

Important Instructions:

1. The test is of 3.20 hours duration and the Test Booklet contains 200 multiple - choice questions (four options with a single correct answer) There are two sections in each subject, i.e. Section-A & Section-B. You have to attempt all 35 questions from Section-A & only 10 questions from Section-B out of 15. **(Candidates are advised to read all 15 questions in each subject of Section-B before they start attempting the question paper. In the event of a candidate attempting more than ten questions, the first ten questions answered by the candidate shall be evaluated.**
2. Each questions carries **4 marks**. For each correct response, the candidate will get **4 marks**. For every wrong response **1 mark** will be deducted from the total scores. The maximum marks are **720**.
3. Use **Blue / Black Ball Point Pen only** for writing particulars on this page / marking responses on Answer Sheet.
4. Rough work is to be done in the space provided for this purpose in the Test Booklet only.
5. On completion of the test, the candidate must hand over the Answer Sheet (ORIGINAL and OFFICE Copy) to the Invigilator before leaving the Room / Hall. The candidates are allowed to take away this Test Booklet with them.
6. The CODE for this Booklet is **Q4**.
7. The candidates should ensure that the Answer Sheet is not folded. Do not make any stray marks on the Answer Sheet. Do not write your Roll No. anywhere else except in the specified space in the Test Booklet/Answer Sheet. Use of white fluid for correction is **NOT** permissible on the Answer Sheet.
8. Each candidate must show on demand his/her Admit Card to the Invigilator.
9. No candidate, without special permission of the centre Superintendent or Invigilator, would leave his / her seat.
10. Use of Electronic / Manual Calculator is prohibited.
11. The candidates are governed by all Rules and Regulations of the examination with regard to their conduct in the Examination Hall. All cases of unfair means will be dealt with as per the Rules and Regulations of this examination.
12. No part of the Test Booklet and Answer Sheet shall be detached under any circumstances.
13. The candidates will write the Correct Test Booklet Code as given in the Test Booklet / Answer Sheet in the Attendance Sheet.

PHYSICS**Section A**

Q 1. The dimensions $[MLT^{-2}A^{-2}]$ belong to the:

- Option A magnetic flux
Option B self-inductance
Option C magnetic permeability
Option D electric permittivity

Correct Option C

Solution:

As we know, S.I unit of magnetic permeability is H/m.

$$\text{i.e., } [\mu] = \frac{[H]}{[L]} \dots (\because [H] = [ML^2T^{-2}A^{-2}])$$

$$\therefore [\mu] = [MLT^{-2}A^{-2}]$$

Thus, the dimensional formula of magnetic permeability is $[MLT^{-2}A^{-2}]$

Q 2. Let T_1 and T_2 be the energy of an electron in the first and second excited states of hydrogen atom, respectively. According to the Bohr's model of an atom, the ratio $T_1 : T_2$ is :

Option A 1 : 4

Option B 4 : 1

Option C 4 : 9

Option D 9 : 4

Correct Option D

Solution:

Given that,

$$n_1 = 2$$

$$n_2 = 2$$

Now, as we know energy of electrons in n^{th} excited state will be.

$$E_n = \frac{E_0}{n^2}$$

Thus, for the given case the ratio of first excited state (T_1) and second excited state (T_2) is given as

$$\Rightarrow \frac{T_1}{T_2} = \frac{\frac{E_0}{4}}{\frac{E_0}{9}} = \frac{9}{4}$$

Q 3. As the temperature increases, the electrical resistance:

Option A increases for both conductors and semiconductors

Option B decreases for both conductors and semiconductors

Option C increases for conductors but decreases for semiconductors

Option D decreases for conductors but increases for semiconductors

Correct Option C

Solution:

As we all know, as the temperature rises, so does the conductivity of the conductor, and thus the electrical resistance. The resistivity of a semiconductor, on the other hand, decreases with temperature. As a result, the electrical resistance of the semiconductor decreases.

Q 4. A long solenoid of radius 1 mm has 100 turns per mm. If 1 A current flows in the solenoid, the magnetic field strength at the centre of the solenoid is :

Option A 6.28×10^{-2} T

Option B 1256×10^{-2} T

Option C 12.56×10^{-4} T

Option D 6.28×10^{-4} T

Correct Option B

Solution:

Given that,

$$\text{Radius, } r = 1\text{mm} = 10^{-3} \text{ m}$$

$$\text{Number of turns, } N = 100$$

Current, $I = 1 \text{ A}$

Now, the magnetic field at centre of solenoid will be

$$B = \mu_0 \frac{N}{l} I = \mu_0 n I \dots \left[\because n = \frac{N}{l} \right]$$

$$= 4\pi \times 10^{-7} \times \frac{100}{10^{-3}} \times 1$$

$$= 4\pi \times 10^{-2} \text{ T}$$

$$B = 12.56 \times 10^{-2} \text{ T}$$

Q 5. When two monochromatic lights of frequency, ν and $\frac{\nu}{2}$ are incident on a photoelectric

metal, their stopping potential becomes $\frac{V_s}{2}$ and V_s respectively. The threshold frequency for

this metal is :

Option A 2ν

Option B 3ν

Option C $\frac{2}{3}\nu$

Option D $\frac{3}{2}\nu$

Correct Option D

Solution:

Given that,

Frequency of monochromatic light 1, $\nu_1 = \nu$

Stopping potential of metal 1, $V_1 = V_s/2$

Frequency of monochromatic light 2, $\nu_2 = \nu/2$

Stopping potential of metal 1, $V_2 = V_s$

Now,

According to Einstein's equation of photoelectric effect.

$$K.E_{max} = eV_s = h\nu - \phi$$

$$\frac{eV_s}{2} = h\nu - h\nu_0 \dots (i)$$

$$eV_s = \frac{h\nu}{2} - h\nu_0 \dots (ii)$$

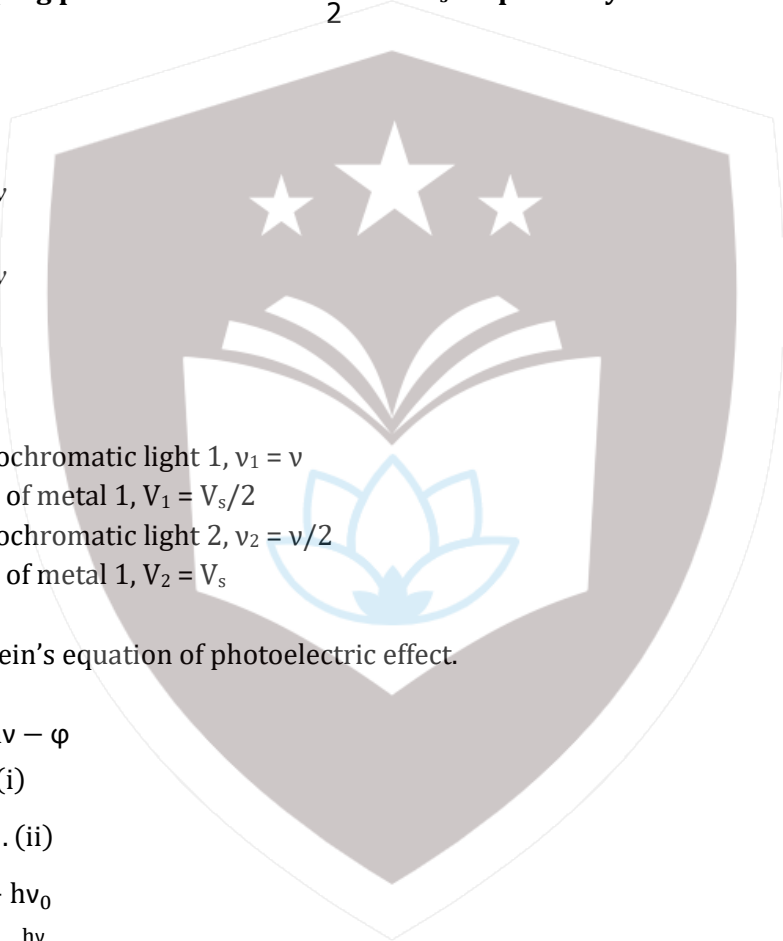
$$\frac{1}{2} \left[\frac{h\nu}{2} - h\nu_0 \right] = h\nu - h\nu_0$$

$$\Rightarrow h\nu_0 - \frac{h\nu_0}{2} = h\nu - \frac{h\nu}{4}$$

$$\Rightarrow \frac{h\nu_0}{2} = \frac{3h\nu}{4}$$

$$\nu_0 = \frac{3\nu}{2}$$

*** Language of question is wrongly framed. The values of stopping potentials should be interchanged.**



Q 6. Match List - I with List - II :

List - I (Electromagnetic waves)	List - II (Wavelength)
(a) AM radio waves	(i) 10^{-10} m
(b) Microwaves	(ii) 10^2 m
(c) Infrared radiations	(iii) 10^{-2} m
(d) X-rays	(iv) 10^{-4} in

Choose the correct answer from the options given below:

- Option A (a) - (iv), (b) - (iii), (c) - (ii), (d) - (i)
 Option B (a) - (ii), (b) - (ii), (c) - (i), (d) - (iv)
 Option C (a) - (iii), (b) - (iv), (c) - (i), (d) - (iv)
 Option D (a) - (ii), (b) - (iii), (c) - (iv), (d) - (i)

Correct Option D

Solution:

Waves	Wavelength
(a) AM radio waves	10^2 m
(b) Microwaves	10^{-2} m
(c) Infrared radiations	10^{-4} m
(d) X-rays	10^{-10} m

i.e., (a) - (ii), (b) - (iii), (c) - (iv), (d) - (i)

Q 7. Two resistors of resistance, 100Ω and 200Ω are connected in parallel in an electrical circuit. The ratio of the thermal energy developed in 100Ω to that in 200Ω in a given time is :

- Option A 1 : 2
 Option B 2 : 1
 Option C 1 : 4
 Option D 4 : 1

Correct Option B

Solution:

Given that,

$$R_1 = 100 \Omega$$

$$R_2 = 200 \Omega$$

Now, as we know electric power is given as

$$P = \frac{V^2}{R} \Rightarrow P \propto \frac{1}{R}$$

Thus, for the given case

$$\frac{P_1}{P_2} = \frac{R_2}{R_1}$$

$$\Rightarrow \frac{P_1}{P_2} = \frac{200}{100} = \frac{2}{1}$$

Q 8. An electric lift with a maximum load of 2000 kg (lift + passengers) is moving up with a constant speed of 1.5 ms^{-1} . The frictional force opposing the motion is 3000 N. The minimum power delivered by the motor to the lift in watts is : ($g = 10 \text{ m s}^{-2}$)

- Option A 23000
 Option B 20000
 Option C 34500

Option D 23500

Correct Option C

Solution:

Given that,

Mass on lift, $m = 2000$

Friction force, $f = 3000$ N

velocity, $v = 1.5$ m/s

Now, minimum force needed to move lift upward

$$F_{\text{up}} = 2000g + 3000$$

$$= 23000 \text{ N}$$

$$\text{Minimum power } P_{\text{min}} = \vec{F} \cdot \vec{v}$$

$$P_{\text{min}} = Fv = 23000 \times \frac{3}{2}$$

$$= 34500 \text{ W}$$

Q 9. The peak voltage of the ac source is equal to

Option A The value of voltage supplied to the circuit

Option B The rms value of the ac source

Option C $\sqrt{2}$ times the rms value of the ac source

Option D $1/\sqrt{2}$ times the rms value of the ac source

Correct Option C

Solution:

We know,

$$\text{RMS value of A.C. } E_{\text{rms}} = \frac{E_0}{\sqrt{2}}$$

$$E_0 = \sqrt{2}E_{\text{rms}}$$

Q 10. The ratio of the radius of gyration of a thin uniform disc about an axis passing through its centre and normal to its plane to the radius of gyration of the disc about its diameter is

Option A 2 : 1

Option B $\sqrt{2} : 1$

Option C 4 : 1

Option D $1 : \sqrt{2}$

Correct Option B

Solution:

As we know,

The moment of inertia of a solid disc rotating about the axis passing through its centre will be

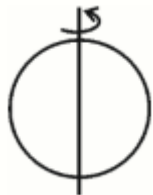


$$I_1 = \frac{MR^2}{2}$$

$$k_1 = \sqrt{\frac{l_1}{M}}$$

$$= \frac{R}{\sqrt{2}} \dots (1)$$

Similarly, moment of inertia of solid disc rotating about its diameter will be.



$$I_2 = \frac{MR^2}{4}$$

$$k_2 = \sqrt{\frac{l_2}{M}}$$

$$= \frac{R}{2} \dots (2)$$

Thus, by dividing equation 1 and 2 we get

$$\frac{k_1}{k_2} = \frac{\frac{R}{\sqrt{2}}}{\frac{R}{2}}$$

$$= \sqrt{2} : 1$$

Q 11. If the initial tension on a stretched string is doubled, then the ratio of the initial and final speeds of a transverse wave along the string is

- Option A 1: 1
 Option B $\sqrt{2} : 1$
 Option C 1: $\sqrt{2}$
 Option D 1: 2

Correct Option C

Solution:

Given that,

Initial tension, $T_i = T$

Final tension, $T_f = 2T$

Now, as we know speed of transverse wave will be

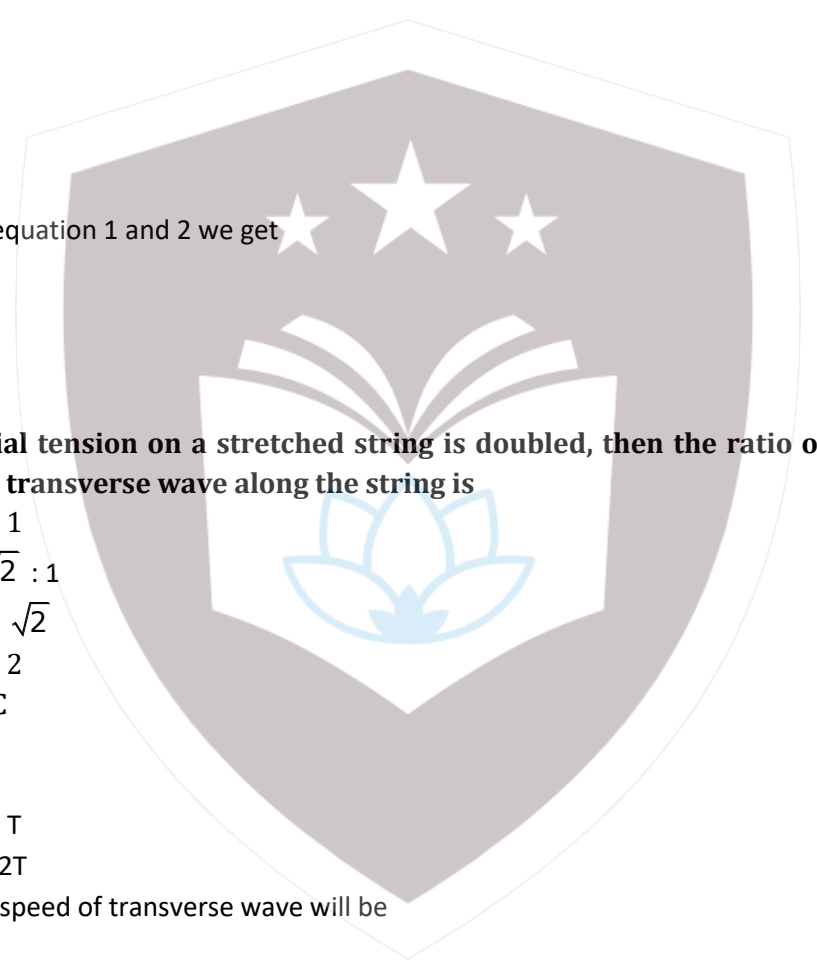
$$v = \sqrt{\frac{T}{\mu}}$$

$$\therefore v_i = \sqrt{\frac{T}{\mu}} \text{ and } v_f = \sqrt{\frac{2T}{\mu}}$$

$$\therefore \frac{v_i}{v_f} = \frac{1}{\sqrt{2}}$$

Q 12. Plane angle and solid angle have plane angle and solid angle have

- Option A Units but no dimensions
 Option B Dimensions but no units



Option C No units and no dimensions

Option D Both units and dimensions

Correct Option A

Solution:

$$\text{Plane angle} = \frac{\text{Arc}}{\text{Radius}} = \frac{[L]}{[L]} \rightarrow \text{Unit} = \text{Radian}$$
$$= [M^0 L^0 T^0]$$

$$\text{Solid angle} = \frac{\text{Arc}}{(\text{Radius})^2} \rightarrow \text{Unit} = \text{Steradian}$$
$$= \frac{L^2}{L^2} = [M^0 L^0 T^0]$$

Q 13. A biconvex lens has radii of curvature, 20 cm each. If the refractive index of the material of the lens is 1.5, the power of the lens is

Option A +2 D

Option B +20 D

Option C +5 D

Option D Infinity

Correct Option C

Solution:

Given that,

Radii of curvature, $R_1 = R_2 = 20 \text{ cm} = 20 \times 10^{-2} \text{ m}$

Refractive index, $\mu = 1.5$

Now, as we know power of lens is given by

$$P = \frac{1}{f(\text{m})}$$

$$\frac{1}{f} = (\mu - 1) \left(\frac{1}{R_1} - \frac{1}{R_2} \right)$$

$$\frac{1}{f} = \left\{ \frac{3}{2} - 1 \right\} \left(\frac{1}{20} + \frac{1}{20} \right)$$

$$f = 20 \text{ cm}$$

$$P = \frac{1}{20 \times 10^{-2}}$$
$$= 5 \text{ D}$$

Q 14. When light propagates through a material medium of relative permittivity ϵ_r and relative permeability μ_r , the velocity of light, v is given by (c-velocity of light in vacuum)

Option A $v = c$

Option B $v = \sqrt{\frac{\mu_r}{\epsilon_r}}$

Option C $v = \sqrt{\frac{\epsilon_r}{\mu_r}}$

Option D $v = \frac{c}{\sqrt{\epsilon_r \mu_r}}$

Correct Option D

Solution:

As we know, the relation between relative permittivity ϵ_r , relative permeability μ_r and the velocity of light v can be expressed as

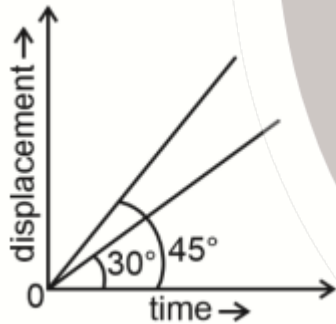
$$v = \frac{1}{\sqrt{\epsilon_m \mu_m}}$$

$$v = \frac{1}{\sqrt{\epsilon_0 \epsilon_r \mu_0 \mu_r}}$$

Since $c = \frac{1}{\sqrt{\epsilon_0 \mu_0}}$

$$\Rightarrow v = \frac{c}{\sqrt{\epsilon_r \mu_r}}$$

Q 15. The displacement-time graphs of two moving particles make angles of 30° and 45° with the x-axis as shown in the figure. The ratio of their respective velocity is



Option A $\sqrt{3} : 1$

Option B $1 : 1$

Option C $1 : 2$

Option D $1 : \sqrt{3}$

Correct Option D

Solution:

Given that,

$$\theta_1 = 30^\circ$$

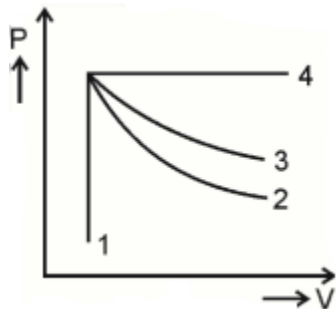
$$\theta_2 = 45^\circ$$

Now, as we know slope of displacement vs time curves gives the velocity

$$\Rightarrow \text{Ratio} = \frac{\tan 30^\circ}{\tan 45^\circ} = \frac{1}{\sqrt{3}} = 1 : \sqrt{3}$$

Q 16. An ideal gas undergoes four different processes from the same initial state as shown in the figure below.

Those processes are adiabatic, isothermal, isobaric and isochoric. The curve which represents the adiabatic process among 1, 2, 3 and 4 is



Option A 1

Option B 2

Option C 3

Option D 4

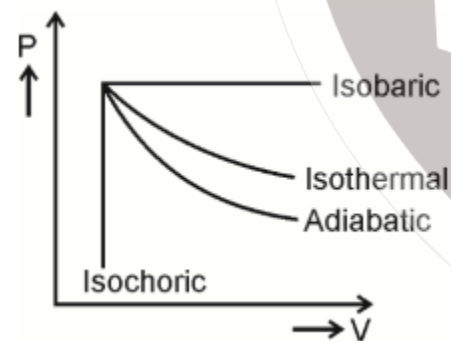
Correct Option B

Solution:

$$\left(\frac{dP}{dV}\right)_{\text{adiabatic}} = -\gamma P$$

$$\left(\frac{dP}{dV}\right)_{\text{isothermal}} = -P$$

$$\left(\frac{dP}{dV}\right)_{\text{adiabatic}} > \left(\frac{dP}{dV}\right)_{\text{isothermal}}$$



Q 17. Given below are two statements

Statement I : Biot-Savart's law gives us the expression for the magnetic field strength of an infinitesimal

current element (Idl) of a current carrying conductor only.

Statement II : Biot-Savart's law is analogous to Coulomb's inverse square law of charge q, with the former

being related to the field produced by a scalar source, Idl while the latter being produced by a vector source, q.

In light of above statements choose the most appropriate answer from the options given below

Option A Both Statement I and Statement II are correct

- Option B Both Statement I and Statement II are incorrect
 Option C Statement I is correct and Statement II is incorrect
 Option D Statement I is incorrect and Statement II is correct

Correct Option C

Solution:

The following equation, which is applicable for infinitesimal elements, is used to determine the direction and magnitude of magnetic field according to Biot-law. Savart's

$$d\vec{B} = \frac{\mu_0}{4\pi} \frac{d\vec{l} \times \vec{r}}{r^3}$$

It is analogous to Coulomb's law, where $d\vec{l}$ is a vector source and q is a scalar source. Here statement I is correct and statement II is incorrect.

Q 18. Two hollow conducting spheres of radii R_1 and R_2 ($R_1 \gg R_2$) have equal charges. The potential would be

- Option A More on bigger sphere
 Option B More on smaller sphere
 Option C Equal on both the spheres
 Option D Dependent on the material property of the sphere

Correct Option B

Solution:

Potential of conducting hollow sphere = $\frac{KQ}{R}$

Now, $Q = \text{same}$

$\Rightarrow V \propto \frac{1}{R} \Rightarrow$ more the radius less will be the potential.

