

## RE-NEET (UG) – 2026

### Test Booklet Code 70 Question Paper with Key, Hints & Solutions

1. A photon and an electron, each of 20 eV energy, move in free space. The ratio of linear momentum of electron  $P_e$  to that of photon  $P_{ph}$ ,  $\frac{P_e}{P_{ph}}$  is (Take speed of light =  $3 \times 10^8 \text{ ms}^{-1}$ , charge of electron =  $-1.6 \times 10^{-19} \text{ C}$  and mass of electron =  $9 \times 10^{-31} \text{ kg}$ )

- (1) 275  
 (2)  $\frac{2}{450}$   
 (3)  $\frac{1}{250}$   
 (4) 225

Ans. (4)

Sol. de-Broglie wavelength and energy of photon

$$E = 20 \text{ eV} = 20 \times 1.6 \times 10^{-19} \text{ J} = 3.2 \times 10^{-18} \text{ J}$$

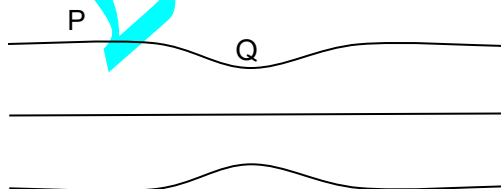
$$\frac{P_e}{P_{ph}} = \frac{\sqrt{2mE}}{E/C} = C \sqrt{\frac{2m}{E}}$$

$$= 3 \times 10^8 \sqrt{\frac{2 \times 9.1 \times 10^{-31}}{3.2 \times 10^{-18}}}$$

$$= 225$$

2. Water flows in a streamline motion through a horizontal pipe of circular cross-section as shown in the figure. The pressure difference of water between P and Q is  $15 \text{ Nm}^{-2}$ . The area of cross-section at P and Q are  $40 \text{ cm}^2$  and  $20 \text{ cm}^2$ , respectively. The rate of flow of water through the pipe, in  $\text{cm}^3\text{s}^{-1}$ , is:

[Take density of water =  $1000 \text{ kg m}^{-3}$ ]



- (1) 400  
 (2) 100  
 (3) 200  
 (4) 300

Ans. (1)

Sol. Equation of Gravity and bernoulli's principle

$$A_P V_P = A_Q V_Q = R \quad (R = \text{Volume flow rate})$$

$$A_P = 40 \text{ cm}^2, A_Q = 20 \text{ cm}^2$$

$$A_Q = \frac{A_P}{2}$$

$$P_P + \frac{1}{2} \rho V_P^2 = P_Q + \frac{1}{2} \rho V_Q^2$$

$$15 = \frac{1}{2} \times 10^3 (4V_P^2 - V_P^2)$$

$$V_P = 0.1 \text{ ms}^{-1}$$

$$R = A_P V_P = (4 \times 10^{-4}) (0.1)$$

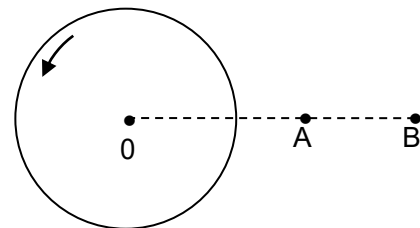
$$= 4 \times 10^{-4} \text{ m}^3 \text{ s}^{-1}$$

$$1 \text{ m}^3 = 10^6 \text{ cm}^3$$

$$R = 400 \text{ cm}^3 \text{ s}^{-1}$$

3. A thin horizontal disc is rotating about a vertical axis passing through its fixed centre O. Its angular momentum is  $L_A$  and  $L_B$  computed about points A and B, respectively, with  $OB = 2 \times OA$ . The value of

$$\frac{L_A}{L_B}$$
 is:



- (1) 2  
 (2)  $\frac{1}{4}$   
 (3)  $\frac{1}{2}$   
 (4) 1

Ans. (4)

Sol. Angular momentum

$$\vec{L} = \vec{L}_{cm} + \vec{V}_{cm} \times \vec{P}_{cm}$$

$$\vec{L}_{cm} = \text{angular momentum about cm,}$$

$$\vec{V}_{cm} = \text{position vector of point about cm,}$$

$$\text{Lines com is not translates, } (\vec{P}_{cm} = \vec{O})$$

$$\therefore \vec{L}_A = \vec{L}_B$$

$$\frac{L_A}{L_B} = 1$$

4. Consider a long solenoid of length  $l$  and radius  $r$ . If  $n$  is the number of turns per unit length and  $\mu_0$  is the permeability of free space, the inductance of the solenoid is:

