

(i) Devices that are used to connect different types of networks. It performs the necessary translation so that the connected networks can communicate properly.

(ii) A device that converts data from digital bit stream into an analog signal and vice-versa.

## Question 38:

Refer to the following diagram and answer the questions given below.

(i). Which of the following devices acts as a server?

a. A               b. B               c. C               d. D

(ii). The arrow from device D to pointing to A represents?

      a. HTTP request                          b. HTTP response

      c. HTTP request & response          d. All of the above

(iii). Which of the following device(s) can have IP Addresses?

      a. A          b. D          c. F          d. All of the above

(iv). Identify the network topology of the above network:

      a. Ring          b. Star          c. Bus          d. None of the above

(v). _____ is a protocol (set of rules) used when transmitting files (data) over the world wide web.

      a. FTP          b. HTTP          c. SMP          d. None of the above

## Question 39:

Freshminds University of India is starting its first campus Anna Nagar of South India with its centre admission office in Kolkata. The university has three major blocks comprising of Office Block, Science Block and Commerce Block in the 5 km area campus.

As a network expert, you need to suggest the network plan as per (i) to (iv) to the authorities keeping in mind the distance and other given parameters.

Expected wire distances between various locations:

| | |
|---|---|
| Office Block to Science Block | 90 m |
| Office Block to Commerce Block | 80 m |
| Science Block to Commerce Block | 15 m |
| Kolkata Admission Office to Anna Nagar Campus | 2450 km |

Expected number of computers to installed at various locations in the university are as follows:

| | |
|---|---|
| Office Block | 10 |
| Science Block | 140 |
| Commerce Block | 30 |
| Kolkata Admission Office | 8 |

(i) Suggest the authorities, the cable layout amongst various blocks inside university campus for connecting the blocks.

(ii) Suggest the most suitable place (i.e. block) to house the server of this university with a suitable reason.

(iii) Suggest an efficient device from the following to be installed in each of the blocks to connect all the computers.

     (a) Switch     (b) Modem     (c) Gateway

(iv) Suggest the most suitable (very high speed) service to provide data connectivity between Admission Office located in Anna Nagar from the following options:

(a) Telephone lines

(b) Fixed line dial-up connection

(c) GSM

(d) Co-axial cable network

(e) Leased lines

(f) Satellite connection

**Question 40:**

Sanskar University of Himachal Pradesh is setting up a secured network for its campus at Himachal Pradesh for operating their day-to-day office & web based activities. They are planning to have network connectivity between four buildings. Answer the question (i) to (iv) after going through the building positions in the campus & other details which are given below –
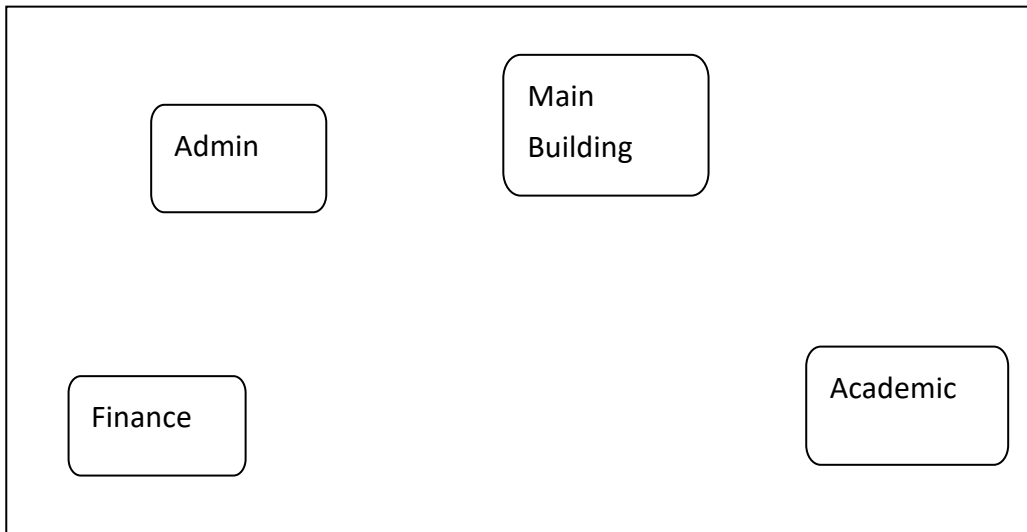


The distances between various buildings of university are given as –

| Building 1 | Building 2 | Distance(in mtrs.) |
|:---:|:---:|:---:|
| Main | Admin | 50 |
| Main | Finance | 100 |
| Main | Academic | 70 |
| Admin | Finance | 50 |
| Finance | Academic | 70 |
| Admin | Academic | 60 |

Number of computers –

| Building | No. of Computers |
|----------|------------------|
| Main | 150 |
| Admin | 75 |
| Finance | 50 |
| Academic | 60 |

As a network expert, you are required to give best possible solutions for the given queries of the university administration –

i). Suggest cable layout for the connections between the various buildings.

ii). Suggest the most suitable building to house the server of the network of the university.

iii). Suggest the placement of following devices with justification –

   a) Switch/Hub

   b) Repeater

iv). Suggest the technology out of the following for setting-up very fast Internet connectivity among buildings of the university

   a) Optical Fiber

   b) Coaxial Cable

   c) Ethernet Cable

## Question 41:

Saumya had previously created a database named 'Product' using MySQL.

Later on she forgets the name of database she created.

i. What command Saumya should write to see all the names of already created database.

   a) show;

   b) show tables;

   c) show databases;

   d) show database;

ii. Now saumya wants to open the database product, which MySql she should use.

    a) Create

    b) use

    c) Open

    d) Show

## Question 42:

Observe the table 'Club' given below:

| Member_ID | Member_Name | Address | Age | Fees |
|-----------|-------------|---------|-----|-------|
| M001 | Sumit | Pune | 23 | 25500 |
| M002 | Sachin | Delhi | 20 | 20000 |
| M003 | Shivam | Bhilai | 23 | 2000 |

Based on Table Club answer following questions:

i. What is the degree and Cardinality of table Club

    a) Degree: 5, Cardinality: 3

    b) Degree: 3, Cardinality: 5

    c) Degree: 5, Cardinality: 4

ii. If a new column contact_no has been added and two more members have joined the club then how these changes will affect the degree and cardinality of the above given table.

    a) Degree: 6, Cardinality: 6

    b) Degree: 5, Cardinality: 6

    c) Degree: 6, Cardinality: 5

## Question 43:

A School in Delhi uses database management system to store student details. The school maintains a database 'school_record' under which there are two tables.

Student Table: Maintains general details about every student enrolled in school.

StuLibrary Table: To store details of issued books. BookID is the unique identification number issued to each book. Minimum issue duration of a book is one Day.

| STUDENT | |
|---|---|
| FIELD | TYPE |
| STUID | NUMERIC |
| STUNAME | VARCHAR(20) |
| STUADDRESS | VARCHAR(50) |
| STUFATHERNAME | VARCHAR(20) |
| STUCONTACT | NUMERIC |
| STUAADHAR | NUMERIC |
| STUCLASS | VARCHAR(5) |
| STUSECTION | VARCHAR(1) |

| STULIBRARY | |
|---|---|
| FIELD | TYPE |
| BOOKID | NUMERIC |
| STUID | NUMERIC |
| ISSUED_DATE | DATE |
| RETURN_DATE | DATE |

i. Identify the SQL Query which displays the data of StuLibrary table in ascending order of StudentID.

i) Select * from StuLibrary Order By BookID

ii) Select * from StuLibrary Order By StuID

iii) Select * from StuLibrary Order By StuID ASC

iv) Select * from StuLibrary Order By StuID DESC

Choose the correct option:

a. Both Query i) and iv) will display the desired data.

b. Both Query i) and ii) will display the desired data.

c. Both Query iii) and iv) will display the desired data.

d. Both Query ii) and iii) will display the desired data.

ii. The Primary Key for StuLibrary Table is/are …….

a. BookID       b. BookID,StuID       c. Return_date     d. Issued_date

iii. Which of the following SQL Query will fetch ID of those issued books which have not been returned?

     a. SELECT BookID from StuLibrary where BookID is NULL;

     b. SELECT BookID from StuLibrary where StuID is NULL;

     c. SELECT BookID from StuLibrary where Issued_date is NULL;

     d. SELECT BookID from StuLibrary where Return_date is NULL;

**Question 44:**

A Departmental store 'Iconic' is planning to automate its system so that they can store all the records on computer. They contacted a Software Company to make the software for the same. The company suggested that there is need of a front end and back-end software. The major challenge was to keep the record of all the items available in the store. To overcome the problem, the software company has shown the glimpses of the

database and table required to resolve their problem:

Database Name: Iconic

Table Name: Garment

Attributes of the table: Gcode – Numeric, Gname – Character 25, Size - Character 5, Colour – Character 10,

Price – Numeric

Consider the following records in 'Garment' table and answer the given questions:

Table: Garment

| Gcode | Gname | Size | Colour | Price |
|-------|-------|------|--------|-------|
| 111 | Tshirt | XL | Red | 1400.00 |
| 112 | Jeans | L | Blue | 1600.00 |
| 113 | Skirt | M | Black | 1100.00 |
| 114 | Jacket | XL | Blue | 4000.00 |
| 115 | Trousers | L | Brown | 1500.00 |
| 116 | Ladies Top | L | Pink | 1200.00 |

i. Choose the command that will give the output as:

COLOUR

Blue

Black

Blue

Brown

    a. Select * from GARMENT where COLOUR = 'B%';

    b. Select COLOUR from GARMENT where COLOUR not like "%B%";

    c. Select COLOUR from GARMENT where COLOUR = '_B%';";

    d. Select COLOUR from GARMENT where COLOUR = 'B%';

ii. Choose the correct command for the following purpose.

To delete the record with GCode as 116

    a. Delete * from GARMENT where GCode='116';

    b. Delete from GARMENTS where GCode =116;

    c. Delete from GARMENT where GCode =116;

    d. Delete from GARMENT where GCode is '116';

iii. Choose the correct command for the following purpose.