\Rightarrow Hence potential would be more on smaller sphere

Q 19. A body of mass 60 g experiences a gravitational force of 3.0 N, when placed at a particular point. The magnitude of the gravitational field intensity at that point is

- Option A 0.05 N/kg
 Option B 50 N/kg
 Option C 20 N/kg
 Option D 180 N/kg

Correct Option B

Solution:

Given that,

Mass of body, $m = 60 \text{ g} = 60/1000 \text{ kg}$

Gravitational force, $F = 3 \text{ N}$

Now,

$$F = mE_G$$

$$3 = \frac{60}{1000} E_G$$

$$E_G = 50 \text{ N/kg}$$

Q 20. In a Young's double slit experiment, a student observes 8 fringes in a certain segment of screen when a monochromatic light of 600 nm wavelength is used. If the wavelength of light is changed to 400 nm, then the number of fringes he would observe in the same region of the screen is

- Option A 6
- Option B 9
- Option C 8
- Option D 12

Correct Option D

Solution:

$$\beta = \frac{\lambda D}{d}$$

Let length of segment of screen = l

$$\Rightarrow l = 8\beta_1 = \frac{8\lambda_1 D}{d} \dots\dots\dots(1)$$

$$\text{and } l = n\beta_2 = \frac{n\lambda_2 D}{d} \dots\dots\dots(2)$$

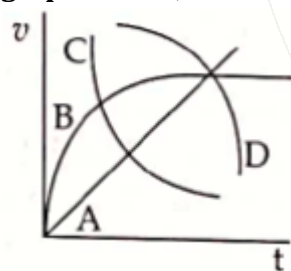
from (1) and (2)

$$8\lambda_1 = n\lambda_2$$

$$8(600 \text{ nm}) = n(400 \text{ nm})$$

$$n = 12$$

Q 21. A spherical ball is dropped in a long column of a highly viscous liquid. The curve in the graph shown, which represents the speed of the ball (v) as a function of time (t) is



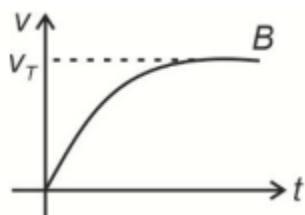
- Option A A
- Option B B
- Option C C
- Option D D

Correct Option B

Solution:

From the given condition we know that, the initial speed of ball is zero and it finally attains terminal speed.

Thus graph B is the correct representation of given case.



Q 22. The angle between the electric lines of force and the equipotential surface is

- Option A 0°
- Option B 45°
- Option C 90°
- Option D 180°

Correct Option C

Solution:

As we know,

$$dV = -\vec{E} \cdot d\vec{r}$$

$$dV = -E dr \cos \theta$$

For equipotential surface,

$$dV = 0$$

$$\cos \theta = 0$$

$$\Rightarrow \theta = 90^\circ$$

Q 23. In half wave rectification, if the input frequency is 60 Hz, then the output frequency would be

- Option A Zero
- Option B 30 Hz
- Option C 60 Hz
- Option D 120 Hz

Correct Option C

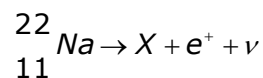
Solution:

As we know,

The negative half of an A.C cycle is removed from the sinusoidal pulse in a half wave rectifier, but the time lag between two positive pulses remains the same, so the frequency remains the same as the input (mains) frequency.

As a result, the output frequency is the same as the input frequency.

Q 24. In the given nuclear reaction, the element X is

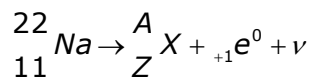


- Option A ${}_{11}^{23}\text{Na}$
- Option B ${}_{10}^{23}\text{Ne}$
- Option C ${}_{10}^{22}\text{Ne}$
- Option D ${}_{12}^{22}\text{Mg}$

Correct Option C

Solution:

Given that,



From conservation of atomic number

$$11 = Z + 1 \Rightarrow Z = 10 \Rightarrow \text{Ne}$$

From conservation of mass number

$$22 = A + 0 \Rightarrow A = 22$$

$$\therefore {}_Z^A\text{X} = {}_{10}^{22}\text{Ne}$$

Q 25. If a soap bubble expands, the pressure inside the bubble

- Option A Decreases
 Option B Increases
 Option C Remains the same
 Option D Is equal to the atmospheric pressure

Correct Option A

Solution:

$$\text{Excess pressure inside the bubble} = \Delta P = \frac{4T}{R}$$

$$P_{\text{in}} = P_{\text{out}} + \frac{4T}{R}$$

as 'R' increases 'P' decreases

Q 26. A square loop of side 1 m and resistance 1 Ω is placed in a magnetic field of 0.5 T. If the plane of loop is perpendicular to the direction of magnetic field, the magnetic flux through the loop is

- Option A 2 weber
 Option B 0.5 weber
 Option C 1 weber
 Option D Zero weber

Correct Option B

Solution:

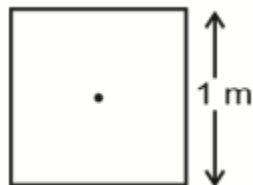
Given that,

$$\text{Area, } A = 1^2 = 1 \text{ m}^2$$

$$\text{Resistance, } R = 1 \Omega$$

$$\text{Magnetic field, } B = 0.5 \text{ T}$$

Now,



$$\text{Magnetic flux } (\phi_B) = \vec{B} \cdot \vec{A}$$

\vec{B} and \vec{A} are in same direction, therefore

$$\begin{aligned} \phi_B &= B \cdot A = 0.5 \times 1^2 \\ &= 0.5 \text{ Wb} \end{aligned}$$

Q 27. A shell of mass m is at rest initially. It explodes into three fragments having mass in the ratio $2 : 2 : 1$. If the fragments having equal mass fly off along mutually perpendicular directions with speed v , the speed of the third (lighter) fragment is

- Option A v
 Option B $\sqrt{2}v$
 Option C $2\sqrt{2}v$
 Option D $3\sqrt{2}v$

Correct Option C

Solution:

Given that,

Initial momentum = 0

Let the masses of 3 fragment be $2m$, $2m$, and m

Momentum along x-direction = $2mv\hat{i}$

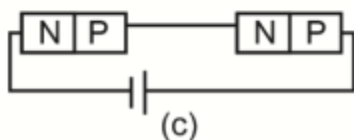
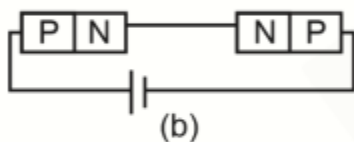
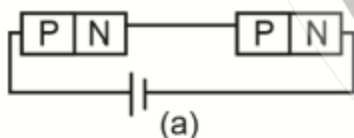
Momentum along y-direction = $2mv\hat{j}$

$$= \sqrt{(2mv)^2 + (2mv)^2} = \sqrt{2} \cdot 2mv$$

Net momentum Now, $2\sqrt{2}mv = mv'$

$$v' = 2\sqrt{2}v$$

Q 28.



In the given circuits (a), (b) and (c), the potential drop across the two p-n junctions are equal in

- Option A Circuit (a) only
 Option B Circuit (b) only
 Option C Circuit (c) only
 Option D Both circuits (a) and (c)

Correct Option D**Solution:**

As we know, potential drops across p-n junctions will be the same if both junctions are forward biased or reverse biased.

Because both junctions in figures (a) and (c) are forward biased, they have the same potential.

Because the first junction in figure (b) is forward biased and the second junction is reverse biased, their potential differences are different.

Q 29. The energy that will be ideally radiated by a 100 kW transmitter in 1 hour is

Option A 36×10^7 J

Option B 36×10^4 J

Option C 36×10^5 J

Option D 1×10^5 J

Correct Option A**Solution:**

As we know,

$$Power = \frac{Work}{time} = \frac{Energy}{time}$$

$$\Rightarrow Energy = Power \times time$$

$$E = 100 \times 10^3 \times 3600$$

$$= 36 \times 10^7$$

Q 30. Two objects of mass 10 kg and 20 kg respectively are connected to the two ends of a rigid rod of length 10 m with negligible mass. The distance of the center of mass of the system from the 10 kg mass is

Option A $\frac{10}{3}$ m

Option B $\frac{20}{3}$ m

Option C 10 m

Option D 5 m

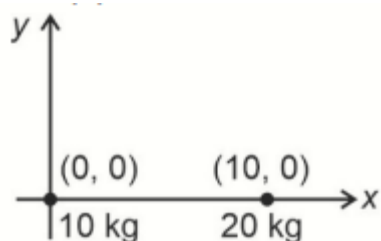
Correct Option B**Solution:**

Given that,

Mass of object placed at x_1 , $m_1 = 10$ kg

Mass of object placed at x_2 , $m_2 = 20$ kg

Now,



$$\begin{aligned}
 X_{\text{cm}} &= \frac{m_1 x_1 + m_2 x_2}{m_1 + m_2} \\
 &= \frac{10 \times 0 + 20 \times 10}{10 + 20} \\
 &= \frac{200}{30} \\
 &= \frac{20}{3} \text{ m}
 \end{aligned}$$

Q 31. A light ray falls on a glass surface of refractive index $\sqrt{3}$, at an angle 60° . The angle between the refracted and reflected rays would be

- Option A 30°
 Option B 60°
 Option C 90°
 Option D 120°

Correct Option C

Solution: Given $i = 60^\circ$ and $\mu = \sqrt{3}$

\Rightarrow Here, angle of incidence $\Rightarrow i = \tan^{-1}(\mu)$

Hence, reflected and refracted rays would be perpendicular to each other.

Q 32. The ratio of the distances travelled by a freely falling body in the 1st, 2nd, 3rd and 4th second

- Option A 1 : 2 : 3 : 4
 Option B 1 : 4 : 9 : 16
 Option C 1 : 3 : 5 : 7
 Option D 1 : 1 : 1 : 1

Correct Option C

Solution:

$$S_{n^{\text{th}}} = u + \frac{1}{2} a (2n - 1)$$

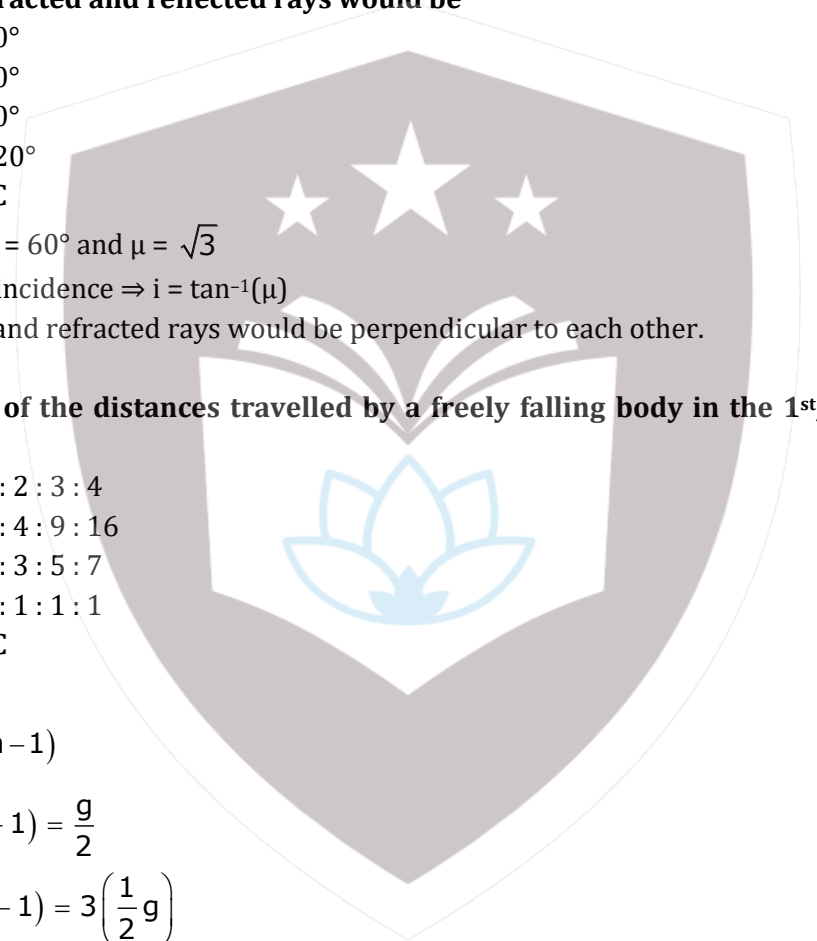
$$S_{1^{\text{st}}} = \frac{1}{2} g (2 \times 1 - 1) = \frac{g}{2}$$

$$S_{2^{\text{nd}}} = \frac{1}{2} g (2 \times 2 - 1) = 3 \left(\frac{1}{2} g \right)$$

$$S_{3^{\text{rd}}} = \frac{1}{2} g (2 \times 3 - 1) = 5 \times \left(\frac{1}{2} g \right)$$

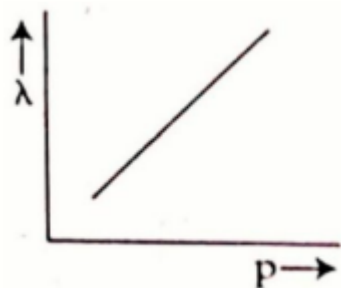
$$S_{4^{\text{th}}} = \frac{1}{2} g (2 \times 4 - 1) = 7 \times \left(\frac{1}{2} g \right)$$

$$\begin{aligned}
 S_{1^{\text{st}}} : S_{2^{\text{nd}}} : S_{3^{\text{rd}}} : S_{4^{\text{th}}} \\
 = 1 : 3 : 5 : 7
 \end{aligned}$$

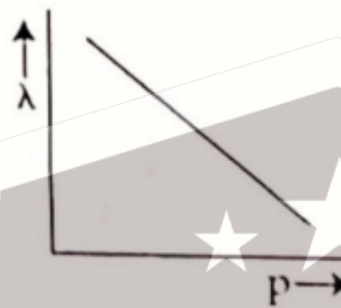


Q 33. The graph which shows the variation of the de Broglie wavelength (λ) of a particle and its associated momentum (p) is

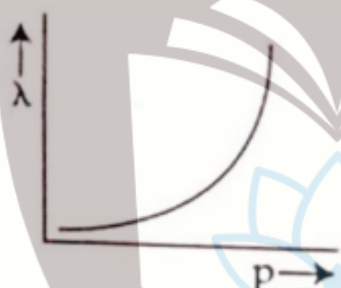
Option A



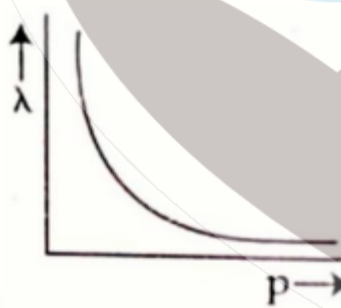
Option B



Option C



Option D



Correct Option D

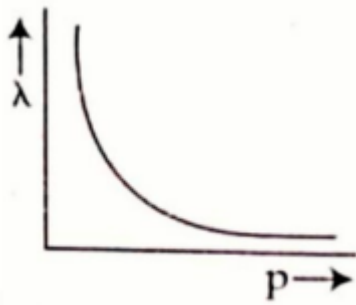
Solution:

As we know, according to De Broglie equation for particle, the relation between wavelength and its linear momentum can be represented as shown below.

$$\lambda = \frac{h}{p}$$

$$\lambda \propto \frac{1}{p}$$

Thus, the correct option for the given case is D.



i.e.,

Q 34. A copper wire of length 10 m and radius $\left(\frac{10^{-2}}{\sqrt{\pi}}\right)$ m has electrical resistance of 10 Ω .

The current density in the wire for an electric field strength of 10 (V/m) is

- Option A 10^4 A/m²
- Option B 10^6 A/m²
- Option C 10^{-5} A/m²
- Option D 10^5 A/m²

Correct Option D

Solution:

Given that,

Length, $l = 10$ m

Area, $\pi r^2 = \pi \left(\frac{10^{-2}}{\sqrt{\pi}}\right)^2$

Now, as we know

$$R = \rho \frac{L}{A} = \frac{L}{\sigma A}$$

$$\Rightarrow \sigma = \frac{L}{RA}$$

$$\text{Current density, } j = \sigma E = \frac{LE}{RA}$$

$$j = \frac{10 \times 10}{10 \times \pi \left(\frac{10^{-2}}{\sqrt{\pi}}\right)^2} = \frac{100}{10 \times \pi \times \left(\frac{10^{-4}}{\pi}\right)}$$

$$= 10^5 \text{ A/m}^2$$

Q 35. The angular speed of a fly wheel moving with uniform angular acceleration changes from 1200 rpm to 3120 rpm in 16 seconds. The angular acceleration in rad/s² is

- Option A 2π
- Option B 4π
- Option C 12π
- Option D 104π

Correct Option B

Solution:

Given that,

$$\omega_i = 1200 \times \frac{2\pi}{60} \text{ rad/s}$$

$$\omega_f = 3120 \times \frac{2\pi}{60} \text{ rad/s}$$

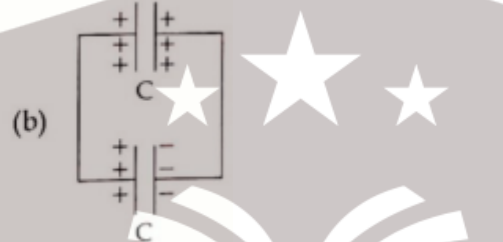
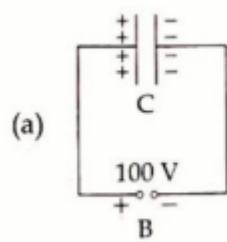
Now, as we know

$$\text{Angular acceleration, } \alpha = \frac{\omega_f - \omega_i}{t}$$

$$\therefore \alpha = \frac{(3120 - 1200)}{16} \times \frac{2\pi}{60} = 4\pi$$

Section B

Q 36. A capacitor of capacitance $C = 900 \text{ pF}$ is charged fully by 100 V battery B as shown in figure (a). Then it is disconnected from the battery and connected to another uncharged capacitor of capacitance $C = 900 \text{ pF}$ as shown in figure (b). The electrostatic energy stored by the system (b) is



- Option A $4.5 \times 10^{-6} \text{ J}$
- Option B $3.25 \times 10^{-6} \text{ J}$
- Option C $2.25 \times 10^{-6} \text{ J}$
- Option D $1.5 \times 10^{-6} \text{ J}$

Correct Option C

Solution:

Given that,

$$\text{Capacitance, } C = 900 \text{ pF} = 900 \times 10^{-12} \text{ F}$$

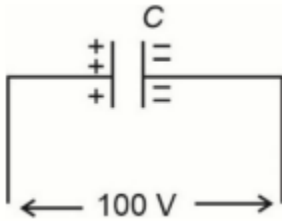
$$\text{Voltage, } V = 100 \text{ V}$$

Now,

We know that

$$C = \frac{Q}{V} \Rightarrow Q = CV$$

$$= 900 \times 10^{-12} \times 100 = 9 \times 10^{-8} \text{ C}$$



$$V = \frac{C_1 V_1 + C_2 V_2}{C_1 + C_2}$$

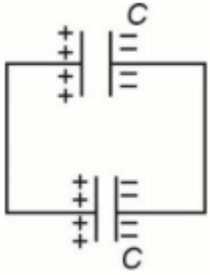
$$= \frac{9 \times 10^{-8} + 0}{1800 \times 10^{-12}} = \frac{100}{2} = 50V$$

$$U = \frac{1}{2}(C_1 + C_2)V^2$$

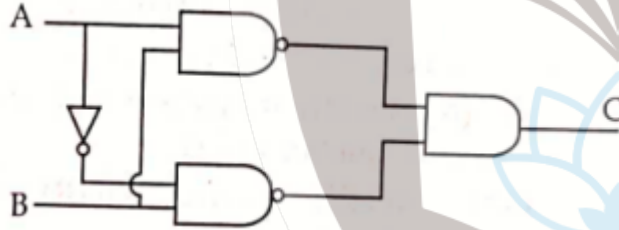
$$= \frac{1}{2} \times 1800 \times 10^{-12} \times 50 \times 50$$

$$= 225 \times 10^{-8}$$

$$U = 2.25 \times 10^{-6} \text{ J}$$



Q 37.



Option A

A	B	C
0	0	0
0	1	1
1	0	1
1	1	0

Option B

A	B	C
0	0	1
0	1	0
1	0	0
1	1	1

Option C

A	B	C
0	0	1
0	1	0
1	0	1
1	1	0

Option D

A	B	C
0	0	0
0	1	1
1	0	0
1	1	1

Correct Option C

Solution:

The Boolean equation for given logic gate is

$$C = (\overline{A \cdot B}) \cdot (\overline{\overline{A} \cdot B})$$

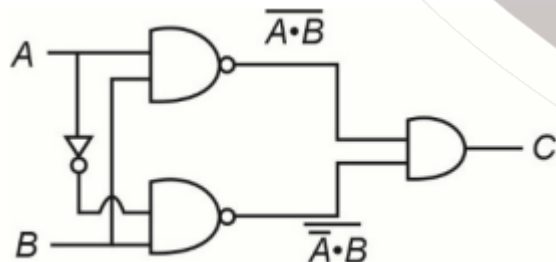
$$\Rightarrow C = \overline{A \cdot B} + \overline{\overline{A} \cdot B}$$

$$\Rightarrow C = \overline{(A + \overline{A})B}$$

$$\Rightarrow C = \overline{B}$$

The truth table would be

A	B	C
0	0	1
0	1	0
1	0	1
1	1	0



Q 38. A ball is projected with a velocity, 10 ms^{-1} , at an angle of 60° with the vertical direction. Its speed at the highest point of its trajectory will be

Option A Zero

Option B $5\sqrt{3} \text{ ms}^{-1}$

Option C 5 ms^{-1}

Option D 10 ms^{-1}

Correct Option B

Solution:

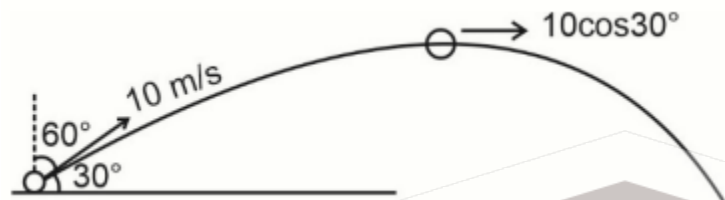
Given that,

Initial velocity, $u = 10 \text{ m/s}$

Angle of projection, $\theta = 60^\circ$

Now, as we know

Vertical component of velocity becomes zero at the highest point.



i.e., at highest point speed of object = $10 \times \cos 30^\circ$

$$= 5\sqrt{3} \text{ ms}^{-1}$$

Q 39. The volume occupied by the molecules contained in 4.5 kg water at STP, if the intermolecular forces vanish away is

Option A $5.6 \times 10^6 \text{ m}^3$

Option B $5.6 \times 10^3 \text{ m}^3$

Option C $5.6 \times 10^{-3} \text{ m}^3$

Option D 5.6 m^3

Correct Option D

Solution:

Given that,

Mass of water, $m = 4.5 \text{ kg}$

$T = 273 \text{ K}$

$P = 10^5 \text{ N/m}^2$

Now,

As we know, from ideal gas equation

$$PV = nRT \dots \left[\because n = \frac{\text{mass of water}}{\text{mol. wt.}} = \frac{4.5 \times 10^3}{18} \right]$$

$$V = \frac{nRT}{P}$$

$$V = \frac{4.5 \times 10^3}{18} \times \frac{8.3 \times 273}{10^5} = 5.66 \text{ m}^3$$

Q 40. Given below are two statements: One is labelled as Assertion (A) and the other is labelled as Reason (R).