- (1)  $2\mu_0\pi n^2 r^2 l$
- (2)  $\mu_0\pi n^2 r^2 l$
- (3)  $\mu_0 n^2 r^2 l$
- (4)  $(\mu_0/2\pi)n^2 r^2 l$

Ans. (2)

Sol.  $L = \frac{N\phi}{I}$ ,  $N$  = total no of turns

$\beta = \mu_0 n l$ ,  $n$  = no of turns per unit length

$\phi = BA = (\mu_0 n l)(\pi r^2)$

$L = \frac{N}{I} \cdot \phi = \frac{N}{I} \cdot (\mu_0 n l \pi r^2)$

$L = \mu_0 n^2 \pi r^2 l \quad \because (N = n l)$

5. The temperature of a metallic sphere of radius  $R$  is increased by a small amount  $\Delta T$ . If the linear coefficient of thermal expansion of the metal is  $\alpha$ , the approximate increase in the volume of the sphere is:

- (1)  $6\pi R^3 \alpha \Delta T$
- (2)  $2\pi R^3 \alpha \Delta T$
- (3)  $3\pi R^3 \alpha \Delta T$
- (4)  $4\pi R^3 \alpha \Delta T$

Ans. (4)

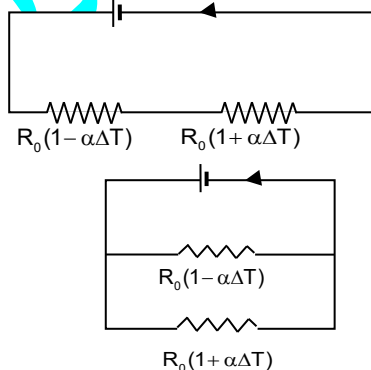
Sol. Thermal expansion

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

$\Delta V = V\beta\Delta T = \left(\frac{4}{3} \pi r^3\right) (3\alpha) \Delta T, (\beta = 3\alpha)$

$\Delta V = 4\pi R^3 \alpha \Delta T$

6. Consider two circuits, A and B, each having two resistors. One of them has a positive temperature coefficient of resistnace,  $+\alpha$ , while the other one has a negative temperature of coefficient,  $-\alpha$ , as shown in the figure. The current through these circuits are denoted by  $I_A$  and  $I_B$ . At initial temperature, the resistance of the two resistors is  $R_0$ . As the temperature is increased, the correct option that describes the variation of current in these circuits is:



- (1) both  $I_A$  and  $I_B$  remain constant
- (2)  $I_A$  remains constant while  $I_B$  increases

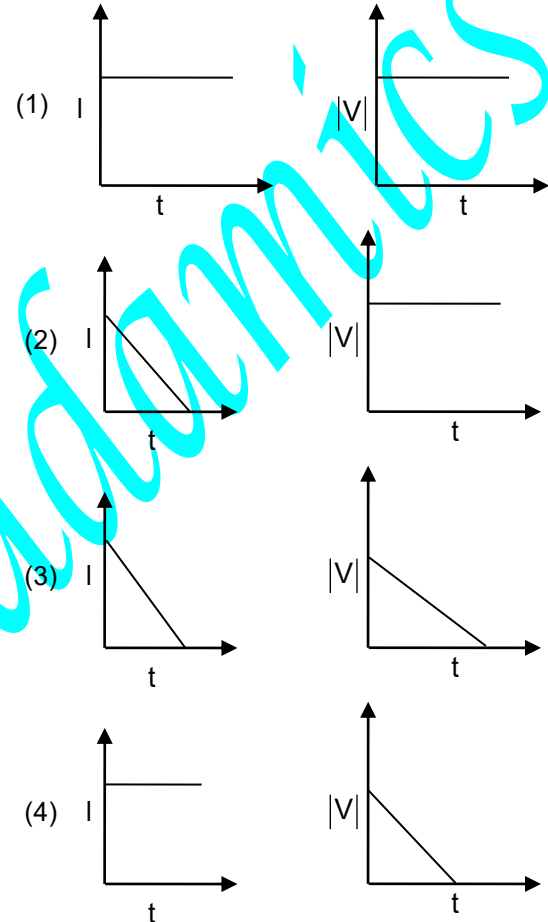
- (3)  $I_A$  decreases while  $I_B$  increases
- (4)  $I_A$  increases while  $I_B$  decreases

Ans. (2)

Sol. Circuit (A) is series and Circuit (B) is parallel.