To change the colour of GARMENT with code as 116 to "Orange".

    a. Update GARMENTS set COLOUR="Orange" where Gcode=116;

    b. Update GARMENT set COLOUR ="Orange" where Gcode=116;

    c. Update GARMENT set COLOUR ="Orange" where Gcode is "116";

    d. Update GARMENT where Gcode=116 set COLOUR =Orange;

iv. To display only unique sizes which clause should be used:

    a) Distinct      b) Desc      c) Show      d) Like

**Question 45:**

A Fashion Store MyStore is considering to maintain database of their Customers in SQL to store the data, As a Database Administrator  Hina  has decided that

Name of the database: MyStore

Name of the table: Customer

Attributes of the tables: Acc_No – Numeric, Cust_Name – Character 25, Cust_City - Character 25, Cust_Phone- Character 11, Open_Bal – Numeric

Consider the following records in 'Customer' table and answer the given questions:

**Table: Customer**

| Acc_no | Cust_name | Cust_city | Cust_Phone | Open_Bal |
|--------|-----------|-----------|------------|----------|
| 1001 | Dhashmesh | Ambala | 9710557614 | 10000 |
| 1002 | Sanya | Patna | 8223545233 | 15000 |
| 1003 | Joe | New Delhi | 9972136576 | 13000 |
| 1004 | Mrinal | New Delhi | 9321305453 | 12000 |
| 1005 | Ishaan | Agra | 9809876798 | 19000 |

i. With reference to the above given table, give query for generating following output

Cust_Name

Dhashmesh

Sanya

Ishaan

   a. Select Name from Customer where Open_bal<20000;

   b. Select Name from Customer where Cust_City like '%a';

   c. Select Cust_Name from Customer where Cust_City like '%a';

   d. Select Cust_name from Customer where Cust_Name like "a%;

ii. Pranay has given the following command to obtain Highest Opening Balance of each City

Select max(Open_Bal) from Customer where group by Cust_City;

but he is not getting the desired result. Help him by writing the correct command.

    a. Select Max(Open_Bal) group by Cust_City;

    b. Select Max(Open_Bal) from Customer where group by Cust_City;

    c. Select Cust_City, Max(Open_Bal) from Customer group by Cust_City;

    d. Select max(Open_Bal) from Customer group by Cust_name;

iii. Help Pranay find the total no. of records having open_bal between 15000 to 20000 by selecting the right command:

    a. Select total from customer having open_bal between 15000 and 20000;;

    b. Select count(*) from customer where open_bal between 15000 to 20000;;

    c. Select count(*) from customer where open_bal between 15000 and 20000;

    d. Select count(*) from customer order by open_bal;

## Question 46:
In a Database, there are two tables with the instances given below:

**Table: STUDENTS**

| ADMNO | Name | Class | Sec | Rno | Address | Phone |
|-------|-------|-------|-----|-----|---------|---------|
| 1211 | MEENA | 12A | D | 4 | A-26 | 3245678 |
| 1212 | Vani | 10A | D | 1 | B-25 | 5456789 |
| 1213 | MEENA | 12B | A | 1 | NULL | NULL |
| 1214 | Karish | 10B | B | 3 | AB-234 | 4567890 |

**Table: SPORTS**

| ADMNO | GAME | COACHNAME | GRADE |
|-------|------------|---------------|-------|
| 1215 | CRICKET | MR. RAVI | A |
| 1213 | VOLLEYBALL | MR. AMANDEEP | B |
| 1211 | VOLLEYBALL | MR. GOVARDHAN | A |
| 1212 | BASKETBALL | MR TEWARI | B |

i. Choose the command to display name and game of those students whose address is available in students' table.

    a. SELECT NAME, GAME FROM STUDENTS, SPORTS WHERE STUDENTS.ADMNO =SPORTS.ADMNO AND ADDRESS IS NOT NULL;

    b. SELECT NAME, GAME FROM STUDENTS, SPORTS WHERE STUDENTS.ADMNO = SPORTS.ADMNO AND ADDRESS IS NULL;

    c. SELECT NAME, GAME FROM STUDENTS, SPORTS WHERE STUDENTS.ADMNO =SPORTS.ADMNO, ADDRESS IS NULL;

    d. SELECT NAME, GAME FROM STUDENTS, SPORTS WHERE STUDENTS.ADMNO =SPORTS.ADMNO NOT ADDRESS IS NULL;

ii. Identify the statement to delete a column phone from the table students.

    a. ALTER TABLE STUDENTS DROP PHONE;

    b. DROP PHONE;

    c. UPDATE DROP PHONE;

    d. DELETE FROM STUDENTS WHERE DROP PHONE;

iii. Choose the command to display Name of the students who are studying in class 12 and their corresponding Coach names

    a. SELECT NAME, COACHNAME FROM STUDENTS, SPORTS WHERE CLASS LIKE "12%" AND STUDENTS.ADMNO =SPORTS.ADMNO;

    b. SELECT NAME, COACHNAME FROM STUDENTS, SPORTS WHERE CLASS LIKE "12%" AND STUDENTS.ADMNO= SPORTS.ADMNO;

    c. SELECT NAME, COACHNAME FROM STUDENTS, SPORTS WHERE CLASS LIKE "12%" AND ADMNO.STUDENTS =ADMNO.SPORTS;

    d. SELECT NAME, COACHNAME FROM STUDENTS, SPORTS WHERE CLASS LIKE= "12%" AND STUDENTS.ADMNO =SPORTS.ADMNO;

iv. which two select queries will give the same output

    A. SELECT NAME, GRADE FROM STUDENTS,SPORTS WHERE ADDRESS IS NULL AND STUDENTS.ADMNO =SPORTS.ADMNO ;

    B. SELECT NAME, GRADE FROM STUDENTS,SPORTS WHERE ADDRESS IS NOT NULL AND STUDENTS.ADMNO =SPORTS.ADMNO ;

    C. SELECT NAME, GRADE FROM STUDENTS,SPORTS WHERE ADDRESS IS NULL OR STUDENTS.ADMNO=SPORTS.ADMNO ;

    D. SELECT ST.NAME, SP.GRADE FROM STUDENTS ST,SPORTS SP WHERE ADDRESS IS NULL AND ST.ADMNO=SP.ADMNO ;

a. A AND B      b. B AND C      c. A AND D      d. C AND D

**Question 47:**
**Assertion** (A): Primary key is a set of one or more attributes that identify tuples in a relation.

**Reason** (R): Every table must have one primary key.

A) Both (A) and (R) are correct and (R) is correct explanation of (A).

B) Both (A) and (R) are correct and (R) is not the correct explanation of (A).

C) (A) is True but (R) is False.

D) (A) is False but (R) is True.

**Question 48:**
**Assertion** (A): The key word DISTINCT is used with select command

**Reason** (R): Distinct Keyword eliminates duplicate rows

A) Both (A) and (R) are correct and (R) is correct explanation of (A).

B) Both (A) and (R) are correct and (R) is not the correct explanation of (A).

C) (A) is True but (R) is False.

D) (A) is False but (R) is True

**Question 49:**
Consider the following query

SELECT name FROM stu WHERE subject LIKE '_____ Computer Science';

Which one of the following has to be added into the blank space to select the subject which has Computer Science as its ending string?

a. $            b. _            c. ||            d. %

**Question 50:**
The HAVING clause does which of the following?
(a) Acts EXACTLY like WHERE clause
(b) Acts like a WHERE clause but is used for columns rather than groups.
(c) Acts like a WHERE clause but is used form groups rather than rows.
(d) Acts like a WHERE clause but is used for rows rather than columns

## Computer Science - Answers Keys

Answer 1: (a), For dictionary, in operator checks for the occurrence of operand as a Key in the dictionary

Answer 2: (c)

Answer 3: (d), Both A and R are True but R is not the correct explanation for A.

Answer 4: (b)

Answer 5: (c)

Answer 6: (c)

Answer 7: (c)

Answer 8: (b), Stack works on the principle of LIFO (Last In First Out)

Answer 9: (a), Insertion to element is performed only from top of stack, peek() function checks the top element without popping it and we may increase the size of stack on each append but size of stack is fixed.

Answer10: (d)

Answer 11:

      a.     It will print % symbol 50 times

      b.     It will print 1000

      c.     It will raise an error, default argument cannot be followed by non-default arguments

Answer 12:

      a.     12

              11

              10

      b.     Alpha

      c.     Gamma

Answer 13:

      (a)    K,V

      (b)    items()

(c)     v

(d)     count+=1

(e)     return

Answer 14:

a.      count+=1 will fail because, inside function count will be declared as local which is unitialized and we are trying to modify variable before initialization

b.      add one statement "global count" before count+=1 will solve this issue

Answer 15:

(a)     Sales[0]

(b)     1

(c)     high < Sales[A]  or Sales[A] > high

(d)     high = Sales[A]

(e)     high

Answer 16:

a.      Tuple

b.      A,B,C

c.      None

Answer 17:

(a)     10

(b)     35

(c)     65

Answer 18:

#Line 1 should be        f =1

#Line 2 should be        for i in range(2,Num+1)

#Line 3 should be        f = f * i

#Line 4                  no change required

Answer 19: 21

Answer 20:

(a)  Marks[r][0]

(b)  len(Marks[r])

(c)  Marks[r][c]

(d)  Marks[r][c]

Answer 21: C

Answer 22: D

Answer 23: (I)   C

(II)   D

(III)  B

(IV)   B

Answer 24: C

Answer 25: A

Answer 26: A

Answer 27: B

Answer 28: A

Answer 29: (I)   B

(II)  C

Answer 30: A

Answer 31:

i.   National Science Foundation Network

ii.   Advanced Research Projects Agency NETwork

iii.   Internet

iv.   Internet service provider

v.   Digital subscriber line

vi.   Hyperlink

Answer 32:

      i.      d. All of the above

      ii.     a. DHCP

      iii.    d. L2CAP

      iv.    a. communication between computers on a network

      v.     d. protocol

Answer 33:

      i.      b. Computer systems

      ii.     d. Both b and c

      iii.    a. Hypertext Transfer Protocol

      iv.    a. Domain name system

      v.     b. Client

      vii.   d. Domain Name System

      viii.  b. 32 bit

Answer 34: The economical cable with high-speed data transfer can be co-axial cable.

Answer 35: He should install firewall system to prevent unauthorised access.

Answer 36: Repeater

Answer 37:

    (i) Router

    (ii) Modem

Answer 38:

      i.      d. D

      ii.     b. HTTP response

      iii.    d. All of the above

      iv.    b. Star

      v.     b. HTTP

Answer 39:

(i) The suggested cable layout amongst various blocks inside university campus for connecting the blocks will be as follow:

Using Star Topology -
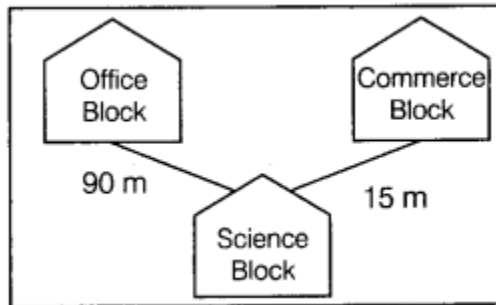


Using Bus Topology –
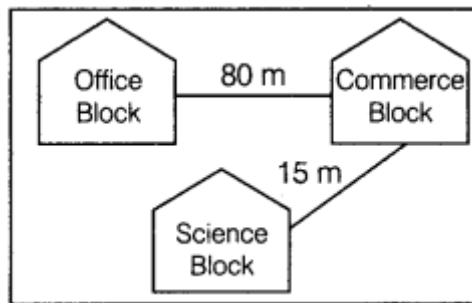


(ii) The most suitable place (i.e. block) to house the server of this university is Science Block, because in this block there are maximum number of computer and according to 80-20 rule 80% of traffic should be local.