Assertion (A): The stretching of a spring is determined by the shear modulus of the material of the spring.

Reason (R): A coil spring of copper has more tensile strength than a steel spring of same dimensions.

In the light of the above statements, choose the most appropriate answer from the options given below

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

Option B Both (A) and (R) are true and (R) is not the correct explanation of (A)

Option C (A) is true but (R) is false

Option D (A) is false but (R) is true

Correct Option C

Solution:

As we know, It is true that stretching of spring is determined by shear modulus of the spring as when coil spring is stretched neither its length nor its volume changes, there is only change in its shape. Tensile strength of steel is more than that of copper.

Hence Assertion is true and reason is false.

As we all know, stretching of string is determined by the shear modulus of the spring because when a coil spring is stretched, neither its length nor volume changes, only its shape changes.

Also, we must note that, Steel has higher tensile strength than copper as a result, thus we can conclude that for the given case assertion is correct while reasoning is incorrect.

Q 41. A nucleus of mass number 189 splits into two nuclei having mass number 125 and 64.

The ratio of radius of two daughter nuclei respectively is

Option A 1 : 1

Option B 4 : 5

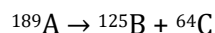
Option C 5 : 4

Option D 25 : 16

Correct Option C

Solution:

Given that,

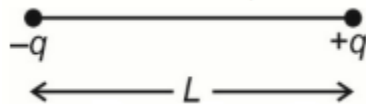


As we know, the relation between radius of nuclei and its mass number A is given as

$$R = R_0 A^{1/3}$$

$$\frac{R_1}{R_2} = \left(\frac{125}{64} \right)^{1/3} = \frac{5}{4} = 5 : 4$$

Q 42. Two point charges $-q$ and $+q$ are placed at a distance of L , as shown in the figure.



The magnitude of electric field intensity at a distance R ($R \gg L$) varies as:

Option A $\frac{1}{R^2}$

Option B $\frac{1}{R^3}$

Option C $\frac{1}{R^4}$

Option D $\frac{1}{R^6}$

Correct Option B

Solution:

Now, for the given case we know that, $R \gg L$,

Thus, given arrangement is an electric dipole

$$E = \frac{2p}{4\pi\epsilon_0 R^3} \dots (\because p = qL)$$

$$\text{i.e., } E \propto \frac{1}{R^3}$$

Q 43. Match List-I with List-II

	List-I		List-II
(a)	Gravitational constant (G)	(i)	$[L^2T^{-2}]$
(b)	Gravitational potential energy	(ii)	$[M^{-1}L^3T^{-2}]$
(c)	Gravitational potential	(iii)	$[LT^{-2}]$
(d)	Gravitational intensity	(iv)	$[ML^2T^{-2}]$

Choose the correct answer from the options given below

Option A (a) - (ii), (b) - (i), (c) - (iv), (d) - (iii)

Option B (a) - (ii), (b) - (iv), (c) - (i), (d) - (iii)

Option C (a) - (ii), (b) - (iv), (c) - (iii), (d) - (i)

Option D (a) - (iv), (b) - (ii), (c) - (i), (d) - (iii)

Correct Option B

Solution:

$$(a) [G] = \frac{Fr^2}{m_1m_2}$$

$$[G] = \frac{Fr^2}{m_1m_2} = \frac{[MLT^{-2}]L^2}{[MM]} = [M^{-1}L^3T^{-2}]$$

$$(b) \text{ Gravitational potential energy} = [ML^2T^{-2}]$$

$$(c) \text{ Gravitational potential} = \frac{PE}{m} = [L^2T^{-2}]$$

$$(d) \text{ Gravitational field intensity} = \frac{F}{m} = [LT^{-2}]$$

Q 44. Two transparent media A and B are separated by a plane boundary. The speed of light in those media are 1.5×10^8 m/s and 2.0×10^8 m/s, respectively. The critical angle for a ray of light for these two media is

Option A $\sin^{-1}(0.500)$

Option B $\sin^{-1}(0.750)$

Option C $\tan^{-1}(0.500)$

Option D $\tan^{-1}(0.750)$

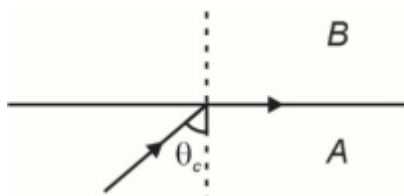
Correct Option B

Solution:

Given that,

Speed of light in A, $v_A = 1.5 \times 10^8$ m/s

Speed of light in B, $v_B = 2 \times 10^8$ m/s



$$\mu_A = \frac{3 \times 10^8}{1.5 \times 10^8} = 2$$

$$\mu_B = \frac{3 \times 10^8}{2 \times 10^8} = 1.5$$

Now,

As we know for total internal reflection, ray of light should travel from denser to rarer medium

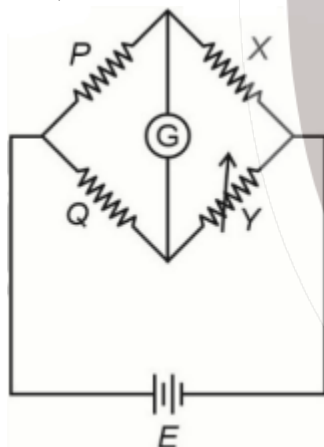
$$\mu_A \sin \theta_c = \mu_B \sin 90^\circ$$

$$2 \sin \theta_c = 1.5 \sin 90^\circ$$

$$\sin \theta_c = 0.75$$

$$\theta_c = \sin^{-1}(0.75)$$

Q 45. A Wheatstone bridge is used to determine the value of unknown resistance X by adjusting the variable resistance Y as shown in the figure. For the most precise measurement of X, the resistances P and Q



- Option A Should be approximately equal to $2X$
- Option B Should be approximately equal and are small
- Option C Should be very large and unequal
- Option D Do not play any significant role

Correct Option B

Solution:

We all know that a Wheatstone bridge is most precise when it is most sensitive.

This can be accomplished by making the ratio arms equal.

$$\text{i.e., } \frac{Q}{Y} = \frac{P}{X}$$

Q 46. Two pendulums of length 121 cm and 100 cm start vibrating in phase. At some instant, the two are at their mean position in the same phase. The minimum number of vibrations of the shorter pendulum after which the two are again in phase at the mean position is:

- Option A 11
- Option B 9

Option C 10

Option D 8

Correct Option A

Solution:

Given that,

Length of 1st pendulum, $l_1 = 121 \text{ cm} = 1.21 \text{ m}$

Length of 2nd pendulum, $l_2 = 100 \text{ cm} = 1.00 \text{ m}$

Now,

The equation for time period of a simple pendulum is

$$T = 2\pi \sqrt{\frac{L}{g}}$$

$$\text{i.e., } T \propto \sqrt{L}$$

$$\frac{T_1}{T_2} = \sqrt{\frac{L_1}{L_2}} = \sqrt{\frac{1.21}{1}}$$

$$\therefore \frac{T_1}{T_2} = 1.1 = \frac{11}{10}$$

As a result, we can conclude that after the 11th oscillation of the shorter pendulum, it will be in phase with the longer pendulum.

Q 47. From Ampere's circuital law for a long straight wire of circular cross-section carrying a steady current, the variation of magnetic field in the inside and outside region of the wire is

Option A Uniform and remains constant for both the regions.

Option B A linearly increasing function of distance upto the boundary of the wire and then linearly decreasing for the outside region.

Option C A linearly increasing function of distance r upto the boundary of the wire and then decreasing one with $\frac{1}{r}$ dependence for the outside region.

Option D A linearly decreasing function of distance upto the boundary of the wire and then a linearly increasing one for the outside region.

Correct Option C

Solution:

According to Ampere's law for a solid wire, the magnetic field intensity at some point inside

$$B = \frac{\mu_0 l r^2}{R^2 \times 2\pi r}$$

$$= \frac{\mu_0 l r}{R^2 \times 2\pi}$$

$$B \propto r$$

Whereas, magnetic field intensity at some point outside

$$B = \frac{\mu_0 l}{2\pi r}$$

$$B \propto \frac{1}{r}$$

Q 48. The area of a rectangular field (in m^2) of length 55.3 m and breadth 25 m after rounding off the value for correct significant digits is

Option A 138×10^1

Option B 1382

Option C 1382.5

Option D 14×10^2

Correct Option D**Solution:**

As we know,

Area of rectangle = Length \times Breadth

$$= 55.3 \times 25 \text{ m}^2$$

$$= 1382.5 \text{ m}^2$$

$$\approx 14 \times 10^2 \text{ m}^2$$

Q 49. A big circular coil of 1000 turns and average radius 10 m is rotating about its horizontal diameter at 2 rad s^{-1} . If the vertical component of earth's magnetic field at that place is $2 \times 10^{-5} \text{ T}$ and electrical resistance of the coil is 12.56Ω , then the maximum induced current in the coil will be

Option A 0.25 A

Option B 1.5 A

Option C 1 A

Option D 2 A

Correct Option C**Solution:**

Given that,

Number of turns, $N = 1000$

Radius, $r = 10 \text{ m}$

Area, $A = \pi r^2 = \pi \times (10)^2$

Earth's magnetic field strength, $B = 2 \times 10^{-5} \text{ T}$

Resistance, $R = 12.56 \Omega$

Now,

$$\phi_B = NBA \cos \omega t$$

$$\varepsilon = \frac{-d\phi_B}{dt} = -NBA\omega(-\sin \omega t)$$

$$\varepsilon = NBA\omega \sin \omega t$$

$$i_{\max} = \frac{\varepsilon_{\max}}{R} = \frac{NBA\omega}{R}$$

$$= \frac{1000 \times 2 \times 10^{-5} \times \pi (10)^2 \times 2}{12.56}$$

$$= 1 \text{ A}$$

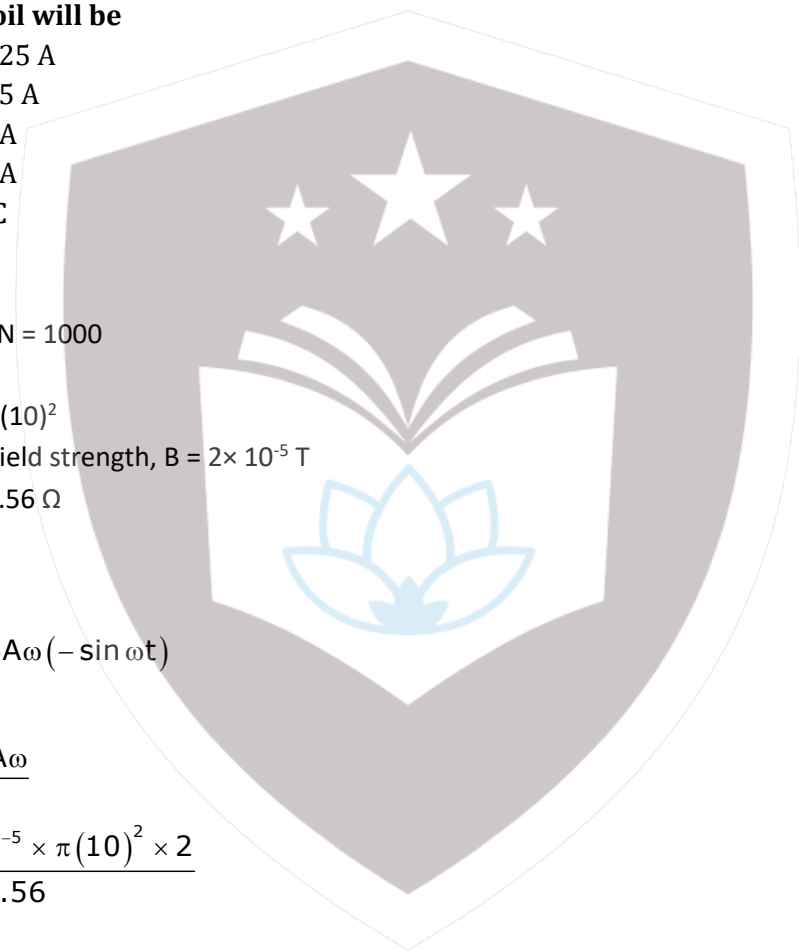
Q 50. A series LCR circuit with inductance 10 H , capacitance $10 \mu\text{F}$, resistance 50Ω is connected to an ac source of voltage, $V = 200\sin(100t)$ volt. If the resonant frequency of the LCR circuit is ν_0 and the frequency of the ac source is ν , then

Option A $\nu_0 = \nu = 50 \text{ Hz}$

Option B $\nu_0 = \nu = \frac{50}{\pi} \text{ Hz}$

Option C $\nu_0 = \frac{50}{\pi} \text{ Hz}, \nu = 50 \text{ Hz}$

Option D $\nu = 100 \text{ Hz}; \nu_0 = \frac{100}{\pi} \text{ Hz}$



Correct Option B

Solution:

Given that,

Inductance, $L = 10 \text{ H}$

Capacitance, $C = 10 \mu\text{F}$

Resistance, $R = 50 \Omega$

Peak voltage, $V = 200 \text{ V}$

Frequency of A.C source, $v = \frac{\omega}{2\pi} = \frac{100}{2\pi} = \frac{50}{\pi}$

As we know, at the resonating frequency

$$\omega L = \frac{1}{\omega C}$$

$$\omega = \frac{1}{\sqrt{LC}} = \frac{1}{\sqrt{10 \times 10 \times 10^{-6}}}$$

$$\omega = 100 \text{ rad/sec}$$

$$\omega = 2\pi f \Rightarrow f = \frac{\omega}{2\pi}$$

Now, the frequency of resonance for given LCR circuit is

$$v_0 = f_0 = \frac{100}{2\pi} = \frac{50}{\pi} \text{ Hz}, \omega = 100 \text{ rad/sec}$$

CHEMISTRY

Section A

Q 51. The incorrect statement regarding enzymes is:

- Option A Enzymes are biocatalysts.
- Option B Like chemical catalysts enzymes reduce the activation energy of bio processes.
- Option C Enzymes are polysaccharides.
- Option D Enzymes are very specific for a particular reaction and substrate.

Correct Option C

Solution:

Enzymes are complex nitrogenous organic compounds. They are produced by living plants and animals. They are protein molecules of high molecular mass and are not polysaccharides.

Q 52. The IUPAC name of the complex - $[\text{Ag}(\text{H}_2\text{O})_2][\text{Ag}(\text{CN})_2]$ is :

- Option A dicyanosilver (II) diaquaargentate(II)
- Option B diaquasilver (II) dicyanidoargentate(II)
- Option C dicyanosilver(I) diaquaargentate(I)
- Option D diaquasilver(I) dicyanidoargentate(I)

Correct Option D

Solution: The IUPAC name of $[\text{Ag}(\text{H}_2\text{O})_2][\text{Ag}(\text{CN})_2]$ is diaquasilver(I)dicyanidoargentate(I)

Q 53. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).

Assertion (A): In a particular point defect, an ionic solid is electrically neutral, even if few of its cations are missing from its unit cells.

Reason (R): In an ionic solid, Frenkel defect arises due to dislocation of cation from its lattice site to interstitial site, maintaining overall electrical neutrality.

In the light of the above statements, choose the most appropriate answer from the options given below:

- Option A Both (A) and (R) are correct and (R) is the correct explanation of (A)
Option B Both (A) and (R) are correct but (R) is not the correct explanation of (A)
Option C (A) is correct but (R) is not correct
Option D (A) is not correct but (R) is correct

Correct Option B

Solution:

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

Assertion statement is the classic explanation of Schottky defect wherein cation and anion leaves their site, or impurity defect.

Reason statement is true but not correct explanation for assertion as it is defining Frenkel defect wherein ion does not leave crystal.

Q 54. Gadolinium has a low value of third ionisation enthalpy because of

- Option A small size
Option B high exchange enthalpy
Option C high electronegativity
Option D high basic character

Correct Option B

Solution:

Gadolinium has a low value of third ionisation enthalpy because of high exchange enthalpy.

Electronic configuration of Gadolinium (Gd) = $[\text{Xe}] 4f^7 5d^1 6s^2$

For 3rd ionisation enthalpy, electron will be removed from 5d.

So the resultant configuration will be $[\text{Xe}]4f^7$ that is stable electronic configuration as it will have high exchange energy.

Therefore, less energy will be required to remove 3rd electron.

Q 55. Which statement regarding polymers is not correct?

- Option A Elastomers have polymer chains held together by weak intermolecular forces.
Option B Fibers possess high tensile strength.
Option C Thermoplastic polymers are capable of repeatedly softening and hardening on heating and cooling respectively.
Option D Thermosetting polymers are reusable.

Correct Option D

Solution:

Thermoplastic polymers are the linear or slightly long chain molecules capable of repeatedly softening and hardening on cooling and can be reused.

Thermosetting polymers are cross-linked or heavily branched molecules, which on heating undergo extensive cross-linking in moulds and again become infusible.

The thermosetting polymer, often called a thermoset, is obtained by irreversibly hardening a soft solid or viscous liquid prepolymer. These cannot be reused.

Elastomers have polymer chains held together by weak intermolecular forces and high elasticity.

Fibres have high tensile strength.

Q 56. Which one is not correct mathematical equation for Dalton's Law of partial pressure?

Here p = total pressure of gaseous mixture

Option A $p = p_1 + p_2 + p_3$

Option B $p = n_1 \frac{RT}{V} + n_2 \frac{RT}{V} + n_3 \frac{RT}{V}$

Option C $p_i = x_i p$, where p_i = partial pressure of i^{th} gas
 x_i = mole fraction of i^{th} gas in gaseous mixture

Option D $p_i = x_i p_i^{\circ}$, where x_i = mole fraction of i^{th} gas in gaseous mixture
 p_i° = pressure of i^{th} gas in pure state

Correct Option D

Solution:

$$p_i = x_i p_i^{\circ}$$

where

p_i = partial pressure of i^{th} gas

x_i = mole fraction of i^{th} gas in gaseous mixture

x_i = mole fraction of i^{th} gas in gaseous mixture

p_i° = pressure of i^{th} gas in pure state

According to Dalton's law of partial pressure, the total pressure by the mixture of non-reactive gases is equal to the sum of the partial pressures of individual gases.

$$p_{\text{Total}} = p_1 + p_2 + p_3$$

Also, $p_i = x_i p$; where p_i and x_i are the partial pressure and mole fraction of i^{th} gas respectively and p is the total pressure.

$$\begin{aligned} p_{\text{Total}} &= p_1 + p_2 + p_3 \\ &= n_1 \frac{RT}{V} + n_2 \frac{RT}{V} + n_3 \frac{RT}{V} \\ &= (n_1 + n_2 + n_3) \frac{RT}{V} \end{aligned}$$

Q 57. What mass of 95% pure CaCO_3 will be required to neutralise 50 mL of 0.5 M HCl solution according to the following reaction?



[Calculate up to second place of decimal point]

Option A 1.25 g

Option B 1.32 g

Option C 3.65 g

Option D 9.50 g

Correct Option B

Solution:

Consider mass of CaCO_3 required as 'm' gram.

$$\text{Pure CaCO}_3 \text{ in m gram} = \frac{95}{100} \times m$$

$$\text{Mole of CaCO}_3 = \frac{95}{100} \times \frac{m}{100}$$

$$\text{Moles of HCl required} = 2 \times \text{moles of CaCO}_3 = 2 \times \frac{95}{100} \times \frac{m}{100}$$

$$2 \times \frac{95}{100} \times \frac{m}{100} = \frac{50}{1000} \times 0.5$$

$$m = 1.315\text{g} \approx 1.32\text{g}$$

Q 58. The IUPAC name of an element with atomic number 119 is

- Option A ununennium
- Option B unnilennium
- Option C unununnium
- Option D ununoctium

Correct Option A

Solution: IUPAC name of element with atomic number 119 is ununennium.

Q 59. Given below are two statements:

Statement I:

In the coagulation of a negative sol, the flocculating power of the three given ions is in the order - $\text{Al}^{3+} > \text{Ba}^{2+} > \text{Na}^+$

Statement II:

In the coagulation of a positive sol, the flocculating power of the three given salts is in the order - $\text{NaCl} > \text{Na}_2\text{SO}_4 > \text{Na}_3\text{PO}_4$

In the light of the above statements, choose the most appropriate answer from the options given below:

- Option A Both Statement I and Statement II are correct.
- Option B Both Statement I and Statement II are incorrect
- Option C Statement I is correct but Statement II is incorrect.
- Option D Statement I is incorrect but Statement II is correct

Correct Option C

Solution:

Statement I is correct but Statement II is incorrect.

According to hardy Schulze rule we know that,

In negatively charged colloid, the flocculating power of cation increases with increase in charge on the cation of electrolyte.

Therefore, the order is $\text{Al}^{3+} > \text{Ba}^{2+} > \text{Na}^+$

In positively charged colloids, the flocculating power of anion increases with increases in charge on anion of electrolyte in case of positively charge colloids.

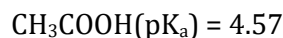
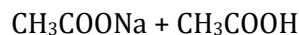
Therefore, order is $\text{NaCl} < \text{Na}_2\text{SO}_4 < \text{Na}_3\text{PO}_4$

Q 60. The pH of the solution containing 50 mL each of 0.10 M sodium acetate and 0.01 M acetic acid is [Given pK_a of $CH_3COOH = 4.57$]

- Option A 5.57
 Option B 3.57
 Option C 4.57
 Option D 2.57

Correct Option A

Solution:



Since, it is a mixture of weak acid and salt of its conjugate base, so it is acidic buffer.

$$\begin{aligned} pH &= pK_a + \log \frac{[\text{Salt}]}{[\text{Acid}]} \\ &= 4.57 + \log \left(\frac{0.1}{0.01} \right) \\ &= 4.57 + 1 \\ &= 5.57 \end{aligned}$$

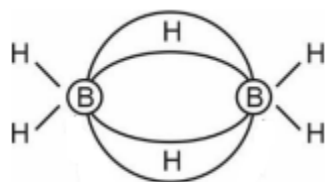
Q 61. Which of the following statement is not correct about diborane?

- Option A There are two 3-centre-2-electron bonds.
 Option B The four terminal B-H bonds are two centre two electron bonds.
 Option C The four terminal Hydrogen atoms and the two Boron atoms lie in one plane.
 Option D Both the Boron atoms are sp^2 hybridised.

Correct Option D

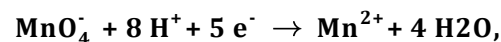
Solution:

Each boron atom in diborane molecule uses sp^3 hybrid orbitals for bonding.

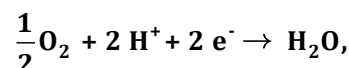


sp^3 hybridised boron

Q 62. Given below are half cell reactions:



$$E_{Mn^{2+}/MnO_4^-}^{\circ} = -1.510 \text{ V}$$



$$E_{O_2/H_2O}^{\circ} = +1.223 \text{ V}$$

Will the permanganate ion MnO_4^- liberate O_2 from water in the presence of an acid?

