NEET - 2017

Questions with Solutions

General Instructions:

1. The test is of **3 hours** duration.
2. The Test Paper contains **180** questions. There are **three** parts in the question paper consisting of **Physics and Chemistry** having **45** questions each and **Biology** with **90 questions.**
3. Each question carries **4 marks**. For each correct response, the candidate will get **4 marks**. For each incorrect response, **1 mark** will be deducted from the total scores. The maximum marks are **720**.
4. Out of the four options given for each question, only one option is the correct answer. If more than one response is marked in any question, it will be treated as wrong response and marked up for wrong response will be deducted.
5. No deduction from the total score will be made if no response is indicated for an item in the answer box.
6. Use of Electronic/Manual Calculator is prohibited.

PHYSICS

Q 1. Spring of force constant k is cut into length of ratio 1: 2: 3. They are connected in series and the new force constant is K'. Then they are connected in parallel and force constant is k". then k': k" is:

Option A   1: 9
Option B   1: 11
Option C   1: 14
Option D   1: 6
Correct Option B

Solution:

$\ell_1 K_1 = \text{const.}$

Spring constant $\propto \dfrac{1}{l}$

For parallel $k_{parallel} = K_1 + K_2 + K_3 = \dfrac{1}{1\ell} + \dfrac{1}{2\ell} + \dfrac{1}{3\ell}$

$= \dfrac{6+3+2}{6} = \dfrac{11}{6\ell}$

For series $\dfrac{1}{K_s} = \dfrac{1}{K_1} + \dfrac{1}{K_2} + \dfrac{1}{K_3}$

$K_s = \dfrac{1}{6\ell}$

$\dfrac{K_s}{K_p} = \dfrac{1}{6\ell} \times \dfrac{6\ell}{11} = 1:11$

Q 2. The ratio of resolving powers of an optical microscope for two wavelenght $\lambda_1 = 4000$ Å and $\lambda_2 = 6000$ Å is:

Option A   9: 4

Option B   3: 2

Option C   16: 81

Option D   8: 27

Correct Option B

Solution:

Resolving power: $P \propto \dfrac{1}{\lambda}$

$R_1 / R_2 = \lambda_2 / \lambda_1 = \dfrac{6000\,\overset{0}{A}}{4000\,\overset{0}{A}} 6:4 = 3:2$

Q 3. The two nearest harmonics of a tube closed at one end and open at other end are 220 Hz and 260 Hz. What is the fundamental frequency of the system?

Option A   20 Hz

Option B   30 Hz

Option C   40 Hz

Option D   10 Hz

Correct Option A

Solution:

General formula for pipe closed at one end is given by

$\dfrac{nV}{4\ell}$ Where$(n = 1, 3, 5, \ldots)$

Lets take $\dfrac{nV}{4\ell} = 220$

and

$\dfrac{(n+2)V}{4\ell} = 260$

$\dfrac{n}{n+2} = \dfrac{220}{260} = \dfrac{11}{13}$

On solving

n=11

so

$\dfrac{11 \times V}{4\ell} = 220$

$\dfrac{V}{4\ell} = \dfrac{220}{11} = 20\text{Hz}$

Q 4. Consider a drop of rain water having mass 1g falling from a height of 1 km. It hits the ground with a speed of 50 m/s. Take 'g' constant with a value 10 m/s². The work done by the
(i) gravitational force and the
(ii) Resistive force of air is:

Option A   (i) 1.25 J (ii)-8.25 J
Option B   (i) 100 J (ii) 8.75 J
Option C   (i) 10 J (ii)-8.75 J
Option D   (i) -10 J (ii) -8.25 J

Correct Option C

Solution:

According to work energy theorem
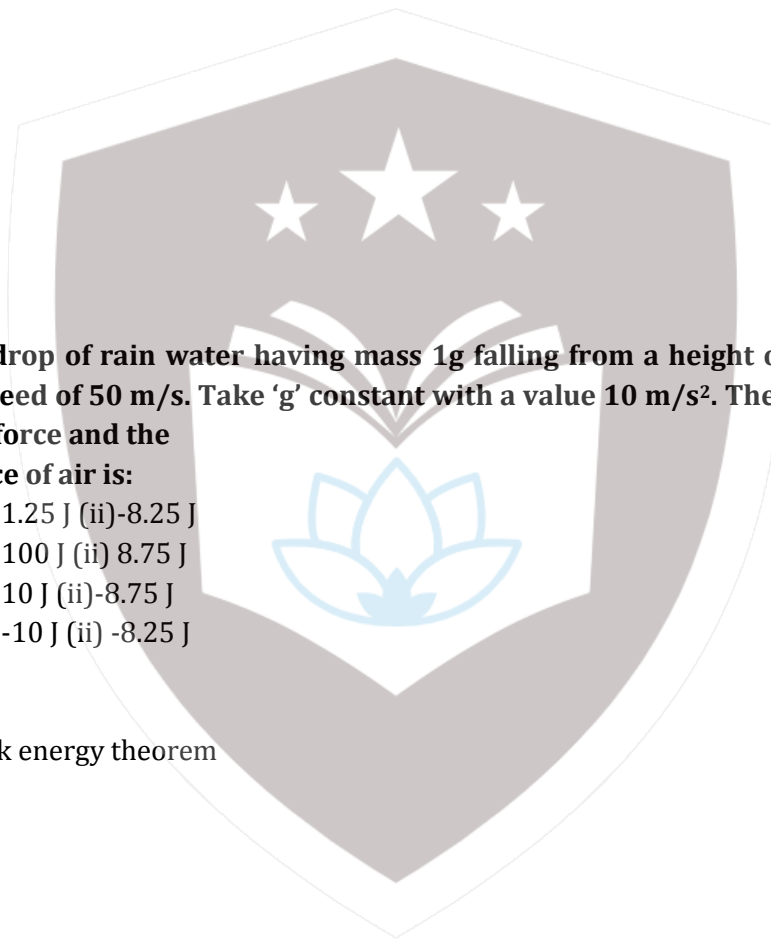
$w_g + w_R = \dfrac{1}{2} mv^2$

$w_g = mgh$

$= 10^{-3} \times 10 \times 1000$

$= 10\text{J}$

$10 + w_R = \dfrac{1}{2} \times 10^{-3} \times 50 \times 50$

$10 + w_R = 1.25$

$w_R = -8.75\text{J}$

Q 5. A physical quantity of the dimension of length that can be formed out of c, G and $\dfrac{e^2}{4\pi\varepsilon_0}$ is

[c is velocity of light, G is universal constant of gravitation and e is charge]:

Option A $\qquad c^2\left[G\dfrac{e^2}{4\pi\varepsilon_0}\right]^{1/2}$

Option B $\qquad \dfrac{1}{C^2}\left[\dfrac{e^2}{G\,4\pi\varepsilon_0}\right]^{1/2}$

Option C $\qquad \dfrac{1}{c}G\dfrac{e^2}{4\pi\varepsilon_0}$

Option D $\qquad \dfrac{1}{c^2}\left[G\dfrac{e^2}{4\pi\varepsilon_0}\right]^{1/2}$

Correct Option D

Solution:

$G = M^{-1}\,L^3\,T^{-2}$

$C = L^{1\,T^{-1}}$

$\dfrac{e^2}{4\Pi\varepsilon_0} = M^1\,L^3\,T^{-2}$

$\ell \propto C^P\,G^Q\left[\dfrac{e^2}{4\pi\varepsilon_0}\right]^R$

$\ell \propto L^P\,T^{-P}\left(M^{-1}\,L^3\,T^{-2}\right)^Q\left(M^1\,L^3\,T^{-2}\right)^R$

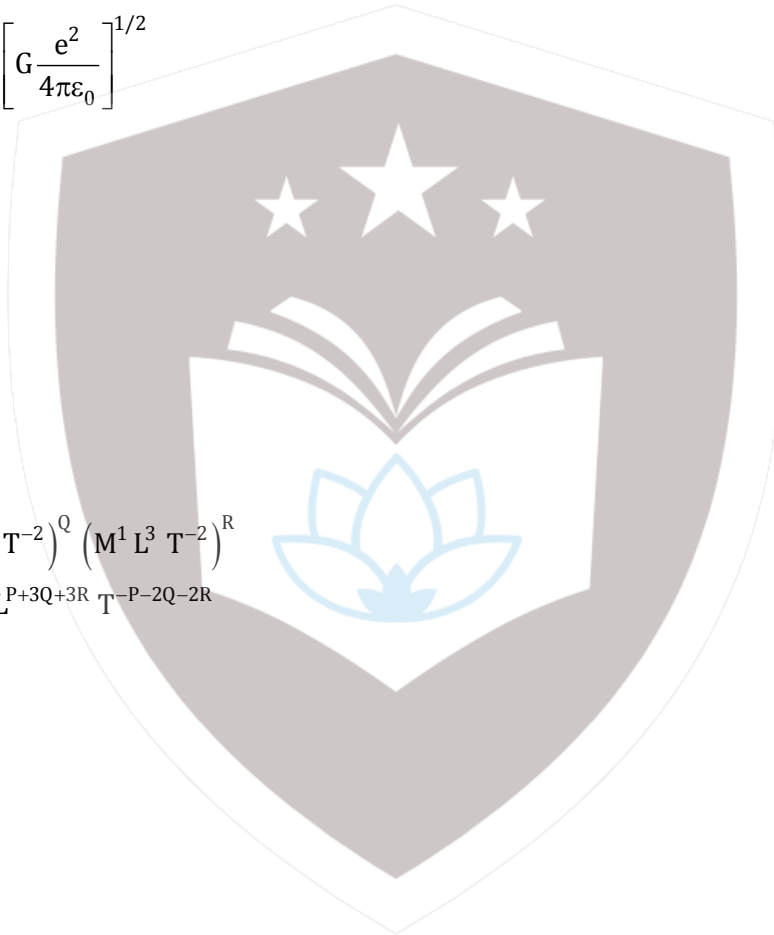$M^0\,L^1\,T^0 = M^{-Q+R}\,L^{P+3Q+3R}\,T^{-P-2Q-2R}$

$-Q+R = 0, Q = R$
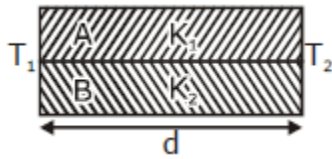
$P+3Q+3R = 1$

$-P-2Q-2R = 0$

Onsolving

$Q = R = \dfrac{1}{2}, P = -2$

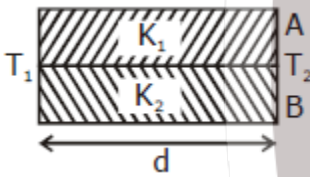$\dfrac{1}{C^2}\,G^{1/2}\left(\dfrac{e_2}{4\pi\varepsilon_0}\right)^{1/2}$

Q 6. Two rods A and B of different materials are welded together as shown in figure. Their thermal conductivities are K_1 and K_2. The thermal conductivity of the composite rod will be:

Option A $\qquad \dfrac{3(K_1 + K_2)}{2}$

Option B $\qquad K_1 + K_2$

Option C $\qquad 2(K_1 + K_2)$

Option D $\qquad \dfrac{K_1 + K_2}{2}$

Correct Option D

Solution:

$$R = \frac{\ell}{KA}$$

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$$

$$\frac{1}{\dfrac{\ell}{K_{eff}A}} = \frac{1}{\dfrac{\ell}{K_1 \frac{A}{2}}} + \frac{1}{\dfrac{\ell}{K_2 \frac{A}{2}}}$$

On solving

$$K = \frac{K_1 + K_2}{2}$$

Q 7. A capacitor is charged by a battery. The battery is removed and another identical uncharged capacitor is connected in parallel. The total electrostatic energy of resulting system:

Option A $\qquad$ decreases by a factor of 2

Option B $\qquad$ remains the same

Option C $\qquad$ increases by a factor of 2

Option D $\qquad$ increases by a factor of 4

Correct Option A

Solution:

Let the capacitance be C and potential difference be V

Initially q=CV

Initial energy=$\dfrac{CV^2}{2}$

when connected with uncharged capacitor

$V=\dfrac{q_1+q_2}{C_1+C_2}=\dfrac{q+0}{C+C}=\dfrac{q}{2C}$

Finalenergy

$\dfrac{1}{2}(2C)\left(\dfrac{V}{2}\right)^2$

$\dfrac{CV^2}{4}$

Loss of energy

$\dfrac{CV^2}{2}-\dfrac{CV^2}{4}=\dfrac{CV^2}{4}$

Therefore the total electrostatic energy decreases by

factor of 2.

Q 8. In a common emitter transistor amplifier the audio signal voltage across the collector is 3 V. The resistance of collector is 3 KΩ If current gain is 100 and the base resistance is 2 KΩ, the voltage and power gain of the amplifier is:

Option A   15 and 200
Option B   150 and 15000
Option C   20 and 2000
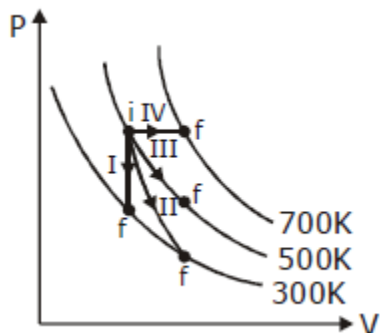Option D   200 and 1000

Correct Option B

Solution:

$V_0 =3$ volt $R_0 =3\times10^3$

Current gain $\beta =100$ $R_i =2\times10^3$

Voltage gain $A_\vee =\beta\dfrac{\text{Collector resistance}}{\text{Base resistance}}=100\times\dfrac{3}{2}=150$

Power gain $A_v\beta=\beta^2\dfrac{\text{Collector resistance}}{\text{Base resistance}}=100\times100\times\dfrac{3}{2}=15000$

Q 9. Thermodynamic process are indicated in the following diagram.

Match the following:

	Column-1		Column-2
P.	Process I	a.	Adiabatic
Q.	Process II	b.	Isobaric
R.	Process III	c.	Isochoric
S.	Process IV	d.	Isothermal

Option A   P→c, Q→a, R→d, S→b
Option B   P→c, Q→d , R→b, S→a
Option C   P→d, Q→b, R→a, S→c
Option D   P→a, Q→c, R→d, S→b
Correct Option A
Solution:
I → Volume constant → Isochoric P → C
II adiabatic process
II → Temperature Constant → Isothermal R → D
IV → Pressure constant → Adiabatic S → B

Q 10. Suppose the charge of a proton and an electron differ slightly. One of them is –e, the other is (e+ Δe). If the net of electrostatic force and gravitational force between two hydrogen atoms placed at a distance d (much greater than atomic size) apart is zero, then Δe is of the order od [Given mass of hydrogen $m_h = 1.67 \times 10^{-27}$ kg]
Option A 10^{-23} C
Option B 10^{-37} C
Option C 10^{-47} C
Option D 10^{-20} C
Correct Option B

Solution:

−e   e + Δe

Net charge = Δe

Electrostatic force = Gravitation force

$$\frac{Kq_1q_2}{r^2} = \frac{Gm_1m_2}{r^2}$$

$$\frac{K(\Delta e)^2}{d^2} = \frac{G \times (1.67 \times 10^{-27})^2}{d^2}$$

$$9 \times 10^9 (\Delta e)^2 = 6.627 \times 10^{-11} \times 1.67 (10^{-27})^2$$

On solving

$$\Delta e = 10^{-37}$$

Q 11. The resistance of a wire is 'R' ohm. If it is melted and stretched to 'n' times its original length, its new resistance will be:

Option A $\frac{R}{n}$

Option B n^2R

Option C $\frac{R}{n^2}$

Option D nR

Correct Option B

Solution:

Resistance of a wire is given by

$$R = \frac{\rho l}{A}$$

Volume of wire will emain const

$$A\ell = A_{new} n\ell$$

$$R' = \frac{\rho.nl}{A/n} \qquad A_{new} = A/n$$

$$= n^2R$$

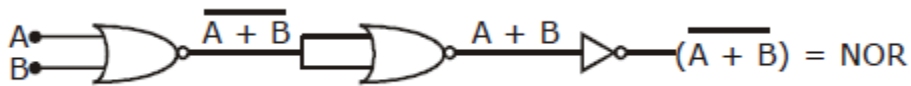**Q 12. The given electrical network is equivalent to:**

Option A   OR gate
Option B   NOR gate
Option C   NOT gate
Option D   AND gate

Correct Option B

Solution: The effective combination of gates are shown below.

$A + B$ ... $\overline{A + B}$ ... $A + B$ ... $\overline{(A + B)}$ = NOR

Q 13. The de-Broglie wavelenght of a neutron in thermal equilibrium with heavy water at a temperature T (Kelvin) and mass m, is:

Option A $\qquad \dfrac{h}{\sqrt{3mkT}}$

Option B $\qquad \dfrac{2h}{\sqrt{3mkT}}$

Option C $\qquad \dfrac{2h}{\sqrt{mkT}}$

Option D $\qquad \dfrac{h}{\sqrt{mkT}}$

Correct Option A

Solution:

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

$$\lambda = \frac{h}{\sqrt{2mKE}} \quad ----- \{KE = KineticEnergy\}$$

$$\lambda = \frac{h}{\sqrt{2m \times \dfrac{3}{2}kT}}$$

$$\lambda = \frac{h}{\sqrt{3mKT}}$$

Q 14. Which one of the following represents forward bias diode?

Option A	
Option B	
Option C	
Option D	

Correct Option D

Solution: In forward bias condition P type semiconductor should be at higher potential. Hence option 4 is correct.

Q 15. A long solenoid of diameter 0.1 m has 2×10^4 turns per meter. At the centre of the solenoid, a coli of 100 turns and radius 0.01 m is placed with its axis coinciding with the solenoid axis. The current in the solenoid reduces at a constant rate of 0A form 4 A in 0.05 s. If the charge flowing through the coli during this time is:

Option A   16 μC

Option B   32 μC

Option C   16 πμC

Option D   32 πμC

Correct Option B

Solution:

$$\text{emf} = \frac{d\phi}{dt}$$

$$i = \frac{\text{emf}}{R}$$

$$\frac{\text{emf}}{R} = \frac{d\phi}{Rdt}$$

$$i = \frac{dq}{dt}$$

$$dq = \frac{d\phi}{R}$$

$$q = \frac{d\phi}{R} = \frac{NA(B_2 - B_1)}{R}$$

$$= \frac{NA\mu_0 n(i_1 - i_2)}{R}$$

$$= \frac{100 \times \pi \times 10^{-4} \times 4\pi \times 10^{-7} \times 2 \times 10^4 (4)}{10\pi^2}$$

$$= 32 \times 10^{-6}$$

Q 16. Preeti reached the metro station and found that the escalator was not working. She walked up the stationary escalator in time t_1. On other days, If she remains stationary on the moving escalator, then the escalator takes her up in time t_2. The time taken by her to walk up on the moving escalator will be:
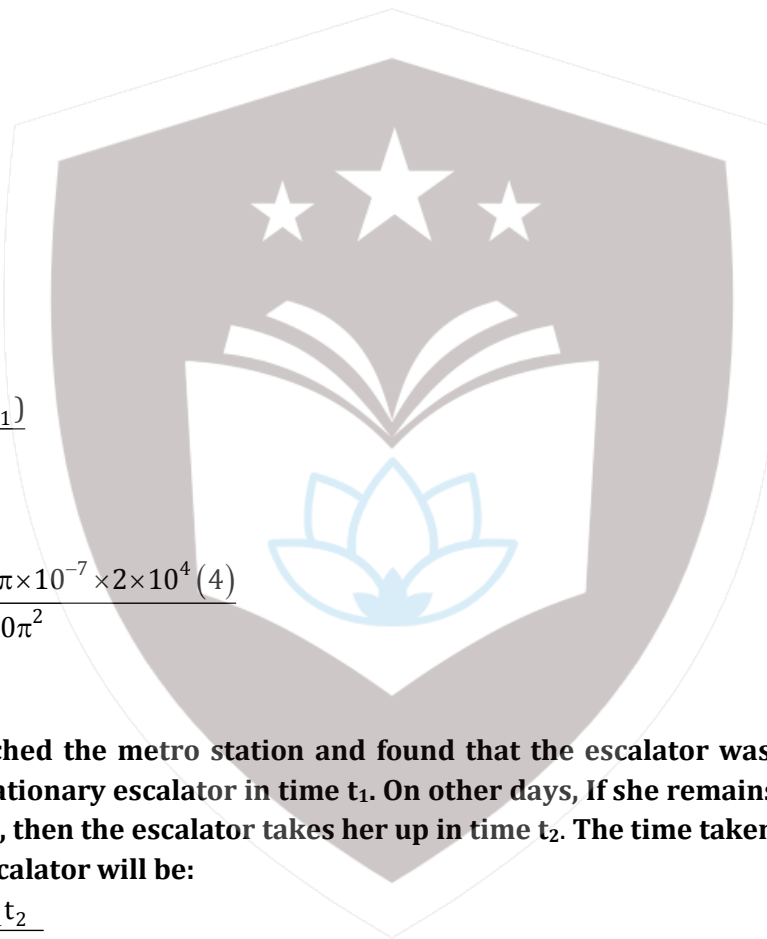
Option A $\dfrac{t_1 t_2}{t_2 - t_1}$

Option B $\dfrac{t_1 t_2}{t_2 + t_1}$

Option C $t_1 - t_2$

Option D $\dfrac{t_1 + t_2}{2}$

Correct Option B

Solution:

Let the distance travelled be d

$$t_1 = \dfrac{d}{v_p}$$

$$t_2 = \dfrac{d}{v_e}$$

Velocity of preeti with respect to ground

$$V = v_p + v_e$$

$$T = \dfrac{d}{v_p + v_e}$$

$$= \dfrac{d}{\dfrac{d}{t_1} + \dfrac{d}{t_2}}$$

$$t = \dfrac{t_1 t_2}{t_1 + t_2}$$

Q 17. Young's double slit experiment is first performed in air and then in a medium other than air. It is found that 8th bright fringe in the medium lies where 5th dark fringe lies in air. The refractive index of the medium is nearly.