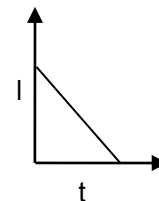
$I_A$  remains constant  $I_B$  increases.

7. A beam of light falls on a metal surface such that photo-electrons are generated. If power of the light source starts to decrease linearly with time  $t$ , then variation of the photocurrent  $I$  and magnitude of the stopping potential  $|V|$  with time is best represented by:

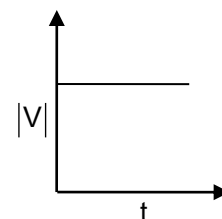


Ans. (2)

Sol: The number of photo electron emitted per second is directly proportional to the intensity

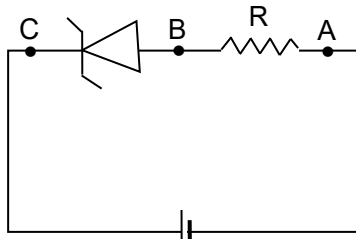


Stopping potential depends entirely at the frequency of the incident light and independent of the light intensity.



8. An ideal Zener diode with breakdown voltage of  $-3$  V is reverse biased with a negative input voltage  $V_i$

= -5 V. The magnitude of voltage difference between points B and A is:



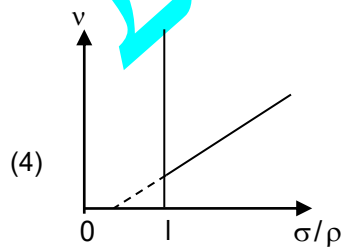
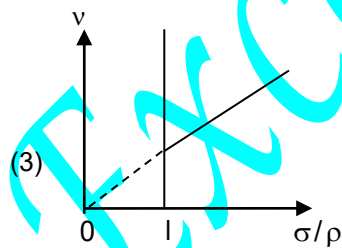
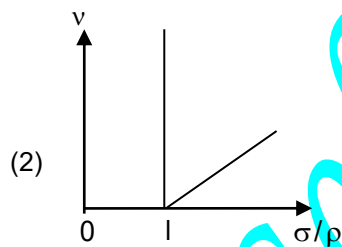
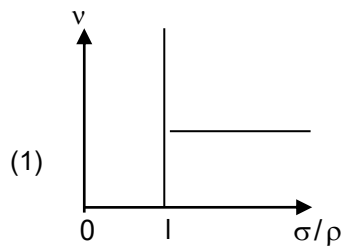
- (1) 0 V
- (2) 3 V
- (3) 2 V
- (4) 1 V

Ans. (3)

Sol.  $V_z = 3$  volt, Applied reverse voltage  $|V_i| = 5$  volt  
Zener break voltage  $V_z = 3$  volts

The zener diode under goes breakdown keeping the magnitude of the voltage difference into its terminals equal to 2 volt.

9. In the measurement of viscosity of liquids using terminal velocity experiment, spherical balls of same radius but having different densities are used. The variation of the terminal velocity ( $v$ ) with the ratio of density of spherical ball ( $\sigma$ ) to density of the liquid ( $\rho$ ), is best represented by:



Ans. (2)

Sol.  $v = \frac{2r^2g\rho}{9\eta} \left( \frac{\sigma}{\rho} - 1 \right)$

$$v = k \left( \frac{\sigma}{\rho} - 1 \right)$$

$$v = k \left( \frac{\sigma}{\rho} \right) - k; \quad y = mx + c$$

10. Two planets  $P_1$  and  $P_2$  with equal mass have radii  $R_1$  and  $R_2$ , respectively, where  $R_2 = \frac{R_1}{2}$ . The escape speeds of  $P_1$  and  $P_2$  are  $v_1$  and  $v_2$ , respectively. Then  $\frac{v_2}{v_1}$  is :

- (1) 2
- (2)  $\frac{1}{\sqrt{2}}$
- (3) 1
- (4)  $\sqrt{2}$

Ans. (4)

Sol.  $V_1 = \sqrt{\frac{2GM}{R_1}}; V_2 = \sqrt{\frac{2GM}{R_2}}$

$$\frac{V_2}{V_1} = \sqrt{\frac{R_1}{R_2}} \text{ or } \frac{V_2}{V_1} = \sqrt{2}$$

11. An ac voltage  $V = 220 \sin(2 \times 10^3 t)$  Volt is applied to a series LCR circuit. Then the current amplitude in this circuit is :