Option A Yes, because $E_{\text{cell}}^{\circ} = + 0.287 \text{ V}$

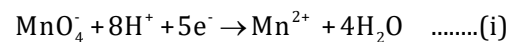
Option B No, because $E_{\text{cell}}^{\circ} = - 0.287 \text{ V}$

Option C Yes, because $E_{\text{cell}}^{\circ} = + 2.733 \text{ V}$

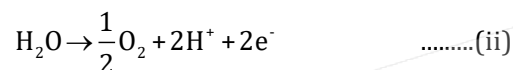
Option D No, because $E_{\text{cell}}^{\circ} = -2.733 \text{ V}$

Correct Option A

Solution:

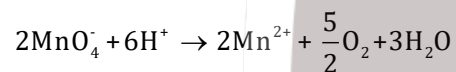


$$E_{\text{MnO}_4^-/\text{Mn}^{2+}}^{\circ} = -E_{\text{Mn}^{2+}/\text{MnO}_4^-}^{\circ} = 1.51 \text{ V}$$



$$E_{\text{O}_2/\text{H}_2\text{O}}^{\circ} = 1.223 \text{ V}$$

Using $2 \times \text{(i)} + 5 \times \text{(ii)}$, net cell reactions is



$$\begin{aligned} E_{\text{cell}}^{\circ} &= E_{\text{C}}^{\circ} - E_{\text{A}}^{\circ} = E_{\text{MnO}_4^-/\text{Mn}^{2+}}^{\circ} - E_{\text{O}_2/\text{H}_2\text{O}}^{\circ} \\ &= 1.51 - 1.223 \\ &= 0.287 \text{ V} \end{aligned}$$

As cell $E_{\text{cell}}^{\circ} > 0$, the net cell reaction is spontaneous and therefore, MnO_4^- liberate O_2 from H_2O in presence of an acid.

Q 63. Given below are two statements:

Statement I:

The acidic strength of monosubstituted nitrophenol is higher than phenol because of electron withdrawing nitro group.

Statement II:

***o*-nitrophenol, *m*-nitrophenol and *p*-nitrophenol will have same acidic strength as they have one nitro group attached to the phenolic ring.**

In the light of the above statements, choose the most appropriate answer from the options given below:

Option A Both Statement I and Statement II are correct

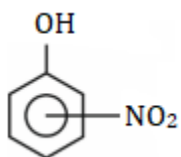
Option B Both Statement I and Statement II are incorrect.

Option C Statement I is correct but Statement II is incorrect.

Option D Statement I is incorrect but Statement II is correct.

Correct Option C

Solution:



Nitro group has electron withdrawing property as it can withdraw electrons both by $-I$ effect and $-R$ effect.

Hence, the acidic strength of monosubstituted nitrophenol is higher than phenol.

Nitro group present at o- and p-positions will have strong -R effect while nitro group present at m-position will influence only -I effect hence acidity of ortho and para isomers will be more meta isomer.

The acidic nature of nitrophenols increases in the order: meta < ortho < para.

Q 64. Given below are two statements:

Statement I:

Primary aliphatic amines react with HNO₂ to give unstable diazonium salts.

Statement II:

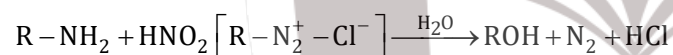
Primary aromatic amines react with HNO₂ to form diazonium salts which are stable even above 300 K.

In the light of the above statements, choose the most appropriate answer from the options given below:

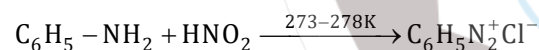
- Option A Both Statement I and Statement II are correct
Option B Both Statement I and Statement II are incorrect.
Option C Statement I is correct but Statement II is incorrect
Option D Statement I is incorrect but Statement II is correct

Correct Option C

Solution: Primary aliphatic amines react with HNO₂ and give unstable diazonium salt which turns into alcohol.



Primary aromatic amines reacts with HNO₂ and yields stable diazonium salt which are stable at 273 to 278 K due to resonance stabilisation of aromatic ring, but at higher temperature, they are unstable.



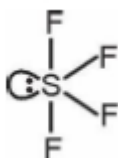
Q 65. Amongst the following which one will have maximum 'lone pair - lone pair' electron repulsions?

- Option A ClF₃
Option B IF₅
Option C SF₄
Option D XeF₂

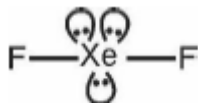
Correct Option D

Solution:

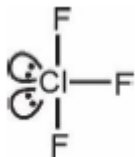
SF₄ → sp³d + 1 lone pair



XeF₂ → sp³d + 3 lone pair



$\text{ClF}_3 \rightarrow \text{sp}^3\text{d} + 2 \text{ lone pair}$



$\text{IF}_5 \rightarrow \text{sp}^3\text{d}^2 + 1 \text{ lone pair}$



As, XeF_2 consists of maximum lone pairs, it has maximum 'lone pair-lone pair' electron repulsions.

Q 66. The incorrect statement regarding chirality is:

- Option A $\text{S}_{\text{N}}1$ reaction yields 1 : 1 mixture of both enantiomers.
Option B The product obtained by $\text{S}_{\text{N}}2$ reaction of haloalkane having chirality at the reactive site shows inversion of configuration.
Option C Enantiomers are superimposable mirror images on each other.
Option D A racemic mixture shows zero optical rotation.

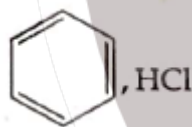
Correct Option C

Solution: The stereoisomers which are non-superimposable mirror image of each other are called enantiomers.

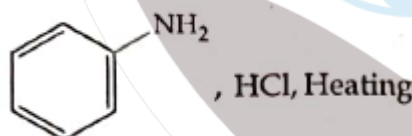
Q 67. Which of the following is suitable to synthesize chlorobenzene?

- Option A Benzene, Cl_2 , anhydrous FeCl_3
Option B Phenol, NaNO_2 , HCl , CuCl

Option C

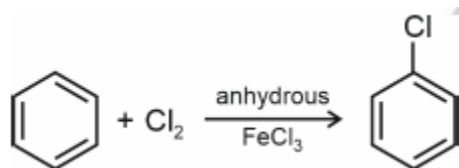


Option D



Correct Option A

Solution:



Benzene reacts with chlorine in presence of anhydrous FeCl_3 to yield chlorobenzene.

Q 68. Match List - I with List - II.

- | List - I
(Drug class) | List - II
(Drug molecule) |
|--------------------------|------------------------------|
| (a) Antacids | (i) Salvarsan |
| (b) Antihistamines | (ii) Morphine |
| (c) Analgesics | (iii) Cimetidine |
| (d) Antimicrobials | (iv) Seldane |

Choose the correct answer from the options given below :

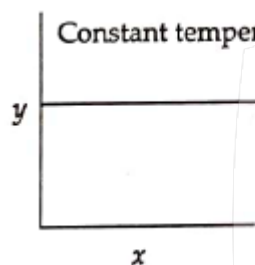
- Option A (a) – (iii), (b) – (ii), (c) – (iv), (d) – (i)
Option B (a) – (iii), (b) – (iv), (c) – (ii), (d) – (i)
Option C (a) – (i), (b) – (iv), (c) – (ii), (d) – (iii)
Option D (a) – (iv), (b) – (iii), (c) – (i), (d) – (ii)

Correct Option B

Solution:

- (a) – (iii) Cimetidine is an antacid,
(b) – (iv) Seldane is an antihistamine
(c) – (ii) Morphine is an analgesic
(d) – (i) Salvarsan is an antimicrobial drug

Q 69. The given graph is a representation of kinetics of a reaction.



The y and x axes for zero and first order reactions, respectively are

- Option A zero order ($y = \text{concentration}$ and $x = \text{time}$), first order ($y = t_{1/2}$ and $x = \text{concentration}$)
Option B zero order ($y = \text{concentration}$ and $x = \text{time}$), first order ($y = \text{rate constant}$ and $x = \text{concentration}$)
Option C zero order ($y = \text{rate}$ and $x = \text{concentration}$), first order ($y = t_{1/2}$ and $x = \text{concentration}$)
Option D zero order ($y = \text{rate}$ and $x = \text{concentration}$), first order ($y = \text{rate}$ and $x = t_{1/2}$)

Correct Option C

Solution:

- For zero order reaction, rate is independent of concentration of reactants.

$$r = k[A]^0$$

$$r = k \text{ (constant)}$$

Therefore, 'y' as 'rate' and 'x' as concentration will give desired graph.

- For first order reaction, $t_{1/2}$ is dependent only on K, hence no change with respect to concentration.

$$t_{1/2} = \frac{0.693}{k} \quad (\text{k is constant})$$

Therefore, 'y' as ' $t_{1/2}$ ' and 'x' as concentration will give desired graph.

Q 70. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).

Assertion (A): ICl is more reactive than I_2 .

Reason (R): I-Cl bond is weaker than I-I bond.

In the light of the above statements, choose the most appropriate answer from the options given below:

- Option A Both (A) and (R) are correct and (R) is the correct explanation of (A).
 Option B Both (A) and (R) are correct but (R) is not the correct explanation of (A).
 Option C (A) is correct but (R) is not correct.
 Option D (A) is not correct but (R) is correct

Correct Option A

Solution: Interhalogen compounds are more reactive than halogens (except fluorine). This is because X - X' bond in interhalogens is weaker than X - X bond in halogens except F - F bond. Hence, I - Cl is more reactive than I₂ because of weaker I - Cl bond than I - I bond.

Q 71. Choose the correct statement :

- Option A Diamond and graphite have two dimensional network.
 Option B Diamond is covalent and graphite is ionic.
 Option C Diamond is sp^3 hybridised and graphite is sp^2 hybridized.
 Option D Both diamond and graphite are used as dry lubricants.

Correct Option C

Solution:

Diamond:

(sp^3 hybridised C atoms, Covalent, 3-D structure, Cannot be used as dry lubricant)

Graphite:

(sp^2 hybridised C atoms, Covalent, Planar structure, Used as dry lubricant)

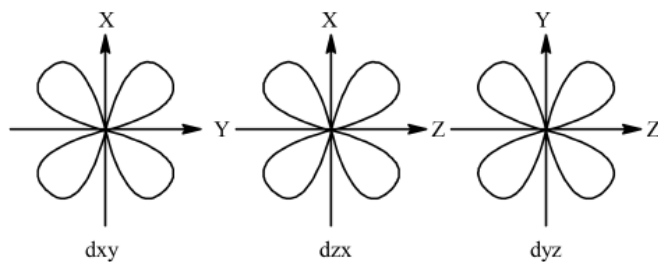
Q 72. Identify the incorrect statement from the following.

- Option A All the five 5d orbitals are different in size when compared to the respective 4d orbitals.
 Option B All the five 4d orbitals have shapes similar to the respective 3d orbitals.
 Option C In an atom, all the five 3d orbitals are equal in energy in free state.
 Option D The shapes of d_{xy} , d_{yz} , and d_{zx} orbitals are similar to each other; and $d_{x^2-y^2}$ and d_{z^2} are similar to each other.

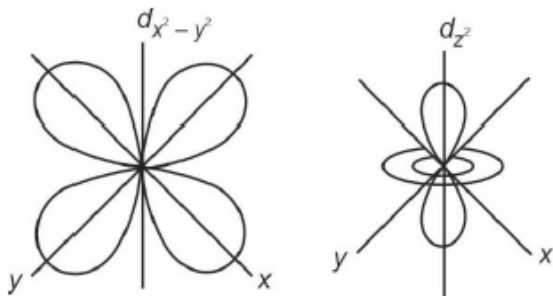
Correct Option D

Solution:

In an atom, the shapes of 3d orbital are same as respective 4d and 5d orbitals, only the size of the orbital changes, when the respective shell number increases. All the d orbitals are degenerate (equal in energy) in free state.



The shape of $d_{x^2-y^2}$ is different than shape of d_{z^2} .



The size of orbital depends on principal quantum number 'n', hence all the five 3d orbitals are different in size when compared to the respective 4d orbitals.

Shape of orbitals depends on azimuthal quantum number 'l', hence shapes of 4d orbitals are similar to the respective 3d orbitals.

Q 73. Identify the incorrect statement from the following

- Option A Alkali metals react with water to form their hydroxides.
- Option B The oxidation number of K in KO_2 is + 4.
- Option C Ionisation enthalpy of alkali metals decreases from top to bottom in the group.
- Option D Lithium is the strongest reducing agent among the alkali metals.

Correct Option B

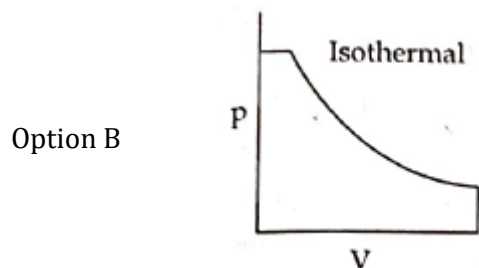
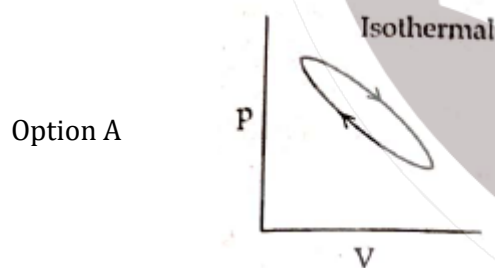
Solution:

Alkali metals like potassium show only '+1' oxidation state in all of their compounds.

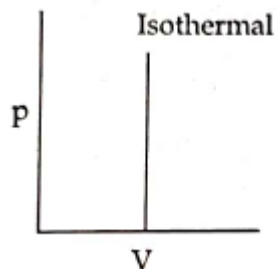
KO_2 is a super-oxide in which O_2^- is anion and K^+ is cation.

The oxidation state of K is +1 in KO_2 .

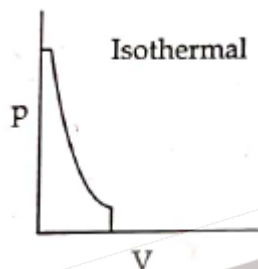
Q 74. Which of the following p-V curve represents maximum work done?



Option C



Option D

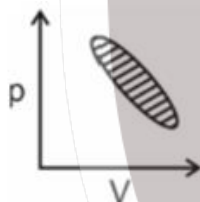


Correct Option B

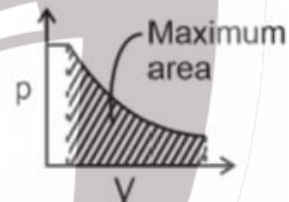
Solution:

Work done under any thermodynamic process can be determined by area under the 'p-V' graph. From the given graphs, the maximum area is covered in option 'B'.

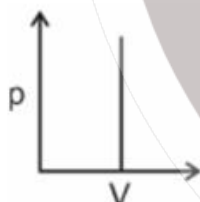
Option A



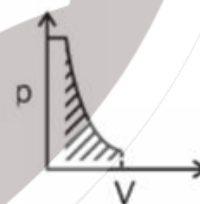
Option B



Option B

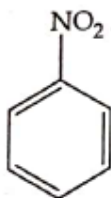


Option D

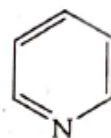


Q 75. The Kjeldahl's method for the estimation of nitrogen can be used to estimate the amount of nitrogen in which one of the following compounds?

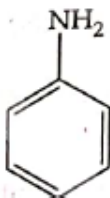
Option A



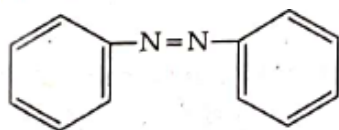
Option B



Option C



Option D



Correct Option C

Solution: Kjeldahl method cannot be used for the nitrogen content determination of compounds having nitro group, azo groups and nitrogen present in the ring (e.g., pyridine) as nitrogen of these compounds does not change to ammonium sulphate under these conditions.

Hence, nitrogen content of aniline can be determined by Kjeldahl's method.

Q 76. Match List - I with List - II.

List - I (Hydrides)

(a) MgH_2

(b) GeH_4

(c) B_2H_6

(d) HF

List - II (Nature)

(i) Electron precise

(ii) Electron deficient

(iii) Electron rich

(iv) Ionic

Choose the correct answer from the options given below:

Option A (a) - (iv), (b) - (i), (c) - (ii), (d) - (iii)

Option B (a) - (iii), (b) - (i), (c) - (ii), (d) - (iv)

Option C (a) - (i), (b) - (ii), (c) - (iv), (d) - (iii)

Option D (a) - (ii), (b) - (iii), (c) - (iv), (d) - (i)

Correct Option A

Solution:

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

List - I (Hydrides)

MgH_2

GeH_4

B_2H_6

HF

List - II (Nature)

Ionic

Electron precise

Electron deficient

Electron rich

- Ionic hydrides are compounds formed between hydrogen and the most active metals, especially with the alkali and alkaline-earth metals.
 - Covalent hydrides are formed when hydrogen reacts group 13 to group 17 elements.
 - All the group 13 elements form electron deficient compounds with hydrogen.
 - All group 14 elements form electron precise compounds.
 - Elements from groups 15 through 17 form bonds which have excess electrons present as lone pairs.
- Therefore,
- MgH_2 is an ionic compound.
 - GeH_4 has sufficient number of electrons required for forming covalent bonds, hence it is electron precise compound.
 - B_2H_6 is electron deficient compound due to incomplete octet.

- HF is electron rich compound due to pair of unpaired electrons on fluorine.

Q 77. Given below are two statements:

Statement I:

The boiling points of the following hydrides of group 16 elements increases in the order –
 $\text{H}_2\text{O} < \text{H}_2\text{S} < \text{H}_2\text{Se} < \text{H}_2\text{Te}$.

Statement II:

The boiling points of these hydrides increase with increase in molar mass.

In the light of the above statements, choose the most appropriate answer from the options given below:

- Option A Both Statement I and Statement II are correct
 Option B Both Statement I and Statement II are incorrect
 Option C Statement I is correct but Statement II is incorrect
 Option D Statement I is incorrect but Statement II is correct

Correct Option B

Solution:

Compound	Boiling point (K)
H_2O	373
H_2S	213
H_2Se	232
H_2Te	269

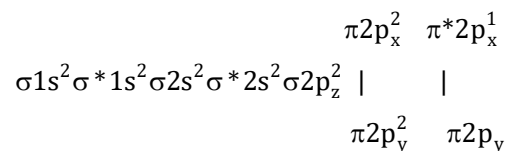
- The boiling points of these hybrids not exactly increases with increase in molar mass.
- H_2O has maximum boiling point due to intermolecular hydrogen bonding.
- Boiling point increases with molar mass of the compound, but it is also get affected by hydrogen bonding.
- By considering both the factors, the correct order of boiling points of 16th group hydrides is $\text{H}_2\text{S} < \text{H}_2\text{Se} < \text{H}_2\text{Te} < \text{H}_2\text{O}$

Q 78. Which amongst the following is incorrect statement?

- Option A The bond orders of O_2^+ , O_2 , O_2^- and O_2^{2-} are 2.5, 2, 1.5 and 1, respectively.
 Option B C_2 molecule has four electrons in its two degenerate it molecular orbitals.
 Option C H_2^+ ion has one electron.
 Option D O_2^+ ion is diamagnetic.

Correct Option D

Solution:



Due to one unpaired electron in $\pi^* 2p$ molecular orbital, O_2^+ is a paramagnetic ion and not diamagnetic.

Q 79. Match List - I with List - II.

List - I (Products formed)

- (a) Cyanohydrin
- (b) Acetal
- (c) Schiff's base
- (d) Oxime

List -II (Reaction of carbonyl compound with)

- (i) NH_2OH
- (ii) RNH_2
- (iii) alcohol
- (iv) HCN

Choose the correct answer from the options given below:

- Option A (a) - (iii), (b) - (iv), (c) - (ii), (d) - (i)
- Option B (a) - (ii), (b) - (iii), (c) - (iv), (d) - (i)
- Option C (a) - (i), (b) - (iii), (c) - (ii), (d) - (iv)
- Option D (a) - (iv), (b) - (iii), (c) - (ii), (d) - (i)

Correct Option D

Solution:

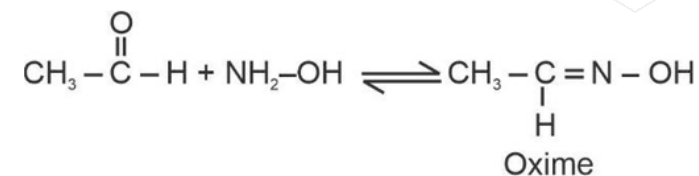
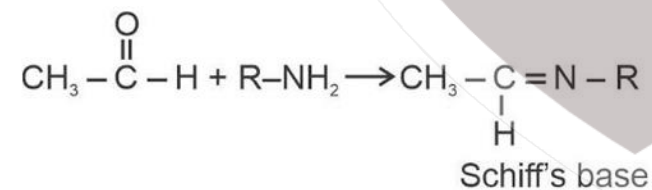
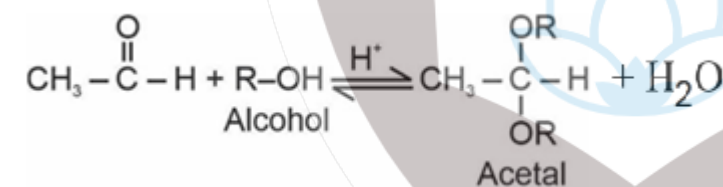
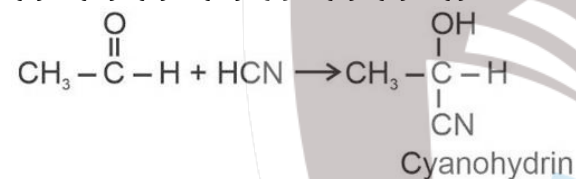
List - I (Products formed)

- Cyanohydrin
- Acetal
- Schiff's base
- Oxime

List -II (Reaction of carbonyl compound with)

- HCN
- Alcohol
- RNH_2
- NH_2OH

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

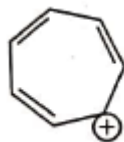


Q 80. Which compound amongst the following is not an aromatic compound?

Option A



Option B



Option C



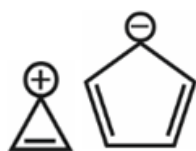
Option D



Correct Option D

Solution:

Planar, cyclic, conjugated species consisting of $(4n + 2)\pi$ electrons are aromatic in nature (where n is an integer).



and



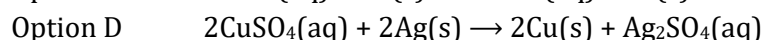
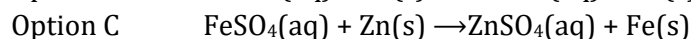
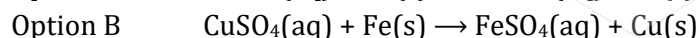
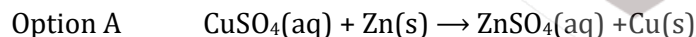
are aromatic.



is not an aromatic compound

Q 81. At 298K, the standard electrode potentials of $\text{Cu}^{2+} / \text{Cu}$, $\text{Zn}^{2+} / \text{Zn}$, $\text{Fe}^{2+} / \text{Fe}$ and Ag / Ag are 0.34 V, - 0.76 V, - 0.44 V and 0.80 V, respectively.