(iii) The efficient device to be installed in each of the blocks to connect all the computers is switch.

(iv) For very high-speed connectivity between Admission office located in Kolkata and the campus office in Anna Nagar is satellite connection.

Answer 40:
i).    Star Topology –
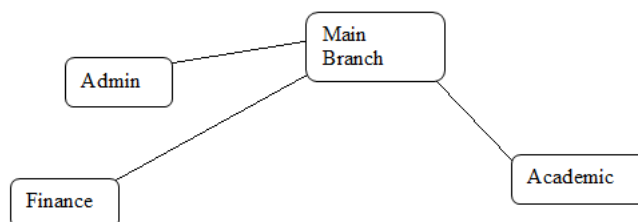
ii).    Server should be placed at Main Building as it has the maximum number of computers.

iii).

a)    Switch/Hub - Hub/Switch each would be needed in all the buildings to interconnect the group of cables from the different computers in each building

b)    Repeater - A repeater needs to be placed along the wire between main building & finance building as the distance between them is more than 70 mtr.

iv).

a)    Optical Fiber

Answer 41:

i.    c          ii.    b

Answer 42:

i.    a          ii.    c

Answer 43:

i.    d          ii.    a          iii.    d

Answer 44:

i.    d          ii.    c          iii.    b          iv.    a

Answer 45:

i.    c          ii.    c          iii.    c

Answer 46:

i.    a          ii.    a          iii.    a          iv.    c

Answer 47: A

Answer 48: A

Answer 49: d

Answer 50: c

# Informatics Practices Practices

Good specifications will always improve programmer productivity far better than any programming tool or technique.

— Milt Bryce

## 2022

## CCT Questions

### CLASS XII

**Question 1:**

Kritika is a new learner for the python pandas, and she is aware of some concepts of python. She has created some lists, but is unable to create the Series that will have chemical element name as value and symbol as index. Help her by identifying the statement which will create the data series.

import pandas as pd

Name= ['Hydrogen', 'Helium', 'Lithium', 'Beryllium']

Symbol=['H', 'He', 'Li', 'Be']

1: Help her by identifying the statement which will create the data series.

| a) C=pd.series(Name,index=Symbol) | b) C=pd.Series(Name,index=Symbol) |
|---|---|
| c) C=pd.Series(Symbol,Name) | c) C=df.Series(Name,index=Symbol) |

She has written a code to create a panda series S1 of even numbers, but she got the result, as shown below

    0  2

    1  4

    2  6

    3  7

dtype: int64

2: Help her to choose correct code to modify S1 for desired result
a)     S1[3]=8
b)     S1.loc[3]=8
c)     S1.iloc[3]=8
d)     All are correct

3: Choose the correct statement/ method to get number of elements in series:
a)     S1.size
b)     S1.size()
c)     S1.index
d)     S1.shape()

4: print last three elements from series.
a)      S1.tail(3)
b)      S1.iloc[(len(s1)-3):]
c)      S1.loc[(len(s1)-3):]
d)      All are correct


**Question 2:**

Consider the following Series object school

Lucknow    350

Delhi         230

Mumbai     350

Punjab       400

Bihar          322

Write python code to:

1: Change the value of state Punjab by 460.

a)      School('punjab')=460    b)      school['Punjab']=460

c)      school.iloc[3]=460       d)      Both b and c are correct


2: Display schools of state Bihar and Mumbai.
a)      print(['Bihar','Mumbai'])

b)      print(school.Bihar,school.Mumbai)

c)      print(school[['Bihar','Mumbai']])

d)      print(school(['Bihar'],['Mumbai'])


3: Display which state has maximum number of schools
a)      print(max(school))                         b)      print(school.max())

c)      print(school.sort_values().tail(1))    d)      both a and c


4: Delete the details of Delhi from series.
a)      school.drop('Delhi',inplace=True)    b)      school.del('Delhi')

c)      school.pop('Delhi')                            d)      school.pop(['Delhi'])

**Question 3:**

Sumit a student of class XII wants to create a Series, He had written following code, Help him to choose statement to get the desired result.His aim is to create series which will store total marks as value and students name as index.

    import pandas as _____    #statement 1

    Name = ['Amit','Harsh','Rajnish','Manish','Aman','Dolly','Suman']

    Tmarks =[345,200,350,400,450,250,370]

    Mark=pd._____    #statement2

    Mark._____=Name    #statement 3

    print(_____)            # statement4

1: Statement 1 will be

a)    pd          b)    p          c)    df          d)    data

2: Statement 2 will be
a)    Series(data=Tmark)    b)    Series(Tmark)

c)    Series(value=Tmark)    d)    Both a and b are correct

3: statement 3 will be
a)    loc          b)    iloc          c)    index          d)    [index]

4: statement 4 will be
a)    Tmark    b)    Name    c)    Mark    d)    'Mark'

**Question 4:**
Ravi a student of class XII wants to create a Series. Consider the following Series object Mark. He had written code for series Mark, help him to write correct statement to accomplish the task.

Amit          345
Harsh         200
Rajnish       350
Manish        400
Aman          450
Dolly         250
Suman         370

print(_____) # statement1, to display marks of Amit.

print(_____ ) # statement2, Display details of those students who score less than 300

_____#statement 3, Delete the details of Rajnish, Manish and Dolly.

_____# Increase the marks of students by 5 who score more than 300.

**Question 5:**

Annu, has created a Series that stores the registered migrants in some states,

import pandas as pd

Migrants=[334,8910,6789,14677,8291,17632]

Regis_Mig=pd.Series(Migrants)

Regis_Mig.index=['Punjab', 'Delhi', 'Haryana', 'Rajasthan', 'Tamil Nadu', 'Maharashtra']

1: what will she should write to get output:

    Delhi    8910

    Haryana   6789

    dtype: int64

a)    print(Regis_Mig.iloc[1:3])    b)    print(Regis_Mig.loc[1:3])

c)    print(Regis_Mig(Delhi,Haryana))    d)    print(Regis_Mig)

2:    Punjab    334
    Haryana    6789

    Tamil Nadu   8291

    dtype: int64

a)    print(Regis_Mig.iloc[:3])    b)    print(Regis_Mig.loc[::2])

c)    print(Regis_Mig.iloc[::2])    d)    print(Regis_Mig[['',''," ]])

3: Print the states having more than 8000 registered migrants.
a)    print(Regis_Mig[Regis_Mig>8000])  b)    print(Regis_Mig>8000)

c)    print(Regis_Mig(Regis_Mig>8000))  d)    Both b and c are correct

4: output of print(Regis_Mig.sort_values().tail(3)) is:

a)      Rajasthan     14677

       Tamil Nadu     8291

       Maharashtra    17632

       dtype: int64

b)      Delhi       8910

       Rajasthan     14677

       Maharashtra    17632

       dtype: int64

c)      Punjab     334

       Delhi     8910

       Haryana    6789

       dtype: int64

d)      Punjab      334

       Haryana     6789

       Tamil Nadu    8291

       dtype: int64

## Question 6:

Zeenat has created the following data frame dataframe1 to keep track of data about aids, of different states.

|  | TOYS | BOOKS | UNIFORM | SHOES |
|---|---|---|---|---|
| ANDHRA | 7916 | 6189 | 610 | 8810 |
| ODISHA | 8508 | 8210 | 508 | 6798 |
| M.P. | 7226 | 6149 | 611 | 9611 |

1: Which among the following option will give 8508, 8210 as output
     a) print(max(dataframe1[' TOYS ',' BOOKS  '])
     b) print((dataframe1. TOYS.max(),(dataframe1. BOOKS .max())))
     c) print(max(dataframe1[' TOYS'])
     d) print(max(dataframe1[' BOOKS '])

2.Which of the following statement/s will delete the 3rd column?

       a. del dataframe1['Marks1']

       b. dataframe1.pop('Marks1')

       c. drop dataframe1['Marks1']

       d. pop dataframe1['Marks1']

Choose the correct option:

a) both (a) and (b)

b) only (b)

c) (a), (b) and (c)

d) (a), (b) and (d)

## Question 7:

Consider the following DataFrame df1

| | POPULATION | HOSPITALS | SCHOOLS |
|---|---|---|---|
| DELHI | 10927986 | 189 | 7916 |
| MUMBAI | 12691836 | 208 | 8508 |
| KOLKATA | 4631392 | 149 | 7226 |
| CHENNAI | 4328063 | 157 | 7617 |

1. Write command that will give the following output:

| DELHI | 10927986 |
|---|---|
| MUMBAI | 12691836 |
| KOLKATA | 4631392 |
| CHENNAI | 4328063 |

i. print(df1['POPULATION'])

ii. print(df1. POPULATION)

iii. print(df1(POPULATION))

iv. print(df1('POPULATION'))

chose the correct option

a)    Only i  b)    Only i and ii    c)    Only i and iii    d)    Only iv

2. Display all details of DELHI

a)    df1.loc['DELHI':]    b)    df1.iloc[0:]

c)    df1[DELHI]          d)    Both a and b

## Question 8:
Rohit has created a dataframe, Consider the dataframe Df1 which stores details of students. Now further he wants add more columns, what will be the command/statement, he should choose to achieve desired results.

|    | NAME | ACCOUNTS | MATHS | BST | IP | ECO |
|----|------|----------|-------|-----|----|-----|
| 10 | Ritu | 88 | 67 | 87 | 97 | 56 |
| 11 | Mridul | 67 | 78 | 77 | 87 | 90 |
| 21 | Yashvi | 87 | 89 | 78 | 82 | 92 |
| 12 | Deepak | 67 | 82 | 76 | 98 | 78 |
| 13 | Jatin | 56 | 66 | 77 | 87 | 67 |

Write python code to

1. add a new column 'Total' to display total marks of each student.

| NAME | ACCOUNTS | MATHS | BST | IP | ECO | Total |
|------|----------|-------|-----|----|-----|-------|
| Ritu | 88 | 67 | 87 | 97 | 56 | 395 |
| Mridul | 67 | 78 | 77 | 87 | 90 | 399 |
| Yashvi | 87 | 89 | 78 | 82 | 92 | 428 |
| Deepak | 67 | 82 | 76 | 98 | 78 | 401 |
| Jatin | 56 | 66 | 77 | 87 | 67 | 353 |

2. add a new column 'AVG'.
3. change BST marks of Ritu to 90.
4. remove details of Yashvi.