(Given :  $L = 10$  mH,  $C = 25 \mu\text{F}$ ,  $R = 100 \Omega$ )

- (1) 22.0 A
- (2) 2.2 A
- (3) 5.5 A
- (4) 11.0 A

Ans. (2)

Sol.  $V = 220 \sin(2 \times 10^3 t)$

$$x_c = \omega L = (2 \times 10^3)(10 \times 10^{-3}) = 20 \Omega$$

$$x_c = \frac{1}{\omega C} = \frac{1}{2 \times 10^3 \times (25 \times 10^{-6})} = \frac{1}{0.05} = 20 \Omega$$

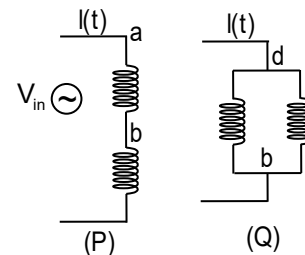
Since  $x_L = x_C$  Resonance

$$\therefore Z = R = 100 \Omega$$

$$i = \frac{V}{Z} = \frac{220}{100} = 2.2 \text{ A}$$

12. Two identical inductors are connected in two different configurations P and Q, where a time varying current  $I(t)$  is flowing, as shown in the figure. The induced emf between points a and b for configuration P is  $E_P$  and that for configuration Q is  $E_Q$ . The ratio  $E_P/E_Q$  is:

[Neglect the effect of mutual inductance.]



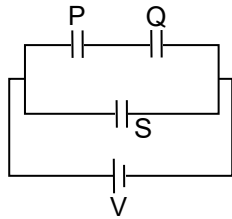
- (1) 2
- (2) 1/4
- (3) 1/2
- (4) 1

Ans. (1)

Sol. P – between a& b one inductor  $E_{ab}=L \frac{di}{dt}$   
 Q – between a& b – connected in parallel

$$E = \frac{L di}{2 dt}, E_P/E_Q = 2$$

13. Three identical capacitors P, Q and S, each of the capacitance C, are connected to a battery of voltage V, as shown in the figure. If the energy stored in the capacitor P and total energy stored in the system are  $U_P$  and  $U_T$ , respectively, then the ratio  $\frac{U_P}{U_T}$  is :



- (1) 1/6
- (2) 2/3
- (3) 1/3
- (4) 1/2

Ans. (1)

Sol. Energy stored in p

$$U_P = \frac{1}{2} C \left( \frac{V}{2} \right)^2 = \frac{1}{8} CV^2$$

$$U_T = \frac{1}{2} C_{eq} V^2$$

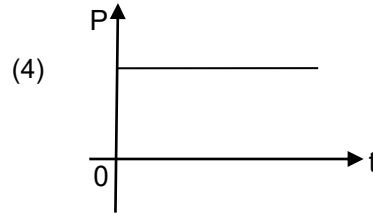
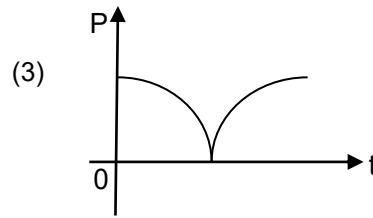
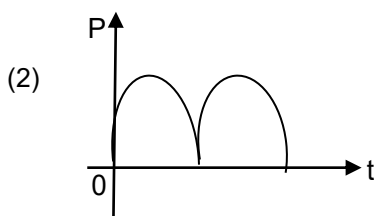
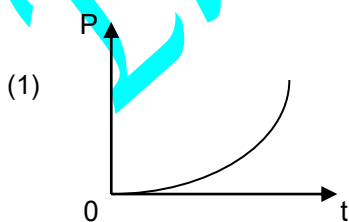
$$C_{eq} = \frac{C}{2} + C = C \left( \frac{1}{2} + 1 \right) = \frac{3}{2} C$$

Total energy stored

$$U_T = \frac{1}{2} \left( \frac{3}{2} CV^2 \right)$$

$$\frac{U_P}{U_T} = \frac{\frac{1}{8} CV^2}{\frac{3}{4} CV^2} = \frac{1}{6}$$

14. A conducting loop of finite resistance lies on the x - y plane. There is a constant magnetic field in the z direction. The area of the loop varies with time t, as  $A = A_0(1 + \sin t)$  in appropriate units. The figure that correctly indicates the qualitative behaviour of the power P dissipated in the loop as a function of time is:



Ans. (3)

Sol.  $e = -\frac{d\phi}{dt}$   
 $e = -BA_0 \cos t$

$$P = \frac{e^2}{R}$$

$$\text{Power } P = \frac{B^2 A_0^2}{R} \cos^2 t$$

15. In an adiabatic expansion, the temperature of one mole of an ideal monatomic gas ( $\gamma = 5/3$ ) decrease from 60 K to 50 K. The work done by the gas in the process is:

(Take the universal gas constant as  $R = 8.3 \text{ J mol}^{-1} \text{ K}^{-1}$ )

- (1) 166 J
- (2) 41.5 J
- (3) 83 J
- (4) 124.5 J

Ans. (4)

Sol.  $W = nR \frac{(T_i - T_f)}{\gamma - 1}$

$$W = 1 \times \frac{8.3(60 - 50)}{\frac{5}{3} - 1}$$

$$W = 124.5 \text{ J}$$

16. Consider a particle moving along a straight line, whose position as a function of time is given by  $s(t)^2 = \alpha t^2 - \beta t + \gamma$ , where  $\alpha = 1 \text{ ms}^{-2}$ ,  $\beta = 6 \text{ ms}^{-1}$  and  $\gamma = 5 \text{ m}$ . The average speed of the particle, in  $\text{ms}^{-1}$ , from  $t = 0$  to  $t = 6$  is:

- (1) 0
- (2) 12
- (3) 6
- (4) 3

Ans. (4)

Sol.  $S(t) = \alpha t^2 - \beta t + \gamma$

$$\alpha = 1 \text{ ms}^{-2}$$

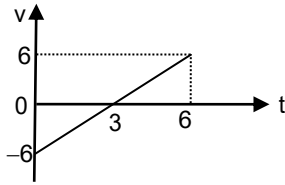
$$\beta = 6 \text{ ms}$$

$$\gamma = 5 \text{ m}$$

$$s(t) = 1t^2 - 6t + 5$$

$$v = \frac{ds}{dt}$$

$$v = 2t - 6$$



$$\text{Average speed} = \frac{\text{Total distance}}{\text{Total time}} = \frac{18}{6} = 3 \text{ m/s}$$

17. The following table presents the part of the electromagnetic spectrum and their corresponding major applications.

Parts of the electromagnetic spectrum		Applications	
P	Microwave	I	For purifying the water
Q	UV rays	II	For warming the food
R	Gamma rays	III	For AM and FM communication systems
S	Radio wave	IV	For treating the Cancer cells

The **correct** option is:

- (1) P-II, Q-IV, R-III, S-I  
 (2) P-I, Q-II, R-III, S-IV  
 (3) P-I, Q-IV, R-II, S-III  
 (4) P-II, Q-I, R-IV, S-III

Ans. (4)

Sol. P-II, Q-I, R-IV, S-III

18. An ideal gas is made of polyatomic molecules. Each of the molecules has three translational, three rotational and  $f$  number of vibrational modes. If the ratio of heat capacities  $C_p/C_v$  of the gas is  $8/7$ , then the value of  $f$  is

- (1) 1 (2) 4  
 (3) 3 (4) 2

Ans. (2)

Sol. Given

3 rotational

3 translational & vibrational

$$C_v = \frac{3}{2}R + \frac{3}{2}R + fR = (3 + f)R$$

$$C_p = C_v + R = (4 + f)R$$

$$\text{And } = \frac{C_p}{C_v} = \frac{8}{7}$$

$$\frac{(4 + f)R}{(3 + f)R} = \frac{8}{7}$$

$$7(4 + f) = 8(3 + f)$$

$$28 + 7f = 24 + 8f$$

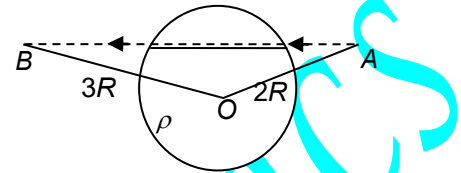
$$28 - 24 = 8f - 7f$$

$$\therefore f = 4$$

19. A unit positive point charge is taken slowly through an infinitesimally thin tube that is inside a charged dielectric sphere of radius  $R$ , having uniform positive charge density  $\rho$ , as shown in the figure. The initial and final positions of the charge are marked by A and B at distances  $2R$  and  $3R$  respectively, from the centre of the sphere. In this process, the magnitude of the total work done on the point charge is  $\frac{\rho R^2}{n \epsilon_0}$ .