On the basis of standard electrode potential, predict which of the following reaction cannot occur?



Correct Option D

Solution: For a reaction to be spontaneous, E_{cell}° must be positive.

- For, $\text{CuSO}_4(\text{aq}) + \text{Zn}(\text{s}) \rightarrow \text{ZnSO}_4(\text{aq}) + \text{Cu}(\text{s})$

$$E_{\text{cell}}^{\circ} = 0.34 \text{ V} - (-0.76 \text{ V})$$

$$= 1.1 \text{ V}$$

- For, $\text{CuSO}_4(\text{aq}) + \text{Fe}(\text{s}) \rightarrow \text{FeSO}_4(\text{aq}) + \text{Cu}(\text{s})$

$$E_{\text{cell}}^{\circ} = 0.80 \text{ V} - (-0.44 \text{ V})$$

$$= 1.24 \text{ V}$$

- For, $\text{FeSO}_4(\text{aq}) + \text{Zn}(\text{s}) \rightarrow \text{ZnSO}_4(\text{aq}) + \text{Fe}(\text{s})$

$$\begin{aligned} E_{\text{cell}}^{\circ} &= E_{\text{cathode}}^{\circ} - E_{\text{anode}}^{\circ} \\ &= -0.44 \text{ V} - (-0.76 \text{ V}) \\ &= 0.32 \text{ V} \end{aligned}$$

- For, $2\text{CuSO}_4(\text{aq}) + 2\text{Ag}(\text{s}) \rightarrow 2\text{Cu}(\text{s}) + \text{Ag}_2\text{SO}_4(\text{aq})$

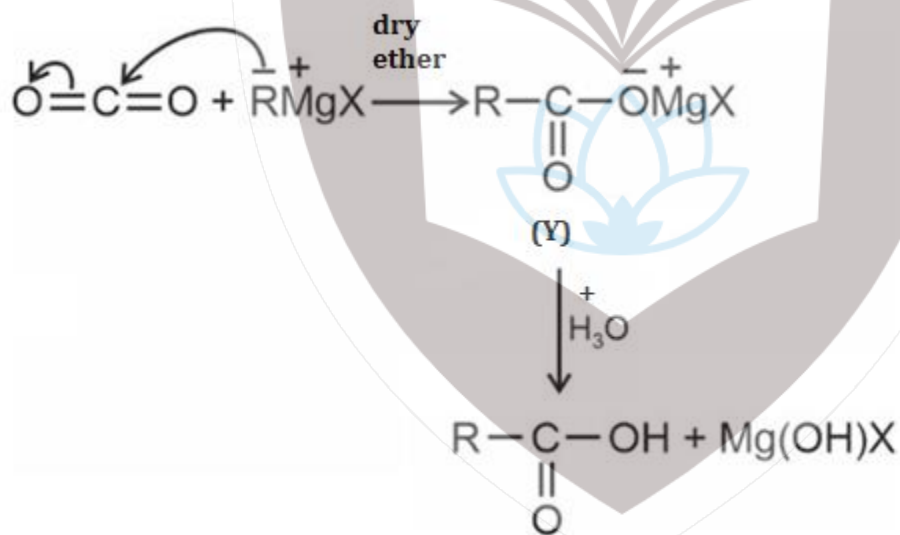
$$\begin{aligned} E_{\text{cell}}^{\circ} &= 0.34 \text{ V} - 0.80 \text{ V} \\ &= -0.46 \text{ V} \quad (E_{\text{cell}}^{\circ} \text{ is negative hence reaction cannot occur.}) \end{aligned}$$

Q 82. $\text{RMgX} + \text{CO}_2 \xrightarrow[\text{ether}]{\text{dry}} \text{Y} \xrightarrow{\text{H}_3\text{O}^+} \text{RCOOH}$ What is Y in the above reaction?

- Option A $\text{RCOO}\cdot\text{Mg}^+\text{X}$
 Option B $\text{R}_3\text{CO}\cdot\text{Mg}^+\text{X}$
 Option C $\text{RCOO}\cdot\text{X}^+$
 Option D $(\text{RCOO})_2\text{Mg}$

Correct Option A

Solution:



Thus, Y is $\text{RCOO}\cdot\text{Mg}^+\text{X}$.

Q 83. In one molal solution that contains 0.5 mole of a solute, there is

- Option A 500 mL of solvent
 Option B 500 g of solvent
 Option C 100 mL of solvent
 Option D 1000 g of solvent

Correct Option B

Solution: Molality is the moles of solute dissolved per kg of solvent.

As given 1 molal solution contains 0.5 moles of solute,

$$m = \frac{\text{Moles of solute}}{\text{Mass of solvent (in kg)}}$$

$$1 = \frac{0.5}{\text{Mass of solvent (in kg)}}$$

Therefore, mass of solvent = 0.5 kg = 500 g

Q 84. Match List - I with List - II.

List - I

- (a) Li
- (b) Na
- (c) KOH
- (d) Cs

List - II

- (i) absorbent for carbon dioxide
- (ii) electrochemical cells
- (iii) coolant in fast breeder reactors
- (iv) photoelectric cell

Choose the correct answer from the options given below:

Option A (a) - (iv), (b) - (i), (c) - (iii), (d) - (ii)

Option B (a) - (iii), (b) - (iv), (c) - (ii), (d) - (i)

Option C (a) - (i), (b) - (iii), (c) - (iv), (d) - (ii)

Option D (a) - (ii), (b) - (iii), (c) - (i), (d) - (iv)

Correct Option D

Solution:

- Lithium is used in many electrochemical cells.
- Liquid sodium metal is used as a coolant in fast breeder nuclear reactor.
- KOH used to adsorb CO_2 which changes into K_2CO_3 .
- Cs is used in photoelectric cell due to its low ionisation enthalpy.

Q 85. Given below are two statements

Statement I:

The boiling points of aldehydes and ketones are higher than hydrocarbons of comparable molecular masses because of weak molecular association in aldehydes and ketones due to dipole - dipole interactions.

Statement II:

The boiling points of aldehydes and ketones are lower than the alcohols of similar molecular masses due to the absence of H-bonding.

In the light of the above statements, choose the most appropriate answer from the options given below:

Option A Both Statement I and Statement II are correct.

Option B Both Statement I and Statement II are incorrect.

Option C Statement I is correct but Statement II is incorrect.

Option D Statement I is incorrect but Statement II is correct.

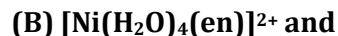
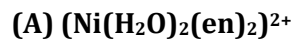
Correct Option A

Solution:

- The boiling points of aldehydes and ketones are higher than hydrocarbons of comparable molecular masses. It is due to weak molecular association in aldehydes and ketones arising out of the dipole - dipole interaction.
- The boiling point of aldehydes and ketones are lower than the alcohols of similar molecular masses because alcohols involves intermolecular hydrogen bonding.

Section B

Q 86. The order of energy absorbed which is responsible for the color of complexes



is

Option A (A) > (B) > (C)

Option B (C) > (B) > (A)

Option C (C) > (A) > (B)

Option D (B) > (A) > (C)

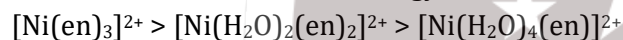
Correct Option C

Solution:

Stronger the field strength of ligand, higher will be the energy absorbed by the complex.

Ethylene diamine (en) is a strong field ligand than 'H₂O' according to spectrochemical series.

Hence, the correct order of energy absorbed is:



i.e. (C) > (A) > (B)

Q 87. Given below are two statements:

Statement I:

In Lucas test, primary, secondary and tertiary alcohols are distinguished on the basis of their reactivity with conc. HCl + ZnCl₂, known as Lucas Reagent.

Statement II :

Primary alcohols are most reactive and immediately produce turbidity at room temperature on reaction with Lucas Reagent.

In the light of the above statements, choose the most appropriate answer from the options given below:

Option A Both Statement I and Statement II are correct.

Option B Both Statement I and Statement H are incorrect

Option C Statement I is correct but Statement II is incorrect.

Option D Statement I is incorrect but Statement II is correct.

Correct Option C

Solution: Primary, secondary and tertiary alcohols can be differentiated by their reaction with Lucas reagent (anhyd. ZnCl₂ + conc. HCl).

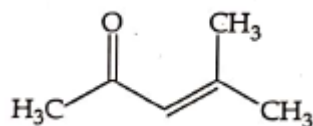
• 3^o alcohol $\xrightarrow{\text{Anhyd. ZnCl}_2 + \text{conc. HCl}}$ Turbidity appears immediately at room temperature

• 2^o alcohol $\xrightarrow{\text{Anhyd. ZnCl}_2 + \text{conc. HCl}}$ Turbidity appears after 5 minutes at room temperature

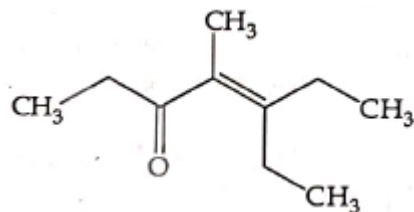
• 1^o alcohol $\xrightarrow{\text{Anhyd. ZnCl}_2 + \text{conc. HCl}}$ Do not gives turbidity at room temperature

Q 88. Which one of the following is not formed when acetone reacts with 2-pentanone in the presence of dilute NaOH followed by heating?

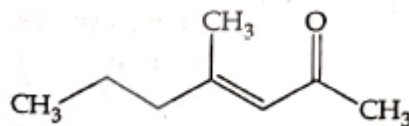
Option A



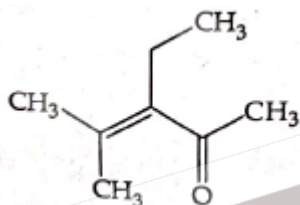
Option B



Option C



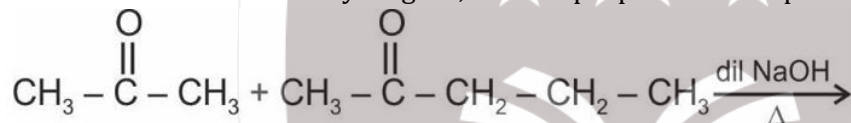
Option D



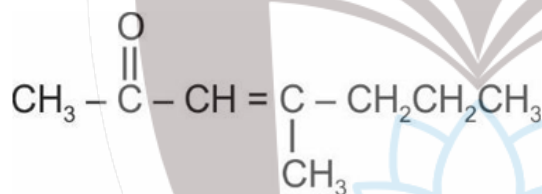
Correct Option B

Solution: Cross Aldol condensation reaction:

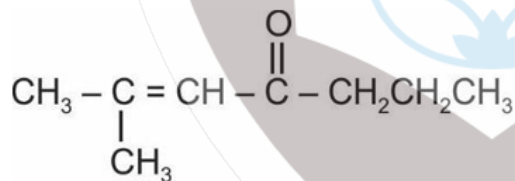
Both reactants contain α -Hydrogens, so multiple products are possible which are as follows:



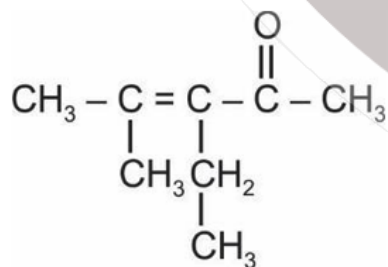
1.



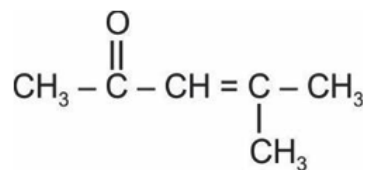
2.



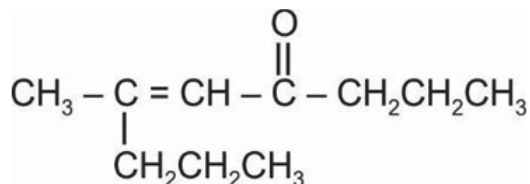
3.

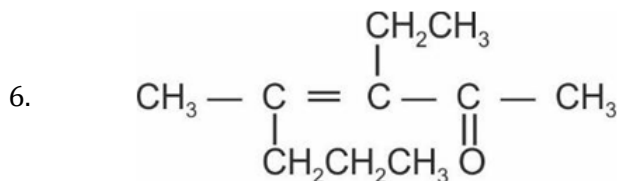


4.



5.





Hence, option (B) is not possible.

Q 89. A 10.0 L flask contains 64 g of oxygen at 27°C. (Assume O₂ gas is behaving ideally). The pressure inside the flask in bar is (Given R = 0.0831 L bar K⁻¹ mol⁻¹)

- Option A 2.5
 Option B 498.6
 Option C 49.8
 Option D 4.9

Correct Option D

Solution:

For ideal gas,

$$PV = nRT$$

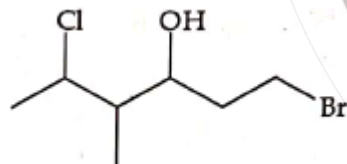
$$P = n \frac{RT}{V}$$

$$P = \frac{64}{32} \times \frac{0.0831 \times 300}{10}$$

$$P = 4.9 \text{ bar}$$

Therefore, pressure of O₂ gas inside the flask is 4.9 bar.

Q 90. The correct IUPAC name of the following compound is:



- Option A 1-bromo-5-chloro-4-methylhexan-3-ol
 Option B 6-bromo-2-chloro-4-methylhexan-4-ol
 Option C 1-bromo-4-methyl-5-chlorohexan-3-ol
 Option D 6-bromo-4-methyl-2-chlorohexan-4-ol

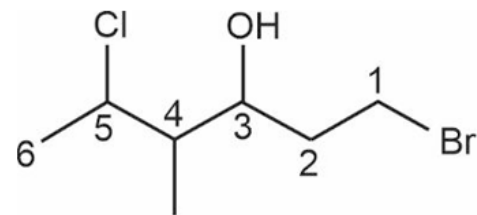
Correct Option A

Solution:

The root word in the given structure is hex and alcoholic group forms the suffix.

According to the least sum rule of the substituents the position of the substituents that is bromo, chloro and methyl groups should be 1, 5 and 4 respectively.

Also, the functional group with highest priority should be getting least possible number in position.



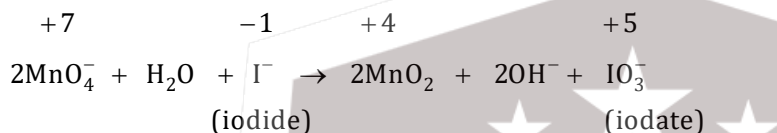
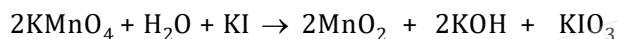
Q 91. In the neutral or faintly alkaline medium, KMnO_4 oxidises iodide into iodate. The change in oxidation state of manganese in this reaction is from

- Option A +7 to +4
 Option B +6 to +4
 Option C +7 to +3
 Option D +6 to +5

Correct Option A

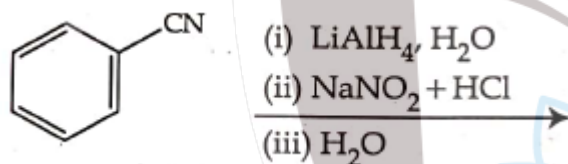
Solution:

In neutral or faintly alkaline solution.

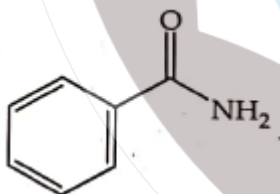


Oxidation state of Manganese (Mn) changes from +7 to +4.

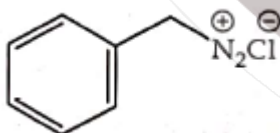
Q 92. The product formed from the following reaction sequence is



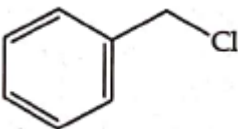
Option A



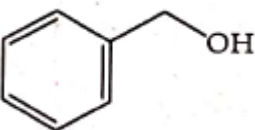
Option B



Option C

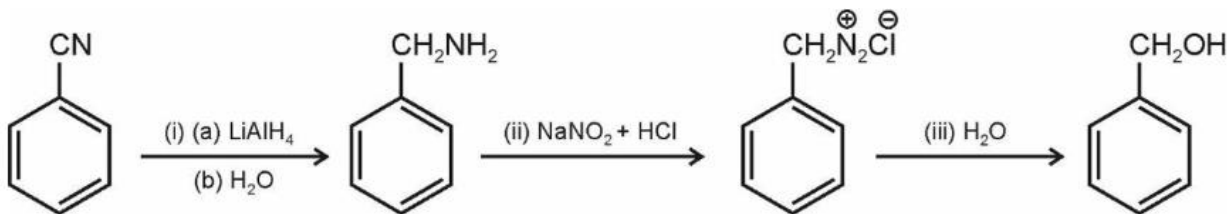


Option D



Correct Option D

Solution: In the presence of LiAlH_4 and H_2O , phenyl cyanide is converted into primary amine followed by conversion of this primary amine into alcohol in the presence of NaNO_2 , HCl and H_2O .



Q 93. The pollution due to oxides of sulphur gets enhanced due to the presence of:

- (a) particulate matter
- (b) ozone
- (c) hydrocarbons
- (d) hydrogen peroxide

Choose the most appropriate answer from the options given below:

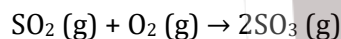
- Option A (a), (d) only
- Option B (a), (b), (d) only
- Option C (b), (c), (d) only
- Option D (a), (c), (d) only

Correct Option B

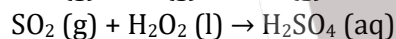
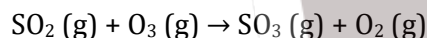
Solution:

Uncatalysed oxidation of sulphur dioxide is slow.

However, the presence of particulate matter in polluted air catalyzes the oxidation of SO_2 to SO_3 .



This reaction can also be promoted by O_3 and H_2O_2 , as,



Q 94. Compound X on reaction with O_3 followed by $\text{Zn}/\text{H}_2\text{O}$ gives formaldehyde and 2-methyl propanal as products. The compound X is:

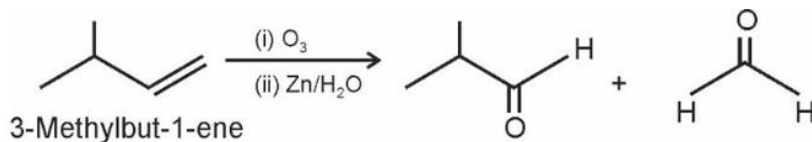
- Option A 3-Methylbut-1-ene
- Option B 2-Methylbut-1-ene
- Option C 2-Methylbut-2-ene
- Option D Pent-2-ene

Correct Option A

Solution:

Reductive ozonolysis of alkenes yields aldehydes and ketones.

3-Methylbut-1-ene on ozonolysis yields formaldehyde and 2-methyl propanal.



Q 95. Find the emf of the cell in which the following reaction takes place at 298 K
 $\text{Ni}(\text{s}) + 2\text{Ag}^+ (0.001 \text{ M}) \rightarrow \text{Ni}^{2+} (0.001 \text{ M}) + 2 \text{Ag}(\text{s})$

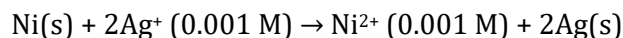
(Given that $E_{\text{cell}}^0 = 1.05 \text{ V}$, $\frac{2.303 RT}{F} = 0.059$ at 298 K)

(Please note that $E_{\text{cell}}^0 = 10.5 \text{ V}$ is modified to $E_{\text{cell}}^0 = 1.05 \text{ V}$ for accuracy point of view)

- Option A 1.0385 V
Option B 1.385 V
Option C 0.9615 V
Option D 1.05 V

Correct Option C

Solution:



$$E_{\text{cell}}^0 = 1.05 \text{ V}$$

$$\begin{aligned} E_{\text{cell}} &= E_{\text{cell}}^0 - \frac{0.059}{n} \log \frac{[\text{Ni}^{2+}]}{[\text{Ag}^+]^2} \\ &= 1.05 - \frac{0.059}{2} \log \frac{(10^{-3})}{(10^{-3})^2} \\ &= 1.05 - \frac{0.059}{2} \log(10)^3 \\ &= 1.05 - 0.0295 \times 3 \\ &= 1.05 - 0.0885 \\ &= 0.9615 \text{ V} \end{aligned}$$

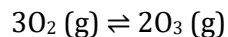
Q 96. $3\text{O}_2(\text{g}) \rightleftharpoons 2\text{O}_3(\text{g})$

for the above reaction at 298 K, K_c is found to be 3.0×10^{-59} . If the concentration of O_2 at equilibrium is 0.040 M then concentration of O_3 in M is

- Option A 4.38×10^{-32}
Option B 1.9×10^{-63}
Option C 2.4×10^{31}
Option D 1.2×10^{21}

Correct Option A

Solution:



$$K_c = \frac{[\text{O}_3]^2}{[\text{O}_2]^3}$$

$$[\text{O}_3]^2 = K_c [\text{O}_2]^3 = 3 \times 10^{-59} \times (0.04)^3$$

$$[\text{O}_3]^2 = 1.9 \times 10^{-63} = 19 \times 10^{-64}$$

$$[\text{O}_3] = 4.38 \times 10^{-32}$$

Therefore, concentration of O_3 at equilibrium = $4.38 \times 10^{-32} \text{ M}$

Q 97. If radius of second Bohr orbit of the He^+ ion is 105.8 pm, what is the radius of third Bohr orbit of Li^{2+} ion?

- Option A 158.7 pm
Option B 15.87 pm

Option C 1.587 pm

Option D 158.7 Å

Correct Option A

Solution:

$$r_n \propto \frac{n^2}{Z}$$

$$\frac{r_3(\text{Li}^{2+})}{r_2(\text{He}^+)} = \frac{(n_3)^3}{Z(\text{Li}^{2+})} \times \frac{Z(\text{He}^+)}{(n_2)^2}$$

$$\frac{r_3(\text{Li}^{2+})}{105.8} = \frac{(3)^2}{3} \times \frac{2}{(2)^2}$$

$$= 105.8 \times \frac{3}{2}$$

$$r_3(\text{Li}^{2+}) = 158.7 \text{ pm}$$

Q 98. Match List-I with List - II.

List - I (Ores)

(a) Haematite

(b) Magnetite

(c) Calamine

(d) Kaolinite

List - II (Composition)

(i) Fe_3O_4

(ii) ZnCO_3

(iii) Fe_2O_3

(iv) $[\text{Al}_2(\text{OH})_4\text{Si}_2\text{O}_5]$

Choose the correct answer from the options given below:

Option A (a) - (i), (b) - (ii), (c) - (iii), (d) - (iv)

Option B (a) - (iii), (b) - (i), (c) - (ii), (d) - (iv)

Option C (a) - (iii), (b) - (i), (c) - (iv), (d) - (ii)

Option D (a) - (i), (b) - (iii), (c) - (ii), (d) - (iv)

Correct Option B

Solution:

List - I (Ores)

Haematite

Magnetite

Calamine

Kaolinite

List - II (Composition)

Fe_2O_3

Fe_3O_4

ZnCO_3

$[\text{Al}_2(\text{OH})_4\text{Si}_2\text{O}_5]$

Q 99. Copper crystallises in fcc unit cell with cell edge length of 3.608×10^{-8} cm. The density of copper is 8.92 g cm^{-3} . Calculate the atomic mass of copper.