## Question 9:
Wild life department has appointed Sumit as data analyst, He has prepared a dataframe to do some analysis, Observe the following Dataframe df1,

|   | Tiger | Deer | Bear | Fox |
|---|-------|------|------|-----|
| 0 | 35 | 115 | 70 | 125 |
| 1 | 65 | 52 | 15 | 65 |
| 2 | 75 | 45 | 40 | 120 |
| 3 | 50 | 55 | 50 | 123 |
| 4 | 25 | 68 | 82 | 89 |

1: Mr. Sumit wants to change the index of the Data Frame and the output for the same is given below. Identify the correct statement to change the index.

|         | Tiger | Deer | Bear | Fox |
|---------|-------|------|------|-----|
| Assam   | 35    | 115  | 70   | 125 |
| UP      | 65    | 52   | 15   | 65  |
| Odisha  | 75    | 45   | 40   | 120 |
| Sikkim  | 50    | 55   | 50   | 123 |
| Manipur | 25    | 68   | 82   | 89  |

a)   df1.index=['Assam','U.P.','Odisha','Sikkim','Manipur']

b)   df1[]=['Assam','U.P.','Odisha','Sikkim','Manipur']

c)   df1[index]= ['Assam','U.P.','Odisha','Sikkim','Manipur']

d)   df1.index()=['Assam','U.P.','Odisha','Sikkim','Manipur']

2:

| Tiger | Deer | Elephant | Bear | Fox |
|-------|------|----------|------|-----|
| 35    | 115  | 20       | 70   | 125 |
| 65    | 52   | 25       | 15   | 65  |
| 75    | 45   | 38       | 40   | 120 |
| 50    | 55   | 21       | 50   | 123 |
| 25    | 68   | 16       | 82   | 89  |

a)   df1.loc[Élephant]= [20,25,38,21,16]

b)   df1.insert(2, 'Elephant', [20,25,38,21,16])

c)   df1.iloc['Elephant']= [20,25,38,21,16]

d)   df1.append('Elephant':[20,25,38,21,16])

3: What code should write to get state wise Elephants details

```
Assam    20
U.P.     25
Odisha   38
Sikkim   21
Manipur  16
Name: Elephant, dtype: int64
```

a)   print(df1['Elephant'])
b)   print(df1.loc['Elephant'])
c)   print(df1.Elephant)
d)   both a and c

**Question 10:**

Raman has created the following dataframe "Climate" to record the data about climatic conditions of four years.

| Year | MaxTemp | MinTemp | Rainfall |
|------|---------|---------|----------|
| 2017 | 32 | 20 | 123 |
| 2018 | 33 | 22 | 140 |
| 2019 | 35 | 21 | 135 |
| 2020 | 34 | 23 | 160 |

1: Which of the following code snippets will return the MaxTemp and Rainfall for year 2018 and 2019?

    a. Climate[['MaxTemp','Rainfall']][1:3]

    b. Climate['MaxTemp', 'Rainfall'][1:3]

    c. Climate.iloc[1:3]

    d. Climate.iloc[1:3,1:2]

2: Display the temperature difference between MaxTemp and MinTemp for all the rows in the dataframe Climate.

    a. Climate=Climate["MaxTemp"]-Climate["MinTemp"]

    b. print(Climate["maxt"]-Climate["mint"])

    c. print(Climate["MaxTemp"]-Climate["MinTemp"])

    d. print(Climate.Climate["MaxTemp"]-Climate["MinTemp"])

3: To display 2 rows from the top in the dataframe, which of the following statement is correct:

    a. print (Climate.head()=2 )

    b. print (Climate.head(n==2) )

    c. print (Climate.head(range(2)) )

    d. print (Climate.head(2) )

4: Which of the following statement/s will give the exact number of values in each column of the dataframe?

   a. print(Climate.count())

   b. print(Climate.count(0))

   c. print(Climate.count)

   d. print(Climate.count(axis='index'))

Choose the correct option:

   a) both (a) and (b)

   b) only (b)

   c) (a), (b) and (c)

   d) (a), (b) and (d)

**Question11:**
Given below are two statements one labelled as **Assertion (A)** and other is labelled as a **Reason (R)**.

**Assertion (A)** : A histogram is basically used to represent data in the form of some groups.
**Reason (R):**  It is a type of bar plot where the X-axis represents the bin ranges while the Y-axis gives information about frequency. The hist() function is used to compute and create a histogram.

Consider the above statement and choose the correct answer from the options given below:
A.      Both (A) and (R) are true, and (R) is the correct explanation of (A).
B.      Both (A) and (R) are true, but (R) is not the correct explanation of (A).
C.      (A) is true but (R) is false.
D.      (A)  is false but (R) is true.

**Question12:**

Given below are two statements one labelled as **Assertion (A)** and other is labelled as a **Reason (R)**.

**Assertion (A)** : Scatter plot is plotted using the **scatterplot()** method.
**Reason (R):** This is similar to Matplotlib, but additional argument data is required.

Consider the above statement and choose the correct answer from the options given below:
A.      Both (A) and (R) are true, and (R) is the correct explanation of (A).
B.      Both (A) and (R) are true, but (R) is not the correct explanation of (A).
C.      (A) is true but (R) is false.
D.      (A)  is false but (R) is true.

## Question13:

Read the passage given below and answer the following question:

In today's world, a lot of data is being generated on a daily basis. And sometimes to analyse this data for certain trends, patterns may become difficult if the data is in its raw format. To overcome this data visualization comes into play. Data visualization provides a good, organized pictorial representation of the data which makes it easier to understand, observe, analyse. In this tutorial, we will discuss how to visualize data using Python.
     Python provides various libraries that come with different features for visualizing data. All these libraries come with different features and can support various types of graphs. In this tutorial, we will be discussing four such libraries.

- Matplotlib
- Seaborn
- Bokeh
- Plotly

(i)  Data visualization provides a . . . . . . . . . representation of the data which makes it easier to understand, observe, analyse.
(a) good                                      (b) good, pictorial
(c)  pictorial                                 (d) good, organized pictorial

(ii)  Which library is used to that supports graph for data visualisation.
   (a)graphics     (b) Math     (c) Matplotlib          (d) pandas

## Question14:

Given below are two statements one labelled as **Assertion (A)** and other is labelled as a **Reason (R)**.

**Assertion (A)**: A bar plot or bar chart is a line.
**Reason (R):** A bar chart represents the category of data with rectangular bars with lengths and heights that is proportional to the values which they represent. It can be created using the **bar()** method

Consider the above statement and choose the correct answer from the options given below:

A. Both (A) and (R) are true, and (R) is the correct explanation of (A).
B. Both (A) and (R) are true, but (R) is not the correct explanation of (A).
C. (A) is true but (R) is false.
D. (A) is false but (R) is true.

## Question15:

Given below are two statements one labelled as **Assertion (A)** and other is labelled as a **Reason (R)**.

**Assertion (A)**: **Seaborn** is a high-level interface built on top of the Matplotlib.
**Reason (R):** It provides beautiful design styles and colour palettes to make more attractive graphs.
Consider the above statement and choose the correct answer from the options given below:

A. Both (A) and (R) are true, but (R) is not the correct explanation of (A).
B. Both (A) and (R) are true, and (R) is the correct explanation of (A).
C. (A) is true but (R) is false.
D. (A) is false but (R) is true.

## Question16:

Given below are two statements one labelled as **Assertion (A)** and other is labelled as a **Reason (R)**.

**Assertion (A)**:  The data visualisation should be light and must highlight essential aspects of the data.
**Reason (R):**  looking at important variables, what is relatively important, what are the trends and changes. Besides, data visualisation must be visually appealing but should not have unnecessary information in it.
One can answer this question in multiple ways: from technical points to mentioning key aspects, but be sure to remember saying these points:
 1. Data positioning
 2. Bars over circle and squares
 3. Use of colour theory
 4. Reducing chart junk by avoiding 3D charts and eliminating the use of pie charts to show proportions
 5. why sunburst visualization is more effective for hierarchical plots

Consider the above statement and choose the correct answer from the options given below:

  A. Both (A) and (R) are true, and (R) is the correct explanation of (A).
  B. Both (A) and (R) are true, but (R) is not the correct explanation of (A).
  C. (A) is true but (R) is false.
  D. (A) is false but (R) is true.

## Question17:

Observer The following code of python and give the answer in true or false -

  1. import pandas as pd
  2. import matplotlib.pyplot as plt
  3. data = pd.read_csv("tips.csv")
  4. plt.plot(data['tip'])
  5. plt.plot(data['size'])
  6. plt.title("Scatter Plot")
  7. plt.xlabel('Day')
  8. plt.ylabel('Tip')
  9. plt.show()

  A. Line 1 and Line 2 are importing library to program file. (True/False)
  B. In Line 3 Data will be inputted manually in data object. (True/False)
  C. Line 6 will put the "Scatter Plot" above the diagram. (True/False)
  D. If we skip Line 9. Still the plot will be visible. (True/False)

## Question18:

Given below are two statements one labelled as **Assertion (A)** and other is labelled as a **Reason (R)**.

**Assertion (A)**: Anil wants to visualise Lowe/Upper Quartile, Median & dispersion of his data.
**Reason (R):** He may use box-plot in python to obtain Lowe/Upper Quartile, Median & dispersion.

Consider the above statement and choose the correct answer from the options given below:

  A. Both (A) and (R) are true, and (R) is the correct Solution of (A).
  B. Both (A) and (R) are true, but (R) is not the correct Solution of (A).
  C. (A) is true but (R) is false.
  D. (A) is false but (R) is true.

**Question19:**

Given below are two statements one labelled as **Assertion (A)** and other is labelled as a **Reason (R)**.

**Assertion (A):** The plot() function is used to draw points (markers) in a diagram
**Reason (R):** By default, the plot() function draws a line from point to point. The function takes parameters for specifying points in the diagram. Parameter 1 is an array containing the points on the x-axis. Parameter 2 is an array containing the points on the y-axis. If we need to plot a line from (1, 3) to (8, 10), we have to pass two arrays [1, 8] and [3, 10] to the plot function
Consider the above statement and choose the correct answer from the options given below:
    A. Both (A) and (R) are true, and (R) is the correct Solution of (A).
    B. Both (A) and (R) are true, but (R) is not the correct Solution of (A).
    C. (A) is true but (R) is false.
    D. (A) is false but (R) is true.

**Question 20:**

Given below are two statements one labelled as **Assertion (A)** and other is labelled as a **Reason (R)**.