Option A 1.59
Option B 1.69
Option C 1.78
Option D 1.25

Correct Option C

Solution:

Position of dark fringe is given by

$$(2n\text{-}1)\dfrac{\lambda D}{2d}$$

So 5th darrk fringe is given by

$$(2\times5\text{-}1)\dfrac{\lambda D}{2d}$$

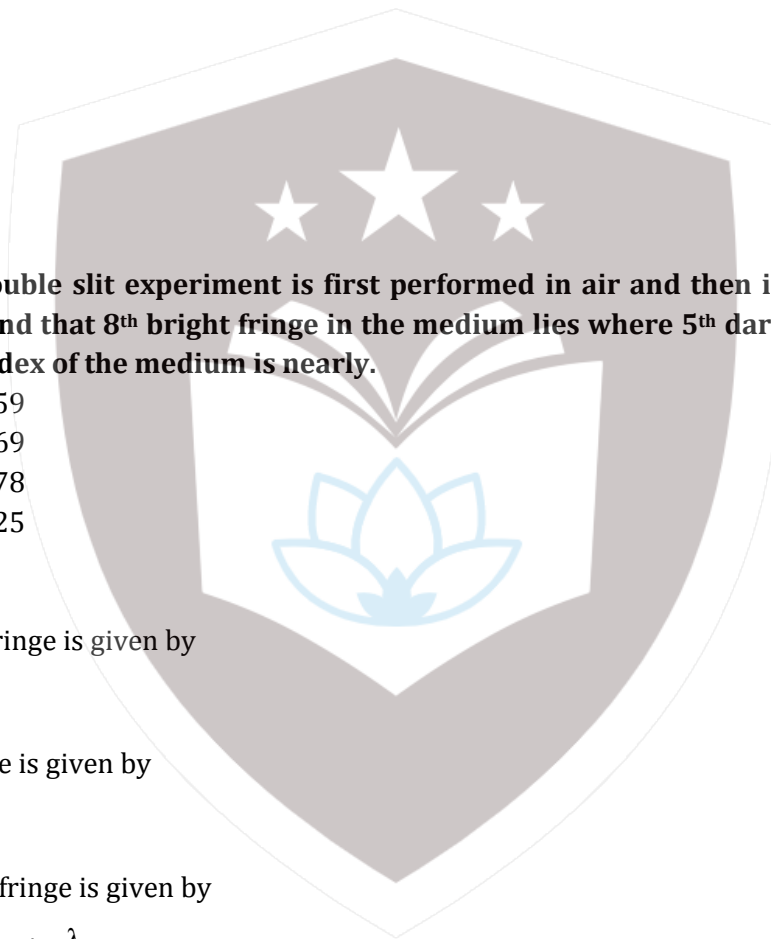Position of bright fringe is given by

$$\dfrac{n\lambda' D}{d} \text{-------}(\lambda' = \dfrac{\lambda}{\mu})$$

so for 8th bright fringe

$$\dfrac{9\lambda D}{2d} = \dfrac{8\lambda D}{\mu d}$$

$$\mu = \dfrac{16}{9} = 1.78$$

Q 18. A beam of light from a source L is incident normally on a plane mirror fixed at a certain distance x from the source. The beam is reflected back as a spot on a scale placed just above the source L. When the mirror is rotated through a small angle θ, the spot of the light is found to move through a distance y on the scale. The angle θ is given by:
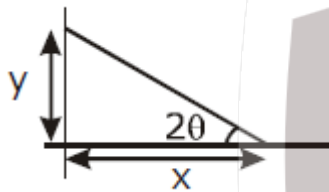
Option A $\dfrac{y}{x}$

Option B $\dfrac{x}{2y}$

Option C $\dfrac{x}{y}$

Option D $\dfrac{y}{2x}$

Correct Option D

Solution:

When the mirror is rotated by θ
the reflected ray will be rotated by 2θ

$\tan 2\theta = \dfrac{y}{x}$

as the angle is small

$2\theta = \dfrac{y}{x}$

$\theta = \dfrac{y}{2x}$

Q 19. If θ_1 and θ_2 be the apparent angles of dip observed in two vertical planes at right angles to each other, then the true angle of dip θ is given by:

Option A $\tan^2 \theta = \tan^2\theta_1 + \tan^2\theta_2$
Option B $\cot^2\theta = \cot^2\theta_1 - \cot^2\theta_2$
Option C $\tan^2 \theta = \tan^2\theta_1 - \tan^2\theta_2$
Option D $\cot^2\theta = \cot^2\theta_1 + \cot^2\theta_2$

Correct Option D

Solution: At angle α from magnetic meridian

$$\tan \phi_1 = \frac{B_V}{B_H \cos \alpha} \quad \dots\dots(1)$$

$$(\ )\cot \phi_1 = \frac{B_H \cos \alpha}{B_V}$$

For other plane

$$\tan \phi_2 = \frac{B_V}{B_H \cos(90-\alpha)} = \dots\dots(2)$$

$$\cot \phi_2 = \frac{B_H \sin \alpha}{B_V}$$

$$\cot^2 \phi_1 + \cot^2 \phi_2 = \left(\frac{B_H \cos \alpha}{B_V}\right)^2 + \left(\frac{B_H \sin \alpha}{B_V}\right)^2$$

$$\cot^2 \phi_1 + \cot^2 \phi_2 = \left(\frac{B_H}{B_V}\right)^2 \left(\cos^2 \alpha + \sin^2 \alpha\right)$$

$$\cot^2 \phi_1 + \cot^2 \phi_2 = \left(\frac{B_H}{B_V}\right)^2 \times 1$$
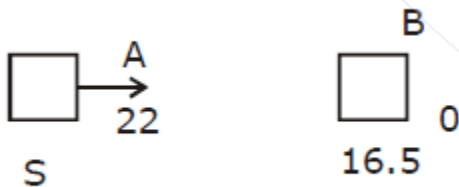
$$\cot^2 \phi_1 + \cot^2 \phi_2 = \cot^2 \phi$$

Q 20. Two cars moving in opposite directions approach each with speed of 22 m/s and 16.5 m/s respectively. The driver of the first car blows a horn having a frequency 400 Hz. The frequency heard by the driver of the second car is [velocity of sound 340 m/s]

Option A   361 Hz
Option B   411 Hz
Option C   448 Hz
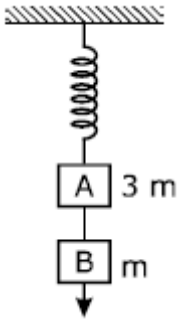Option D   350 Hz
Correct Option C
Solution:

$$f' = f_0 \left(\frac{V + V_0}{V - V_s}\right)$$

$$f' = 400 \left(\frac{340 + 16.5}{340 - 22}\right)$$

$$f' = 400 \left(\frac{356.5}{318}\right) = 448 \text{Hz}$$

Q 21. Two blocks A and B of masses 3m and m respectively are connected by a massless and inextensible string. The whole system is suspended by a massless spring as shown in figure. The magnitudes of acceleration of A and B immediately after the string is cut, are respectively.

Option A $\frac{g}{3}, g$

Option B g, g

Option C $\frac{g}{3}, \frac{g}{3}$

Option D $g, \frac{g}{3}$

Correct Option A

Solution:

Before cutting the string

$Kx = T + 3mg$

$T = mg$

$Kx = 4mg$

After cutting the string the tension $T = 0$

Acc of 3mg block

$Kx - 3mg = 3ma$

$a = \frac{4mg - 3mg}{3m}$

$a = \frac{g}{3}$

As the string is cut the another block is in free fall

$a = g$

Q 22. A thin prism having refracting angle 10° is made glass of refracting index 1.42. This prism is combination with another thin prism of glass of refracting index 1.7. This combination produces dispersion without deviation. The refracting angle of second prism should be:

Option A   6°

Option B   8°

Option C   10°

Option D   4°

Correct Option A

Solution:

For dispersion without deviation the total deviation
through both the prism should be zero
deviation by the prism is given by

$$A(\mu - 1) + A'\left(\mu' - 1\right) = 0$$

on substituting the values

$\therefore$

$$\left|A(\mu - 1)\right| = \left|A'\left(\mu' - 1\right)\right|$$

$$10(1.42 - 1) = A'(1.7 - 1)$$

$$A' = 6^0$$

Q 23. The acceleration due to gravity at a height 1 km above the earth is the same as at a depth d below the surface of earth. Then:

Option A   d = 1 km

Option B $d = \dfrac{3}{2} km$

Option C   d = 2 km

Option D $d = \dfrac{1}{2} km$

Correct Option C
Solution:

acc due to gravity above the earth surface $= g\left(1 - \dfrac{2h}{R}\right)$

acc due to gravity below the surface of the earth $= g\left(1 - \dfrac{d}{R}\right)$

$$g_h = g_d$$

$$g\left(1 - \frac{2h}{R}\right) = \left(1 - \frac{d}{R}\right)g$$

$$d = 2h$$

$$d = 2km$$

Q 24. A potentiometer is an accurate and versatile device to make electrical measurements of E. M. F. because the method involves:
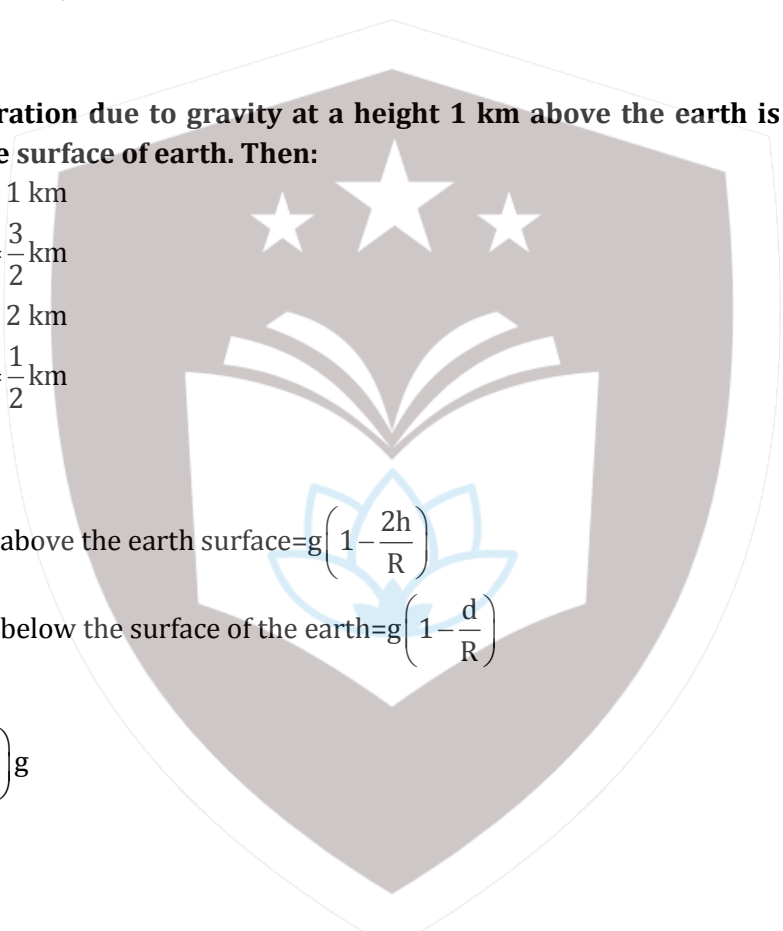
Option A   potential gradients
Option B   a condition of no current flow through the galvanometer
Option C   a combination of cells, galvanometer and resistance
Option D   cells

Correct Option B
Solution: Zero deflection. It does not draw any current from the circuit during reading.

Q 25. A spherical black body with a radius of 12 cm radiates 450 watt power at 500 K. If the radius were halved and the temperature doubled, the power radiated in watt would be:

Option A   450
Option B   1000
Option C   1800
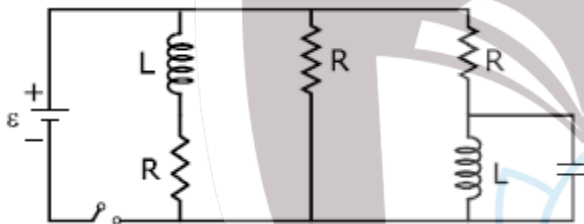Option D   225

Correct Option C
Solution:

$$P \propto R^2 T^4$$

$$R' = \frac{R}{2}, T' = 2T$$

$$P_2 = \left(\frac{R}{2}\right)^2 (2T)^4 P_1 = \frac{16}{4} P_1 = 4P_1 = 1800 \text{ watt.}$$

Q 26. Figure shows a circuit that contains three identical resistor with resistance R = 9.0 Ω each, two identical inductors with inductance L = 2.0 mH each, and an ideal battery with emf ε = 18 V. The current "i" through the battery just after the switch closed is,...

Option A   0.2 A
Option B   2 A
Option C   4 A
Option D   2 mA

Correct Option C
Solution: Just after switch is closed
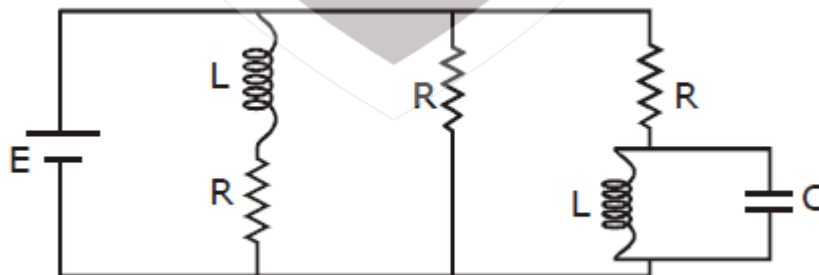
C = short circuit
L = open circuit
Current will not pass through inductor

$$R_{eff} = \frac{R \times R}{R + R} = \frac{R}{2} = \frac{9}{2} = 4.5\Omega$$

$$\therefore = \frac{18}{4.5} = 4 \text{ amp}$$

Q 27. Radiaactive material 'A' as decay constant '8 λ'. and material 'B' has decay constant 'λ'. Initially they have same number of nuclei. After what time, the ratio of number of muclei

Of material 'B' to that 'A' will be $\dfrac{1}{e}$?

Option A $\qquad \dfrac{1}{7\lambda}$

Option B $\qquad \dfrac{1}{8\lambda}$

Option C $\qquad \dfrac{1}{9\lambda}$

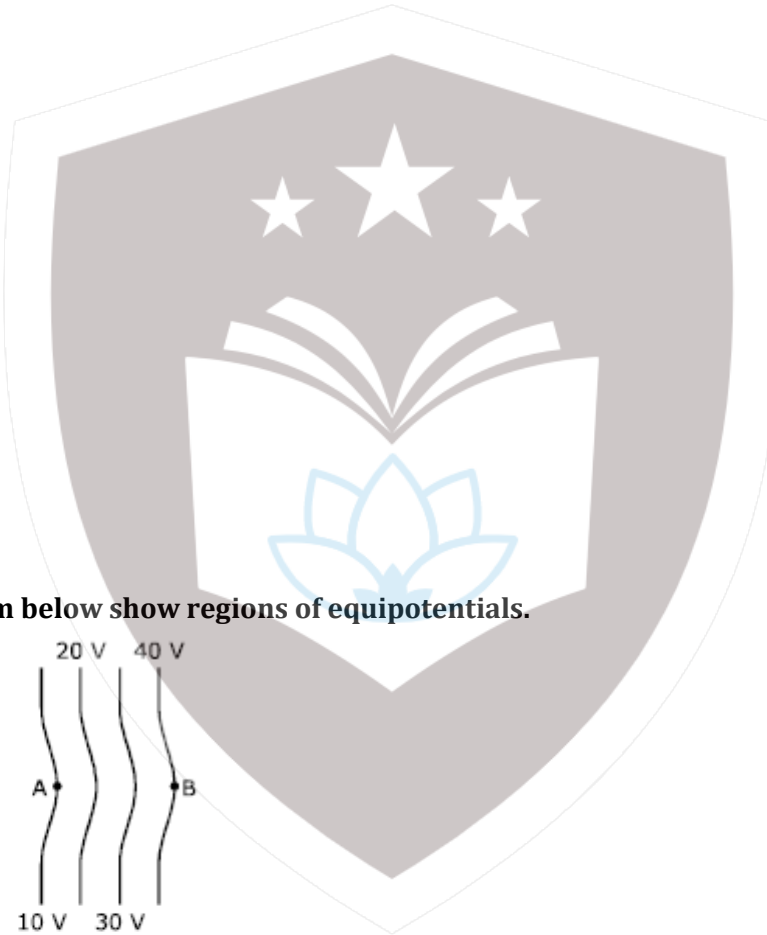Option D $\qquad \dfrac{1}{\lambda}$

Correct Option A

Solution:

$$\frac{N_A}{N_B} = \frac{e^{-8\lambda t}}{e^{-\lambda t}} = e^{-7\lambda t}$$
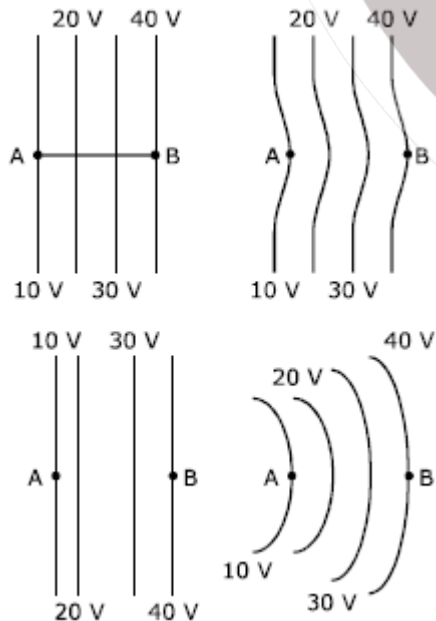
$$\frac{1}{e} = e^{-7\lambda t}$$

$$7\lambda t = 1$$

$$t = \frac{1}{7\lambda}$$

Q 28. The diagram below show regions of equipotentials.

A positive charge is moved from A to b in each diagram.

Option A $\qquad$ In all the four cases the work done is the same.