Option A 63.1 u

Option B 31.55 u

Option C 60 u

Option D 65 u

Correct Option A

Solution:

$$d = \frac{ZM}{N_A (a)^3}$$

$Z = 4$ (for FCC)

$d = 8.92 \text{ g cm}^{-3}$

$$N_A = 6.023 \times 10^{23}$$

$$a = 3.608 \times 10^{-8} \text{ cm}$$

$$\begin{aligned} M &= \frac{dN_A(a)^3}{Z} \\ &= \frac{8.92 \times 6.023 \times 10^{23} \times (3.608 \times 10^{-8})^3}{4} \\ &= \frac{8.92 \times 6.023 \times 10^{23} \times 46.97 \times 10^{-24}}{4} \\ &= \frac{2523.47 \times 10^{-1}}{4} \\ &= 630.8 \times 10^{-1} = 63.08 \approx 63.1 \text{ u} \end{aligned}$$

Q 100. For a first order reaction $A \rightarrow \text{Products}$, initial concentration of A is 0.1 M, which becomes 0.001 M after 5 minutes. Rate constant for the reaction in min^{-1} is

Option A 1.3818

Option B 0.9212

Option C 0.4606

Option D 0.2303

Correct Option B

Solution: For first order reaction,

$$K = \frac{2.303}{t} \log \frac{[R_0]}{[R]}$$

Where R_0 is the initial concentration of reactant A

$$R_0 = 0.1 \text{ M}$$

$$R = 0.001 \text{ M}$$

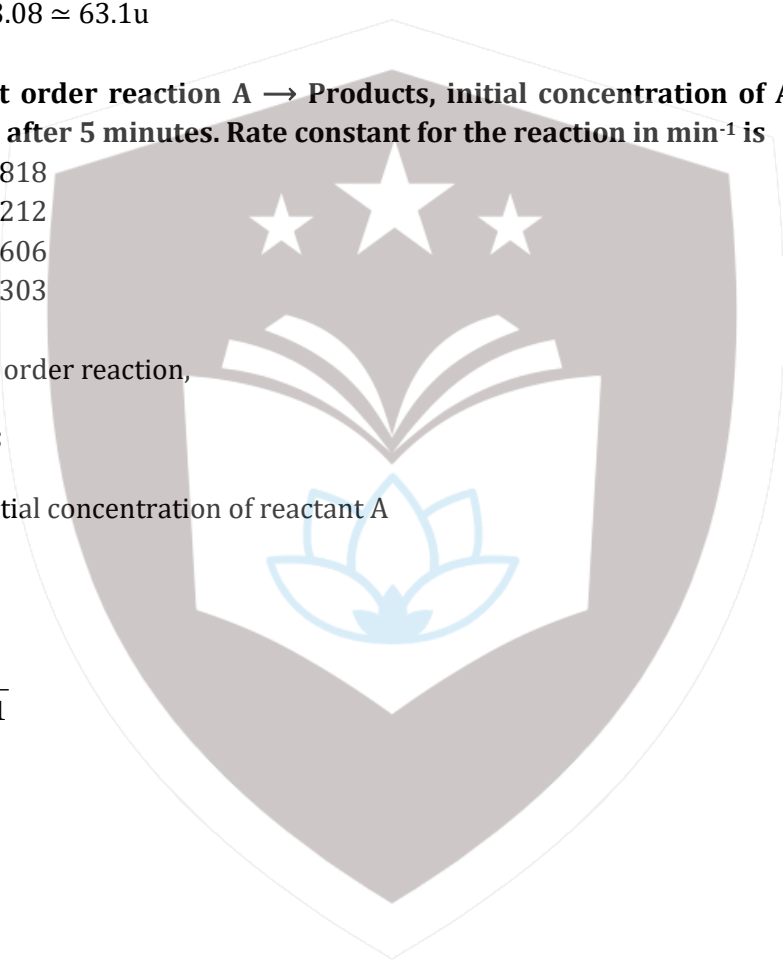
$$t = 5 \text{ minute}$$

$$K = \frac{2.303}{5} \log \frac{0.1}{0.001}$$

$$= \frac{2.303}{5} \log 10^2$$

$$= \frac{2.303}{5} \times 2$$

$$K = 0.9212 \text{ min}^{-1}$$



BOTANY

Section A

Q 101. Exoskeleton of arthropods is composed of:

- Option A Cutin
- Option B Cellulose
- Option C Chitin
- Option D Glucosamine

Correct Option C

Solution:

Arthropod bodies are supported by chitin-composed external bones or hardened exoskeletons. It is formed by their skin to form a protective outer covering that hardens.

Q 102. Given below are two statements:

Statement I:

Decomposition is a process in which the detritus is degraded into simpler substances by microbes.

Statement II: Decomposition is faster if the detritus is rich in lignin and chitin.

In the light of the above statements, choose the correct answer from the options given below:

- Option A Both **Statement I** and **Statement II** are correct
- Option B Both **Statement I** and **Statement II** are incorrect
- Option C **Statement I** is correct and **Statement II** is incorrect
- Option D **Statement I** is incorrect and **Statement II** is correct

Correct Option C

Solution:

Decomposition is a process in which the detritus is broken down into smaller, simpler substances by microbes. Decomposition rate is slower if the detritus is rich in lignin and chitin, and quicker, if detritus is rich in nitrogen and water - soluble substances like sugars.

Q 103. A Given below are two statements:

Statement I:

Cleistogamous flowers are invariably autogamous.

Statement II:

Cleistogamy is disadvantageous as there is no chance for cross pollination.

In the light of the above statements, choose the correct answer from the options given below:

- Option A Both **Statement I** and **Statement II** are correct
- Option B Both **Statement I** and **Statement II** are incorrect
- Option C **Statement I** is correct and **Statement II** is incorrect
- Option D **Statement I** is incorrect and **Statement II** is correct

Correct Option A

Solution:

Cleistogamous flowers are invariably autogamous because the anther and stigma lie close to each other. They are bisexual and cannot open even at maturity and hence self-pollination is mandatory. This makes cleistogamy disadvantageous as there is no scope for cross-pollination.

Q 104. The process of translation of mRNA to proteins begins as soon as:

- Option A The small subunit of ribosome encounters mRNA
- Option B The larger subunit of ribosome encounters mRNA
- Option C Both the subunits join together to bind with mRNA
- Option D The tRNA is activated and the larger subunit of ribosome encounters mRNA

Correct Option A

Solution:

The process of translation of mRNA to protein begins when the small subunit of ribosome encounters an mRNA. This process is followed by the binding of bigger or larger subunit. t-RNA is activated by the addition of amino acid prior to the attachment of ribosome, in the first phase.

Q 105. What amount of energy is released from glucose during lactic acid fermentation?

- Option A Approximately 15%
- Option B More than 18%
- Option C About 10%
- Option D Less than 7%

Correct Option D

Solution:

In lactic acid fermentation, less than 7% of the energy in glucose is released because only two ATPs are produced at this stage compared to the total number of 32 ATPs in aerobic respiration. Thus, energy produced is $\frac{2}{32} \times 100 = 6.25\%$.

Q 106. "Girdling Experiment" was performed by Plant Physiologists to identify the plant tissue through which:

- Option A water is transported
- Option B food is transported
- Option C for both water and food transportation
- Option D osmosis is observed

Correct Option B

Solution: The girdling experiment shows that phloem is the tissue responsible for the translocation of food; and that transport takes place in one direction i.e. towards the root.

Q 107. Which of the following is not observed during apoplastic pathway?

- Option A Movement of water occurs through intercellular spaces and wall of the cells.
- Option B The movement does not involve crossing of cell membrane.
- Option C The movement is aided by cytoplasmic streaming.
- Option D Apoplast is continuous and does not provide any barrier to water movement.

Correct Option C

Solution:

The symplastic system is system of interconnected protoplasts. Neighbouring cells are connected through cytoplasmic strands that extend through the plasmodesmata. The water travels through cell cytoplasm and plasmodesmata, hence the movement is relatively slower. Symplastic movement is aided by cytoplasmic streaming.

Q 108. In old trees the greater part of secondary xylem is dark brown and resistant to insect attack due to:

- (a) Secretion of secondary metabolites and their deposition in the lumen of vessels.
- (b) Deposition of organic compounds like tannins and resins in the central layers of stem.
- (c) Deposition of suberin and aromatic substances in the outer layer of stem.
- (d) Deposition of tannins, gum, resin and aromatic substances in the peripheral layers of stem.
- (e) Presence of parenchyma cells, functionally active xylem elements and essential oils.

Choose the correct answer from the options given below:

- Option A (a) and (b) Only
- Option B (c) and (d) Only
- Option C (d) and (e) Only
- Option D (b) and (d) Only

Correct Option A

Solution:

In old trees, the greater part of secondary xylem is dark brown due to the deposition of organic compounds like tannins, resins, oils, gums, aromatic substances and essential oils in the central or innermost layers of the stem. These substances make this layer hard, durable and resistant to the attack of micro-organisms and insects.

Q 109. Hydrocolloid carrageen is obtained from:

- Option A Chlorophyceae and Phaeophyceae
- Option B Phaeophyceae and Rhodophyceae
- Option C Rhodophyceae only
- Option D Phaeophyceae only

Correct Option C

Solution:

Hydrocolloids such as carrageen are water holding substances obtained from red algae (Rhodophyceae).

Q 110. Identify the incorrect statement related to pollination:

- Option A Pollination by water is quite rare in flowering plants
- Option B Pollination by wind is more common amongst abiotic pollination
- Option C Flowers produce foul odours to attract flies and beetles to get pollinated
- Option D Moths and butterflies are the most dominant pollinating agents among insects

Correct Option D

Solution:

Among the animals, insects, particularly bees are the most dominant biotic pollinating agents.

Q 111. DNA polymorphism forms the basis of:

- Option A Genetic mapping
- Option B DNA finger printing
- Option C Both genetic mapping and DNA finger printing
- Option D Translation

Correct Option C

Solution:

Polymorphism in DNA sequence is the basis of genetic mapping of human genome as well as of DNA fingerprinting.

Q 112. Which of the following is not a method of *ex situ* conservation?

- Option A *In vitro* fertilization
- Option B National Parks
- Option C Micropropagation
- Option D Cryopreservation

Correct Option B

Solution:

In-situ conservation means on site conservation i.e. when we conserve and protect the whole ecosystem, its biodiversity at all levels is protected.

National parks are a type of *in-situ* conservation whereas, micropropagation, cryopreservation and *in-vitro* fertilisation are methods of *ex-situ* conservation.

Q 113. Which one of the following is not true regarding the release of energy during ATP synthesis through chemiosmosis? It involves:

- Option A Breakdown of proton gradient
- Option B Breakdown of electron gradient
- Option C Movement of protons across the membrane to the stroma
- Option D Reduction of NADP to NADPH₂

Correct Option B

Solution:

Chemiosmosis requires a membrane, a proton pump, a proton gradient and ATP synthase. Energy is used to pump protons across a membrane to create a gradient or a high concentration of protons within the thylakoid lumen.

The enzyme, NADP reductase is located on the stroma side of the membrane. Along with the electrons that come from the acceptor of electrons of PS I, protons are necessary for the reduction of NADP⁺ to NADPH and H⁺. The process does not involve breakdown of electron gradient.

Q 114. What is the net gain of ATP when each molecule of glucose is converted to two molecules of pyruvic acid?

- Option A Four
- Option B Six
- Option C Two
- Option D Eight

Correct Option C

Solution:

During glycolysis, total 4 ATPs are produced from one glucose molecule with a net gain of 2 ATPs.

Q 115. The flowers are Zygomorphic in:

- (a) Mustard
- (b) Gulmohar
- (c) *Cassia*
- (d) *Datura*
- (e) Chilli

Choose the correct answer from the options given below:

- Option A (a), (b), (c) Only
Option B (b), (c) Only
Option C (d), (e) Only
Option D (c), (d), (e) Only

Correct Option B

Solution:

When a flower can be divided into two similar halves only in one particular vertical plane, it is zygomorphic, e.g. pea, gulmohar, bean, *Cassia*. Rest of the flowers i.e., mustard, *Datura* and chilli are actinomorphic.

Q 116. Given below are two statements:

Statement I:

Mendel studied seven pairs of contrasting traits in pea plants and proposed the Laws of Inheritance.

Statement II:

Seven characters examined by Mendel in his experiment on pea plants were seed shape and colour, flower colour, pod shape and colour, flower position and stem height.

In the light of the above statements, choose the correct answer from the options given below

- Option A Both **Statement I** and **Statement II** are correct
Option B Both **Statement I** and **Statement II** are incorrect
Option C **Statement I** is correct but **Statement II** is incorrect
Option D **Statement I** is incorrect but **Statement II** is correct

Correct Option A

Solution:

Gregor J. Mendel, conducted hybridisation experiments on garden pea and selected 14 true breeding pea plant varieties (seven contrasting traits). Contrasting traits studied were smooth or wrinkled seeds, yellow or green seeds, inflated or constricted pods, green or yellow pods, tall or dwarf plants, violet or white flowers and axial or terminal flower positions.

Q 117. Which of the following is incorrectly matched?

- Option A *Ectocarpus* – Fucoxanthin
Option B *Ulothrix* – Mannitol
Option C *Porphyra* – Floridian Starch
Option D *Volvox* – Starch

Correct Option B

Solution:

Ulothrix is a member of Chlorophyceae (green algae), with reserve food material as starch. Mannitol is a stored food material of Phaeophyceae (brown algae).

Q 118. Production of cucumber has increased manifold in recent years. Application of which of the following phytohormones has resulted in this increased yield as the hormone is known to produce female flowers in the plants:

- Option A ABA
Option B Gibberellin
Option C Ethylene
Option D Cytokinin

Correct Option C

Solution:

Ethylene increases the number of female flowers and fruits in certain plants such as cucumber. Gibberellins are used to increase the size of fruits in some plants.

Q 119. Which one of the following produces nitrogen fixing nodules on the roots of *Alnus*?

- Option A *Rhizobium*
 Option B *Frankia*
 Option C *Rhodospirillum*
 Option D *Beijerinckia*

Correct Option B**Solution:**

The microbe, *Frankia*, produces nitrogen fixing nodules on the roots of non-leguminous plants such as *Alnus*.

Q 120. Match List-I with List-II

	List - I		List - II
(a)	Manganese	(i)	Activates the enzyme catalase
(b)	Magnesium	(ii)	Required for pollen germination
(c)	Boron	(iii)	Activates enzymes of respiration
(d)	Iron	(iv)	Functions in splitting of water during photosynthesis

Choose the correct answer from the options given below:

- Option A (a)-(iii), (b)-(iv), (c)-(i), (d)-(ii)
 Option B (a)-(iv), (b)-(iii), (c)-(ii), (d)-(i)
 Option C (a)-(iv), (b)-(i), (c)-(ii), (d)-(iii)
 Option D (a)-(iii), (b)-(i), (c)-(ii), (d)-(iv)

Correct Option B**Solution:**

Manganese plays a major role in the splitting of water during photolysis to liberate oxygen during photosynthesis.

Magnesium activates several enzymes involved in photosynthesis and respiration.

Boron is involved in pollen germination.

Iron activates the enzyme catalase along with some other enzymes.

Q 121. The gaseous plant growth regulator is used in plants to:

- Option A speed up the malting process
 Option B promote root growth and root hair formation to increase the absorption surface
 Option C help overcome apical dominance
 Option D kill dicotyledonous weeds in the fields

Correct Option B**Solution:**

Ethylene is a gaseous plant hormone. It induces development of adventitious roots on various types of cuttings. It promotes the development of lateral roots and growth of root hairs.

Cytokinin helps to overcome apical dominance.

Auxin is used to kill dicotyledonous weeds.

Gibberellin speeds up the malting process.

Q 122. Identify the correct set of statements:

- (a) The leaflets are modified into pointed hard thorns in *Citrus* and *Bougainvillea*
- (b) Axillary buds form slender and spirally coiled tendrils in cucumber and pumpkin
- (c) Stem is flattened and fleshy in *Opuntia* and modified to perform the function of leaves
- (d) *Rhizophora* shows vertically upward growing roots that help to get oxygen for respiration
- (e) Sub-aerially growing stems in grasses and strawberry help in vegetative propagation

Choose the correct answer from the options given below:

- Option A (b) and (c) Only
- Option B (a) and (d) Only
- Option C (b), (c), (d) and (e) Only
- Option D (a), (b), (d) and (e) Only

Correct Option C

Solution:

Axillary buds of stems and not leaflets get modified into woody, straight and pointed thorns. Thorns are found in many plants such as *Citrus* and *Bougainvillea*.

Q 123. Read the following statements about the vascular bundles:

- (a) In roots, xylem and phloem in a vascular bundle are arranged in an alternate manner along the different radii.
- (b) Conjoint closed vascular bundles do not possess cambium
- (c) In open vascular bundles, cambium is present in between xylem and phloem
- (d) The vascular bundles of dicotyledonous stem possess endarch protoxylem
- (e) In monocotyledonous root, usually there are more than six xylem bundles present

Choose the correct answer from the options given below:

- Option A (a), (b) and (d) Only
- Option B (b), (c), (d) and (e) Only
- Option C (a), (b), (c) and (d) Only
- Option D (a), (c), (d) and (e) Only

Correct Option (No option is correct)

Solution:

All the given statements are correct regarding vascular bundles, but none of the options with such combination is given.

Q 124. XO type of sex determination can be found in:

- Option A *Drosophila*
- Option B Birds
- Option C Grasshoppers
- Option D Monkeys

Correct Option C

Solution:

Grasshopper is an example of XO type of sex determination in which the males have only one X-chromosome besides the autosomes, whereas females have a pair of X-chromosomes.

Q 125. Habitat loss and fragmentation, over exploitation, alien species invasion and co-extinction are causes for:

- Option A Population explosion
- Option B Competition
- Option C Biodiversity loss
- Option D Natality

Correct Option C

Solution:

Habitat loss and fragmentation, over exploitation, alien species invasion and co-extinction are causes for biodiversity loss.

Q 126. Which one of the following plants does not show plasticity?

- Option A Cotton
- Option B Coriander
- Option C Buttercup
- Option D Maize

Correct Option D

Solution:

Plants follow different pathways in response to environment or phases of life to form different kinds of structures. This ability is called plasticity, e.g. heterophylly in cotton, coriander and larkspur. In such plants, leaves of the juvenile plant have a shape which is different from that in mature plants.

Maize plant does not show plasticity.

Q 127. Given below are two statements:

Statement I:

The primary CO_2 acceptor in C_4 plants is phosphoenol pyruvate and is found in the mesophyll cells.

Statement II:

Mesophyll cells of C_4 plants lack RuBisCo enzyme. In the light of the above statements, choose the correct answer from the options given below:

- Option A Both **Statement I** and **Statement II** are correct
- Option B Both **Statement I** and **Statement II** are incorrect
- Option C **Statement I** is correct but **Statement II** is incorrect
- Option D **Statement I** is incorrect but **Statement II** is correct

Correct Option A

Solution:

The primary CO_2 acceptor in C_4 plants is a 3-carbon molecule, phosphoenol pyruvate (PEP) and is present in the mesophyll cells.

Mesophyll cells of C_4 plants lack RuBisCO enzyme. Instead, this enzyme is found in the bundle sheath cells in C_4 plants.

Q 128. Which one of the following statement is not true regarding gel electrophoresis technique?

- Option A The process of extraction of separated DNA strands from gel is called elution.
- Option B The separated DNA fragments are stained by using ethidium bromide.
- Option C The presence of chromogenic substrate gives blue coloured DNA bands on the gel.

Option D Bright orange coloured bands of DNA can be observed in the gel when exposed to UV light.

Correct Option C

Solution:

Bright colored bands of DNA can be observed in the gel when EtBr (Ethidium bromide) treated DNA is exposed to UV light.

Q 129. The device which can remove particulate matter present in the exhaust from a thermal power plant is:

- Option A STP
- Option B Incinerator
- Option C Electrostatic Precipitator
- Option D Catalytic Converter

Correct Option C

Solution:

Electrostatic precipitator can remove over 99% particulate matter present in the exhaust from a thermal power plant.

Catalytic converters are fitted into automobiles for reducing emission of poisonous gases.

STPs are associated with sewage treatment.

Q 130. The appearance of recombination nodules on homologous chromosomes during meiosis characterizes:

- Option A Synaptonemal complex
- Option B Bivalent
- Option C Sites at which crossing over occurs
- Option D Terminalization

Correct Option C

Solution:

Pachytene stage of meiosis is characterised by the appearance of recombination nodules, the sites at which crossing over occurs between non-sister chromatids of homologous chromosomes.

Q 131. Read the following statements and choose the set of correct statements:

- (a) Euchromatin is loosely packed chromatin
- (b) Heterochromatin is transcriptionally active
- (c) Histone octamer is wrapped by negatively charged DNA in a nucleosome
- (d) Histones are rich in lysine and arginine
- (e) A typical nucleosome contains 400 bp of DNA helix

Choose the correct answer from the options given below:

- Option A (b), (d), (e) Only
- Option B (a), (c), (d) Only
- Option C (b), (e) Only
- Option D (a), (c), (e) Only

Correct Option B

Solution:

Euchromatin is the loosely packed chromatin region.

Heterochromatin is transcriptionally inactive.

The negatively charged DNA is wrapped around the positively charged histone octamer to form a structure called nucleosome.

Histones are rich in basic amino acid residues lysine and arginine.

A typical nucleosome contains 200 bp of DNA helix.

Q 132. Which one of the following never occurs during mitotic cell division?

Option A Spindle fibres attach to kinetochores of chromosomes

Option B Movement of centrioles towards opposite poles

Option C Pairing of homologous chromosomes

Option D Coiling and condensation of the chromatids

Correct Option C

Solution:

Pairing of homologous chromosomes occurs during prophase I of meiosis.

Coiling and condensation of chromatids, attachment of spindle fibres to the kinetochores and movement of centrioles towards opposite poles occur in both mitosis and meiosis.

Q 133. Which one of the following statements cannot be connected to Predation?

Option A It helps in maintaining species diversity in a community

Option B It might lead to extinction of a species

Option C Both the interacting species are negatively impacted

Option D It is necessitated by nature to maintain the ecological balance

Correct Option C

Solution:

One of the species in predation gains benefit at the expense of the other. Predators help in maintaining species diversity in a community, by reducing the intensity of competition among competing prey species. If a predator is too efficient and overexploits its prey, then the prey might become extinct.

Q 134. Which one of the following plants shows vexillary aestivation and diadelphous stamens?

Option A *Colchicum autumnale*

Option B *Pisum sativum*

Option C *Allium cepa*

Option D *Solanum nigrum*

Correct Option B

Solution:

Vexillary aestivation and diadelphous stamens are the characteristic features of family Fabaceae.