**Assertion (A):** Specify that you want a scatter plot with the kind argument:
kind = 'scatter'
 **Reason (R):** A scatter plot needs an x- and a y-axis.
In the example below, we will use "Duration" for the x-axis and "Calories" for the y-axis.
Include the x and y arguments like this:
x = 'Duration', y = 'Calories'

Consider the above statement and choose the correct answer from the options given below:
A.     Both (A) and (R) are true, and (R) is the correct explanation of (A).
B.     Both (A) and (R) are true, but (R) is not the correct explanation of (A).
C.     (A) is true but (R) is false.
D.     (A) is false but (R) is true.

**Question 21:**

A School in Kanpur uses database management system to store student details. The school maintains a database 'school_record' under which there are two tables.
Student Table: Maintains general details about every student enrolled in school.

StuLibrary Table: To store details of issued books. BookID is the unique identification number issued to each book. Minimum issue duration of a book is one Day.

| Student | |
|---|---|
| **Field** | **Type** |
| StuID | numeric |
| StuName | varchar(20) |
| StuAddress | varchar(50) |
| StuFatherName | varchar(20) |
| StuContact | numeric |
| StuAadhar | numeric |
| StuClass | varchar(5) |
| StuSection | varchar(1) |

| StuLibrary | |
|---|---|
| **Field** | **Type** |
| BookID | numeric |
| StuID | numeric |
| Issued_date | Date |
| Return_date | Date |

A. Identify the SQL Query which displays the data of StuLibrary table in ascending order of Student-ID.

i) Select * from StuLibrary Order By BookID;

ii) Select * from StuLibrary Order By StuID;

iii) Select * from StuLibrary Order By StuID ASC;

iv) Select * from StuLibrary Order By StuID DESC;

Choose the correct option:

a. Both Query i) and iv) will display the desired data.

b. Both Query i) and ii) will display the desired data.

c. Both Query iii) and iv) will display the desired data.

d. Both Query ii) and iii) will display the desired data.

B. The Primary Key for StuLibrary Table is/are …….

a. BookID

b. BookID, StuID

c. BookID, Issued_date

d. Issued_date

C. Which of the following SQL Query will fetch number of issued books issue date wise which have not been returned yet?

    a. SELECT Issued_date, count(BookID) ,StuID from StuLibrary where Return_date is NULL GROUP BY Issued_date;

    b. SELECT Issued_date, count(BookID) from StuLibrary where Return_date = NULL GROUP BY Issued_date;

    c. SELECT Issued_date, count(BookID) from StuLibrary where Return_date is 'NULL' GROUP BY Issued_date;

    d. SELECT Issued_date, count(BookID) from StuLibrary where Return_date is NULL GROUP BY Issued_date;


D. Which of the following SQL Query will display the class(es) with number of students greater than 30?

    a. SELECT StuClass, count(StuId) from StuLibrary GROUP BY StuClass HAVING count(StuId)>30;

    b. SELECT StuClass, count(StuId) from StuLibrary GROUP BY StuId HAVING COUNT(StuId)>30;

    c. SELECT StuClass, count(StuId) from StuLibrary GROUP BY StuClass HAVING SUM(StuId)>30;

    d. SELECT StuClass, count(StuId) from StuLibrary GROUP BY StuClass WHERE COUNT(StuId)>30;


E. Which of the following SQL Query will display dates on which number of issued books is greater than 5?

    a. SELECT Issued_date from StuLibrary GROUP BY Issued_date WHERE COUNT(*)>5;

    b. SELECT Issued_date from StuLibrary GROUP BY Return_date HAVING count(*)>5

    c. SELECT Issued_date from StuLibrary GROUP BY Issued_date HAVING count(*)>5

    d. SELECT Issued_date from StuLibrary GROUP BY Return_date WHERE COUNT(*)>5

## Question 22:

Tejasvi Sethi, a car dealer has stored the details of all cars in her showroom in a table called CARMARKET.The table CARMARKET has attributes CARCODE which is aprimary key, CARNAME, COMPANY, COLOR, COST (in lakh rupees) of the car and DOM which is the Date of Manufacture of the car.

Help her by answering the below mentioned questions based on the table CARMARKET given below:

**TABLE: CARMARKET**

| CARCODE | CARNAME | COMPANY | COLOR | COST | DOM |
|---------|---------|---------|-------|------|-----|
| C01 | BALENO | SUZUKI | BLUE | 5.90 | 2019-11-07 |
| CO2 | INDIGO | TATA | SILVER | 12.90 | 2020-10-15 |
| C03 | GLC | MERCEDES | WHITE | 62.38 | 2020-01-20 |
| C04 | A6 | AUDI | RED | 58.55 | 2018-12-29 |
| C05 | INNOVA | TOYOTA | BLACK | 32.82 | 2017-11-10 |
| C06 | WAGON-R | SUZUKI | WHITE | 12.11 | 2016-11-11 |
| C07 | BREZZA | SUZUKI | GOLDEN | 9.80 | 2016-10-03 |

Choose the correct SQL query to do the following (for parts 1 to 4)

i.     Display the car name along with the charges rounded off to 1 digit after decimal place.

   a.     Select carname, round(cost) from carmarket;

   b.     Select carname, round.cost(1) from carmarket;

   c.     Select carname, round.cost() from carmarket;

   d.     Select carname, round(cost,1) from carmarket;

ii.     Display the carname, color and position of the character 'E' in the color of all the cars.

   a. select carname, color from carmarket where color like "%E%";
   b. select carname, color, instr(color,'E') from carmarket;
   c. select carname, color from carmarket where color="%E%";
   d. select carname, color, substr(color,1,'E') from carmarket;

iii.    Display the carname, name of the company in lower case of all cars whose year of dom is 2020.

    a.  select carname, lcase(company) from carmarket where year(dom)=2020;
    b.  select carname, lcase(company) from carmarket where year of(dom) like '2020%';
    c.  select carname, lower(company) from carmarket where dom from'2020-01-01' to '2020-12-31';
    d.  select carname, lower(company) from carmarket where year from(dom)=2020;

iv.    Display the number of cars manufactured each year.

    a.  select count(*),year(dom) from carmarket where year(dom) =distinct;
    b.  select count(*),year(dom) from carmarket group by year(dom);
    c.  select count(carmarket),year(dom) from carmarket group by year(dom);
    d.  select count(distinct*),year(dom) from carmarket group by year(dom);

v.    What is the cardinality and degree of the table CARMARKET?

    a.    Cardinality=8and Degree=6

    b.    Cardinality=6andDegree=7

    c.    Cardinality=7andDegree=6

    d.    Cardinality=7andDegree=8

## Question 23:

Consider the table CarMarket given in Q 2 and guess the correct output of the SQL Queries given below :

i.    SELECT CARNAME, ROUND(COST,1) FROM CARMARKET WHERE CARCODE ='C04';

a.    58.5

b.    58.6

c.    58.0

d.    59.0

ii.     SELECT CARNAME, COLOR, INSTR(COLOR,'E') FROM CARMARKET WHERE YEAR(DOM)>2019;

a.     BALENO   BLUE   4

b.     INDOGO   SILVER   1

         GLC         WHITE   1

c.     INDOGO   SILVER   4

         GLC         WHITE   4

d.     INDOGO   SILVER   5

         GLC         WHITE   5

iii.     SELECT CARNAME, LCASE(COMPANY) FROM CARMARKET WHERE MONTHNAME(DOM)='JANUARY';

    a.     BALENO     suzuki

    b.     GLC           MERCEDES

    c.     GLC           mercedes

    d.     Innova     Toyota

iv.     SELECT COUNT(*),YEAR(DOM) FROM CARMARKET GROUP BY YEAR(DOM) HAVING COUNT(*)=2;

a.     1   2019

        2   2020

        1   2018

        1   2017

        2   2016


b.     1   2019

        1   2018

        1   2017


c.     1   2020

        1    2020

        1   2016

        1   2016

d.     2     2020

       2   2016

v.      SELECT CARNAME, ROUND(COST,-1) FROM CARMARKET WHERE MONTH(DOM)=12;

a.      A6    59

b.      A6    60

c.      A6    58.6

d.      A6    57.55

## Question 24:

Consider the table STUDENT given below

| RollNo | Name | Class | DOB | Gender | City | Marks |
|--------|------|-------|-----|--------|------|-------|
| 1 | Anand | XI | 6/6/97 | M | Agra | 430 |
| 2 | Chetan | XII | 7/5/94 | M | Mumbai | 460 |
| 3 | Geet | XI | 6/5/97 | F | Agra | 470 |
| 4 | Preeti | XII | 8/8/95 | F | Mumbai | 492 |
| 5 | Saniyal | XII | 8/10/95 | M | Delhi | 360 |
| 6 | Maakhiy | XI | 12/12/94 | F | Dubai | 256 |
| 7 | Neha | X | 8/12/95 | F | Moscow | 324 |
| 8 | Nishant | X | 12/6/95 | M | Moscow | 429 |

I) State the command that will give the output as :

| Name |
|------|
| Anand |
| Chetan |
| Geet |
| Preeti |

    i. select name from student where class='XI' and class='XII';

    ii. select name from student where not class='XI' and class='XII';

    iii. select name from student where city="Agra" OR city="Mumbai";

    iv. select name from student where city IN("Agra", "Mumbai");

Choose the correct option:

      a. Both (i) and (ii).

      b. Both (iii) and (iv).

      c. Any of the options (i), (ii) and (iv)

      d. Only (iii)

II)  What will be the output of the following command?