Option B $\qquad$ Minimum work is required to move q in figure (a)

Option C   Maximum work is required to move in q in figure (b)

Option D   Maximum work is required to move in q in figure (c)

Correct Option A

Solution:

  $W = q\Delta V$

Change in potential is same in all cases hence work done is same.

Q 29. Two astronauts are floating in gravitational free space after having lost contact with their spaceship. The two will:

Option A   move towards each other

Option B   move away from each other

Option C   will become stationary

Option D   keep floating at the same distance between them

Correct Option A

Solution: As there is gravitational free space therefore there will be no influence of any external force. The only force is gravitational force of attraction between them. Hence they attract each other and move towards each other.

Q 30. The x and y coordinates of the particle at any time are x = 5t – 2t² and y = 10t respectively, where x and y are in meters and t in seconds. The acceleration of the particle at t= 2s is:

Option A   5 m/s²

Option B   - 4 m/s²

Option C   - 8 m/s²

Option D   0

Correct Option B

Solution:

$x = 5t - 2t^2$

$V_x = \dfrac{dx}{dt} = 5 - 4t$
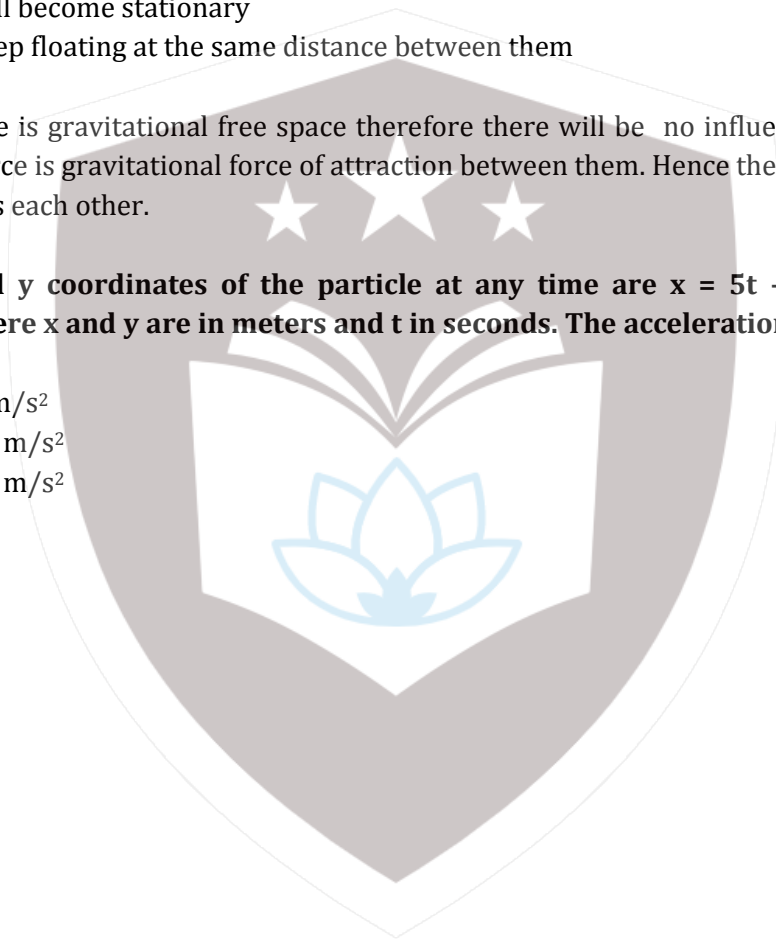
$a_x = \dfrac{dv_x}{dt} = -4ms^{-2}$

$y = 10t$

$V_y = \dfrac{dy}{dt} = 10$

$a_x = \dfrac{dv_y}{dt} = 0$

Acceleration of particle at t=2sec is -4ms^{-2}

Q 31. One end of string of length is connected to a particle of mass 'm' and the other end is connected to a small peg on a smooth horizontal table. If the particle moves in circle with speed 'v', the net force on the particle (directed towards center) will be (T represents the tension in the string)

Option A $\qquad T + \dfrac{mv^2}{l}$

Option B $\qquad T - \dfrac{mv^2}{l}$

Option C $\qquad$ Zero

Option D $\qquad$ T

Correct Option D

Solution:

Here the centripetal force is provided by tension in the sting hence T which is equal to $\dfrac{mv^2}{l}$.

Q 32. A particle executes linear simple harmonic motion with an amplitude of 3 cm. When the particle is at 2 cm from the mean position, the magnitude of its velocity is equal to that of its acceleration. Then its time period in seconds is:

Option A $\qquad \dfrac{\sqrt{5}}{2\pi}$

Option B $\qquad \dfrac{4\pi}{\sqrt{5}}$

Option C $\qquad \dfrac{2\pi}{\sqrt{3}}$

Option D $\qquad \dfrac{\sqrt{5}}{\pi}$

Correct Option B

Solution:

Amplitude, $A = 3 \times 10^{-2}$

$x = 2 \times 10^{-2}$

acceleration, $a = \omega^2 x$

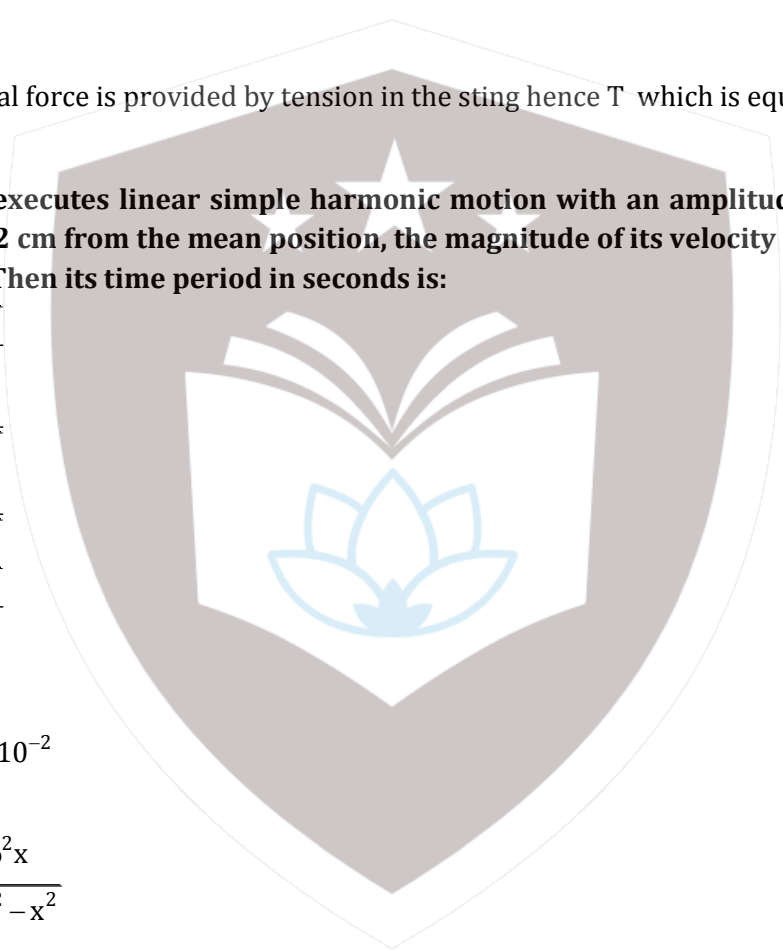Velocity, $v = \omega\sqrt{A^2 - x^2}$

At x=2cm

$a = v$

$\omega^2 x = \omega\sqrt{A^2 - x^2}$

$\omega x = \sqrt{A^2 - x^2}$

$\dfrac{2\pi}{T} \times 2 = \sqrt{3^2 - 2^2}$

$T = \dfrac{4\pi}{\sqrt{5}}$

Q 33. Two Polaroids P_1 and P_2 are placed with their axis perpendicular to each other. Unpolarized light I_0 is incident on P_1. A third polaroid P_3 is kept in between P_1 and P_2 such that axis makes an angle 45° with that of P_1. The intensity of transmitted light through P_2 is:
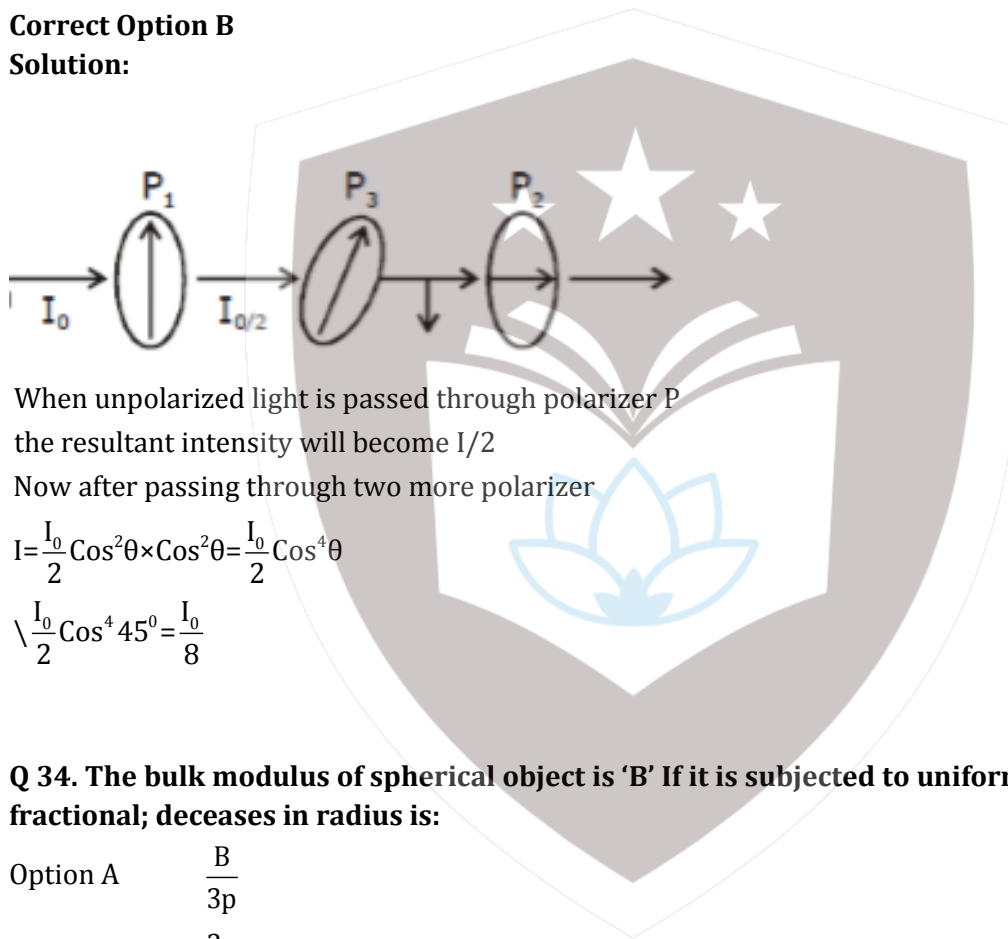
Option A $\dfrac{I_0}{4}$

Option B $\dfrac{I_0}{8}$

Option C $\dfrac{I_0}{16}$

Option D $\dfrac{I_0}{2}$

Correct Option B

Solution:

When unpolarized light is passed through polarizer P

the resultant intensity will become $I/2$

Now after passing through two more polarizer

$I=\dfrac{I_0}{2}Cos^2\theta \times Cos^2\theta=\dfrac{I_0}{2}Cos^4\theta$

$\backslash\dfrac{I_0}{2}Cos^4 45^0=\dfrac{I_0}{8}$

Q 34. The bulk modulus of spherical object is 'B' If it is subjected to uniform pressure 'p' , the fractional; deceases in radius is:

Option A $\dfrac{B}{3p}$

Option B $\dfrac{3p}{B}$

Option C $\dfrac{p}{3B}$

Option D $\dfrac{p}{B}$

Correct Option C

Solution:

$$B = \frac{P}{\Delta V / V}$$

$$\frac{\Delta V}{V} = \frac{P}{B}$$

$$V = \frac{4}{3}\pi R^3$$

$$\frac{3\Delta R}{R} = \frac{P}{B}$$

$$\frac{\Delta R}{R} = \frac{P}{3B}$$

Q 35. In an electromagnetic wave in free space the root mean square value of the electric field is E_{rms} = 6V/m. The peak value of the magnetic field is:

Option A 2.83×10^{-8}T

Option B 0.70×10^{-8}T

Option C 4.23×10^{-8}T

Option D 1.41×10^{-8}T

Correct Option A

Solution:

$$E_{rms} = 6$$

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

$$E_0 = B_0 c$$

$$B_0 = \frac{E_0}{c} = \sqrt{2}\frac{E_{sum}}{C} = \frac{\sqrt{2} \times 6}{3 \times 10^8} = 2\sqrt{2} \times 10^{-8}$$

$$= 2.83 \times 10^{-8}$$

Q 36. A rope is wound around a hollow cylinder of mass 3 kg and radius 40 cm. What is the angular acceleration of the cylinder if the rope is pulled with a force of 30 N?
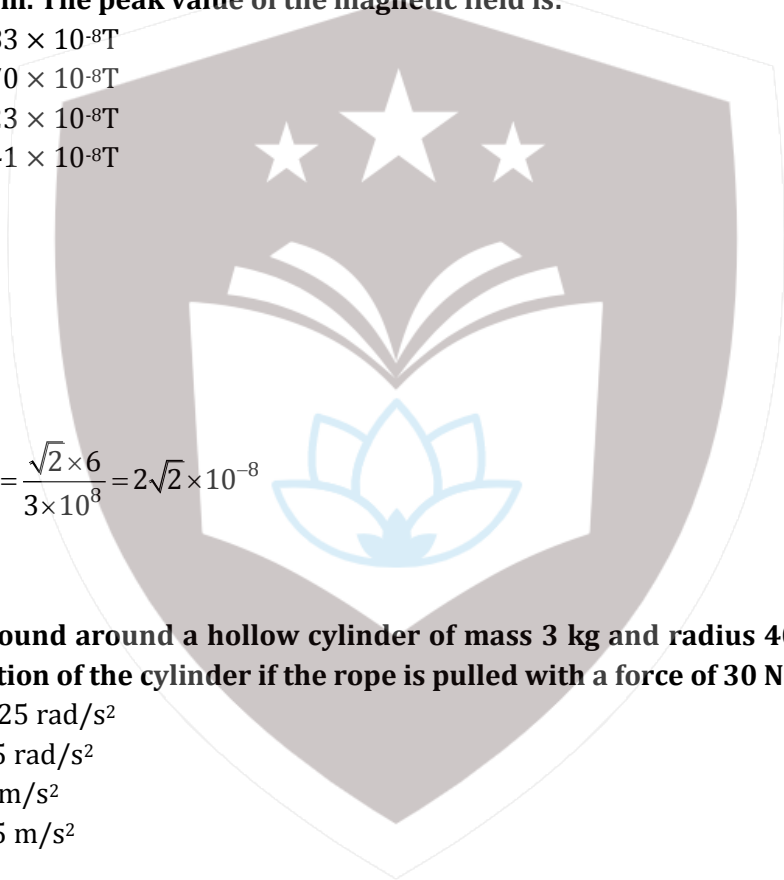
Option A   0.25 rad/s²

Option B   25 rad/s²

Option C   5 m/s²

Option D   25 m/s²

Correct Option B

Solution:

$\tau = F \times R$

and

$\tau = I\alpha$

$F.R = I\alpha$

so

$F \times R = I\alpha$

$\alpha = \dfrac{FR}{I}$

On substituting values

$= \dfrac{30 \times 40 \times 10^{-2}}{3 \times 40 \times 40 \times 10^{-4}}$

$= \dfrac{10}{40} \times 10^2 = \dfrac{1000}{40}$

$= 25 \text{rad}/s^2$

Q 37. Two discs of same moment of inertia rotating about their regular axis passing through center and perpendicular to the plane of disc with angular velocities ω_1 and ω_2. They are brought into contact face to face coinciding the axis of rotation. The expression for loss of energy during this process is:

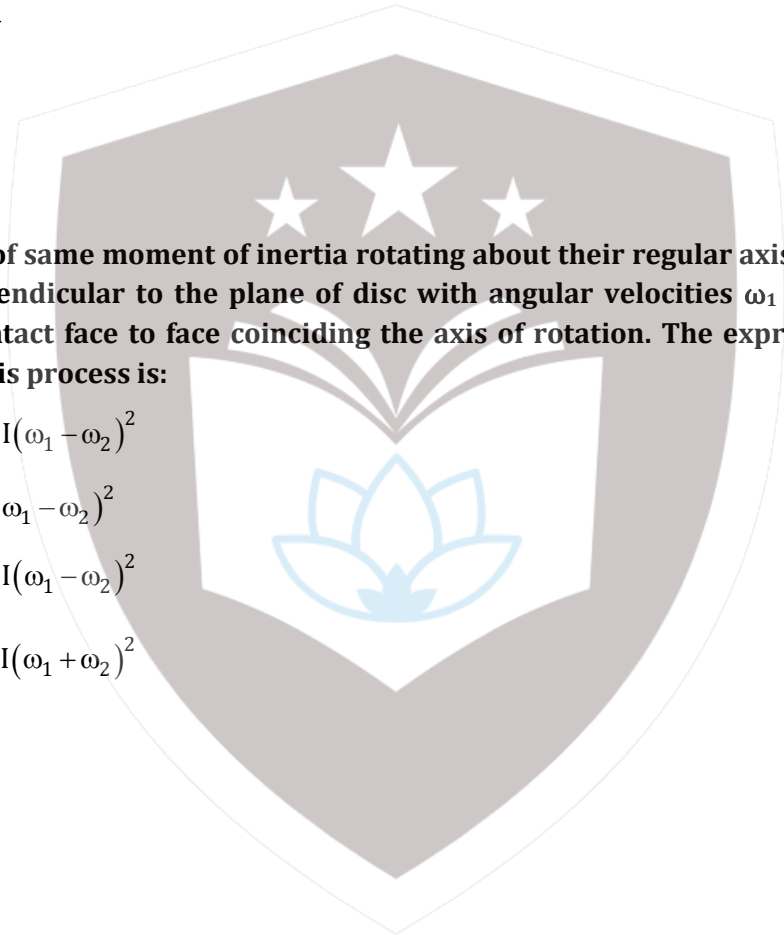Option A $\qquad \dfrac{1}{4}I(\omega_1 - \omega_2)^2$

Option B $\qquad I(\omega_1 - \omega_2)^2$

Option C $\qquad \dfrac{1}{8}I(\omega_1 - \omega_2)^2$

Option D $\qquad \dfrac{1}{2}I(\omega_1 + \omega_2)^2$

Correct Option A

Solution:

According to the law of concervation of angular momentum

The angular moment of the system remain conserved

$I\omega_1 + I_2\omega = 2I\ \omega_0$

$$\omega_0 = \frac{\omega_1 + \omega_2}{2}$$

$$K_{initial} = \frac{1}{2}I\left(\omega_1^2 + \omega_2^2\right)$$

$$K_{Final} = \frac{1}{2}(2I)(\omega_1 + \omega_2)^2$$

Change in kinetic energy will be

$K_{Final} - K_{initial}$

$$= I\left[\frac{\omega_1^2}{4} + \frac{\omega_2^2}{4} - \frac{2\omega_1\omega_2}{4}\right]$$

$$= \frac{I}{4}(\omega_1 - \omega_2)^2$$

Q 38. The photoelectric threshold wavelength of silver is 3250×10^{-10}m. The velocity of the electron ejected from a silver surface by ultraviolet light of wavelength 2536×10^{-10}m is (Given h = 4.14×10^{-15} eVs and c = 3×10^8 ms^{-1})

Option A $\approx 0.6 \times 10^6$ ms^{-1}

Option B $\approx 61 \times 10^3$ ms^{-1}

Option C $\approx 0.3 \times 10^6$ ms^{-1}

Option D $\approx 6 \times 10^8$ ms^{-1}

Correct Option A

Solution:

$\lambda_0 = 325 nm$

$\lambda = 253.6 nm$

Work function$=\phi=\dfrac{1242}{253.6} = 3.82 eV$

$Energy = \dfrac{1242}{325} = 4.89 eV$

$KE_{max} = E - \phi = 4.89 eV - 3.82 eV = 1.07 eV$

$\dfrac{1}{2}mv^2 = 1.07 \times 1.6 \times 10^{-19}$

$V = \sqrt{\dfrac{2 \times 1.077 \times 1.6 \times 10^{-19}}{9.1 \times 10^{-31}}} = 0.6 \times 10^6\, m/s$
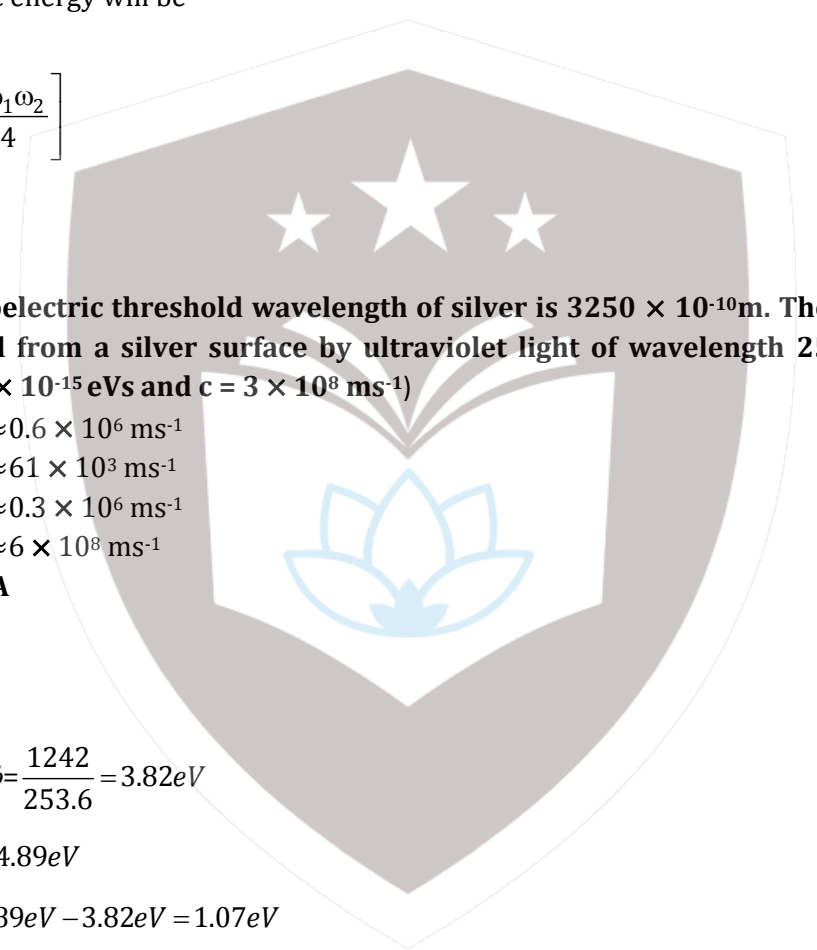
Q 39. A 250 – Turn rectangular coil of length 2.1 cm and width 1.25 cm carries a current of 85 μA and subjected to a magnetic field of strength 0.85T. Work done for rotating the coil by 180° against the torque is:

Option A   4.55 μJ
Option B   2. 3 μJ
Option C   1. 15 μJ
Option D   9. 1 μJ

Correct Option D

Solution:

Work done $= MB\left(Cos\theta_1 - Cos\theta_2\right)$

Work done $= MB\left(Cos0^0 - Cos180^0\right)$

Work done $= 2MB$

Work done $= 2NIAB$

Work done $= 2 \times 250 \times 85 \times 10^{-6} \times 1.25 \times 2.1 \times 10^{-4} \times 0.85$

Work done $= 9.1\mu J$

Q 40. The ratio of wavelenght of the last line of Balmer series and the last line of Lyman series is:

Option A   1
Option B   4
Option C   0.5
Option D   2

Correct Option B

Solution:

$$\frac{1}{\lambda} = R\left[\frac{1}{m^2} - \frac{1}{n^2}\right]$$

For last line of balmer series

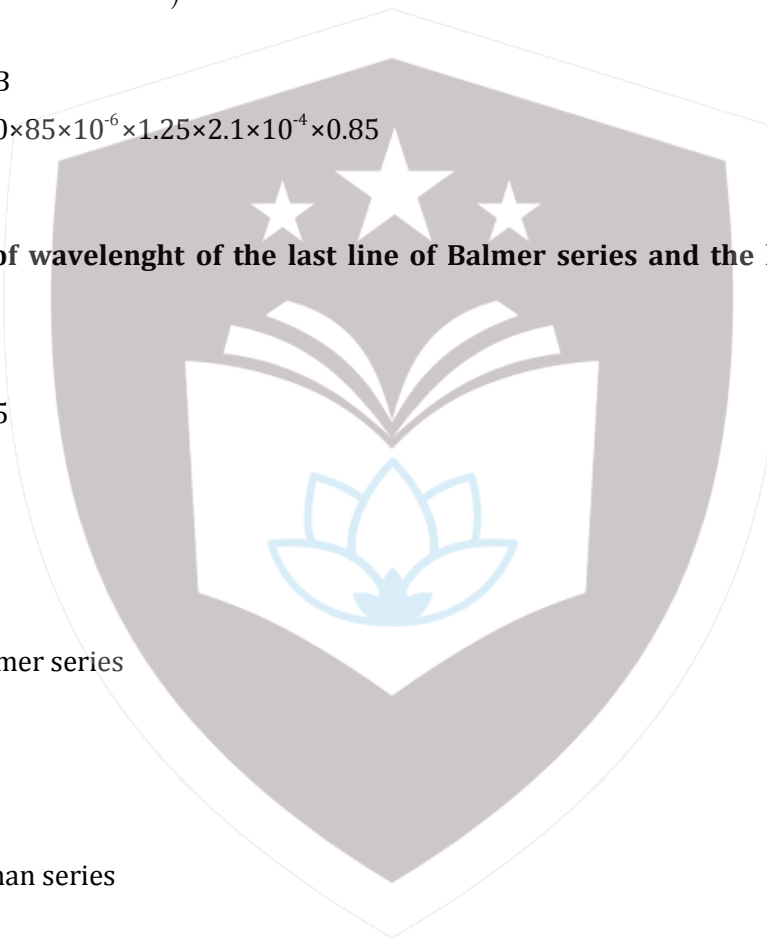$$\frac{1}{\lambda_b} = R\left[\frac{1}{2^2} - \frac{1}{\infty^2}\right]$$

$$\lambda_b = \frac{4}{R}$$

For last line of lyman series

$$\frac{1}{\lambda_b} = R\left[\frac{1}{1^2} - \frac{1}{\infty^2}\right]$$

$$\lambda_a = \frac{1}{R}$$

$$\frac{\lambda_b}{\lambda_a} = 4$$

Q 41. A carnot engine having an efficiency of $\frac{1}{10}$ **as heat engine, is used as a refrigerator. If the work done on the system is 10 J, the amount of energy absorbed from the reservoir at lower temperature is:**

Option A   90 J
Option B   99 J
Option C   100 J
Option D   1 J

Correct Option A

Solution:

$$workdone = Q_2(\frac{T_1}{T_2} - 1) ------1$$

$$\eta = 1 - \frac{T_2}{T_1}$$

$$\frac{1}{10} = 1 - \frac{T_2}{T_1}$$

$$\frac{T_2}{T_1} = 1 - \frac{1}{10}$$

$$\frac{T_2}{T_1} = \frac{9}{10} \Rightarrow \frac{T_1}{T_2} = \frac{10}{9}$$

$using$ equation 1

$$10 = Q_2(\frac{10}{9} - 1)$$

$$Q_2 = 90 J$$

Q 42. A gas mixture consists of 2 moles of O_2 and 4 moles of Argon at temperature T. Neglecting all vibrational modes, the total internal energy of the system is:

Option A   15 RT
Option B   9 RT
Option C   11 RT
Option D   4 RT

Correct Option C

Solution:

Total internal energy of the system is given by

$$U = \frac{n_1 f_1}{2} RT + \frac{n_2 f_2}{2} RT$$

As oxygen is diatomic therefore its degree of freedom would be 5

whereas for monoatomic argon degree of freedom is 3

$$= \frac{RT}{2}[2 \times 5 + 4 \times 3]$$

$$= \frac{22}{2} RT = 11 RT$$
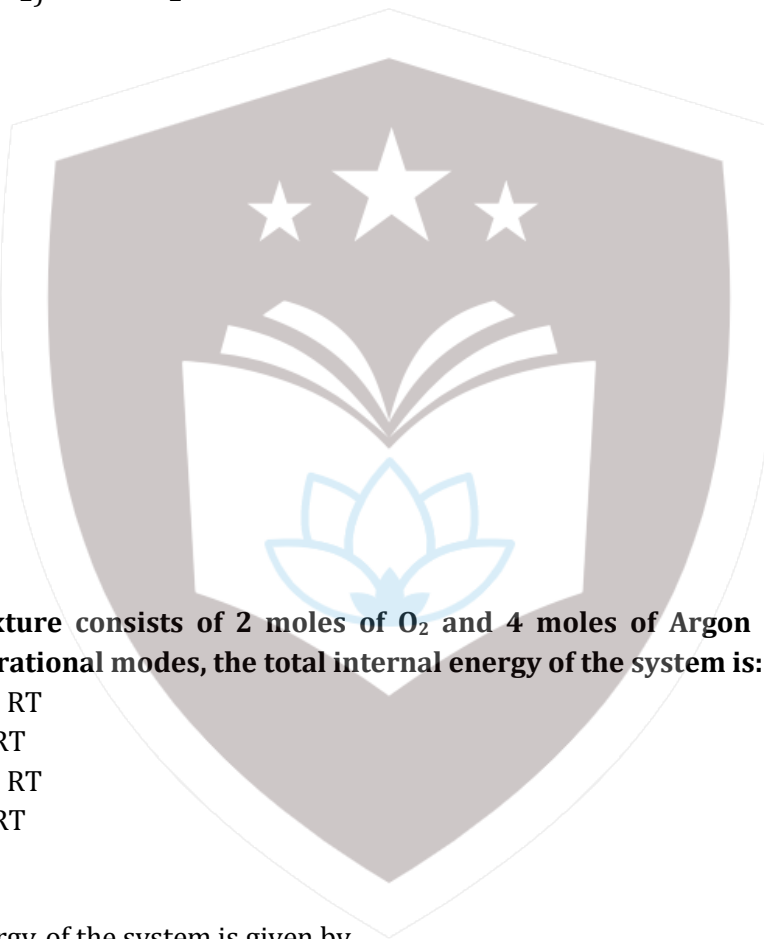
Q 43. An arrangement of three parallel straight wires placed perpendicular to plane of paper carrying same current 'I' along the same direction is shown in figure. Magnitude of force per unit length on the middle wire 'B' is given by:
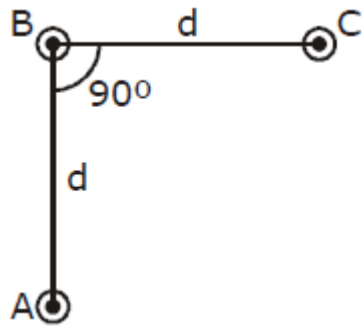
Option A $\dfrac{2\mu_0 i^2}{\pi d}$

Option B $\dfrac{\sqrt{2}\mu_0 i^2}{\pi d}$

Option C $\dfrac{\mu_0 i^2}{\sqrt{2}\pi d}$

Option D $\dfrac{\mu_0 i^2}{2\pi d}$

Correct Option C

Solution:
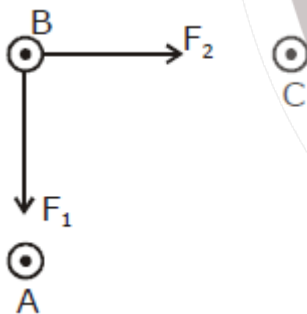
$F_{AB} = F_{BC} = F$

$F_{net} = \sqrt{F_{AB}^2 + F_{BC}^2}$

$= \sqrt{2}\ F$

$\because F = \dfrac{\mu_0 i^2}{2\pi d}$

$= \sqrt{2}\ \dfrac{\mu_0 i^2}{2\pi d}$

$\dfrac{\mu_0 i^2}{\sqrt{2}\pi d}$

The net force act in the directon making angle 45° with both the wires

Q 44. A U tube with both ends open to the atmosphere, is partially filled with water. Oil, which is immiscible with water, is poured into one side until it stands at a distance of 10 mm above the water level on the other side. Meanwhile the water rises by 65 mm from its original level (see diagram). The density of the oil is:
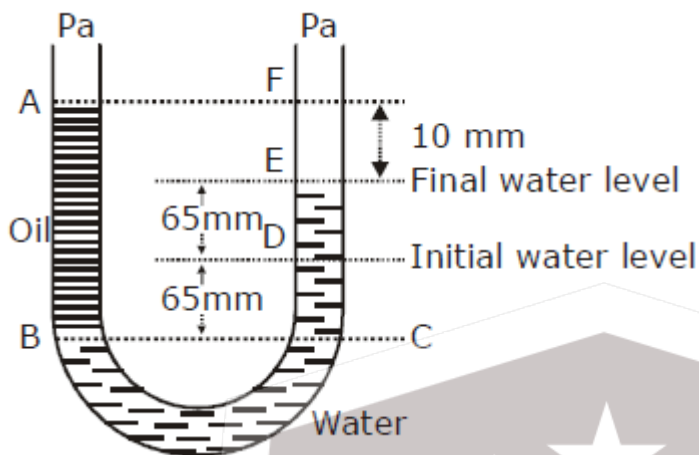
Option A	425 kg m⁻³
Option B	800 kg m⁻³
Option C	928 kg m⁻³
Option D	650 kg m⁻³

Correct Option C

Solution:
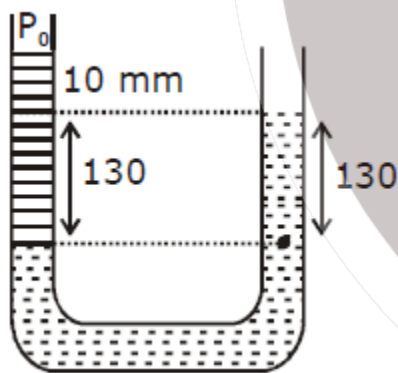
The pressure at horizontal level is same

$$P_{atm} + \rho_{oil}g\,(140) = P_{atm} + \rho_w\,g\,(130)$$

$$P = \frac{\rho_w \times 130}{140} = \rho_w \times \frac{13}{14} = 928\,\frac{kg}{m^3}$$

Q 45. Which of the following statements are correct?
   (a) Centre of mass of a body always coincides with the centre of gravity of the body.
   (b) Centre of mass of a body is the point at which the total gravitational torque on the body is zero.
   (c) A couple on a body produce both translational and rotational motion in a body.
   (d) Mechanical advantage greater than one means that small effort can be used to lift a large load.

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

Correct Option D

Solution: Center of mass and center of gravity may not be same always.

CHEMISTRY

Q 1. Name the gas that can readily decolourise acidified KMnO₄ solution:

Option A SO_2

Option B NO_2

Option C P_2O_5

Option D CO_2

Correct Option A

Solution:

$$KMnO_4 + SO_2 \rightarrow \underset{colourless}{MnSO_4} + H_2SO_4 + K_2SO_4$$

Q 2. Mechanism of a hypothetical reaction $X_2 + Y_2 \rightarrow 2\,XY$ is given below:

  i.   **$X_2 \rightarrow X + X$ (fast)**

 ii.   **$X + Y_2 \rightleftharpoons XY + Y$ (slow)**

iii.   **$X_2 + Y_2 \rightarrow XY$ (fast)**

The overall order of the reaction will be:

Option A   2

Option B   0

Option C   1.5

Option D   1

Correct Option C

Solution:

$X + Y_2 \rightleftharpoons XY + Y$ (slow)

Hence rate = k (X) (Y_2) .... (1)

$X_2 \rightleftharpoons X + X$ (fast)
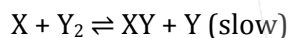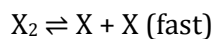
$$K_{eq} = \frac{[X]^2}{[X_2]}, [X] = K_{eq}^{1/2} [x_2]^{1/2} \,........(ii)$$

from (i) and (ii)

$$Rate = K \cdot K_{eq}^{1/2} \cdot [X_2]^{1/2} (Y_2)$$

Order of reaction is 1.5.

Q 3. The element Z = 114 has been discovered recently. It will belong to which of the following family/group and electronic configuration?

Option A   Carbon family,   [Rn] $5f^{14}\,6d^{10}\,7s^2\,7p^2$

Option B   Oxygen family,   [Rn] $5f^{14}\,6d^{10}\,7s^2\,7p^4$

Option C   Nitrogen family, [Rn] $5f^{14}\,6d^{10}\,7s^2\,7p^6$

Option D   Halogen family,   [Rn] $5f^{14}\,6d^{10}\,7s^2\,7p^5$

Correct Option A

Solution: The recently discovered element Z= 114 belongs to Carbon family.

Q 4. The heating of phenyl-methyl ethers with HI produces.

Option A   Iodobenzene

Option B   Phenol

Option C   Benezene

Option D   Ethyl Chlorides

Correct Option B

Solution:

$$Ph-\overset{..}{\underset{..}{O}}-CH_3 \xrightarrow{H^+} Ph-\overset{\oplus}{\underset{\underset{H}{|}}{O}}-CH_3 \xrightarrow{I^+} Ph-OH + HI-CH_3$$

Q 5. Which one is the correct order of acidity?