Pisum sativum (garden pea) belongs to family Fabaceae.

Allium cepa (onion) and *Colchicum autumnale* (colchicine) belong to family Liliaceae.

Solanum nigrum belongs to family Solanaceae.

Q 135. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).

Assertion (A) :

Polymerase chain reaction is used in DNA amplification.

Reason (R):

The ampicillin resistant gene is used as a selectable marker to check transformation.

In the light of the above statements, choose the correct answer from the options given below:

- Option A Both (A) and (R) are correct and (R) is the correct explanation of (A)
Option B Both (A) and (R) are correct but (R) is not the correct explanation of (A)
Option C (A) is correct but (R) is not correct
Option D (A) is not correct but (R) is correct

Correct Option B

Solution:

Polymerase chain reaction is used in DNA amplification because this technique allows to take a very small sample of DNA and amplify it (or a part of it) to a large enough amount to study in detail. Ampicillin resistance gene is a selectable marker that helps to check transformation by selection of transformants.

Section B

Q 136. Which of the following occurs due to the presence of autosome linked dominant trait?

- Option A Sickle cell anaemia
Option B Myotonic dystrophy
Option C Haemophilia
Option D Thalessemia

Correct Option B

Solution:

Myotonic dystrophy is an autosomal dominant disorder i.e. it occurs due to the presence of an autosomal linked dominant trait.

Haemophilia is an X-linked recessive disorder.

Thalassemia and sickle cell anaemia are autosomal recessive disorders.

Q 137. If a geneticist uses the blind approach for sequencing the whole genome of an organism, followed by assignment of function to different segments, the methodology adopted by him is called as:

- Option A Sequence annotation
Option B Gene mapping
Option C Expressed sequence tags
Option D Bioinformatics

Correct Option A

Solution:

Sequencing the whole set of genome that contained all the coding and non-coding sequences and later assigning different regions in the sequence with functions is called sequence annotation.

Q 138. Transposons can be used during which one of the following?

- Option A Polymerase Chain Reaction
Option B Gene silencing
Option C Autoradiography
Option D Gene sequencing

Correct Option B

Solution:

Mobile genetic elements (transposons) that replicate via an RNA intermediate can act as the source of the complementary RNA for the technique of gene silencing or RNA interference (RNAi).

Autoradiography usually follows the technique of hybridisation.

Polymerase chain reaction is used to make copies of the DNA sample and does not need transposons.

Transposons are not required during gene sequencing.

Q 139. While explaining interspecific interaction of population, (+) sign is assigned for beneficial interaction, (-) sign is assigned for detrimental interaction and (0) for neutral interaction. Which of the following interactions can be assigned (+) for one species and (-) for another species involved in the interaction?

- Option A Predation
- Option B Amensalism
- Option C Commensalism
- Option D Competition

Correct Option A

Solution:

In predation, one species is benefitted whereas the other is harmed. It is (+ /-) type of population interaction.

Q 140. Read the following statements on lipids and find out correct set of statements:

- (a) Lecithin found in the plasma membrane is a glycolipid
- (b) Saturated fatty acids possess one or more C = C bonds
- (c) Gingly oil has lower melting point, hence remains as oil in winter
- (d) Lipids are generally insoluble in water but soluble in some organic solvents
- (e) When fatty acid is esterified with glycerol, monoglycerides are formed

Choose the correct answer from the option given below:

- Option A (a), (b) and (c) only
- Option B (a), (d) and (e) only
- Option C (c), (d) and (e) only
- Option D (a), (b) and (d) only

Correct Option C

Solution:

Lecithin is a type of phospholipid found in the plasma membrane.

Saturated fatty acids are without C = C double bond.

Oils have lower melting point and hence remain as oil in winters.

Lipids are generally insoluble in water but soluble in some organic solvents.

Monoglycerides are formed when a fatty acid is esterified with a glycerol.

Q 141. Addition of more solutes in a given solution will:

- Option A raise its water potential
- Option B lower its water potential
- Option C make its water potential zero
- Option D not affect the water potential at all

Correct Option B

Solution:

If some solute is dissolved in pure water, the solution has lower free water and the concentration of water decreases, reducing its water potential. The magnitude of this lowering due to dissolution of a solute is called solute potential.

Q 142. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).

Assertion (A): Mendel's law of Independent assortment does not hold good for the genes that are located closely on the same chromosome.

Reason (R): Closely located genes assort independently.

In the light of the above statements, choose the correct answer from the options given below:

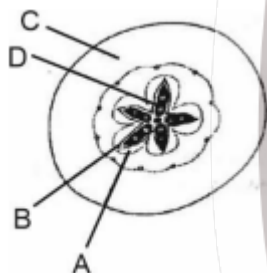
- Option A Both (A) and (R) are correct and (R) is the correct explanation of (A)
- Option B Both (A) and (R) are correct but (R) is not the correct explanation of (A)
- Option C (A) is correct but (R) is not correct
- Option D (A) is not correct but (R) is correct

Correct Option C

Solution:

Closely located genes do not show independent assortment. Mendel's law of independent assortment holds good for those genes which are located on different chromosomes.

Q 143. Which part of the fruit, labelled in the given figure makes it a false fruit?



- Option A A → Mesocarp
- Option B B → Endocarp
- Option C C → Thalamus
- Option D D → Seed

Correct Option C

Solution:

The given figure is of a false fruit. False fruit develops from other floral parts and thalamus along with the development of ovary wall.

Q 144. Which one of the following will accelerate phosphorus cycle?

- Option A Burning of fossil fuels
- Option B Volcanic activity
- Option C Weathering of rocks
- Option D Rainfall and storms

Correct Option C

Solution:

Phosphorus cycle is a sedimentary cycle. Reservoir pool of phosphorus in the ecosystem is the Earth's crust or lithosphere. Therefore, weathering of rocks will accelerate the phosphorus cycle.

Q 145. In the following palindromic base sequences of DNA, which one can be cut easily by a particular restriction enzyme?

- Option A 5'GATACT3'; 3'CTATGA5'
- Option B 5'GAATTC3'; 3'CTTAAG5'
- Option C 5'CTCAGT3'; 3'GAGTCA5'

Option D 5'GTATTC3'; 3'CATAAG5'

Correct Option B

Solution:

Palindromic DNA sequence is a DNA sequence of base pairs that reads same on the two strands when the orientation of reading is kept the same. Out of the given base sequences, the below sequence is the only palindromic sequence-

5'GAATTC3'

3'CTTAAG5'

Q 146. The entire fleet of buses in Delhi were converted to CNG from diesel. In reference to this, which one of the following statements is false?

Option A CNG burns more efficiently than diesel

Option B The same diesel engine is used in CNG buses making the cost of conversion low

Option C It is cheaper than diesel

Option D It cannot be adulterated like diesel

Correct Option B

Solution:

CNG is cheaper than petrol and it burns more efficiently unlike petrol or diesel. It also cannot be adulterated like diesel and petrol. The same diesel engine cannot be used in CNG buses for making the cost conversion low.

Q 147. The anatomy of springwood shows some peculiar features. Identify the correct set of statements about springwood.

(a) It is also called as the earlywood

(b) In spring season cambium produces xylem elements with narrow vessels

(c) It is lighter in colour

(d) The springwood along with autumnwood shows alternate concentric rings forming annual rings

(e) It has lower density

Choose the correct answer from the options given below:

Option A (a), (b), (d) and (e) Only

Option B (a), (c), (d) and (e) Only

Option C (a), (b) and (d) Only

Option D (c), (d) and (e) Only

Correct Option B

Solution:

The vessels are produced with the wider lumens to transport more water to meet the requirement by increased transpiring surface in spring season.

Spring wood is also called early wood. It is lighter in colour and has a lower density.

The springwood and autumn wood appear as alternate concentric rings of light and dark colour forming annual rings.

Q 148. What is the role of large bundle sheath cells found around the vascular bundles in C₄ plants?

Option A To provide the site for photorespiratory pathway

Option B To increase the number of chloroplasts for the operation of Calvin cycle

Option C To enable the plant to tolerate high temperature

Option D To protect the vascular tissue from high light intensity

Correct Option B

Solution:

The large cells around the vascular bundles of C_4 plants form bundle sheath. These cells have large number of chloroplasts to carry out the Calvin cycle.

Q 149. Match the plant with the kind of life cycle it exhibits:

	List - I		List - II
(a)	<i>Spirogyra</i>	(i)	Dominant diploid sporophyte vascular plant, with highly reduced male or female gametophyte.
(b)	Fern	(ii)	Dominant haploid free-living gametophyte.
(c)	<i>Funaria</i>	(iii)	Dominant diploid sporophyte alternating with reduced gametophyte called prothallus.
(d)	<i>Cycas</i>	(iv)	Dominant haploid leafy gametophyte alternating with partially dependent multicellular sporophyte.

Choose the correct answer from the options given below:

Option A (a)-(iv), (b)-(i), (c)-(ii), (d)-(iii)

Option B (a)-(ii), (b)-(iii), (c)-(iv), (d)-(i)

Option C (a)-(iii), (b)-(iv), (c)-(i), (d)-(ii)

Option D (a)-(ii), (b)-(iv), (c)-(i), (d)-(iii)

Correct Option B

Solution:

Spirogyra is an alga. It shows haplontic life-cycle.

Fern is a pteridophyte. The dominant phase of its life-cycle is a diploid sporophyte. Its gametophyte is called prothallus.

Funaria is a bryophyte. Its gametophyte is a leafy stage.

Cycas is a gymnosperm. The main plant body in gymnosperm is a sporophyte. They have highly reduced gametophyte stage.

Q 150. Match List-I with List-II.

	List - I		List - II
(a)	Metacentric chromosome	(i)	Centromere situated close to the end forming one extremely short and one very long arms.
(b)	Acrocentric chromosome	(ii)	Centromere at the terminal end.
(c)	Sub-metacentric chromosome	(iii)	Centromere in the middle forming two equal arms of chromosomes.
(d)	Telocentric chromosome	(iv)	Centromere slightly away from the middle forming one shorter arm and one longer arm.

Choose the correct answer from the options given below:

Option A (a)-(iii), (b)-(i), (c)-(iv), (d)-(ii)

Option B (a)-(i), (b)-(iii), (c)-(ii), (d)-(iv)

Option C (a)-(ii), (b)-(iii), (c)-(iv), (d)-(i)

Option D (a)-(i), (b)-(ii), (c)-(iii), (d)-(iv)

Correct Option A

Solution:

In metacentric chromosome, centromere is in the middle of the chromosome.

Acrocentric chromosome has centromere close to the end of the chromosome.

In sub-metacentric chromosome, centromere is slightly away from the middle of the chromosome.

Telocentric chromosome has a terminal centromere.

ZOOLOGY

Section A

Q 151. Given below are two statements:

Statement I:

Autoimmune disorder is a condition where body defense mechanism recognizes its own cells as foreign bodies.

Statement II:

Rheumatoid arthritis is a condition where body does not attack self-cells.

In the light of the above statements, choose the most appropriate answer from the options given below:

- Option A Both **Statement I** and **Statement II** are correct
Option B Both **Statement I** and **Statement II** are incorrect
Option C **Statement I** is correct but **Statement II** is incorrect
Option D **Statement I** is incorrect but **Statement II** is correct

Correct Option C

Solution:

An **autoimmune disorder** occurs when the body's immune system attacks and destroys healthy body tissue by mistake. Sometimes, due to genetic and other unknown reasons, the body attacks self- cells. Rheumatoid arthritis is an autoimmune disorder and is the result of the body's immune system attacking healthy body tissues, usually the joints (synovial membrane). So, Statement I is correct but Statement II is incorrect.

Q 152. Given below are two statements:

Statement I: The coagulum is formed of network of threads called thrombins.

Statement II: Spleen is the graveyard of erythrocytes.

In the light of the above statements, choose the most appropriate answer from the options given below:

- Option A Both **Statement I** and **Statement II** are correct
Option B Both **Statement I** and **Statement II** are incorrect
Option C **Statement I** is correct but **Statement II** is incorrect
Option D **Statement I** is incorrect but **Statement II** is correct

Correct Option D

Solution:

Coagulum or clot is formed mainly of a network of threads called fibrins.

RBCs are destroyed in the spleen so spleen is known as the graveyard of erythrocytes. Hence, Statement II is correct.

Q 153. Identify the microorganism which is responsible for the production of an immunosuppressive molecule cyclosporin A:

- Option A *Trichoderma polysporum*
Option B *Clostridium butylicum*
Option C *Aspergillus niger*
Option D *Streptococcus cerevisiae*

Correct Option A

Solution:

Bioactive molecule, cyclosporin A, that is used as an immunosuppressive agent in organ transplant patients, is produced by the fungus, *Trichoderma polysporum*.

Q 154. Which of the following statements are true for spermatogenesis but do not hold true for oogenesis?

- (a) It results in the formation of haploid gametes
(b) Differentiation of gamete occurs after the completion of meiosis
(c) Meiosis occurs continuously in a mitotically dividing stem cell population
(d) It is controlled by the Luteinising hormone (LH) and Follicle Stimulating Hormone (FSH) secreted by the anterior pituitary
(e) It is initiated at puberty

Choose the most appropriate answer from the options given below:

- Option A (c) and (e) only
Option B (b) and (c) only
Option C (b), (d) and (e) only
Option D (b), (c) and (e) only

Correct Option D

Solution:

- Haploid gametes are formed in spermatogenesis and oogenesis. So (a) is true for both.
- The spermatids are transformed into spermatozoa (sperms) by the process called spermiogenesis. Hence, (b) is true for spermatogenesis only.
- Spermatogenesis and oogenesis both are controlled by LH and FSH secreted by the anterior pituitary. Hence (d) is true for both.
- Spermatogenesis is a continuous process that begins at puberty. Oogenesis on the other hand begins during embryonic development of the female. So (e) is true for spermatogenesis.

Q 155. Lippe's loop is a type of contraceptive used as:

- Option A Cervical barrier
Option B Vault barrier
Option C Non-Medicated IUD
Option D Copper releasing IUD

Correct Option C

Solution:

The intrauterine device (IUD) presently available as the nonmedicated IUDs, is Lippe's loop.

Option (4) is incorrect as copper releasing IUDs are CuT, Cu7 and multiload 375.

Option (1) and (2) are incorrect as diaphragms, cervical caps and vaults are included in barrier method of contraception.

Q 156. At which stage of life, the oogenesis process is initiated?

- Option A Puberty
- Option B Embryonic development stage
- Option C Birth
- Option D Adult

Correct Option B

Solution:

Oogenesis is the process of formation of functional haploid ova from the diploid germinal cells in the ovary. Oogenesis begins during embryonic development but is completed only after fertilisation of the secondary oocyte with the sperm.

Q 157. In the taxonomic categories which hierarchical arrangement in ascending order is correct in case of animals?

- Option A Kingdom, Phylum, Class, Order, Family, Genus, Species
- Option B Kingdom, Class, Phylum, Family, Order, Genus, Species
- Option C Kingdom, Order, Class, Phylum, Family, Genus, Species
- Option D Kingdom, Order, Phylum, Class, Family, Genus, Species

Correct Option A

Solution:

Hierarchical classification in animals starts from species and ends in kingdom. So, the correct ascending order of taxonomic categories in case of animals is
Species → genus → family → order → class → phylum → kingdom

Q 158. Given below are two statements:

Statement I: Mycoplasma can pass through less than 1 micron filter size.

Statement II: Mycoplasma are bacteria with cell wall.

In the light of the above statements, choose the most appropriate answer from the options given below

- Option A Both **Statement I** and **Statement II** are correct
- Option B Both **Statement I** and **Statement II** are incorrect
- Option C **Statement I** is correct but **Statement II** is incorrect
- Option D **Statement I** is incorrect but **Statement II** is correct

Correct Option C

Solution:

Mycoplasma refers to a genus of bacteria which lack a cell wall and it is currently considered the smallest known cell at about 0.1 micron (μm) in diameter. So, it can pass through less than 1 μm filter size.

Q 159. Which of the following is a correct match for disease and its symptoms?

- Option A Arthritis – Inflamed joints
- Option B Tetany – High Ca^{2+} level causing rapid spasms
- Option C Myasthenia gravis – Genetic disorder resulting in weakening and paralysis of skeletal muscle
- Option D Muscular dystrophy – An auto immune disorder causing progressive degeneration of skeletal muscle

Correct Option A

Solution:

Option (A) is the correct answer because Arthritis is inflammation of joints.

Option (B) is incorrect because tetany is rapid spasms in muscle due to low Ca^{++} in body fluid.

Option (C) is incorrect because myasthenia gravis is an immune disorder affecting neuro-muscular junction leading to fatigue, weakening and paralysis of skeletal muscle.

Option (D) is incorrect because muscular dystrophy is progressive degeneration of skeletal muscle mostly due to genetic disorder.

Q 160. In an *E.coli* strain λ gene gets mutated and its product cannot bind the inducer molecule. If growth medium is provided with lactose, what will be the outcome?

Option A Only z gene will get transcribed

Option B z, y, a genes will be transcribed

Option C z, y, a genes will not be translated

Option D RNA polymerase will bind the promoter region

Correct Option C

Solution:

As the product of ' λ ' gene binds with the operator region and blocks the transcription and translation of z, y and a gene, its product is prevented from binding to the operator by attaching it with the inducer. As the inducer is no more capable of binding with the repressor, thus, in all the cases, operator always gets attached with the repressor thereby preventing the transcription and transmission of z, y and a . Even in the presence of lactose, transcription and translation of z, y and a would not occur.

Q 161. Which of the following is not the function of conducting part of respiratory system?

Option A It clears inhaled air from foreign particles

Option B Inhaled air is humidified

Option C Temperature of inhaled air is brought to body temperature

Option D Provides surface for diffusion of O_2 and CO_2

Correct Option D

Solution:

The conducting part of the respiratory system starts with the external nostrils upto the terminal bronchioles whereas the alveoli and their ducts form the respiratory or exchange part of the respiratory system. The conducting part transports the atmospheric air to the alveoli, clears it from foreign particles, humidifies and also bring the air to body temperature. Exchange part is the site of actual diffusion of O_2/CO_2 between blood and atmospheric air.

Q 162. Breeding crops with higher levels of vitamins and minerals or higher proteins and healthier fats is called:

Option A Bio-magnification

Option B Bio-remediation

Option C Bio-fortification

Option D Bio-accumulation

Correct Option C

Solution:

Biofortification is the process of increasing the micronutrient content of staple crops such as rice, wheat, beans, and other cereals and legumes to improve the nutrition.

Biomagnification refers to increase in concentration of the toxicant at successive trophic levels.
Bioremediation is the phenomenon of using biological organism to handle pollution.

Q 163. Which of the following functions is not performed by secretions from salivary glands?

- Option A Control bacterial population in mouth
- Option B Digestion of complex carbohydrates
- Option C Lubrication of oral cavity
- Option D Digestion of disaccharides

Correct Option D

Solution:

Option (D) is the correct answer because digestion of polysaccharides like starch occurs in mouth and digestion of disaccharides occurs in small intestine.

Option (C) is incorrect because saliva contains mucus which helps in the lubrication of oral cavity.

Option (A) is incorrect because saliva contains lysozyme (antibacterial agent) so that it controls bacterial population in mouth.

Option (B) is incorrect because digestion of complex carbohydrates is performed by secretions from salivary glands.

Q 164. Tegmina in cockroach, arises from

- Option A Prothorax
- Option B Mesothorax
- Option C Metathorax
- Option D Prothorax and Mesothorax

Correct Option B

Solution:

Tegmina or forewings (the first pair of wings) in cockroach arises from mesothorax which is narrow, thick and opaque and helps in protection.

Others are incorrect because no wing arises from prothorax and hindwings arise from metathorax because metathorax is broad, delicate and thin and helps in flight.

Q 165. Which of the following statements with respect to Endoplasmic Reticulum is incorrect?

- Option A RER has ribosomes attached to ER
- Option B SER is devoid of ribosomes
- Option C In prokaryotes only RER are present
- Option D SER are the sites for lipid synthesis

Correct Option C

Solution:

Unlike eukaryotes, membrane bound organelles such as nucleus, mitochondria, endoplasmic reticulum are absent in prokaryotes and RER and SER belongs to endoplasmic reticulum. Hence, option C is incorrect.

Q 166. Given below are two statements:

Statement I:

The release of sperms into the seminiferous tubules is called spermiation.

Statement II:

Spermiogenesis is the process of formation of sperms from spermatogonia.

In the light of the above statements, choose the most appropriate answer from the options given below:

- Option A Both **Statement I** and **Statement II** are correct
- Option B Both **Statement I** and **Statement II** are incorrect
- Option C **Statement I** is correct but **Statement II** is incorrect
- Option D **Statement I** is incorrect but **Statement II** is correct

Correct Option C

Solution:

The transformation of spermatids into spermatozoa (sperms) are called spermiogenesis. After this, sperm head becomes embedded in the Sertoli cells and are finally released from the seminiferous tubules by the process called spermiation whereas spermatogenesis is the process of formation of sperms from spermatogonia.

Hence, Statement I is a correct statement.

Q 167. Which of the following is present between the adjacent bones of the vertebral column?

- Option A Intercalated discs
- Option B Cartilage
- Option C Areolar tissue
- Option D Smooth muscle

Correct Option B

Solution:

Cartilage which forms the intervertebral disc, is present between the adjacent bones of the vertebral column and it is a type of cartilaginous joint.

Option (C) is incorrect because areolar tissue present beneath the skin is a type of loose connective tissue.

Option (D) is incorrect because smooth muscles are present in the visceral organs.

Option (A) is incorrect because intercalated discs are characteristic feature of cardiac muscles present in heart.

Q 168. In which of the following animals, digestive tract has additional chambers like crop and gizzard?

- Option A *Corvus, Columba, Chameleon*
- Option B *Bufo, Balaenoptera, Bangarus*
- Option C *Catla, Columba, Crocodilus*
- Option D *Pavo, Psittacula, Corvus*

Correct Option D

Solution:

Additional chambers like crop and gizzard in alimentary canal are present in birds. *Pavo* (Peacock), *Psittacula* (Parrot), *Corvus* (Crow) and *Columba* (Pigeon) are birds.

Option (A), (B) and (C) are incorrect because *Catla* is a bony fish, *Crocodilus*, *Chameleon* and *Bangarus* are reptiles, *Bufo* is an amphibian and *Balaenoptera* is an aquatic mammal.

Q 169. Identify the asexual reproductive structure associated with *Penicillium*:

- Option A Zoospores
- Option B Conidia
- Option C Gemmules

Option D Buds

Correct Option B

Solution:

Conidia are the asexual reproductive structures produced in *Penicillium*.

Gemmules are produced in sponge.

Buds are produced in *Hydra*.

Zoospores are produced in *Chlamydomonas*.

Q 170. Given below are two statements:

Statement I:

Fatty acids and glycerols cannot be absorbed into the blood.

Statement II:

Specialized lymphatic capillaries called lacteals carry chylomicrons into lymphatic vessels and ultimately into the blood.