Select * from student where gender ="F" order by marks;

a.

| Rollno | Name | Class | DOB | Gender | City | Marks |
|--------|------|-------|-----|--------|------|-------|
| 4 | Preeti | XII | 8/8/95 | F | Mumbai | 492 |
| 3 | Geet | XI | 6/5/97 | F | Agra | 470 |
| 7 | Neha | X | 8/12/95 | F | Moscow | 324 |
| 6 | Maakhiy | XI | 12/12/94 | F | Dubai | 256 |

b.

| Gender | Marks |
|--------|-------|
| F | 256 |
| F | 324 |
| F | 470 |
| F | 492 |

c.

| Rollno | Name | Class | DOB | Gender | City | Marks |
|--------|------|-------|-----|--------|------|-------|
| 6 | Maakhiy | XI | 12/12/94 | F | Dubai | 256 |
| 7 | Neha | X | 8/12/95 | F | Moscow | 324 |
| 3 | Geet | XI | 6/5/97 | F | Agra | 470 |
| 4 | Preeti | XII | 8/8/95 | F | Mumbai | 492 |

d.

| Gender | Marks |
|--------|-------|
| F | 492 |
| F | 470 |
| F | 324 |
| F | 256 |

III) Prachi has given the following command to obtain the highest marks

Select max(marks) from student where group by class;

but she is not getting the desired result. Help her by writing the correct command.

a. Select max(marks) from student where group by class;

b. Select class, max(marks) from student group by marks;

c. Select class, max(marks) group by class from student;

d. Select class, max(marks) from student group by class;

IV) State the command to display the average marks scored by students of each gender who are in class XI?

i. Select gender, avg(marks) from student where class= "XI" group by gender;

ii Select gender, avg(marks) from student group by gender where class="XI";

iii. Select gender, avg(marks) group by gender from student having class="XI";

iv. Select gender, avg(marks) from student group by gender having class = "XI";

Choose the correct option:

  a. Both (ii) and (iii)

  b. Both (ii) and (iv)

  c. Both (i) and (iii)

  d. Only (iii)

V)  Help Ritesh to write the command to display the name of the youngest student?

  a. select name, min(DOB) from student ;

  b. select name, max(DOB) from student ;

  c. select name, min(DOB) from student group by name ;

  d. select name, maximum(DOB) from student;

## Question 25:

Write the output produced by the following SQL commands:

a) SELECT POW(2,3);

b) SELECT ROUND(123.2345, 2),ROUND(342.9234,-1);

c) SELECT LENGTH("Informatics Practices");

d) SELECT YEAR ("1979/11/26"), MONTH ("1979/11/26"), DAY ("1979/11/26"), MONTHNAME ("1979/11/26");

e) SELECT LEFT("INDIA",3), RIGHT("ComputerScience",4);

f) SELECT MID("Informatics",3,4), SUBSTR("Practices",3);

**Question 26:**

**Note:** Consider the records in Table Employee below wherever needed in Query:

```
+----+------------+-----------+------------+----------+---------+
| id | first_name | last_name | date_join  | salary   | city    |
+----+------------+-----------+------------+----------+---------+
| 1  | Amit       | Sharma    | 1996-07-25 | 25000.00 | Delhi   |
| 2  | Deeksha    | Verma     | 1995-06-27 | 30000.00 | Pune    |
| 3  | Navkiran   | Ahluwalia | 1990-02-20 | 32000.50 | Delhi   |
| 4  | Mamta      | Sharma    | 1989-08-18 | 37500.50 | Mumbai  |
| 5  | Bhawna     | Ahlurkar  | 2010-03-01 | 42389.50 | Chennai |
+----+------------+-----------+------------+----------+---------+
```

Read the paragraph carefully and then write the correct output option for the SQL statements given after the paragraph

**MID ()/SUBSTRING ()/SUBSTR ()** String functions of SQL returns the specified number of characters from the middle of the string. Its Syntax is -

SUBSTRING (str,m,n)

 Or

MID(str,m,n)

Or

SUBSTR (str,m,n)

Or

SUBSTR (str from m for n)

There are 3 arguments. The first argument is the source string. The second argument is the position of first character to be displayed. The third argument is the number of characters to be displayed.

If the third argument is missing, then starting from the position specified, the rest of the string is returned. It is also possible to use a negative value for the second argument ie. Position (pos).

In such a case, the beginning of the substring is pos characters from the end of the string,

Note: SUBSTR is the same as SUBSTRING

INSTR (str,substr) returns the position of the first occurrence of substring substr in string str.

Select the correct output option

a) mysql> SELECT INSTR('Computers', 'pet');

     i)    4   ii) 3   iii) 0   iv) No

b) mysql> SELECT INSTR(First_Name,'Kiran') FROM Employee;

i)
```
+----------------------------------+
| INSTR(First_Name,'Kiran') |
+----------------------------------+
| 0                                |
| 4                                |
| 4                                |
| 0                                |
| 0                                |
+----------------------------------+
```

ii)
```
+----------------------------------+
| INSTR(First_Name,'Kiran') |
+----------------------------------+
| 0                                |
| 3                                |
| 3                                |
| 0                                |
| 0                                |
+----------------------------------+
```

iii)
```
+----------------------------------+
| INSTR(First_Name,'Kiran')   |
+----------------------------------+
| 0                                |
| 0                                |
| 4                                |
| 0                                |
| 0                                |
+----------------------------------+
```

iv)
```
+----------------------------------+
| INSTR(First_Name,'Kiran') |
+----------------------------------+
| 0                                |
| 3                                |
| 4                                |
| 0                                |
| 0                                |
+----------------------------------+
```

c) mysql> SELECT SUBSTRING('Informatics', 4);

    i) 'Info'      ii) 'formatics'     iii) 'ormatics'     iv) 'tics'

d) mysql> SELECT SUBSTRING('Computers', -3);

    i) '-Com'      ii) 'moC'    iii) 'sre'    iv) 'ers'


e) mysql> SELECT  MID('Computers', -5, 3);

    i) 'etu'      ii) 'ute'    iii) 'mpu'    iv) 'upm'

f) mysql> SELECT  SUBSTRING('Computers', -4, 2);

    i) 'te'      ii) 'et'    iii) 'ut'    iv) 'tu'

g) mysql> select MID(first_name,3,2) FROM Employee where city like '%a_';

i)
```
+----------------------------+
| MID(first_name,3,2)  |
+----------------------------+
| mt                         |
| aw                         |
+----------------------------+
```

iii)
```
+----------------------------+
| MID(first_name,3,2)  |
+----------------------------+
| ta                         |
| wn                         |
+----------------------------
+
```

ii)
```
+----------------------------+
| MID(first_name,3,2)  |
+----------------------------+
| mt                         |
| wn                         |
+----------------------------+
```

iv)
```
+----------------------------+
| MID(first_name,3,2)  |
+----------------------------+
| mt                         |
| wa                         |
+----------------------------
+
```

## Question 27:

**Read the text carefully and then write the correct output of the SQL statements:**

COUNT() function is used to count the number of values in a column. COUNT() takes one argument which can be any column name, an expression based on a column, or an asterisk (*). When the argument is a column name or an expression based on a column, COUNT() returns the number of non-NULL values in that column. If the argument is a *, then COUNT() counts the total number of rows satisfying the condition, if any, in the table.

**Aggregate functions and NULL values:**

None of the aggregate functions takes NULL into consideration. NULL is simply ignored by all the aggregate functions. For example, the statement:

**SELECT COUNT(*) FROM shoes;**

produces the following output:

**+---------------+**

**| COUNT(*) |**

**+---------------+**

**| 13           |**

**+---------------+**

Indicating that there are 13 records in the Shoes table. Whereas the query:

**SELECT COUNT(margin) FROM shoes;**

produces the output:

```
+---------------------+
| COUNT(margin) |
+---------------------+
| 10              |
+---------------------+
```

This output indicates that there are 10 values in the margin column of Shoes table. This means there are 3 (13-10) NULLs in the margin column.

```
                              SHOES
+------+---------------+--------+------+--------+--------+------+
| Code | Name          | type   | size | cost   | margin | Qty  |
+------+---------------+--------+------+--------+--------+------+
| 1001 | School Canvas | School |    6 | 132.50 |   2.00 | 1200 |
| 1002 | School Canvas | School |    7 | 135.50 |   2.00 |  800 |
| 1003 | School Canvas | School |    8 | 140.75 |   2.00 |  600 |
| 1011 | School Leather| School |    6 | 232.50 |   2.00 | 2200 |
| 1012 | School Leather| School |    7 | 270.00 |   2.00 | 1280 |
| 1013 | School Leather| School |    8 | 320.75 |   NULL | 1100 |
| 1101 | Galaxy        | Office |    7 | 640.00 |   3.00 |  200 |
| 1102 | Galaxy        | Office |    8 | 712.00 |   3.00 |  500 |
| 1103 | Galaxy        | Office |    9 | 720.00 |   3.00 |  400 |
| 1201 | Tracker       | Sports |    6 | 700.00 |   NULL |  280 |
| 1202 | Tracker       | Sports |    7 | 745.25 |   3.50 | NULL |
| 1203 | Tracker       | Sports |    8 | 800.50 |   3.50 |  600 |
| 1204 | Tracker       | Sports |    9 | 843.00 |   NULL |  860 |
+------+---------------+--------+------+--------+--------+------+
```

**Write output of the following:**

a) SELECT COUNT(distinct type) FROM  shoes;  _____

b) SELECT COUNT(margin) FROM shoes WHERE margin > 2; _____

c) SELECT type, COUNT(*) FROM shoes GROUP BY type having  count(*)>4; _____

d) SELECT COUNT(qty) FROM shoes WHERE qty is NULL; _____

e) SELECT COUNT(*) FROM shoes WHERE qty is NULL; _____

**Question 28:**

**Read the text carefully and then write the correct output of the SQL statements:**

ROUND(X,D) / ROUND(X) function rounds the argument X to D decimal places. If number of decimal places is not specified or is zero, the number rounds to the nearest integer OR (0decimal places). If the value of D is negative.

**A) Write the correct output of the following :**

    a) mysql> SELECT ROUND(-1.23); _____

    b) mysql> SELECT ROUND(-1.58); _____

    c) mysql> SELECT ROUND(1.43); _____

    d) mysql> SELECT ROUND(6.298, 1); _____

    e) mysql> SELECT ROUND(4.235, -1); _____

    f) mysql> SELECT ROUND(56.235, -1); _____

**B) Consider the decimal number x with value 8459.2654.**

 i. Select SQL statement to round it off to a whole number

    a) SELECT ROUND(x,0);

    b) SELECT ROUNDOFF(x,0);

    c) SELECT ROUNDTO(x,0);

    d)  SELECT ROUND(0,x);

 ii. Select SQL statement to round it to 2 places before the decimal.

    a) SELECT ROUND(x,2);

    b) SELECT ROUND(x,-2);

    c) SELECT ROUND(-2,x);

    d)  SELECT ROUND(2,x);

**Question 29:**

**Assertion** and **Reason** based Questions

Read (A) and (R) carefully and then select the correct option.

a) Assertion (A): A Table can have only one Primary Key to identify a row uniquely.
   Reason (R): At the time of creation of table X, the data base administrator specified Y as the Primary key. Later on he realized that instead of Y, the combination of column P and Q should have been the primary key of the table. He added combination of P and Q as the second primary key.
   i.     Both A and R are true and R is the correct explanation of A
   ii.    Both A and R are true but R is not the correct explanation of A
   iii.   A is true but R is false
   iv.    A is false but R is true
   v.     Both A and R are false


b) Assertion (A): A Primary key can be defined at the time of creation of a table or later on by using Alter Table Command.
   Reason (R): At the time of creation of table X, the data base administrator specified Y as the Primary key. Later on he realized that instead of Y, the combination of column P andQ should have been the primary key of the table. He dropped the old primary key and created a new primary key using Alter Table statement of SQL.
   i.     Both A and R are true and R is the correct explanation of A
   ii.    Both A and R are true but R is not the correct explanation of A
   iii.   A is true but R is false
   iv.    A is false but R is true
   v.     Both A and R are false


c) Assertion (A): A Primary key can have unique values.
   Reason (R): There is a table T1 with combination of columns C1, C2, and C3 as its primary key. we can enter duplicate values in other columns but not in C1, C2 and C3.
   i.     Both A and R are true and R is the correct explanation of A
   ii.    Both A and R are true but R is not the correct explanation of A
   iii.   A is true but R is false
   iv.    A is false but R is true
   v.     Both A and R are false

d) Assertion (A): A Primary key cannot be left blank.