Option A $CH\equiv CH > CH_3-C\equiv CH > CH_2=CH_2 > CH_3-CH_3$

Option B $CH\equiv CH > CH_2=CH_2 > CH_3-C\equiv CH > CH_3-CH_3$

Option C $CH_3-CH_3 > CH_2=CH_2 > CH_3-C\equiv CH > CH\equiv CH$

Option D $CH_2=CH_2 > CH_3-CH=CH_2 > CH_3-C\equiv CH > CH\equiv CH$

Correct Option A

Solution: As the s-character of carbon atom increases its acidic strength increases, hence the correct order of acidity is $CH\equiv CH > CH_3-C\equiv CH > CH_2=CH_2 > CH_3-CH_3$.
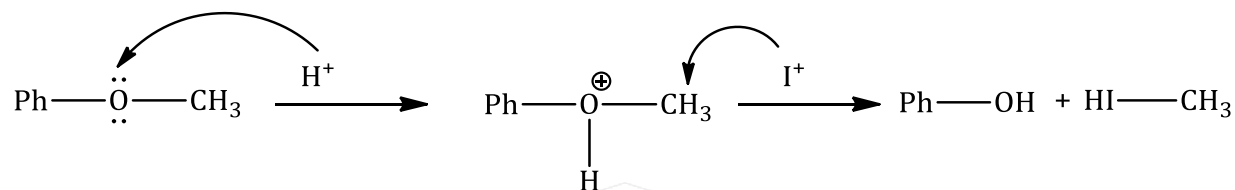
Q 6. Predict the correct intermediate and product in the following reaction:

$$H_3C-C\equiv CH \xrightarrow[HgSO_4]{H_2O, H_2SO_4} \underset{(A)}{intermediate} \rightarrow \underset{(B)}{Product}$$
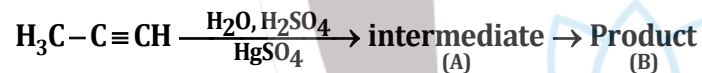
Option A   A: $H_3C-\underset{\underset{OH}{|}}{C}=CH_2$ B: $H_3C-\underset{\underset{SO_4}{|}}{C}=CH_2$

Option B   A: $H_3C-\underset{\underset{O}{|}}{C}-CH_3$ B: $H_3C-C\equiv CH$

Option C   A: $H_3C-\underset{\underset{OH}{|}}{C}=CH_2$ B: $H_3C-\underset{\underset{O}{||}}{C}-CH_3$

Option D   A: $H_3C-\underset{\underset{SO_4}{|}}{C}=CH_2$ B: $H_3C-\underset{\underset{O}{||}}{C}-CH_3$

Correct Option C

Solution:

$$H_3C-C\equiv CH \xrightarrow[\underset{(Oxymercuration)}{HgSO_4}]{H_2O, H_2SO_4} \underset{\underset{(A)}{OH}}{H_3C-C=CH_2} \xrightarrow{Tautomerism} \underset{\underset{(B)}{O}}{H_3C-C-CH_3}$$
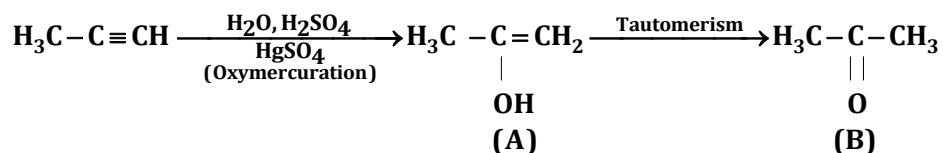
Q 7. The equilibrium constant of the following are:

$N_2 + 3 H_2 \rightleftharpoons 2 NH_3 \qquad K_1$

$N_2 + O_2 \rightleftharpoons 2 NO \qquad K_2$

$H_2 + \dfrac{1}{2} O_2 \longrightarrow H_2O \quad K_3$
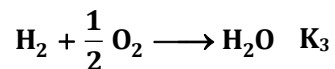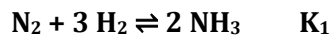
The equilibrium constant (K) of the reaction:

$2NH_3 + \dfrac{5}{2} O_2 \xrightleftharpoons{K} 2NO + 3H_2O$, **will be:**

Option A $K_2 K_3^3 / K_1$

Option B $K_2 K_3 / K_1$

Option C $K_2^3 K_3 / K_1$

Option D $K_1 K_3^3 / K_2$

Correct Option A

Solution:

$2NH_3 \rightleftharpoons N_2 + 3H_2 \quad \dfrac{1}{k_1}$ ....(1)

$3H_2 + \dfrac{3}{2} O_2 \rightleftharpoons 3H_2O \; K_3^3$ ....(2)

$N_2 + O_2 \rightleftharpoons 2NO \; K_2$ ....(3)
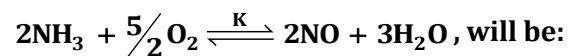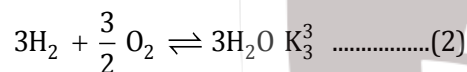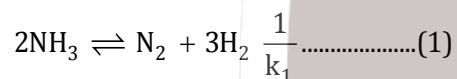
From eq.(1), (2) and (3) we get,

$2NH_3 + \dfrac{5}{2} O_2 \rightleftharpoons 2NO + 3H_2O$
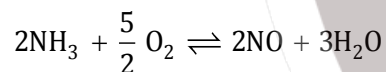
$$k = \dfrac{K_2 K_3^2}{K_1}$$

Q 8. Which one is the most acidic compound?

Option A
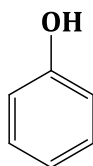
Option B
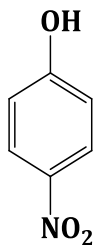
Option C
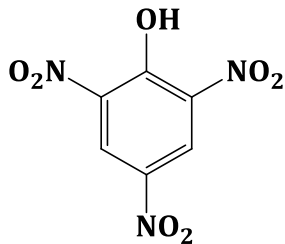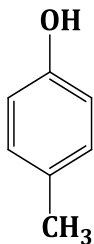
Option D

Correct Option C

Solution: Three nitro groups present on the benzene ring are exerting strong –M and –I effect which decreases electron density of benzene ring and increases the acidic strength.
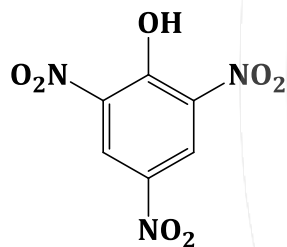
Picric Acid

-M/-I α Acidic Strength

Q 9. The correct increasing order of basic strength for the following compound is:
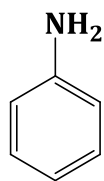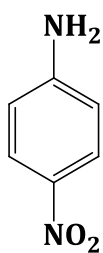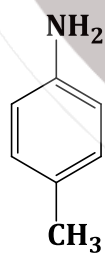
(I)	(II)	(III)

Option A	III < I < II
Option B	III < II < I
Option C	II < I < III
Option D	II < III < I

Correct Option C

Solution: The correct increasing order of basic strength is

$$\underset{(II)}{\underset{NO_2}{\overset{NH_2}{\bigcirc}}} < \underset{(I)}{\overset{NH_2}{\bigcirc}} < \underset{(III)}{\underset{CH_3}{\overset{NH_2}{\bigcirc}}}$$
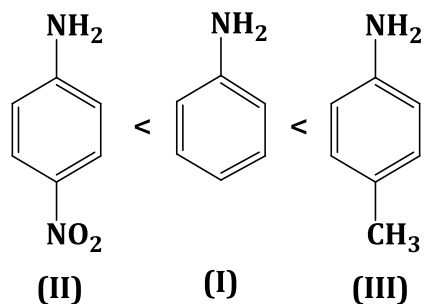
Q 10. Ionic mobility of which of the following alkali metal ions is lowest when aqueous solution of their salts are put under an electric fields?

Option A   K

Option B   Rb

Option C   Li

Option D   Na

Correct Option C

Solution: Smaller the size of hydrated ion highest is the ionic mobility.

Li has larger size of hydrated ion due to high hydration have lowest ionic mobility in aqueous solution.

Q 11. The most suitable method of separation of 1: 1 mixture of ortho and para – nitrophenols is

Option A   Chromatography

Option B   Crystallisation

Option C   steam distillation

Option D   Sublimation

Correct Option C

Solution:

The o and p-nitrophenols are separated by steam distillation sine o-isomer is steam volatile due to intermolecular H-bonding while p-isomer is not steam volatile due to association of molecules by intermolecular H-bonding.

Q 12. $HgCl_2$ and I_2 both when dissolved in water containing I^- ions the pair of species formed is:

Option A HgI_2, I^-

Option B HgI_4^{2-}, I_3^-

Option C $Hg_2 I_2$, I^-

Option D HgI_2, I_3^-

Correct Option B

Solution: HgI_4^{2-}, I_3^-

$$HgCl_2 + 2I^- \xrightarrow[-2Cl^-]{} HgI_2 \xrightarrow{2I^-} \underset{\substack{\text{soluble} \\ \text{complex}}}{[HgI_4]^{-2}}$$

$$I_2 + I^- \longrightarrow \underset{\substack{\text{soluble} \\ \text{complex}}}{I_3^-}$$
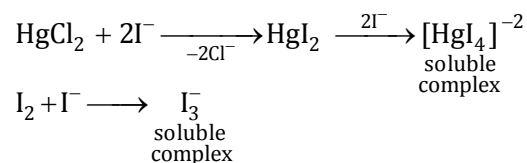
Q 13. Mixture of chloroxylenol and terpineol acts as:

Option A   antiseptic

Option B   antipyretic

Option C   antibiotic

Option D   analgesic

Correct Option A

Solution: A mixture of chloroxylenol and teripinol is known as Dettol which is an antiseptic.

Q 14. An example of a sigma bonded organometallic compound is:

Option A   Grignard' reagent

Option B   Ferrocene

Option C   Cobaltocene

Option d   Ruthenocene

Correct Option A

Solution: In Grignard' reagent, magnesium metal formed a sigma bond with the carbon atom.

Q 15. A first order reaction has a specific reaction rate of 10^{-2} sec^{-1}. How much time will it take for 20 g of the reactant of reduce to 5 g?

Option A   138.6 sec

Option B   346.5 sec

Option C   693.0 sec

Option D   238.6 sec

Correct Option A

Solution:

$$t = \frac{2.303}{k} \log \frac{a}{a-x}$$

$$= \frac{2.303}{10^{-2}} \log \frac{20}{5}$$

$$= \frac{2.303 \times 0.6}{10^{-2}}$$

$$= 138.6 \text{ sec}$$

Q 16. Match the interhalogen compound of column I with the geometry in column II and assign the correct code.

Column I	Column II
XX'	T- shape
XX'$_3$	Pentagonal bipyramial
XX'$_5$	Linear
XX'$_7$	Square-pyramidal
	Tetrahedral

Codes:

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

Correct Option A

Solution:

A. **XX′** →(iii) **Linear**

B. **XX′$_3$** → (i) **T- shape**

C. **XX′$_5$** →(iv) **Square-pyramidal**

D. **XX′$_7$** → (ii) **Pentagonal bipyramial**

Q 17. Concentration of the Ag$^+$ ions in a saturated solution of Ag$_2$C$_2$O$_4$ is 2.2 × 10^{-4} mol L^{-1}. Solubility product of Ag$_2$C$_2$O$_4$ is:

Option A   2.66 × 10^{-12}

Option B   4.5 × 10^{-11}

Option C   5.3 × 10^{-12}

Option D   2.42 × 10^{-8}

Correct Option C

Solution:

$$Ag_2C_2O_4 \rightleftharpoons \underset{2.2 \times 10^{-4}}{2Ag^+} + \underset{\frac{2.2 \times 10^{-4}}{2}}{C_2O_4^{-2}}$$
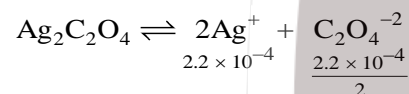
$$K_{sp} = \left[Ag^+\right]^2 \left[C_2O_4^{2-}\right]$$

$$= \left[\left(2.2 \times 10^{-4}\right)^2 \times \left(\frac{2.2 \times 10^{-4}}{2}\right)\right]$$

$$= 5.324 \times 10^{-12}$$

Q 18. In the electrochemical cell:

Zn|ZnSO$_4$ (0.01 M) || CuSO$_4$ (1.0 M)| Cu, the emf of this Daniel cell is E$_1$. When the concentration of ZnSO$_4$ is changed to 1.0 M and that of CuSO$_4$ is changed to 0.01 M, the emf changes to E$_2$. From the followings, which one is the relationship between E$_1$ and E$_2$?

$$\left(\text{Given, } \frac{RT}{F}, 0.059\right)$$

Option A $E_1 < E_2$

Option B $E_1 > E_2$

Option C $E_2 = 0 \neq E_1$

Option D $E_1 = E_2$

Correct Option B

Solution:

Cell reaction : $Zn + Cu^{+2} \longrightarrow Zn^{2+} + Cu$
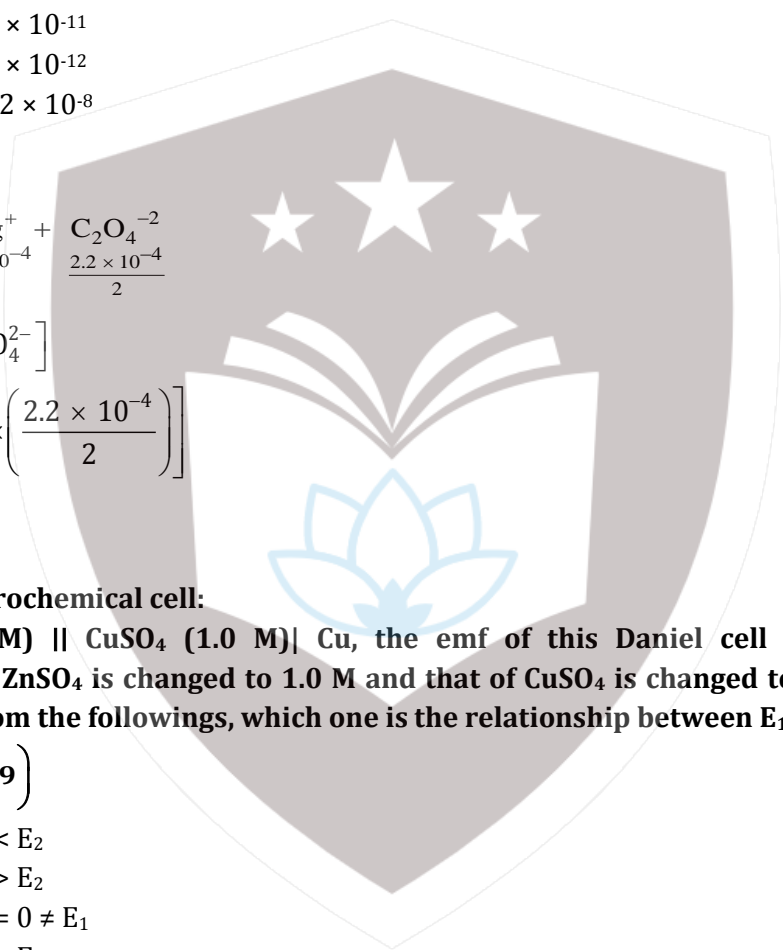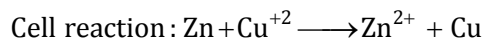
$$E_1 = E^o{}_{cell} + \frac{0.0591}{2} \log_{10} \frac{[Cu^{+2}]}{[Zn^{+2}]}$$

$$E_1 = E^o{}_{cell} + 0.03 \log_{10} \left[\frac{1}{0.01}\right]$$

$$E_1 = E^o{}_{cell} + 0.06$$

$$E_2 = E^o{}_{cell} + \frac{0.0591}{2} \log_{10} \frac{[Zn^{+2}]}{[Cu^{+2}]}$$

$$E_2 = E^o{}_{cell} + 0.03 \log_{10} \left[\frac{0.01}{1}\right]$$

$$E_2 = E^o{}_{cell} - 0.06$$

From above, $E_1 > E_2$

Q 19. Which of the following pairs of compound is isoelectronic and isostructual?

Option A TeI_2, XeF_2

Option B IBr_2^-, XeF_2

Option C IF_3, XeF_2

Option D $BeCl_2$, XeF_2

Correct Option B

Solution:

Compounds	IBr_2^-	XeF_2
Total e^- count	$22\ e^-$	$22\ e^-$
Geometry	sp^3d	sp^3d
Shape	Linear	Linear

Q 20. The IUPAC name of the compound

 is
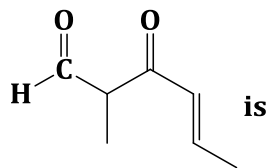
Option A   5–formylhex–2–en–3 one

Option B   5–methyl–4 oxohex–2–en–5–enal

Option C   3–keto–2–methylhex–5–enal

Option D   3–keto–2–methylhex–4–enal

Correct Option D

Solution:
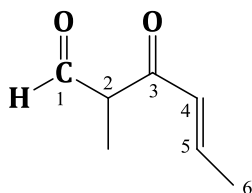
3-keto-2-methylhex-4-enal

Q 21. Which one is the wrong statement?

Option A   The uncertainty principle is $\Delta E \times \Delta t \geq h/4\pi$

Option B   Half-filled and fully filled orbitals have greater stability due to greater exchange energy, greater symmetry and more balanced arrangement

Option C   The energy of 2s orbital is less than the energy of 2p orbital in case of hydrogen like atoms.

Option D   de-Brogle's wavelength is given by $\lambda = \dfrac{h}{m\upsilon}$, where m = mass of the particle , υ = group velocity of the particle.

Correct Option C

Solution: In case of hydrogen like atoms, energy of 2s =2p.

Q 22. Which is the incorrect statement?

Option A   Density decrease in case of crystal with Schottky's defect.

Option B   NaCl(s) insulator, silicon is semiconductor, silver is conductor, quartz is piezo electric crystal.

Option C   Frenkel defect is favoured in those ionic copounds in which sizes of cation and anions are almost equal.

Option D $FeO_{0.98}$ has non stoichiometric metal

Correct Option C

Solution:

In frenkel defect sizes of cation and anions are not equal, the radius of cation is very less than anion.

Q 23. The species, having bond angles of 120° is

Option A ClF_3

Option B NCl_3

Option C BCl_3

Option D PH_3

Correct Option C

Solution:

Compoundzzz	Hybridisation	Bond angle
BCl_3	sp^2	120°

Q 24. For a given reaction, ΔH = 35.5 kJ mol^{-1} and ΔS = 83.6 JK^{-1}mol^{-1}. The reaction is spontaneous at: (Assume that ΔH and ΔS do not vary with temperature)

Option A   T > 425 K

Option B   all temperatures

Option C   T > 298 K

Option D   T < 425 K

Correct Option A

Solution:

$\Delta G = \Delta H - T\Delta S < 0$

$\Delta H < T\Delta S$

$T > \dfrac{\Delta H}{\Delta S}$

$T > \dfrac{35.5 \times 1000}{83.6}$

$T > 424.6 \text{ K}$

$T > 425 \text{ K}$

The reaction is spontaneous at T > 425 since ΔH and ΔS are positive.

Q 25. Which of the following is a sink for CO?

Option A   Micro-organism present in the soil

Option B   Oceans

Option C   Plants

Option D   Haemoglobin

Correct Option A

Solution: Micro-organism present in the soil is a sink for CO.

Q 26. If molality of the dilute solution is doubled the value of molal depression consatant (K_f) will be:

Option A   halved

Option B   tripled

Option C   unchanged

Option D   doubled

Correct Option C

Solution:

$K_b = \dfrac{MRT_b^2}{1000 \, \Delta H_v}, \quad K_f = \dfrac{MRT_f^2}{1000 \, \Delta H_f}$

$\left(K_b = \text{Unchanged} \right) \qquad K_f = \text{unchanged}$

Q 27. Which of the following is dependent on temperature?

Option A   Molarity

Option B   Mole fraction

Option C   Weight percentage

Option D   Molality

Correct Option A

Solution: Molarity depends on volume of solution which is affected by temperature.

Q 28. Which one of the following statement is not correct?

Option A   The value of equilibrium constatnt is changed in the presence of a catalyst in the reaction equilibrium

Option B   Enzymes catalyse maily bio-chemical reactions

Option C   Coenzymes increase the catalytic activity enzyme.

Option D   Catalyst does not initiate any reaction.

Correct Option A

Solution: Value or Eqb. Constant is not changed by catalyst.

Q 29. Identify A and predict the type of reaction
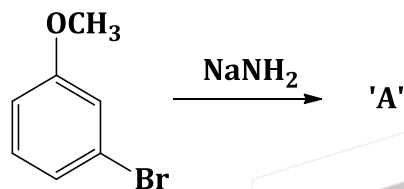
Option A
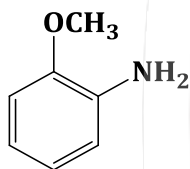
and elimination addition reaction

Option B
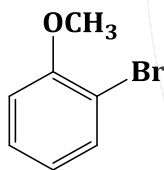
and cine substitution reaction

Option C
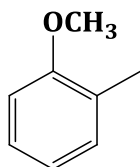
and cine substitution reaction

Option D
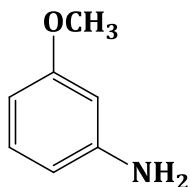
and substitution reaction

Correct Option D

Solution:
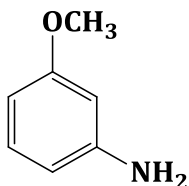
and substitution reaction

Q 30. The correct order of the stoichiometries of AgCl formed when AgNO₃ in excess is treated with the complexes : CoCl₃. NH₃, CoCl₃. 5NH₃, CoCl₃. 4NH₃ respectively is:

Option A   3 AgCl, 1 AgCl, 2 AgCl
Option B   3 AgCl, 2 AgCl, 1 AgCl
Option C   2 AgCl, 3 AgCl, 21 AgCl
Option D   1 AgCl, 3 AgCl, 2 AgCl

Correct Option B

Solution:

$CoCl_3. 6NH_3 + AgNO_3 \rightarrow 3AgCl + [Co(NH_2)_6] Cl_3$
$CoCl_3. 5NH_3 + AgNO_3 \rightarrow 2AgCl + [Co(NH_3)_5Cl] Cl_2$
$CoCl_3. 4NH_3 + AgNO_3 \rightarrow AgCl + [Co(NH_3)_4Cl_2] Cl$
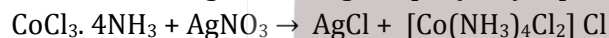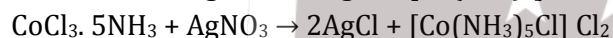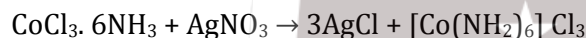
Q 31. The correct statement regarding electrophile is:

Option A   Electrophile is a negatively charged species and can form a bond by accepting a pair of electrons from another electrophile
Option B   Electrophile are generally neturl species and can form a bond by accepting a pair of electron from a nucleophile
Option C   Electrophile can be either netural or positively charged species and can form a bond by accepting a pair of electrons from a nucleophile
Option D   Electrophile is a negatively charged species and can form a bond by accepting a pair of electron from a nucleophile

Correct Option C

Solution:

Electrophile can be either netural or positively charged species and can form a bond by accepting a pair of electrons from a nucleophile

Q 32. A gas is allowed to expand in a well insulted container against a constant external pressure of 2.5 atm from an initial volume of 2.50 L to a final volume of 4.50 L. The change in internal energy ΔU of the gas in joules will be:

Option A   -500 J
Option B   -505 J
Option C   +505 J
Option D   1136.25 J

Correct Option B

Solution:

$\Delta E = q + w$

$q = 0 \qquad w = -pex + \Delta V$

$\Delta E = -505\ J$

$\qquad\qquad = -5 \times 101$

$\qquad\qquad = -505\ J$

Q 33.Which of the following reaction is appropriate for converting acetamide to methanamine?