In the light of the above statements, choose the most appropriate answer from the options given below:

- Option A Both **Statement I** and **Statement II** are correct
Option B Both **Statement I** and **Statement II** are incorrect
Option C **Statement I** is correct but **Statement II** is incorrect
Option D **Statement I** is incorrect but **Statement II** is correct

Correct Option A

Solution:

Since fatty acids and glycerol are not soluble in water, they cannot enter the bloodstream. They first become part of micelles, which are tiny droplets that travel to the intestinal mucosa. They are transformed into chylomicrons, which are incredibly tiny protein-coated fat globules that are carried into the lymph vessels (lacteals) in the villi. The ingested chemicals are eventually released into the blood stream by these lymph veins. So, both the statements are correct.

Q 171. *In-situ* conservation refers to:

- Option A Protect and conserve the whole ecosystem
Option B Conserve only high-risk species
Option C Conserve only endangered species
Option D Conserve only extinct species

Correct Option A

Solution:

The biodiversity of the ecosystem is safeguarded on all scales when the entire system is conserved and preserved. This is a site-specific or *in-situ* conservation technique.

Q 172. If '8' *Drosophila* in a laboratory population of '80' died during a week, the death rate in the population is ____ individuals per *Drosophila* per week.

- Option A 0.1
Option B 10
Option C 1.0
Option D zero

Correct Option A

Solution:

If 8 *Drosophila* in a laboratory population of 80 died during a week, the death rate in the population is $\frac{8}{80} = 0.1$ individuals per *Drosophila* per week.

Q 173. Which of the following is not a connective tissue?

- Option A Blood
- Option B Adipose tissue
- Option C Cartilage
- Option D Neuroglia

Correct Option D

Solution:

Neuroglia is a part of nervous tissue.

The supporting cells of nerve tissue are called neuroglia. They account for more than 50% of the total amount of neural tissue. The building block of the nervous system, neurons, are excitable cells.

Blood and cartilage are specific types of connective tissues

A type of loose connective tissue is adipose tissue.

Q 174. Given below are two statements:

Statement I: Restriction endonucleases recognise specific sequence to cut DNA known as palindromic nucleotide sequence.

Statement II: Restriction endonucleases cut the DNA strand a little away from the centre of the palindromic site.

In the light of the above statements, choose the most appropriate answer from the options given below:

- Option A Both **Statement I** and **Statement II** are correct
- Option B Both **Statement I** and **Statement II** are incorrect
- Option C **Statement I** is correct but **Statement II** is incorrect
- Option D **Statement I** is incorrect but **Statement II** is correct

Correct Option A

Solution:

The DNA contains a unique palindromic nucleotide sequence that each restriction endonuclease can recognise. It will bind to the DNA and cut the double helix's two strands at particular locations. The DNA strand is cut by restriction enzymes between the same two bases on the opposing strands, but just outside of the palindrome location. As a result, statement I and II are both true.

Q 175. Natural selection where more individuals acquire specific character value other than the mean character value, leads to

- Option A Stabilising change
- Option B Directional change
- Option C Disruptive change
- Option D Random change

Correct Option B

Solution:

In directional natural selection more individuals acquire value other than the mean character value. Hence Option B is correct.

Option (C) is incorrect because in disruptive change, more individuals acquire peripheral character value at both ends of the distribution curve.

Option (D) is incorrect because there is no random change in natural selection.

Option (A) is incorrect because natural selection leads to stabilisation when more individuals acquire mean character value.

Q 176. Nitrogenous waste is excreted in the form of pellet or paste by:

Option A *Ornithorhynchus*

Option B *Salamandra*

Option C *Hippocampus*

Option D *Pavo*

Correct Option D

Solution:

Option (D) is the correct answer because birds (*Pavo*) excrete nitrogenous wastes as uric acid in the form of pellet or paste with a minimum loss of water.

Option (3) and (2) are incorrect because many bony fishes (like *Hippocampus*) and aquatic amphibians (like *Salamandra*) are ammonotelic in nature.

Option (1) is incorrect because mammals (like *Ornithorhynchus*) mainly excrete urea and are called ureotelic animals.

Q 177. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).

Assertion (A): Osteoporosis is characterised by decreased bone mass and increased chance of fractures.

Reason (R): Common cause of osteoporosis is increased levels of estrogen.

In the light of the above statements, choose the most appropriate answer from the options given below.

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

Option B Both (A) and (R) are correct but (R) is not the correct explanation of (A)

Option C (A) is correct but (R) is not correct

Option D (A) is not correct but (R) is correct

Correct Option C

Solution:

Osteoporosis is due to decreased levels of oestrogen. Osteoporosis is an age-related disorder characterised by decreased bone mass hence, the chances of fractures increase.

Q 178. Under normal physiological conditions in human being every 100 ml of oxygenated blood can deliver _____ ml of O₂ to the tissues.

Option A 2 ml

Option B 5 ml

Option C 4 ml

Option D 10 ml

Correct Option B

Solution:

Under typical circumstances, the amount of oxygen delivered to the tissues in 100% oxygenated blood is about 5%. For instance, 100 ml of oxygenated blood can provide 5 ml of oxygen to the tissues.

Option (3), (4) and (1) are incorrect because every 100 mL of deoxygenated blood delivers approximately 4 mL of CO₂ to the alveoli.

Q 179. A dehydration reaction links two glucose molecules to product maltose. If the formula for glucose is C₆H₁₂O₆ then what is the formula for maltose?

Option A C₁₂H₂₀O₁₀

Option B C₁₂H₂₄O₁₂

Option C C₁₂H₂₂O₁₁

Option D C₁₂H₂₄O₁₁

Correct Option C

Solution:

Maltose is a disaccharide formed by dehydration process i.e., synthesis by elimination of one water molecule to form a glycosidic bond in between two glucose molecules. So, its molecular formula is.



Q 180. If the length of a DNA molecule is 1.1 metres, what will be the approximate number of base pairs?

Option A 3.3×10^9 bp

Option B 6.6×10^9 bp

Option C 3.3×10^6 bp

Option D 6.6×10^6 bp

Correct Option A

Solution:

Number of base pairs \times distance between 2 consecutive base pairs = Length of DNA molecule

$$x \cdot 0.34 \times 10^{-9} \text{ m} = 1.1 \text{ m}$$

$$x = \frac{1.1}{0.34 \times 10^{-9}}$$

$$= 3.6 \times 10^9$$

$$\approx 3.3 \times 10^9 \text{ bp}$$

Q 181. Select the incorrect statement with reference to mitosis:

Option A All the chromosomes lie at the equator at metaphase

Option B Spindle fibres attach to centromere of chromosomes

Option C Chromosomes decondense at telophase

Option D Splitting of centromere occurs at anaphase

Correct Option B

Solution:

Spindle fibres attach to the kinetochores of chromosomes. Kinetochores are the disc shaped structures present on sides of primary constriction or centromere of chromosomes.

Q 182. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).

Assertion (A): All vertebrates are chordates but all chordates are not vertebrates.

Reason (R): Notochord is replaced by vertebral column in the adult vertebrates.

In the light of the above statements, choose the most appropriate answer from the option given below:

- Option A Both (A) and (R) are correct and (R) is the correct explanation of (A)
Option B Both (A) and (R) are correct but (R) is not the correct explanation of (A)
Option C (A) is correct but (R) is not correct
Option D (A) is not correct but (R) is correct

Correct Option A

Solution:

Urochordata, Cephalochordata, and Vertebrata are the three subphyla of chordates. In adults, the notochord is replaced by a bony or cartilaginous vertebral column in the subphylum Vertebrata. As a result, all vertebrates are chordates, but not all chordates are vertebrates.

Q 183. Regarding Meiosis, which of the statements is incorrect?

- Option A There are two stages in Meiosis, Meiosis-I and II
Option B DNA replication occurs in S phase of Meiosis-II
Option C Pairing of homologous chromosomes and recombination occurs in Meiosis-I
Option D Four haploid cells are formed at the end of Meiosis-II

Correct Option B

Solution:

Meiosis is the process through which cells divide into two successive nuclear and cellular cycles known as meiosis-I and meiosis-II, but only one DNA replication cycle. Interkinesis, which is often brief and devoid of DNA replication, occurs between two meiotic divisions.

Q 184. In gene therapy of Adenosine Deaminase (ADA) deficiency, the patient requires periodic infusion of genetically engineered lymphocytes because:

- Option A Retroviral vector is introduced into these lymphocytes.
Option B Gene isolated from marrow cells producing ADA is introduced into cells at embryonic stages
Option C Lymphocytes from patient's blood are grown in culture, outside the body.
Option D Genetically engineered lymphocytes are not immortal cells.

Correct Option D

Solution:

A normal functional copy of the human gene coding for ADA is inserted into these cells using a retroviral vector after being removed from the patient's bone marrow. The patient's bone marrow is then given the cells that have undergone this treatment. These cells create functioning ADA genes in their lymphocytes, which reactivate the immune system of the victim. Though these cells are not immortal, the patient needs regular infusions of these genetically modified lymphocytes. Hence, Option (B) is correct.

Option (C) is not the correct answer as the lymphocytes from patient's blood are grown in culture, outside the body but it is not the correct reason.

In option (B), if the gene isolated from bone marrow cells producing ADA is introduced into cells at early embryonic stages, it could be a permanent cure

Option (A) is just a process in periodic infusion but not the reason.

Q 185. Detritivores breakdown detritus into smaller particles. This process is called:

- Option A Catabolism
- Option B Fragmentation
- Option C Humification
- Option D Decomposition

Correct Option B

Solution:

Detritivores (eg. earthworm) break down detritus into smaller particles. This process is called fragmentation.

Section B

Q 186. Match List-I with List-II with respect to methods of Contraception and their respective actions.

	List-I		List-II
(a)	Diaphragms	(i)	Inhibit ovulation and Implantation
(b)	Contraceptive Pills	(ii)	Increase phagocytosis of sperm within Uterus
(c)	Intra Uterine Devices	(iii)	Absence of Menstrual cycle and ovulation following parturition
(d)	Lactational Amenorrhea	(iv)	They cover the cervix blocking the entry of sperms

Choose the correct answer from the options given below:

- Option A (a) - (iv), (b) - (i), (c) - (iii), (d) - (ii)
- Option B (a) - (iv), (b) - (i), (c) - (ii), (d) - (iii)
- Option C (a) - (ii), (b) - (iv), (c) - (i), (d) - (iii)
- Option D (a) - (iii), (b) - (ii), (c) - (i), (d) - (iv)

Correct Option B

Solution:

- Barrier methods of contraception include diaphragms. They protect the cervix and prevent sperm from entering.
- Progestogen-alone or progestogen-and-oestrogen-combined formulations are used as contraceptive pills. They modify the quality of cervical mucus to stop sperm entry, hinder ovulation and implantation, and other processes.
- Intra uterine devices increase the phagocytosis of sperms within the uterus.
- Lactational amenorrhoea is a natural method of contraception that is based on the observation that the menstrual cycle and ovulation do not coincide during the period of strong lactation that occurs after delivery.

Q 187. Which of the following statements is not true?

- Option A Analogous structures are a result of convergent evolution
- Option B Sweet potato and potato is an example of analogy
- Option C Homology indicates common ancestry
- Option D Flippers of penguins and dolphins are a pair of homologous organs

Correct Option D

Solution:

Homologous organs have the same structure but have different functions according to the needs of the organisms. Hence, homology indicates common ancestry.

Analogous structures have developed for the same function but do not show a similarity in structure. Hence, they are a result of convergent evolution.

Option (D) is the correct answer because flippers of penguins and dolphins are analogous organs as they help in swimming but do not have the same structure.

Sweet potato is a root modification for food storage whereas potato is an underground stem modification for storage. Hence, they are analogous.

Q 188. Select the incorrect statement with respect to acquired immunity.

Option A Primary response is produced when our body encounters a pathogen for the first time

Option B Anamnestic response is elicited on subsequent encounters with the same pathogen

Option C Anamnestic response is due to memory of first encounter

Option D Acquired immunity is non-specific type of defense present at the time of birth

Correct Option D**Solution:**

Option (D) is the correct answer as acquired immunity is a specific type of defence which is not present at the time of birth.

Option (A), (B) and (C) are true statements and hence cannot be the answer.

Anamnestic response or secondary immune response is a highly intensified response due to memory of first encounter. When our body encounters a pathogen for the first time then the body elicits the primary immune response. When there is a subsequent encounter with the same pathogen, secondary or anamnestic immune response is elicited.

Q 189. The recombination frequency between the genes a & c is 5%, b & c is 15%, b & d is 9%, a & b is 20%, c & d is 24% and a & d is 29%. What will be the sequence of these genes on a linear chromosome?

Option A a, d, b, c

Option B d, b, a, c

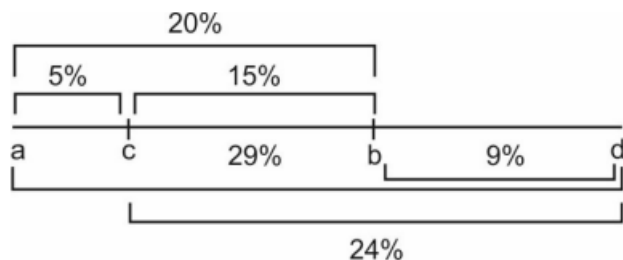
Option C a, b, c, d

Option D a, c, b, d

Correct Option D**Solution:**

1% recombination frequency = 1 centi Morgan

To place the genes on a linear chromosome, decreasing order of recombination frequency will be considered.

**Q 190. Match List-I with List-II**

	List-I (Biological Molecules)		List-II (Biological functions)
(a)	Glycogen	(i)	Hormone
(b)	Globulin	(ii)	Biocatalyst
(c)	Steroids	(iii)	Antibody
(d)	Thrombin	(iv)	Storage product

Choose the correct answer from the options given below:

- Option A (a) - (iii), (b) - (ii), (c) - (iv), (d) - (i)
 Option B (a) - (iv), (b) - (ii), (c) - (i), (d) - (iii)
 Option C (a) - (ii), (b) - (iv), (c) - (iii), (d) - (i)
 Option D (a) - (iv), (b) - (iii), (c) - (i), (d) - (ii)

Correct Option D

Solution:

- Glycogen is a polysaccharide and is a storage product in animals.
- Globulins form antibodies which are also known as immunoglobulins.
- Steroids form hormones like testosterone.
- Thrombin is a biocatalyst which converts soluble fibrinogen to insoluble fibrin

Q 191. Select the incorrect statement regarding synapses:

- Option A The membranes of presynaptic and postsynaptic neurons are in close proximity in an electrical synapse.
 Option B Electrical current can flow directly from one neuron into the other across the electrical synapse.
 Option C Chemical synapses use neurotransmitters
 Option D Impulse transmission across a chemical synapse is always faster than that across an electrical synapse.

Correct Option D

Solution:

Impulse transmission across an electrical synapse is always faster than that across a chemical synapse.

Chemical synapses use chemicals for transmission which are known as neurotransmitters.

The membranes of presynaptic and postsynaptic neurons are in close proximity in an electrical synapse.

An electrical current is used to transmit an impulse from one neuron to the following neuron in an electrical synapse.

Q 192. Statements related to human Insulin are given below.

Which statement(s) is/are correct about genetically engineered Insulin?

- (a) Pro-hormone insulin contain extra stretch of C-peptide
 (b) A-peptide and B-peptide chains of insulin were produced separately in *E.coli*, extracted and combined by creating disulphide bond between them.
 (c) Insulin used for treating Diabetes was extracted from Cattles and Pigs.
 (d) Pro-hormone Insulin needs to be processed for converting into a mature and functional hormone.

(e) Some patients develop allergic reactions to the foreign insulin.
 Choose the most appropriate answer from the options given below:

- Option A (a), (b) and (d) only
 Option B (b) only
 Option C (c) and (d) only
 Option D (c), (d) and (e) only

Correct Option B

Solution:

Genetically engineered insulin contains A-peptide and B-peptide chains of insulin that are produced separately in *E.coli* before being extracted and combined via a disulphide bond. Hence, Option B is the appropriate answer.

Statement (a) is incorrect as genetically engineered insulin does not have an extra stretch of C-peptide.

Statement (c) is incorrect as insulin obtained from cattle and pigs is not genetically engineered insulin.

Statement (d) is incorrect because conversion of pro-insulin to insulin is not required during production of insulin by genetic engineering as A-peptide and B-peptide chains are produced separately.

Statement (e) is incorrect as allergic reactions to insulin are mostly seen when the insulin is obtained from animals.

Q 193. Ten *E.coli* cells with ^{15}N - dsDNA are incubated in medium containing ^{14}N nucleotide. After 60 minutes, how many *E.coli* cells will have DNA totally free from ^{15}N ?

- Option A 20 cells
 Option B 40 cells
 Option C 60 cells
 Option D 80 cells

Correct Option C

Solution:

From 10 parent *E.coli* cells

1st generation

^{15}N containing 10 cells $\xrightarrow{20 \text{ mins}}$ 20 cells (all hybrid) $^{15}\text{N} - ^{14}\text{N}$

2nd generation

20 cells (hybrid) $\xrightarrow{20 \text{ mins}}$ 40 cells $\begin{cases} 20 \text{ cells hybrid } ^{15}\text{N} - ^{14}\text{N} \\ 20 \text{ cells with } ^{14}\text{N} \end{cases}$

3rd generation

40 cells $\xrightarrow{20 \text{ min}}$ 20 ^{14}N containing cells + 20 hybrid and 40 ^{14}N containing cells
 (20 cells hybrid + 20 ^{14}N containing cells)

Therefore, after 60 minutes, 60 *E.coli* cells will have DNA totally free from ^{15}N

Q 194. Which one of the following statements is correct?

- Option A The atrio-ventricular node (AVN) generates an action potential to stimulate atrial contraction
- Option B The tricuspid and the bicuspid valves open due to the pressure exerted by the simultaneous contraction of the atria
- Option C Blood moves freely from atrium to the ventricle during joint diastole
- Option D Increased ventricular pressure causes closing of the semilunar valves

Correct Option C

Solution:

Option (C) is the correct answer because during joint diastole, blood moves freely from atrium to ventricle as atrioventricular valve remain open during joint diastole.

Option (D) is incorrect because decrease in ventricular pressure, during ventricular diastole closes semilunar valves to produce 'dub' heart sound.

Option (A) is incorrect because SA node generates action potential to stimulate atrial contraction.

Option (B) is incorrect because bicuspid and tricuspid valves open due to pressure exerted by blood present in atria and decrease in pressure in ventricles during ventricular diastole.

Q 195. Which of the following is not a desirable feature of a cloning vector?

- Option A Presence of origin of replication
- Option B Presence of a marker gene
- Option C Presence of single restriction enzyme site
- Option D Presence of two or more recognition sites

Correct Option D

Solution:

Cloning vectors are the carriers of the desired gene in the host cell.

The features desirable in a cloning vector are: -

- Presence of origin of replication
- Presence of marker genes
- Presence of very few, preferably single recognition site for the commonly used restriction enzymes

Q 196. Given below are two statements:

Statements I:

In a scrubber the exhaust from the thermal plant is passed through the electric wires to charge the dust particles.

Statement II:

Particulate matter (PM 2.5) cannot be removed by scrubber but can be removed by an electrostatic precipitator.

In the light of the above statements, choose the most appropriate answer from the options given below:

- Option A Both **Statement I** and **Statement II** are correct
- Option B Both **Statement I** and **Statement II** are incorrect
- Option C **Statement I** is correct but **Statement II** is incorrect
- Option D **Statement I** is incorrect but **Statement II** is correct

Correct Option D

Solution:

Scrubber is used by the industries which produce SO_2 as a by-product. The limestone present in slurry of scrubber remove SO_2 from the exhaust. Electrostatic precipitator is the most effective device to remove 99% of particulate matter, 'even PM 2.5' present in the exhaust.

Q 197. Which of the following are not the effects of Parathyroid hormone?

- (a) Stimulates the process of bone resorption
- (b) Decreases Ca^{2+} level in blood
- (c) Reabsorption of Ca^{2+} by renal tubules
- (d) Decreases the absorption of Ca^{2+} from digested food
- (e) Increases metabolism of carbohydrates

Choose the most appropriate answer from the options given below:

- Option A (a) and (c) only
- Option B (b), (d) and (e) only
- Option C (a) and (e) only
- Option D (b) and (c) only

Correct Option B

Solution:

Option (B) is the correct answer because parathyroid hormone is a hypercalcemic hormone, which means it raises blood calcium levels. It also improves calcium absorption from digested food.

Glucocorticoids regulate the carbohydrate metabolism.

Option (C) is not true because parathyroid hormone stimulates the process of bone resorption.

Option (A) and (D) are not true because reabsorption of Ca^{2+} by renal tubules is a function of PTH.

Q 198. Which of the following is a correct statement?

- Option A Cyanobacteria are a group of autotrophic organisms classified under kingdom Monera
- Option B Bacteria are exclusively heterotrophic organisms
- Option C Slime moulds are saprophytic organisms classified under Kingdom Monera
- Option D Mycoplasma have DNA, ribosome and cell wall

Correct Option A

Solution:

Kingdom Monera is classified into three sub-kingdoms- Archaeobacteria, Eubacteria, and Cyanobacteria. Monerans are the group of organisms that show the maximum number of modes of nutrition. Some of the monerans like Cyanobacteria are autotrophs and can produce their own food. Slime moulds are classified under kingdom Protista.

Mycoplasma lack cell wall.

Bacteria can be autotrophic as well as heterotrophic.

Q 199. Match List-I with List-II

	List-I		List-II
(a)	Bronchioles	(i)	Dense Regular Connective Tissue
(b)	Goblet Cell	(ii)	Loose Connective Tissue
(c)	Tendons	(iii)	Glandular Tissue

(d) Adipose Tissue	(iv) Ciliated Epithelium
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Choose the correct answer from the options given below:

- Option A (a) - (iv), (b) - (iii), (c) - (i), (d) - (ii)
- Option B (a) - (i), (b) - (ii), (c) - (iii), (d) - (iv)
- Option C (a) - (ii), (b) - (i), (c) - (iv), (d) - (iii)
- Option D (a) - (iii), (b) - (iv), (c) - (ii), (d) - (i)

Correct Option A

Solution:

The inner surface of hollow organs like bronchioles and fallopian tubes are where ciliated epithelium is primarily found. The purpose is to move particles or mucus over the epithelium in a particular direction.

Some columnar or cuboidal cells become specialised for secretion and are referred to as glandular epithelium. Goblet cells are single-celled glands.

Tendons are dense regular connective tissues. They attach skeletal muscles to bones.

A form of loose connective tissue called adipose tissue is primarily found beneath the skin. This tissue's cells have been specifically designed to store fat.

Q 200. If a colour blind female marries a man whose mother was also colour blind, what are the chances of her progeny having colour blindness?

- Option A 25%
- Option B 50%
- Option C 75%
- Option D 100%

Correct Option D

Solution:

If mother of man is colourblind, then man will also be colourblind as colour blindness is an X-linked recessive trait and shows criss-cross inheritance.