Reason (R): There is a table T1 with alternate keys C4 and C5. We cannot enter Null values in any of these columns.

i. Both A and R are true and R is the correct explanation of A
ii. Both A and R are true but R is not the correct explanation of A
iii. A is true but R is false
iv. A is false but R is true
v. Both A and R are false

**Question 30:**

i) Which type of SQL function work with a single-row at a time?

(a) Multiple-row functions      (b) Single-row functions

(c) Both (a) and (b)      (d) None of the above

ii) Which function accepts a character string as an input and provides character string or numeric values as an output?

(a) Text      (b) Date      (c) Time      (d) Math

iii) Which of the following function converts the characters of an argument string to the uppercase characters?

(a) UCASE( )      (b) UPPER( )

(c) Both (a) and (b)      (d) None of the above

iv) The default date format is

(a) MM-DD-YYYY      (b) YYYY-MM-DD

(c) DD-MM-YYYY      (d) None of these

v) Which of the following function returns an integer that indicates the position of the first occurrence of the sub-string within the string?

(a) INSTR( )      (b) RTRIM( )      (c) LENGTH( )      (d) TRIM( )

vi) Which of the following function returns the name of the month from selected date?

(a) MONTH(date)      (b) MONTH_NAME(date)

(c) MONTHNAME(date)      (d) NAME_MONTH()

vii) Which of the following function returns only the day number from month of selected date?

    (a) DAY(date)             (b) DAYNO(date)

    (c) DAY_NUMBER(date)     (d) DATE(date)

viii) What will be returned by the given query? SELECT INSTR('INDIA', 'DI');

   (a) 2     (b) 3     (c) –2     (d) –3


ix) Write the output of the following SQL command

   SELECT ROUND (47.89);

   (a) 47.88     (b) 47.8     (c) 48.0     (d) 50

x) Choose the correct query to display the length of customer's name (CNAME) for those customers whose name end with R or L from table Customers.

(a) mysql>SELECT LEN(CNAME)FROM Customers WHERE CNAME LIKE '%R' OR CNAME LIKE '%L';

(b) mysql>SELECT LENGTH(CNAME)FROM Customers WHERE CNAME LIKE '%R' OR CNAME LIKE '%L';

(c) mysql>SELECT LENGTH(CNAME)FROM Customers WHERE CNAME = '%R' OR CNAME = '%L';

(d) mysql>SELECT LENGTH(CNAME)FROM Customers WHERE CNAME LIKE '%R' OR  '%L';


**Question 31:**
A computer network extends interpersonal communications by electronic means with various technologies, such as email, instant messaging, online chat, voice and video telephone calls, and video conferencing. A network allows sharing of network and computing resources. Users may access and use resources provided by devices on the network, such as printing a document on a shared network printer or use of a shared storage device.
1. A group of two or more digital system interconnected with each other is called _____
   A. Internet
   B. Intranet
   C. Network
   D. Net

2. Which of the following are examples of network in our everyday life?
    A. Social Network
    B. Mobile Network
    C. Airlines network
    D. All of the above

3. Computer in a network is called _____
    A. Network Computer
    B. Node
    C. Special Computer
    D. Server

**Question 32:**
Communication media is defined as means of delivering or receiving a message, information, or data. The means through which the information is passed can be in verbal or non-verbal type. There has to be a common language known by both the sender or receiver to transfer information successfully.
1. Devices in a network can be connected through _____
    A. Wired media
    B. Wireless media
    C. Both of the above
    D. None of the above.

2. For communication, data in a network is divided into smaller chunks called _____
    A. Small data
    B. Parcel
    C. Packets
    D. Photons

**3.** Which communication media can penetrate solid objects?
    A. Radio wave
    B. Microwave
    C. Infrared wave
    D. Ultraviolet waves

**Question 33:**
Which of the following can be used as communication medium in wired economic LAN?
    A. Ethernet Cable          B. Optical fibre
    C. Wi-Fi                         D. All of the above

**Question 34:**
Suppose your internet provider has advertised to give you a speed of 80 Mbps (Megabits per second) and you have a file of say 80 MB then how much time will it take? Let's calculate, we know that there are 8 bits in 1 byte so speed should be divided by 8 as our file is in bytes not in bits.
So speed will be 80/8 = 10 MBps
Now 80 MB file will be transferred in 80/10 = 8 seconds.
This is how we calculate the downloading speed and time of files.

Q1. What is bound rate?

Q2. GBps stands for _____
     A. Gigabyte per second
     B. Gigabits per second
     C. Megabits per second
     D. Morebits per second

**Question 35:**
**Case Study 01:**
Web server is a special computer system running on HTTP through web pages. The web page is a medium to carry data from one computer system to another. The working of the webserver starts from the client or user. The client sends their request through the web browser to the webserver. Web server takes this request, processes it and then sends back processed data to the client. The server gathers all of our web page information and sends it to the user, which we see on our computer system in the form of a web page. When the client sends a request for processing to the web server, a domain name and IP address are important to the webserver. The domain name and IP address are used to identify the user on a large network.

a) Web servers are:
    1. IP addresses
    2. Computer systems
    3. Webpages of a site
    4. A medium to carry data from one computer to another

b) What does the webserver need to send back information to the user?
    1. Home address
    2. Domain name
    3. IP address
    4. Both b and c

c) What is the full form of HTTP?

1. Hypertext Transfer Protocol

2. Hypertext Transfer Procedure

3. Hyperlink Transfer Protocol

4. Hyperlink Transfer Procedure

d) The _____ translates internet domain and host names to IP address
1. Domain name system

2. Routing information protocol

3. Google

4. Network time protocol

e) Computer that requests the resources or data from other computer is called as _____ computer
1. Server

2. Client

3. None of the above

4. a and b

f) DNS stands for:
1. Domain Name Security

2. Domain Number System

3. Document Name System

4. Domain Name System

**Question 36:**
Shaurya uses computer and mobile for his personal use. Study the following cases and answer the questions given below.
 Once he got the message in Telegram that CBSE is announcing the result of class XII tomorrow at 10:10 pm. He forwarded the message to his few friends. But later he came to know that no such Announcement was there in CBSE official web-site. he is violating:
A. net etiquettes      B. Communication etiquettes
C. copy right           D. None of the above

**Question 37:**
Assertion (A): Digital footprint is the trail of data we leave behind when we visit any website (or use any online application or portal) to fill-in data or perform any transaction.
Reason (R): While online, all of us need to be aware of how to conduct ourselves, how best to relate with others and what ethics, morals and values to maintain.
A. Both A and R are true and R is the correct explanation of A
B. Both A and R are true but R is not the correct explanation of A
C. A is true but R is false
D. A is false but R is true

**Question 38:**
Which of the following is False in case of Child Pornography
Statement I: Images/movies or texts that depicts sexual activity of anyone under 18 years of age is Child pornography.
Statement II: IT ACT 2000 does not protect from Child Pornography
Statement III: IT ACT section 67 is amended that browsing sites of Child Pornography is also an Offence.
a) Statements I and III
b) Statement II is only
c) Statement III is only
d) Statements I and II

**Question 39:**
The garbage of electronic gadgets such as computer peripherals, laptop accessories, mobiles is known as _____.
(a) Electronic waste        (b) Electrical waste
(c) Garbage of Goods        (d)None of the above

**Question 40:**
The cadmium used in semiconductors and registers can damage a human's
a). kidney, heart
b) Liver, bones & kidney
c) Neurological system
d) Human eyes

**Question 41:**
**Statement A:** Social media are websites or applications that enable their users to participate in social networking but they cannot create and share content with others in the community.

**Statement B:** We should not waste precious time in responding to unnecessary emails or comments unless they have some relevance for us.

a. Both statements are correct.

b. Both statements are incorrect

c. Statement A is correct, but Statement B is incorrect

d. Statement A is incorrect, but Statement B is correct

**Question 42:**

Mr. Sharma is writing a document on Cyber Crime. While writing he came to know about Plagiarism. Which of the following statements is/are Fales?

Statement I: Plagiarism is using someone's work and not giving credit for it

Statement II: Plagiarism is entering into someone's computer to steal data

Statement III: Plagiarism is Criminal offence

a) Statement II only

b) Both Statements I and III

c) Statement II and III

d) Statements I, II, III

**Question 43:**

Which of the following is True.

Statement I: Phishing is catching fish in a game

Statement II: Phishing is sending an email or text message sent to steal user's information such as Credit card data, Login credentials, Personal information

Statement III: Phishing need not be targeted to a specific person or organization

a) Statement I and II are only True

b) Statement II only True

c) Statements III only True

d) Statements I, II and III are all True

**Question 44:**

---------------- is the act of unauthorised access to a computer, computer network or digital system.

    a. Illegal access

    b. Virus

    c. Hacking

    d. None of the above

**Question 45:**
A ___ is a type of contract between the creator of an original work permitting someone to use their work, generally for some price.
a. Agreement
b. License
c. Patent
d. Copyright


**Question 46:**
An internet address or web address, a URL (Uniform Resource Locator) is a URL and standardized naming convention for addressing documents accessible over the Internet and Intranet. The URL makes it possible for a computer to locate and open a web page on a different computer on the Internet.

Q1: Assertion (A):  URL is naming convention for addressing documents accessible over the Internet.
Reason (R):   The URL makes it possible for a computer to locate and open a web page on a different computer on the Internet

Consider the above statements, choose the correct answer from the options given below:
A.      Both (A) and (R) are true, and (R) is the correct explanation of (A).
B.      Both (A) and (R) are true, but (R) is not the correct explanation of (A).
C.      (A) is true but (R) is false.
D.      (A) is false but (R) is true.

Q2: Write name of label 1, 2, 3, 4 in given URL
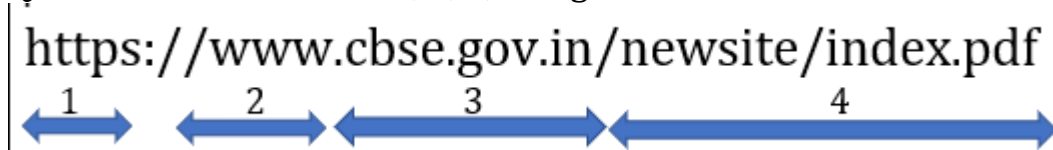


Q3: Which of the following protocol is used for WWW?