Option A   Hoffmann hypobromamide reaction

Option B   Stephens reaction

Option C   Gabriels phthalimide synthesis

Option D   Carbylamine reaction

Correct Option A

Solution: Hoffmann hypobromamide reaction is appropriate for converting acetamide to methanamine.

Q 34. With respect to the conformers of ethane, which of the following statements is true?

Option A   Bond angle changes but bond length remains same

Option B   Both bond angle and bond length change

Option C   Both bond angles and bond length remains same

Option D   Bond angle remains same but bond length changes

Correct Option C

Solution: Both bond angles and bond length remains same in the conformers of ethane.

Q 35. In which pair of ions both the species contain S-S bond?

Option A $S_2O_6^{2-}$, $S_2O_3^{2-}$

Option B $S_2O_7^{2-}$, $S_2O_8^{2-}$

Option C $S_4O_6^{2-}$, $S_2O_7^{2-}$

Option D $S_4O_7^{2-}$, $S_2O_3^{2-}$

Correct Option A

Solution: $S_2O_6^{2-}$, $S_2O_3^{2-}$ are the species contain S-S bond.

Q 36. It is because inability of ns^2 electrons of the valence shell to participate on bonding that:

Option A Sn^{2+} is oxidising while Pb^{4+} is redusing

Option B Sn^{2+} and Pb^{4+} are both oxidising and reducing

Option C Sn^{4+} is reducing while Pb^{4+} is oxidising

Option D Sn^{2+} is reducing while Pb^{4+} is oxidising

Correct Option D

Solution: Sn^{2+} is reducing while Pb^{4+} is oxidising

Q 37. Correct wavelength order for the wavelengths of absorption in the visible region for the complexes of Co³⁺ is:

Option A $\quad$ $[Co(H_2O)_6]^{3+}$, $[Co(en)_3]^{3+}$, $[Co(NH_3)_6]^{3+}$

Option B $\quad$ $[Co(H_2O)_6]^{3+}$, $[Co(NH_3)_6]^{3+}$, $[Co(en)_3]^{3+}$

Option C $\quad$ $[Co(NH_3)_6]^{3+}$, $[Co(en)_3]^{3+}$, $[Co(H_2O)_6]^{3+}$

Option D $\quad$ $[Co(en)_3]^{3+}$, $[Co(NH_3)_6]^{3+}$, $[Co(H_2O)_6]^{3+}$

Correct Option D

Solution: On Increasing strength of ligand wavelength of absorbed radiations decreases.

Order of spectrochemical series- $H_2O < NH_3 < en$

Order of absorbed wavelength- $en < NH_3 < H_2O$

$[Co(en)_3]^{3+}$, $[Co(NH_3)_6]^{3+}$, $[Co(H_2O)_6]^{3+}$

Q 38. Consider the reactions:
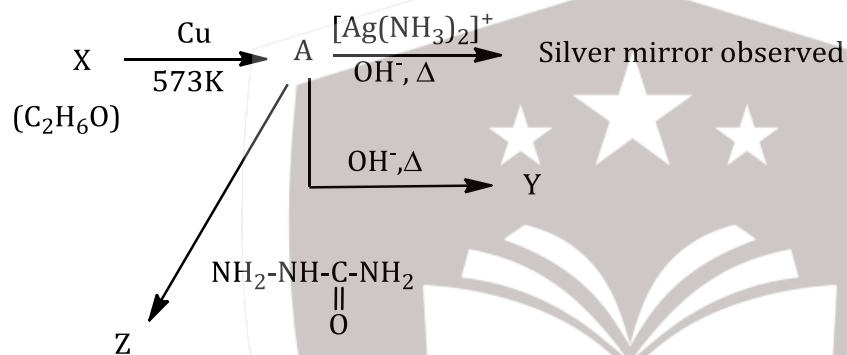
Identify A, X, Y and Z

Option A $\quad$ A- Methoxymethane, X- Ethanol, Y- Ethanoic acid, Z- Semicarbazide

Option B $\quad$ A- Ethanal, X- Ethanol, Y- But-2-enal, Z- Semicarbazone

Option C $\quad$ A- Ethanol, X- Acetaldehyde, Y- Butanone, Z-Hydrazone

Option D $\quad$ A- Methoxymenthane, X- Ethanoic acid, Y- acetate ion, Z- hydxrazine

Correct Option B
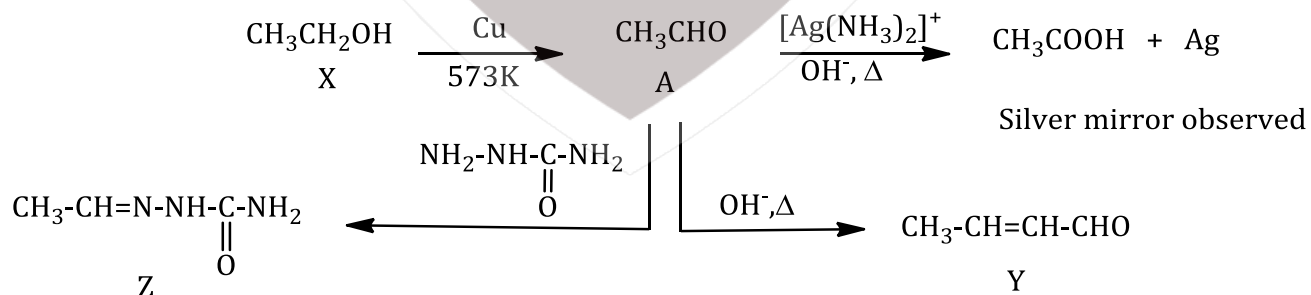
Solution:

Q 39. Which of the following, which is the product formed when cyclohexanone undergoes aldol condensation followed by heating?

Option A
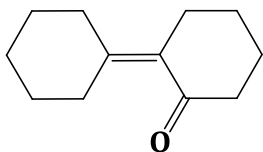
Option B
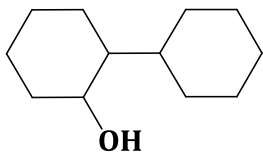
Option C
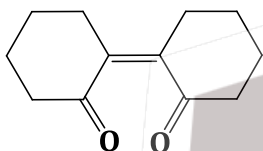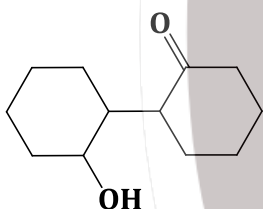
Option D

Correct Option A
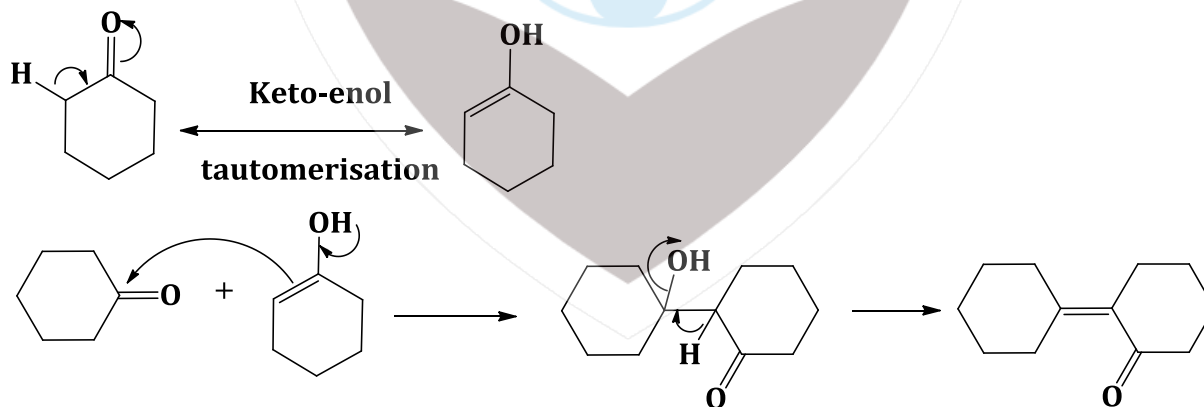
Solution:

Q 40. Which one of the following pairs of species have the same bond order?

Option A	CN^-, NO^+
Option B	CN^-, CN^+
Option C	O_2^-, CN^-
Option D	CO, NO

Correct Option A

Solution: For any species to have same bond order we can expect them to have same number of electrons.

Calculating the number of electrons in various species.

$O_2^- = 8+8+1 = 17$, $CN^- = 6+7+1 = 14$

$NO^+ = 7+8-1 = 14$, $CN^+ = 6+7-1 = 12$

Q 41. Extraction of gold and silver involves leaching with CN⁻ ion. Silver is later recovered by:

Option A   distillation

Option B   zone refining

Option C   displacement with Zn

Option D   liquation

Correct Option C

Solution: After the leaching of silver with CN^-, silver is recovered by displacement with Zn.

Q 42. A 20 litre container at 400 K contains CO_2 (g) at pressure 0.4 atm and an excess of SrO (neglate the volume of soilds SrO). The volume of the container is now decreased by moving the movable piston fitted in the container. The maximum volume of the container, when pressure of CO_2 attains its maximum value, will be:

(Given that: $SrCO_3$ (s) $\rightleftharpoons$ SrO (s) + CO_2 (g), Kp = 1.6 atm)

Option A   10 litre

Option B   4 litre

Option C   2 litre

Option D   5 litre

Correct Option D

Solution:

$$SrCO_3 (s) \rightleftharpoons SrO (s) + CO_2 (g)$$

$$K_p = P_{CO_2}$$

$$1.6 \text{ atm} = P_{CO_2}$$

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2} = \frac{0.4 \times 20}{400} = \frac{1.6 \times V_2}{400}$$

$$V_2 = \frac{0.4 \times 20}{1.64} = 5$$

$$V_2 = 5L$$

Q 43. Pick out the correct statement with respect to $[Mn(CN)_6]^{3-}$:

Option A   It is sp^3d^2 hybridised and tetrahedral

Option B   It is d^2sp^3 hybridised and octahedral

Option C   It is dsp^2 hybridied and square planar

Option D   It is sp^3d^2 hybridised and octahedral

Correct Option B

Solution: CN^- is strong field ligand. As coordination number of Mn=6 so it will form an octahedral complex and hybridization will be d^2sp^3.

Q 44. The reason for greater range of oxidation states in actinoids is attributed to:

Option A   actionoid contraction

Option B   5f, 6d and 7s levels having comparable energies

Option C   4f and 5d levels being close in energies

Option D   the radioactive nature of actinoids

Correct Option B

Solution: The reason for greater range of oxidation states in actinoids is attributed to 5f, 6d and 7s levels having comparable energies

Q 45. Which of the following statements is not correct?

Option A   Ovalbumin is a simple food reserve in egg-white

Option B   Blood proteins thrombin and fibrinogen are involved in blood aclotting

Option C   Denaturation makes the proteins more active

Option D   Insulin maintains sugar level in the blood of a human body

Correct Option C

Solution: Denaturation changes the structure of a protein and protein loses its activity.
'Denturation makes the proteins more active' this is not a correct statement.
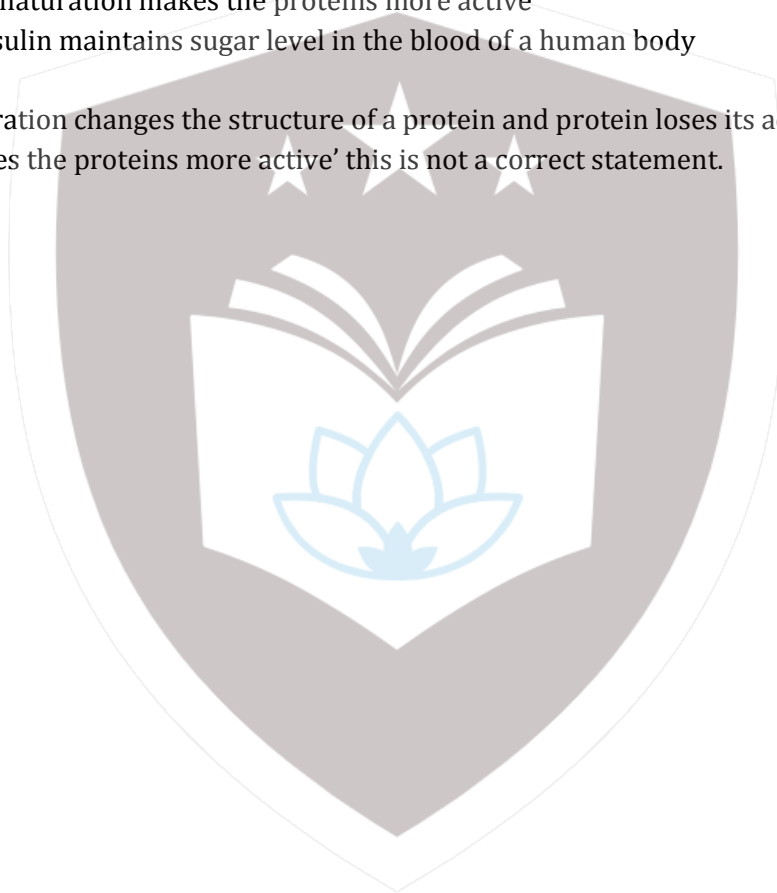
BIOLOGY

Q 1. Which one of the following statements is correct with reference to enzymes?
Option A   Holoenzyme = Apoenzyme + Coenzyme
Option B   Coenzyme = Apoenzyme + Holoenzyme
Option C   Holoenzyme = Coenzyme + Co-factor
Option D   Apoenzyme = Holoenzyme + Coenzyme
Correct Option A
Solution: The complete conjugate enzyme, consisting of an apoenzyme and a coenzyme is called a holoenzyme.

Q 2. A decrease in blood pressure/volume will not cause the release of:
Option A   Atrial Natriuretic Factor
Option B   Aldosterone
Option C   ADH
Option D   Renin
Correct Option A
Solution: A decrease in blood pressure/volume stimulates the release of aldosterone, ADH and renin whereas an increase in blood pressure/volume stimulates the release of Atrial Natriuretic Factor (ANF).

Q 3. Which cells of 'Crypts of Lieberkuhn' secrete antibacterial lysozyme?
Option A   Paneth cells
Option B   Zymogen cells
Option C   Kupffer cells
Option D   Argentaffin cells
Correct Option A
Solution: The paneth cells that form the intestinal mucosa are present in the villi of small intestine or 'Crypts of Lieberkuhn' which secrete antibacterial lysozyme.

Q 4. Which of the following are not polymeric?
Option A   Proteins
Option B   Polysaccharides
Option C   Lipids
Option D   Nucleic acids
Correct Option C
Solution: Proteins are large-sized heteropolymeric macromolecules. Polysaccharides are complex carbohydrates that are formed by the polymerisation of large number of monosaccharide monomers. Nucleic acids are long chain macromolecules which are formed by end to end polymerisation of nucleotides. Lipids are fatty acid esters of alcohol and related substances. Hence, lipids are not polymeric in nature.

Q 5. Functional megaspore in an angiosperm develops into:

Option A   Endosperm

Option B   Embryo sac

Option C   Embryo

Option D   Ovule

Correct Option B

Solution: The functional megaspore is the first cell of female gametophyte which enlarges and undergoes three free nuclear mitotic divisions. The first division produces two nucleate embryo sacs. Hence, the functional megaspore in an angiosperm develop into embryo sacs.

Q 6. Myelin sheath is produced by:

Option A   Astrocytes and schwann cells

Option B   Oligodendrocytes and osteoclasts

Option C   Osteoclasts and astrocytes

Option D   Schwann cells and oligodendrocytes

Correct Option D

Solution: In central nervous system, myelin sheath is produced by two types of cells - Schwann cells and oligodendrocytes which wrap around the axon.

Q 7. Attractants and rewards are required for:

Option A   Entomophily

Option B   Hydrophily

Option C   Cleistogamy

Option D   Anemophily

Correct Option A

Solution: The insect-pollinated flowers or entomophilous flowers are showy and brightly coloured and produce a pleasant odour and nectar to attract insects. Hence, attractants and rewards are required for entomophily.

Q 8. Receptor sites for neurotransmitters are present on the

Option A   Pre-synaptic membrane

Option B   Tips of axons

Option C   Post-synaptic membrane

Option D   Membranes of synaptic vesicles

Correct Option C

Solution: The post-synaptic membrane contains large protein molecules which act as receptor sites for neurotransmitters and numerous channels and pores.

Q 9. Coconut fruit is a:

Option A   Berry

Option B   Nut

Option C   Capsule

Option D   Drupe

Correct Option D

Solution: Coconut fruit has a membranous epicarp, fibrous mesocarp and a stony endocarp. Hence, it is a drupe or stone fruit.

Q 10. Adult human RBCs are enucleate. Which of following statement(s) provide the most appropriate explanation for this feature?
a.   They do not need to reproduce.
b.   They are somatic cells.
c.   They do not metabolise.
d.   All their internal space is available for oxygen transport.

Option A   Only a
Option B   a, c, and d
Option C   b and c
Option D   only d

Correct Option D

Solution: Adult human RBCs are enucleated which allows them to contain more haemoglobin and carry more oxygen molecules. Hence, the internal space in RBCs helps in oxygen transport.

Q 11. Capacitation occurs in:
Option A   Epididymis
Option B   Vas deferens
Option C   Female reproductive tract
Option D   Rete testis

Correct Option C

Solution: Capacitation is the phenomena of activation of sperms. It occurs in the female genital tract where the secretions of the female genital tract remove coating substances deposited on the surface of the sperms, particularly on the acrosome.

Q 12. Which of the following are found in extreme saline conditions?
Option A   Eubacteria
Option B   Cyanobacteria
Option C   Mycobacteria
Option D   Archaebacteria

Correct Option D

Solution: Archaebacteria (halophiles) are found in extreme saline conditions because of the following reasons:
- They have special lipids in their cell membrane.
- They have a mucilage covering.
- They lack sap vacuoles.
- They have a high internal salt content.

Q 13. Asymptote in a logistic growth curve is obtained when:
Option A   k=N
Option B   k>N
Option C   k<N
Option D   The value of r approaches zero

Correct Option A

Solution: In a given habitat there are enough resources to support a particular maximum number of individuals, beyond which no further increase in population size is possible. This limit is called the carrying capacity (k). No population can sustain exponential growth indefinitely as there will be competition for basic needs.
Hence, k = N where k is the carrying capacity and N is the population density at a time.

Q 14. Artificial selection to obtain cows yielding higher milk output represents:

Option A   Directional selection as it pushes the mean of the character in one direction.

Option B   Disruptive selection as it splits the population into two, one yielding higher output and the other lower output.

Option C   Stabilising selection followed by disruptive selection as it stabilises the population to produce higher yielding cows.

Option D   Stabilising selection as it stabilises this character in the population.

Correct Option A

Solution: Directional selection occurs when an extreme phenotype is favoured and the distribution curve shifts in that direction. Thus, the population changes towards one particular direction. Hence, artificial selection to obtain cows yielding higher milk output represents directional as it pushes the mean of the character in one direction.

Q 15. Select the mismatch:

Option A   *Rhodospirillum- Mycorrhiza*

Option B   *Anabaena* - Nitrogen fixer

Option C   *Rhizobium* - Alfalfa

Option D   *Frankia - Alnus*

Correct Option A

Solution: *Rhodospirillum* is a nitrogen-fixing, anaerobic, photoautotrophic bacteria. It is not a *Mycorrhiza* (a symbiotic association between a fungus and a plant).

Q 16. Good vision depends on adequate intake of carotene rich food.
Select the best option from the following statements.

a.   Vitamin A derivatives are formed from carotene.
b.   The photopigments are embedded in the membrane discs of the inner segment.
c.   Retinal is a derivative of Vitamin A.
d.   Retinal is a light absorbing part of all the visual photopigments.

Option A   a, c and d

Option B   a and c

Option C   b, c and d

Option D   a and b

Correct Option A

Solution: Good vision depends on adequate intake of carotene rich food as vitamin A derivatives are formed from carotene. Retinal is a derivative of Vitamin A. The photopigments are embedded in the membrane discs of the inner segment is not related to good vision or carotene rich food. However, retinal is a light absorbing part of all the visual photopigments.

Q 17. The DNA fragments separated on an agarose gel can be visualised after staining with:

Option A   Acetocarmine

Option B   Aniline blue

Option C   Ethidium bromide

Option D   Bromophenol blue

Correct Option C

Solution: The DNA fragments separated on an agarose gel can be seen as bright orange coloured bands only after staining the DNA with a compound known as ethidium bromide followed by exposure to UV radiation.

Q 18. The hepatic portal vein drains blood to liver from the:

Option A   Stomach

Option B   Kidneys

Option C   Intestine

Option D   Heart

Correct Option C

Solution: The hepatic portal vein drains blood from the spleen and gastrointestinal tract to liver.

Q 19. The vascular cambium normally gives rise to:

Option A   Primary phloem

Option B   Secondary xylem

Option C   Periderm

Option D   Phelloderm

Correct Option B

Solution: The vascular cambium gives rise to secondary vascular tissues such as secondary xylem.

Q 20. Thalassemia and sickle cell anemia are caused due to a problem in globin molecule synthesis. Select the correct statement:

Option A   Both are due to quantitative defect in globin chain synthesis.

Option B   Thalassemia is due to less synthesis of globin molecules.

Option C   Sickle cell anemia is due to a quantitative problem of globin molecules.

Option D   Both are due to a qualitative defect in globin chain synthesis.

Correct Option B

Solution: Thalassemia occurs due to mutation or deletion of the genes controlling the formation of globin chains of haemoglobin. Hence, thalassemia occurs due to less synthesis of globin molecules.

Q 21. The genotypes of husband and wife are I^AI^B and I^Ai.
Among the blood types of their children, how many different genotypes and phenotypes are possible?

Option A   3 genotypes; 4 phenotypes

Option B   4 genotypes; 3 phenotypes

Option C   4 genotypes; 4 phenotypes

Option D   3 genotypes; 3 phenotypes

Correct Option B

Solution: The genotypes of husband and wife are I^AI^B and I^Ai.

Parents....   Husband   ×   Wife

Genes.... I^AI^B × I^Ai

Gametes..... I^A, I^B × I^A, i

	I^A	i
I^A	I^AI^A **Blood Group - A**	I^Ai **Blood Group - A**
I^B	I^AI^B **Blood Group - AB**	I^Bi **Blood Group - B**

Hence, there will be 4 genotypes and 3 phenotypes.

Q 22. Which of the following facilitates the opening of stomatal aperture?
Option A   Decrease in turgidity of guard cells.
Option B   Radial orientation of cellulose microfibrils in the cell wall of guard cells.
Option C   Longitudinal orientation of cellulose microfibrils in the cell wall of guard cells.
Option D   Contraction of outer wall of guard cells.
Correct Option B
Solution: The radial orientation of cellulose microfibrils helps in opening the stomatal aperture which opens when guard cells become turgid and the curvature of the cells increases.

Q 23. In *Bougainvillea* thorns are a modification of:
Option A   Adventitious root
Option B   Stem
Option C   Leaf
Option D   Stipules
Correct Option B
Solution: In *Bougainvillea*, the stems are able to rise up a support by clinging to it with the help of curved thorns. Hence, in *Bougainvillea*, thorns are a modification of the stem.

Q 24. Which one of the following is related to ex-situ conservation of threatened animals and plants?
Option A   Biodiversity hot spots
Option B   Amazon rainforest
Option C   Himalayan region
Option D   Wildlife safari parks
Correct Option D
Solution: Ex-situ conservation includes taking out endangered species from their natural habitat and protecting them in artificial habitats. It includes wildlife safari parks, zoos and botanical gardens. Biodiversity hot spots, Amazon rainforest and Himalayan region are in-situ conservation which protect animals in their natural habitats.

Q 25. Root hairs develop from the region of:
Option A   Elongation
Option B   Root cap
Option C   Meristematic activity
Option D   Maturation
Correct Option D
Solution: Root hairs develop from the region of maturation of root. It represents the zone of differentiation or maturation because different types of primary tissues differentiate or mature in this region.

Q 26. A disease caused by an autosomal primary non-disjunction is:
Option A   Klinefelter's syndrome
Option B   Turner's syndrome
Option C   Sickle cell anemia
Option D   Down's syndrome
Correct Option D

Solution: Down's syndrome is caused due to trisomy or autosomal primary non-disjunction of 21st chromosome in the human female. The egg possess 24 chromosomes which on fertilisation with a normal sperm (23 chromosomes), leads to the formation of an individual with 47 chromosomes (45 + XY) in males and (45 + XX) in females.

Q 27. The water potential of pure water is:
Option A   Less than zero
Option B   More than zero but less than one
Option C   More than one
Option D   Zero
Correct Option D
Solution: Solute potential and pressure potential are the two main components that determine water potential. The water potential of pure water is zero because there is no solute and no pressure in the container containing pure water.

Q 28. Which of the following options gives the correct sequence of events during mitosis?
Option A   Condensation → nuclear membrane disassembly → arrangement at equator →
             centromere division → segregation → telophase
Option B   Condensation → crossing over → nuclear membrane disassembly → segregation →
             telophase
Option C   Condensation → arrangement at equator → centromere division → segregation →
             telophase
Option D   Condensation → nuclear membrane disassembly → crossing over → segregation →
             telophase
Correct Option A
Solution: Karyokinesis in mitosis is completed in four stages –
   i.   Prophase, which is marked by the initiation of condensation of chromatin material. By
           the end of prophase, the nuclear membrane and nucleolus disappear or disintegrate
           completely.
   ii.   Metaphase, which is marked by the arrangement of chromosomes at the equator.
   iii.   Anaphase, which is marked by the splitting of centromeres of all the chromosomes
           which moves towards the poles.
   iv.   Telophase, which is the last phase of nuclear division in mitosis.

Q 29. The process of separation and purification of expressed protein before marketing is called
Option A   Downstream processing
Option B   Bioprocessing
Option C   Postproduction processing
Option D   Upstream processing
Correct Option A
Solution: The products formed after completion of biosynthetic phase undergo a series of processes before putting them in the market as a finished product. These processes include separation and purification of the expressed protein and are collectively called downstream processing.

Q 30. A temporary endocrine gland in the human body is:

Option A   Corpus cardiacum

Option B   Corpus luteum

Option C   Corpus allatum

Option D   Pineal gland

Correct Option B

Solution: In the luteal phase of menstruation, the corpus luteum secretes a large amount of progesterone which stimulates the uterine glands to produce increased amount of watery mucus. Hence, corpus luteum behaves as a temporary endocrine gland in the human body.

Q 31. Which of the following is made up of dead cells?

Option A   Collenchyma

Option B   Phellem

Option C   Phloem

Option D   Xylem parenchyma

Correct Option B

Solution: The cork or phellem is made up of dead cells whereas collenchyma, phloem and xylem parenchyma are made up of living cells.

Q 32. An example of colonial algae is:

Option A   *Volvox*

Option B   *Ulothrix*

Option C   *Spirogyra*

Option D   *Chlorella*

Correct Option A

Solution: Colony of *Volvox* is hollow and has a fixed number of cells (500 – 60,000). Hence, *Volvox* is an example of colonial algae.

Q 33. Match the following sexually transmitted diseases (Column-I) with their causative agent (Column-II) and select the correct option.

Column-I	Column-II
a. Gonorrhea	i. HIV
b. Syphilis	ii. *Neisseria*
c. Genital warts	iii. *Treponema*
d. AIDs	iv. Human Papilloma-Virus

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

Correct Option D

Solution: Sexually transmitted diseases and their causative agents:

STDs	Causative Agents
a. Gonorrhoea	*Neisseria gonorrhoeae* (bacteria)
b. Syphilis	*Treponema pallidum* (bacteria)

c.	Genital warts	Human Papilloma-Virus
d.	AIDs	HIV

Q 34. The function of copper ions in copper releasing IUDs is:

Option A   They inhibit gametogenensis.

Option B   They make the uterus unsuitable for implantation.

Option C   They inhibit ovulation.

Option C   They suppress sperm motility and fertilising capacity of sperms.

Correct Option D

Solution: The IUDs are placed in the uterus of female. The copper ions present in the copper releasing IUDs suppress sperm motility and fertilising capacity of sperms.

Q 35. Which of the following in sewage treatment removes suspended solids?

Option A   Secondary treatment

Option B   Primary treatment

Option C   Sludge treatment

Option D   Tertiary treatment

Correct Option B

Solution: Primary treatment of sewage involves the physical removal of coarse solid particles through filtration and sedimentation.

Q 36. An important characteristic that Hemichordates share with Chordates is:

Option A   Ventral tubular nerve cord

Option B   Pharynx with gill slits

Option C   Pharynx without gill slits

Option D   Absence of notochord

Correct Option B

Solution: In Hemichordates, there are narrow openings in the pharynx called gill slits which are dorsal in position. However, in Chordates, a series of narrow paired openings called gill slits are present on the lateral side of the pharynx at some stage of life. Hence, Hemichordates and Chordates have this characteristic in common.

Q 37. The final proof of DNA as the genetic material came from the experiments of:

Option A   Hershey and Chase

Option B   Avery, Mcleod and McCarty

Option C   Hargobind Khorana

Option D   Griffith

Correct Option A

Solution: Hershey and Chase indicated that DNA is the genetic material and not protein by their blender experiment.

Q 38. Among the following characters, which one was not considered by Mendel in his experiments on pea?

Option A   Trichomes-Glandular or non-glandular

Option B   Seed-Green or Yellow

Option C   Pod-Inflated or Constricted

Option D   Stem-Tall or Dwarf

Correct Option A

Solution: Mendel studied 7 traits in his breeding experiments which included pod colour, pod shape, seed colour, seed shape, flower colour, position of flowers and plant height.

Q 39. Plants which produce characteristic pneumatophores and show vivipary belong to:

Option A   Halophytes

Option B   Psammophytes

Option C   Hydrophytes

Option D   Mesophytes

Correct Option A

Solution: Halophytes are found in marshy areas, so they have pneumatophores for gaseous exchange and show vivipary, that is, germination of seeds before they detach from the parent plant.

Q 40. The pivot joint between atlas and axis is a type of:

Option A   Cartilaginous joint

Option B   Synovial joint

Option C   Saddle joint

Option D   Fibrous joint

Correct Option B

Solution: The pivot joint between atlas and axis is a type of synovial joint which allows movement in various directions.

Q 41. With reference to factors affecting the rate of photosynthesis, which of the following statements is not correct?

Option A   Increasing atmospheric CO_2 concentration upto 0.05% can enhance CO_2 fixation rate.

Option B C_3 plants respond to higher temperature with enhanced photosynthesis while C_4 plants have much lower temperature optimum.

Option C   Tomato is a greenhouse crop which can be grown in CO_2 - enriched atmosphere for higher yield.

Option D   Light saturation for CO_2 fixation occurs at 10% of full sunlight.

Correct Option B

Solution: At low temperature, C_3 plants are more efficient while at higher temperature their photosynthetic activity is reduced. The optimum temperature for photosynthesis in C_3 plants is about 25°C whereas C_4 plants are less efficient for photosynthesis at low temperature. The optimum temperature for photosynthesis in C_4 plants is about 35°C – 45°C.

Q 42. DNA fragments are:

Option A   Negatively charged

Option B   Neutral

Option C   Either positively or negatively charged depending on their size

Option D   Positively charged

Correct Option A

Solution: DNA fragments are negatively charged molecules which move towards the anode during separation through gel electrophoresis technique.

Q 43. Which of the following components provides sticky character to the bacterial cell?

Option A   Nuclear membrane

Option B   Plasma membrane

Option C   Glycocalyx

Option D   Cell wall

Correct Option C

Solution: Glycocalyx, rich in glycoprotein, surrounds the cell membrane of some bacteria that provides sticky character to the bacterial cell.

Q 44. Which of the following options best represents the enzyme composition of pancreatic juice?

Option A   Amylase, pepsin, trypsinogen, maltase

Option B   Peptidase, amylase, pepsin, rennin

Option C   Lipase, amylase, trypsinogen, procarboxypeptidase

Option D   Amylase, peptidase, trypsinogen, rennin

Correct Option C

Solution: The pancreatic juice is composed of lipase, amylase, trypsinogen, procarboxypeptidase and chymotrypsinogen.

Q 45. Which among these is the correct combination of aquatic mammals?

Option A   Dolphins, Seals, Trygon

Option B   Whales, Dolphins, Seals

Option C   Trygon, Whales, Seals

Option D   Seals, Dolphins, Sharks

Correct Option B

Solution: Trygon and sharks are chondrichthyes while whales, dolphins and seals are aquatic mammals.

Q 46. Fruit and leaf drop at early stages can be prevented by the application of:

Option A   Ethylene

Option B   Auxins

Option C   Gibberellic acid

Option D   Cytokinins

Correct Option B

Solution: Auxins delays the abscission of young leaves and fruits and hence prevent premature fruit and leaf drop in plants.

Q 47. Select the correct route for the passage of sperms in male frogs:
Option A   Testes → Vasa efferentia → Kidney → Seminal Vesicle → Urinogenital duct → Cloaca
Option B   Testes → Vasa efferentia → Bidder's canal → Ureter → Cloaca
Option C   Testes → Vasa efferentia → Kidney → Bidder's canal → Urinogenital duct → Cloaca
Option D   Testes → Bidder's canal → Kidney → Vasa efferentia → Urinogenital duct → Cloaca
Correct Option C
Solution: The testes are composed of seminiferous tubules which forms sperms. The sperms are passed to vasa efferentia which connects the kidney and open into the anterior part of Bidder's canal. This carries the sperms to the collecting tubules and then to the urinogenital duct and finally reaches the common chamber, cloaca.

Q 48. In case of a couple where the male is having a very low sperm count, which technique will be suitable for fertilization?
Option A   Gamete intracytoplasmic fallopian transfer
Option B   Artificial insemination
Option C   Intracytoplasmic sperm injection
Option D   Intrauterine transfer
Correct Option B
Solution: Artificial insemination is a technique to make a female pregnant by artificially introducing semen into the vagina. If the male is having a very low sperm count, some donor's semen can be introduced into the female vagina through this technique.

Q 49. Which ecosystem has the maximum biomass?
Option A   Grassland ecosystem
Option B   Pond ecosystem
Option C   Lake ecosystem
Option D   Forest ecosystem
Correct Option D
Solution: Biomass is the mass or number of living organisms in a unit area. The rate of biomass production is called productivity. Forest ecosystem has the maximum biomass because it includes organisms of all trophic levels as compared to grassland, pond or lake ecosystem and hence the rate of productivity is also high which contributes to maximum biomass.

Q 50. Lungs are made up of air-filled sacs, the alveoli. They do not collapse even after forceful expiration because of:
Option A   Inspiratory Reserve Volume
Option B   Tidal Volume
Option C   Expiratory Reserve Volume
Option D   Residual Volume
Correct Option D
Solution: Volume of air remaining in the lungs even after forcible expiration is called residual volume. This prevents collapsing of lungs even after forceful expiration.

Q 51. Presence of plants arranged into well-defined vertical layers depending on their height can be seen best in:

Option A   Tropical rain forest

Option B   Grassland

Option C   Temperate forest

Option D   Tropical savannah

Correct Option A

Solution: Vertical distribution of different species of plants occupying different levels is called stratification. Tropical rain forests show a tall plant canopy at the top whereas the medium plants/trees form lower canopies.

Q 52. Which of the following statements is correct?

Option A   The descending limb of loop of Henle is impermeable to water.

Option B   The ascending limb of loop of Henle is permeable to water.

Option C   The descending limb of loop of Henle is permeable to electrolytes.

Option D   The ascending limb of loop of Henle is impermeable to water.

Correct Option D

Solution: The ascending limb of loop of Henle is impermeable to water but permeable to K^+,

Cl^-, and Na^+ and partially permeable to urea. So, these solutes are reabsorbed and the filtrate becomes hypotonic to blood plasma.

Q 53. Alexander Von Humboldt described for the first time:

Option A   Laws of limiting factor

Option B   Species area relationship

Option C   Population growth equation

Option D   Ecological biodiversity

Correct Option B

Solution: Alexander von Humboldt observed that within a region, species richness increased with increasing explored area, but only upto a limit. Hence, Alexander Von Humbolt described the species area relationship for the first time.

Q 54. Zygotic meiosis is characteristic of:

Option A   *Fucus*

Option B   *Funaria*

Option C   *Chlamydomonas*

Option D   *Marchantia*

Correct Option C

Solution: In *Chlamydomonas*, the gametes are haploid which fuse and give rise to a diploid zygote. Hence, *Chlamydomonas* represents zygotic meiosis or haplontic life cycle.

Q 55. If there are 999 bases in an RNA that codes for a protein with 333 amino acids, and the base at position 901 is deleted such that the length of the RNA becomes 998 bases, how many codons will be altered?

Option A   11

Option B   33

Option C   333

Option D   1

Correct Option B

Solution: We know that 1 codon consists of three bases, corresponding to a single amino acid.

There are 999 bases in the RNA which code for 333 amino acids.

This implies that there are 333 codons which codes for 333 amino acids.

Now, out of 999 bases, if the base at position 901 is deleted, then the remaining 98 bases corresponding to around 33 codons of amino acids will be altered because deletion of base at 901 position causes a frame shift mutation in the remaining 33 codons.

Q 56. Flowers which have single ovule in the ovary and are packed into inflorescence are usually pollinated by:

Option A   Bee

Option B   Wind

Option C   Bat

Option D   Water

Correct Option B

Solution: Wind-pollinated flowers are small and light weight so that they are easily blown away. Such flowers have either reduced or absent calyx and corolla and hence have a single ovule in the ovary and are packed into inflorescence.

Q 57. Transplantation of tissues / organs fails often due to non-acceptance by the patient's body. Which type of immune-response is responsible for such rejections?

Option A   Cell-mediated immune response

Option B   Humoral immune response

Option C   Physiological immune response

Option D   Autoimmune response

Correct Option A

Solution: Cell mediated immune response, mediated by T-lymphocyte is able to differentiate between self and non-self organs. This type of immune response recognises tissues or organs from other individual as foreign antigen and causes rejection of the graft. It can also elicit a response against body's own cells which can then become cancerous.