A. FTP

B. SMTP

C. TCP

D. HTTP

**Question 47:**

Most people give Ray Tomlinson the title of email's inventor. He came up with the idea while working for ARPANET, the government-funded research project that eventually became the internet. At the time, you could only leave messages for people using the same computer. Tomlinson created a program that gave users the ability to send messages between connected computers on the ARPANET system.

Q1: Unsolicited commercial email is known as:
A) Malware
B) Virus
C) Spam
D) Spyware

Q2. Which of the following protocol is used for e-mail services?
A) SMAP
B) SAIP
C) SMTP
D) STIP

Q3. Ideally, what characters should be used in a password to make it strong?
A) Letters and numbers only
B) Mixed Case (Upper and Lower)
C) Special characters
D) All of above

**Question 48:**

Q 1: Assertion (A):  Content of Web pages cannot be change at runtime.
Reason (R):   Same content is delivered every time the page is loaded, if website is a static website.

Consider the above statements, choose the correct answer from the options given below:

A.      Both (A) and (R) are true, and (R) is the correct explanation of (A).
B.      Both (A) and (R) are true, but (R) is not the correct explanation of (A).
C.      (A) Is true but (R) is false.
D.      (A) is false but (R) is true.

Q 2: Assertion (A): Web hosting is the activity of providing storage space for a website that is connected to the Internet.
Reason (R): When a company that has space on servers and people buy space to store their websites so they can appear on the Internet, this is an example of web hosting
Consider the above statements, choose the correct answer from the options given below:
A.     Both (A) and (R) are true, and (R) is the correct explanation of (A).
B.     Both (A) and (R) are true, but (R) is not the correct explanation of (A).
C.     (A) Is true but (R) is false.
D.     (A) is false but (R) is true.

Q3. Which of the following explains Cookies nature?
A. Non-Volatile
B. Volatile
C. Intransient
D. Transient

**Question 49:**
Q1: Assertion (A) A browser, short for web browser, is the software application that is used to search for, reach and explore websites.
Reason (R) The primary function of a web browser is to render HTML
Code
Consider the above statements, choose the correct answer from the options given below:
A.     Both (A) and (R) are true, and (R) is the correct explanation of (A).
B.     Both (A) and (R) are true, but (R) is not the correct explanation of (A).
C.     (A) is true but (R) is false.
D.     (A) is false but (R) is true.

 Q2: Verification of a login name and password is known as_____.
A. configuration
B. accessibility
C. authentication
D. logging in

Q3: _____ are set of rules and procedures for communicating.
A. Programs
B. Algorithms
C. Protocols
D. Mails

**Question 50:**
Q1: _____ is a type of telephone service is an alternative to a regular phone line.
A. Wireless
B. DSL
C. ISDN
D. Dialup

Q2: Which of the following networks extends a private network across public networks?
A. Local area network
B) virtual private network
C) enterprise private network
D) storage area network

Q3: The _____ translates internet domain and host names to IP address.
A. domain name system
B. routing information protocol
C. network time protocol
D. internet relay chat

**Information Practices - Answers Keys**

Answer 1:  1.   b      2.   d      3.   a      4.   d

Answer 2:  1.   d      2.   c      3.   d      4.   a

Answer 3:  1.   a      2.   d      3.   c      4.   c

Answer 4:

1. print(Mark['Amit'])

2. print(Mark[Mark>300])

3. Mark.drop(['Rajnish',' Manish',' Dolly'],inplace=True)

4. NMark=Mark[Mark>300]+5

Answer 5:  1.   a      2.   c      3.   a      4.   b

Answer 6:  1.   b      2.   a

Answer 7:  1.   b      2.   d

Answer 8:

      a)  Df1['Total']=Df1['ACCOUNTS']+Df1['MATHS']+ Df1['BST']+ Df1['IP']+ Df1['ECO']
      b)  T=[395,399,428,401,353]
         Df1[Total]=T
      c)  T=pd.Series([395,399,428,401,353])
         Df1.['Total']=T
      d)  Both a and c

   2. Df1['AVG']=Df1['Total']/5

   3. Df1.loc[:0,['BST']]=90

   4.Df1.drop(2,axis=0)

Answer 9:  1.   a      2.   b      3.   d

Answer 10: 1.   c      2.   c      3.   d      4.   d

Answer 11:      A

Answer 12:      A

Answer 13:      (I)  D

               (II)  C

Answer 14:     D

Answer 15:     B

Answer 16:     A

Answer 17:     A – True

              B – False

              C – True

              D - False

Answer 18:     A

Answer 19:     A

Answer 20.     A

| | | |
|---|---|---|
| Answer 21 | A. | d) Both Query ii) and iii) will display the desired data. |
| | B. | c) BookID, Issued_date |
| | C. | d)SELECT Issued_date, count(BookID) from StuLibrary where Return_date is NULL GROUP BY Issued_date ; |
| | D. | a) SELECT StuClass, count(StuId) from StuLibrary GROUPBY StuClass  HAVING count(StuId)>30; |
| | E. | c)SELECT Issued_date from StuLibrary GROUP BY Issued_date having count(*)>5 |
| Answer 22 | i | d) Select carname, round(cost,1) from carmarket; |
| | ii | b) select carname, color, instr(color,'E') from carmarket; |
| | iii | a) select  carname, lcase(company)  from  carmarket  where year(dom)=2020; |
| | iv | b) select count(*),year(dom) from carmarket group by year(dom); |
| | v | c) Cardinality=7 and Degree=6 |
| Answer 23 | i | b) 58.6 |
| | ii | d) INDOGO    SILVER    5 |
| | | GLC          WHITE    5 |
| | iii | c) GLC         mercedes |
| | iv | d) 2    2020 |
| | | 2   2016 |
| | v | b) A6    60 |

| | | | |
|---|---|---|---|
| **Answer 24** | **i** | | b. Both (iii) and (iv)<br>select name from student where city="Agra" or city="Mumbai";<br>      or<br>select name from student where city IN("Agra", "Mumbai");<br><br>d. Only (iii)<br>      iii. select name from student where city="Agra" or city="Mumbai"; |
| | **ii** | | b.<br>| Rollno | Name | Class | DOB | Gender | City | Marks |<br>|---|---|---|---|---|---|---|<br>| 6 | Maakhiy | XI | 12/12/94 | F | Dubai | 256 |<br>| 7 | Neha | X | 8/12/95 | F | Moscow | 324 |<br>| 3 | Geet | XI | 6/5/97 | F | Agra | 470 |<br>| 4 | Preeti | XII | 8/8/95 | F | Mumbai | 492 | |
| | **iii** | | d. Select class, max(marks) from student group by class;<br>b. Both (ii) and (iv) |
| | **iv** | | Select gender, average(marks) from student group by gender where class="XI";<br>or<br>Select gender, average(marks) from student group by gender having class = "XI"; |
| | **v** | | b. select name,max(DOB) from student ; |
| **Answer 25** | **a)**<br>**b)**<br>**c)**<br>**d)**<br>**e)**<br>**f)** | | 8<br>123.23      340<br>21<br>1979      11      26      November<br>IND ence<br>form actices |
| **Answer 26** | **a)**<br>**b)**<br><br><br><br><br><br><br><br><br><br>**c)**<br>**d)**<br>**e)**<br>**f)**<br>**g)** | | iii) 0<br>iii) +-----------------------------------+<br>    \| INSTR(First_Name,'Kiran')  \|<br>    +-----------------------------------+<br>    \| 0                                 \|<br>    \| 0                                 \|<br>    \| 4                                 \|<br>    \| 0                                 \|<br>    \| 0                                 \|<br>        +-----------------------------------+<br>    iii) 'ormatics'<br>    iv) 'ers'<br>    ii) 'ute'<br>    i) 'te'<br>    +---------------------------+<br>    \| MID(first_name,3,2)   \|<br>    +---------------------------+<br>    \| mt                        \| |

| | | | aw | |
|---|---|---|---|---|
| | | | +----------------------------+ | |
| Answer 27 | a) b) c) d) e) | 3 5 school   6 0 1 | | |
| Answer 28 | A) a) | -1 | | |
| | b) | -2 | | |
| | c) | 1 | | |
| | d) | 6.3 | | |
| | e) | 0 | | |
| | f) B) a) | 60 a) SELECT ROUND(x,0); | | |
| | b) | b) SELECT ROUND(x,-2); | | |
| Answer 29 | A) B) C) D) | iii. A is true but R is false i. Both A and R are true and R is the correct explanation of A i. Both A and R are true and R is the correct explanation of A iii. A is true but R is false | | |
| Answer 30 | i ii iii iv v vi vii viii ix x | (b) Single-row functions (a) Text (c) Both (a) and (b) (b) YYYY-MM-DD (a) INSTR( ) (c) MONTHNAME(date) (a) DAY(date) (b) 3 (c) 48.0 (b) mysql>SELECT LENGTH(CNAME)FROM Customers WHERE CNAME LIKE '%R' OR CNAME LIKE '%L'; | | |

Answer 31: (i) C       (ii) D         (iii) B

Answer 32: (i) C       (ii) C         (iii) A

Answer 33: A

Answer 34:

(1) It is a measure of the speed at which the data is being transferred in a communication channel. The rate indicates the number of electrical oscillations

per second that occurs within a data transmission. The higher the baud rate, the more bits per second that are transferred.

(2) A

| Answer 35: | **Case Study 01:** | | |
|---|---|---|---|
| | a) 2 | b) 4 | c) 1 |
| | d) 1 | e) 2 | f) 4 |

ANSWER 36:      B

ANSWER 37:      B

ANSWER 38:      B

ANSWER 39:      A

ANSWER 40:      B

ANSWER 41:      D

ANSWER 42:      A

ANSWER 43:      B

ANSWER 44:      C

ANSWER 45:      B

ANSWER 46:      1.      B

2.      Label1: Protocol

Label 2: Sub Domain

Label 3: Domain

Label4: Path

3.      D

| ANSWER 47: | 1. | C | 2. | C | 3. | D |
|---|---|---|---|---|---|---|
| ANSWER 48: | 1. | B | 2. | B | 3. | D |
| ANSWER 49: | 1. | B | 2. | C | 3. | C |
| ANSWER 50: | 1. | C | 2. | B | 3. | A |

# Critical Thinking Skills

**1 Observation**
The ability to notice and predict opportunities, problems and solutions.

**2 Analysis**
The gathering, understanding and interpreting of data and other information.

**3 Inference**
Drawing conclusions based on relevant data, information and personal knowledge and experience.

**4 Communication**
Sharing and receiving information with others verbally, nonverbally and in writing.

**5 Problem solving**
The process of gathering, analyzing and communicating information to identify and troubleshoot solutions.

तत् त्वं पूषन् अपावृणु
केन्द्रीय विद्यालय संगठन

# केन्द्रीय विद्यालय संगठन, लखनऊ संभाग

## Kendriya Vidyalaya Sangathan, Lucknow Region