Q 58. Life cycle of *Ectocarpus* and *Fucus* respectively are:

Option A   Diplontic, Haplodiplontic

Option B   Haplodiplontic, Diplontic

Option C   Haplodiplontic, Haplontic

Option D   Haplontic, Diplontic

Correct Option B

Solution: The life cycle of *Ectocarpus* is haplodiplontic where both the sporophyte and the gametophyte are multicellular and equally dominant.

The life cycle of *Fucus* is diplontic as the dominant phase in its life cycle is the independent sporophytic plant and the gametophyte is short-lived and dependent on the sporophyte..

Q 59. A gene whose expression helps to identify transformed cell is known as a:
Option A   Vector
Option B   Plasmid
Option C   Structural gene
Option D   Selectable marker
Correct Option D
Solution: A selectable marker is often an antibiotic resistance gene which helps to identify transformed cells. E.g., due to the ampicillin resistant gene, we can select transformed cells in the presence of ampicillin. Such an ampicillin resistant gene is called a selectable marker.

Q 60. A dioecious flowering plant prevents both:
Option A   Autogamy and geitonogamy
Option B   Geitonogamy and xenogamy
Option C   Cleistogamy and xenogamy
Option D   Autogamy and xenogamy
Correct Option A
Solution: A dioecious plant species has male and female flowers on separate plants. Autogamy is a condition where pollen from the anther are deposited to the stigma of the same flower. Geitonogamy is a condition where pollen from one flower are deposited on the stigma of another flower borne on the same plant. Both autogamy and geitonogamy are ways of self-pollination which cannot occur on a dioecious plant. Hence, a dioecious flowering plant prevents both autogamy and geitonogamy.

Q 61. Which statement is wrong for Krebs cycle?
Option A   There is one point in the cycle where FAD^+ is reduced to $FADH_2$.
Option B   During conversion of succinyl CoA to succinic acid, a molecule of GTP is synthesised.
Option C   The cycle starts with the condensation of acetyl group (acetyl CoA) with pyruvic acid to yield citric acid.
Option D   There are three points in the cycle where NAD^+ is reduced to $NADH + H^+$.
Correct Option C
Solution: The Krebs cycle begins with the reaction acetyl CoA in the presence of water with oxalo-acetic acid to yield 6 carbon molecule citric acid.

Q 62. Phosphoenol pyruvate (PEP) is the primary CO_2 acceptor in:
Option A C_4 plants
Option B C_2 plants
Option C C_3 and C_4 plants
Option D C_3 plants
Correct Option A
Solution: In C_4 plants, initially the carbon dioxide of the atmosphere comes in contact with the mesophyll cells where it combines with phosphoenol pyruvate (PEP) to form oxaloacetic acid in the presence of an enzyme phosphoenol pyruvate carboxylase (PEP carboxylase).

Q 63. During DNA replication, Okazaki fragments are used to elongate:
Option A   The lagging strand towards the replication fork.
Option B   The leading strand away from the replication fork
Option C   The lagging strand away from the replication fork
Option D   The leading strand towards the replication fork.
Correct Option C
Solution: During DNA replication, the enzyme DNA polymerase synthesizes the DNA in the form of short stretches in the 5' – 3' direction starting from a RNA primer. These short segments are called Okazaki fragments which form lagging strand away from the replication fork.

Q 64. Which of the following RNAs should be most abundant in an animal cell?
Option A   t - RNA
Option B   m - RNA
Option C   mi - RNA
Option D   r - RNA
Correct Option D
Solution: r – RNA is responsible for all kinds of protein synthesis in an animal cell. Hence, r – RNA should be most abundant in an animal cell.

Q 65. GnRH, a hypothalamic hormone, needed in reproduction, acts on:
Option A   Anterior pituitary gland and stimulates secretion of LH and FSH.
Option B   Posterior pituitary gland and stimulates secretion of oxytocin and FSH.
Option C   Posterior pituitary gland and stimulates secretion of LH and relaxin.
Option D   Anterior pituitary gland and stimulates secretion of LH and oxytocin.
Correct Option A
Solution: GnRH is secreted by the hypothalamus which stimulates the anterior lobe of pituitary gland to secrete LH and FSH. Increase in the level of progesterone inhibits the release of GnRH, which in turn, inhibits the production of FSH and LH.

Q 66. What is the criterion for DNA fragments movement on an agarose gel during gel electrophoresis?
Option A   The smaller the fragment size, the farther it moves.
Option B   Positively charged fragments move to farther end.
Option C   Negatively charged fragments do not move.
Option D   The larger the fragment size, the farther it moves.
Correct Option A
Solution: The DNA fragments are sorted according to their length on an agarose gel slab by the technique called electrophoresis. The fragments get arranged according to their length and electric charge. The DNA fragments move towards the anode as they are negatively charged. The smaller fragments move farther than the larger fragments as they take longer time to move in the gel matrix. Hence, the smaller the fragment size, the farther it moves.

Q 67. Hypersecretion of growth hormone in adults does not cause further increase in height, because:

Option A   Epiphyseal plates close after adolescence.

Option B   Bones lose their sensitivity to growth hormone in adults.

Option C   Muscle fibres do not grow in size after birth

Option D   Growth hormone becomes inactive in adults.

Correct Option A

Solution: Hypersecretion of growth hormone in childhood results in gigantism and the patient attains abnormal height and long bones whereas in adults hypersecretion of growth hormone does not cause further increase in height because epiphyseal plates responsible for the growth of bones close after adolescence.

Q 68. DNA replication in bacteria occurs:

Option A   Within nucleolus

Option B   Prior to fission

Option C   Just before transcription

Option D   During S phase

Correct Option B

Solution: DNA replication in bacteria takes place in the cytoplasm. The bacteria do not show well marked S-phase due to their primitive nature. Hence, DNA replication in bacteria occurs prior to fission.

Q 69. Which one from those given below is the period for Mendel's hybridisation experiments?

Option A   1840 - 1850

Option B   1857 – 1869

Option C   1870 - 1877

Option D   1856 - 1863

Correct Option D

Solution: Mendel carried out hybridisation experiments on garden pea for 7 years from 1856 – 1863.

Q 70. Viroids differ from viruses in having:

Option A   DNA molecules without protein coat

Option B   RNA molecules with protein coat

Option C   RNA molecules without protein coat

Option D   DNA molecules with protein coat

Correct Option C

Solution: Viroids are smaller than viruses having free RNA that lacks a protein coat unlike viruses.
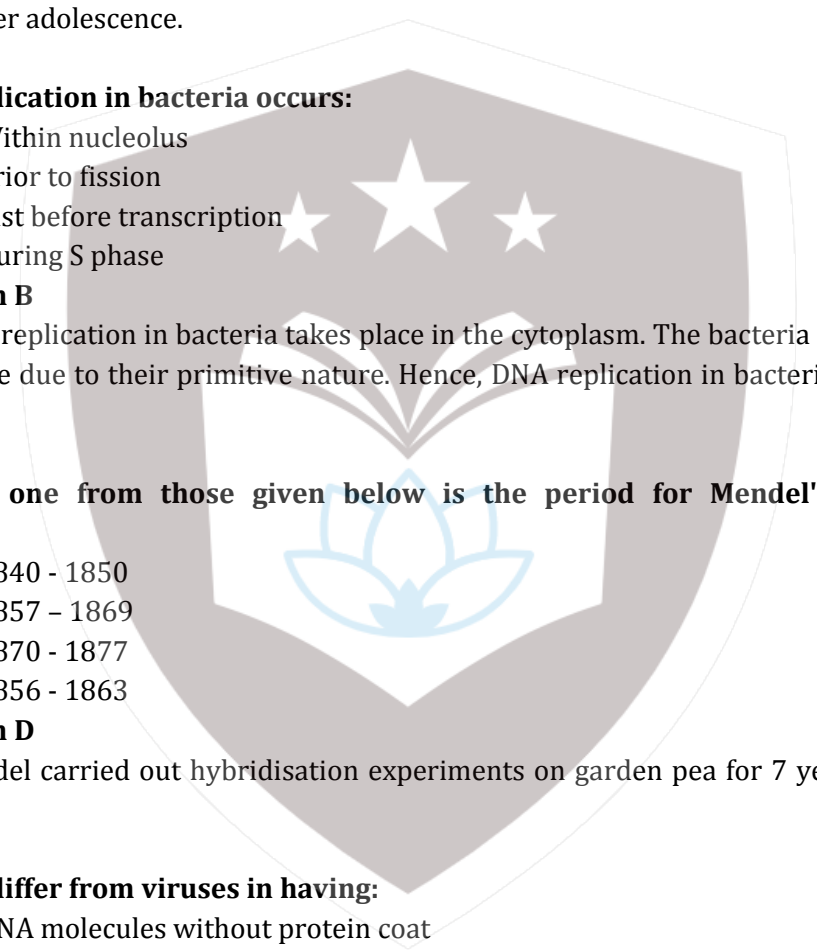
Q 71. MALT constitutes about_____ percent of the lymphoid tissue in human body.
Option A   20%
Option B   70%
Option C   10%
Option D   50%
Correct Option D
Solution: Mucosal-Associated Lymphoid Tissues (MALT) are aggregations of lymphoid tissues which are seen in relation to the mucosa of the major tracts and constitute about 50% of the lymphoid tissue in the human body.

Q 72. Which of the following is correctly matched for the product produced by them?
Option A   *Methanobacterium*: Lactic acid
Option B   *Penicillium notatum*: Acetic acid
Option C   *Saccharomyces cerevisiae*: Ethanol
Option D   *Acetobacter aceti*: Antibiotics
Correct Option C
Solution: The selected strains of *Sacchromyces* cerevisiae are commonly employed for the fermentation process to produce ethanol.

Q 73. Which among the following are the smallest living cells, known without a definite cell wall, pathogenic to plants as well as animals and can survive without oxygen?
Option A   *Pseudomonas*
Option B   *Mycoplasma*
Option C   *Nostoc*
Option D   *Bacillus*
Correct Option B
Solution: *Mycoplasma* are the simplest and the smallest living cells. They do not have a definite cell wall so they can change their shape. They are pathogenic to plants as well as animals and can survive without oxygen.

Q 74. Which of the following represents the order of 'Horse'?
Option A   Perissodactyla
Option B   Caballus
Option C   Ferus
Option D   Equidae
Correct Option A
Solution: The order Perissodactyla, includes a group of herbivorous mammals possessing one or three hoofed toes (odd-toes) on each hind foot. They include the horses, asses, and zebras, the tapirs, and the rhinoceroses. Hence, horse belongs to order Perissodactyla of Class Mammalia.

Q 75. Frog's heart when taken out of the body continues to beat for some time.
Select the best option from the following statements.
a. Frog is a poikilotherm.
b. Frog does not have any coronary circulation.
c. Heart is "myogenic" in nature.
d. Heart is auto-excitable

Option A   only d
Option B   a and b
Option C   c and d
Option D   only c
Correct Option C
Solution: The heart beat in frog's heart originates from a muscle, however, it is regulated by nerves and keeps on beating for some time even outside the body. Hence, frog's heart is myogenic and auto-excitable.

Q 76. Homozygous pure lines in cattle can be obtained by:
Option A   Mating of unrelated individuals of same breed.
Option B   Mating of individuals of different breed.
Option C   Mating of individuals of different species.
Option D   Mating of related individuals of same breed.
Correct Option D
Solution: Inbreeding is a method of breeding between animals of the same breed for 4 – 6 generations. It increases homozygosity. Thus, inbreeding is necessary to develop a pure line in any animal. Hence, homozygous purelines in cattle can be obtained by mating of related individuals of same breed.

Q 77. Identify the wrong statement in context of heartwood. :
Option A   It is highly durable.
Option B   It conducts water and minerals efficiently.
Option C   It comprises of dead elements with highly lignified walls.
Option D   Organic compounds are deposited in it.
Correct Option B
Solution: Heartwood is non-functional. It has lignin deposits and other organic compounds. So, it cannot help in conduction of water and minerals.

Q 78. Anaphase Promoting Complex (APC) is a protein degradation machinery necessary for proper mitosis of animal cells. If APC is defective in a human cell, which of the following is expected to occur?
Option A   Chromosomes will be fragmented.
Option B   Chromosomes will not segregate.
Option C   Recombination of chromosome arms will occur.
Option D   Chromosomes will not condense.
Correct Option B
Solution: During anaphase the spindle fibres break and the centromeres of all the chromosomes split simultaneously. The spindle fibres contract, the daughter chromosomes begin their

migration towards the opposite poles. Hence, the chromosomes will not segregate if the APC becomes defective.

Q 79. Which of the following cell organelles is responsible for extracting energy from carbohydrates to form ATP?

Option A   Ribosome

Option B   Chloroplast

Option C   Mitochondrion

Option D   Lysosome

Correct Option C

Solution: Mitochondria are miniature biochemical factories which extract energy from carbohydrates in the form of reduced coenzymes and reduced prosthetic groups and later undergo oxidation to form ATP.

Q 80. Mycorrhizae are the example of:

Option A   Amensalism

Option B   Antibiosis

Option C   Mutualism

Option D   Fungistasis

Correct Option C

Solution: Mycorrhizae are mutualistic interactions which involve a fungus and a root (*Pinus*). The root provides food and shelter to the fungus. The fungus helps the plant in solubilisation and absorption of minerals, water uptake and protection against pathogenic fungi.

Q 81. Out of 'X' pairs of ribs in humans only ' Y' pairs are true ribs. Select the option that correctly represents values of X and Y and provides their explanation:

Option A   X = 12, Y = 5, True ribs are attached dorsally to the vertebral column and sternum on the two ends.

Option B   X = 24, Y = 7, True ribs are dorsally attached to the vertebral column but are free on ventral side.

Option C   X = 24, Y = 12, True ribs are dorsally attached to the vertebral column but are free on ventral side.

Option D   X = 12, Y = 7, True ribs are attached dorsally to the vertebral column and ventrally to the sternum.

Correct Option D

Solution: There are 12 pairs of ribs out of which 7 pairs are true ribs. True ribs are attached dorsally to the vertebral column and ventrally to the sternum by means of small pieces of hyaline cartilage.

Q 82. In case of poriferans, the spongocoel is lined with flagellated cells called:

Option A   Oscula

Option B   Choanocytes

Option C   Mesenchymal cells

Option D   Ostia

Correct Option B

Solution: In Poriferans, the spongocoel is lined with highly specialised flagellated cells called choanocytes.

Q 83. Which one of the following statements is not valid for aerosols?
Option A   They alter rainfall and monsoon patterns.
Option B   They cause increased agricultural productivity.
Option C   They have a negative impact on agriculture.
Option D   They are harmful to human health.
Correct Option B
Solution: Aerosols are chemicals used as refrigerants, propellants and solid plastic foams. They are the primary air pollutants which alter rainfall and monsoon patterns. They have a negative impact on agriculture and are harmful to human health. Hence, they do not cause increased agricultural productivity.

Q 84. A baby boy aged two year is admitted to play school and passes through a dental check - up. The dentist observed that the boy had twenty teeth. Which teeth were absent?
Option A   Canines
Option B   Pre-molars
Option C   Molars
Option D   Incisors
Correct Option B
Solution: The milk teeth in children are 20 in number which includes 8 incisors, 4 canines and 8 molars. However, pre-molars are absent in children.

Q 85. Select the mismatch.
Option A   *Cycas* - Dioecious
Option B   *Salvinia* - Heterosporous
Option C   *Equisetum* - Homosporous
Option D   *Pinus* - Dioecious
Correct Option D
Solution: *Pinus* is not dioecious in nature. It is monoecious as it bears both male and female cones on the same tree.

Q 86. The morphological nature of the edible part of coconut is:
Option A   Cotyledon
Option B   Endosperm
Option C   Pericarp
Option D   Perisperm
Correct Option B
Solution: The edible part of coconut is white oily endosperm which contains a watery fluid called 'milk of coconut'.

Q 87. Double fertilisation is exhibited by:
Option A   Algae
Option B   Fungi
Option C   Angiosperms
Option D   Gymnosperms
Correct Option C
Solution: During the process of fertilisation in angiosperms, one of the male gametes of the pollen tube fuses with the egg cell and forms the embryo of the seed. The other male gamete fuses with
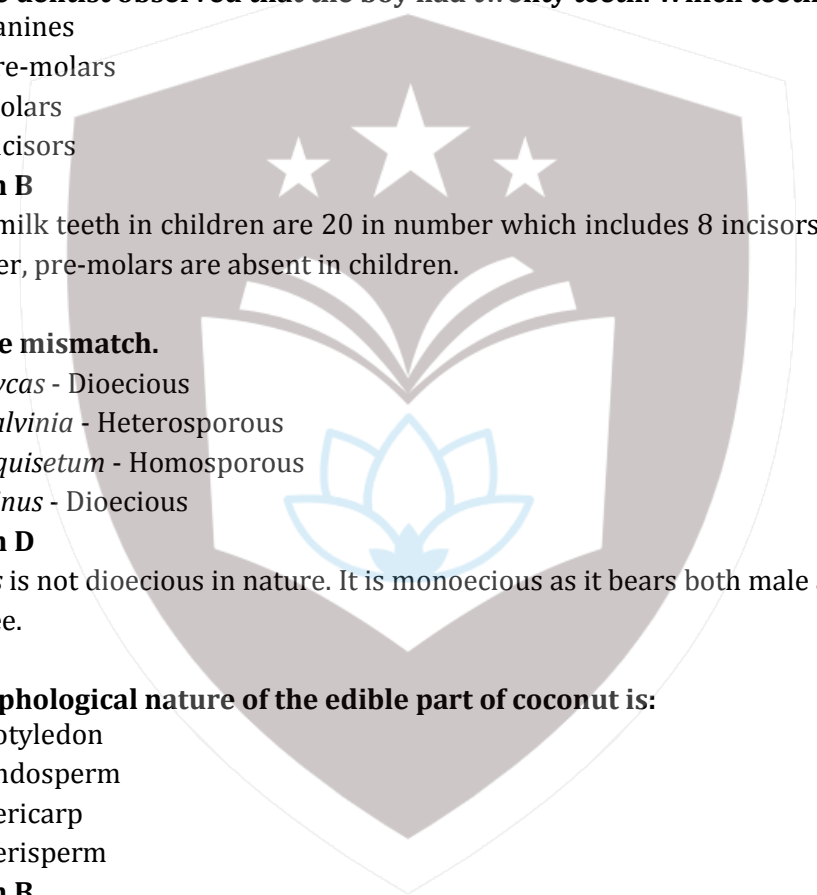
the diploid polar nuclei and develops the triploid endosperm. Hence, fertilisation in angiosperms is termed as double fertilisation.

Q 88. Spliceosomes are not found in cells of:
Option A   Fungi
Option B   Animals
Option C   Bacteria
Option D   Plants
Correct Option C
Solution: Eukaryotic transcripts possess extra segments called introns or non-coding sequences which do not appear in mature or processed RNA due to splicing. Splicing refers to the removal of non-coding regions or introns from the heterogeneous RNA and joining of exons or the coding sequences to form the mature mRNA. Spliceosomes are the machinery used for splicing in eukaryotic cells. Splicing does not occur in prokaryotes. Hence, spliceosomes are absent in prokaryotes, like bacteria.

Q 89. The association of histone H_1 with a nucleosome indicates:
Option A   DNA replication is occurring.
Option B   The DNA is condensed into a chromatin fibre.
Option C   The DNA double helix is exposed.
Option D   Transcription is occurring.
Correct Option B
Solution: In eukaryotes, the DNA and histones are loosely bound together to form deoxyribonucleoproteins called chromatin. Hence, the association of histone H_1 with a nucleosome indicates that the DNA is condensed into a chromatin fibre.

Q 90. The region of biosphere reserve which is legally protected and where no human activity is allowed is known as:
Option A   Buffer zone
Option B   Transition zone
Option C   Restoration zone
Option D   Core zone
Correct Option D
Solution: The region of biosphere reserve which is legally protected and where no human activity is allowed is known as core zone. In buffer zone, limited human activities like research, education and research strategy are permitted. In transition zone, several human activities like settlements, cropping, recreation, and forestry are carried out without disturbing the environment.