The value of  $n$  is:

( $\epsilon_0$  is the permittivity of vacuum)



- (1) 18 (2) 2  
 (3) 6 (4) 9

Ans. (1)

Sol.  $V = \frac{\rho R^3}{3\epsilon_0 r}$  formula

$$V_A = \frac{\rho R^3}{3\epsilon_0 (2R)} = \frac{\rho R^2}{6\epsilon_0}$$

$$V_B = \frac{\rho R^3}{3\epsilon_0 (3R)} = \frac{\rho R^2}{9\epsilon_0}$$

Work done on unit positive charge is

$$W = q(V_B - V_A)$$

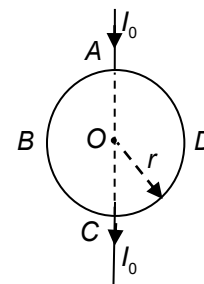
$$= 1 \left( \frac{\rho R^2}{9\epsilon_0} - \frac{\rho R^2}{6\epsilon_0} \right)$$

$$W = -\frac{\rho R^2}{18\epsilon_0}$$

$$\text{Given } W = \frac{\rho R^2}{n\epsilon_0}$$

$$\therefore n = 18$$

20. A current  $I_0$  flows through a metallic circular loop of radius  $r$  as shown in the figure. Resistance of the segment ABC is half that of ADC. Magnitude of magnetic field at the center O of the loop is:



- (1)  $\frac{\mu_0 I_0}{2\pi r}$  (2)  $\frac{\mu_0 I_0}{12r}$   
 (3)  $\frac{\mu_0 I_0}{4r}$  (4)  $\frac{\mu_0 I_0}{2r}$

Ans. (2)

Sol. Segment ABC → R

ADC → 2R

Current in ABC ( $I_1$ ):

$$I_1 = \left( \frac{2R}{R+2R} \right) I_0 = \frac{2}{3} I_0$$

Current in ADC ( $I_2$ ):

$$I_2 = \left( \frac{R}{R+2R} \right) I_0 = \frac{1}{3} I_0$$

Field due to (ABC) is  $B_1$

$$B_1 = \frac{\mu_0 (2I_0 / 3)}{4r} = \frac{\mu_0 I_0}{6r}$$

Field due to ADC is  $B_2$

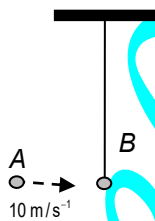
$$B_2 = \frac{\mu_0 (I_0 / 3)}{4r} = \frac{\mu_0 I_0}{12r}$$

Net magnetic field

$$B_{\text{net}} = B_1 - B_2$$

$$B = \frac{\mu_0 I_0}{12r}$$

21. Bob B of mass  $m$  at rest is hanging vertically from the ceiling via a massless string of length 10 m, as shown in the figure. Point mass A of mass  $m$  travelling horizontally with speed  $10 \text{ ms}^{-1}$  hits bob B elastically. The bob B rises  $h$  meter after the collision. Taking the acceleration due to gravity  $g = 10 \text{ ms}^{-2}$  and neglecting the size of the bob, the value of  $h$  is:



- (1) 2.5                      (2) 8  
 (3) 7                        (4) 5

Ans. (4)

Sol.  $\frac{1}{2}mv^2 = mgh$

$$h = \frac{v^2}{2g}$$

$$h = \frac{100}{2 \times 10} = 5 \text{ m}$$

22. An electromagnetic wave travelling in a lossless dielectric medium having a dielectric constant,  $\epsilon_r = 9$ , has the electric field,  $E_x = E_0 \sin(kz - 2\pi \times 10^6 t)$   $\text{Vm}^{-1}$  where  $E_0$  is the amplitude and  $k$  is the wave vector. Among the following options. The **incorrect** choice is:

- (1) The direction of propagation of the electromagnetic wave is along +z

- (2) The speed of the electromagnetic wave inside the medium is  $10^8 \text{ ms}^{-1}$   
 (3) The wavelength of the electromagnetic wave inside the medium is 300 m  
 (4) The magnetic field is given by the relation  $B_y = \frac{B_0}{v} \sin(kz - 2\pi \times 10^6 t)$  where  $v$  is the speed of the electromagnetic wave inside the medium

Ans. (3)

Sol.  $v = \nu \lambda$

$$\lambda = \frac{v}{\nu}$$

$$\omega = 2\pi \nu$$

$$2\pi \times 10^6 = 2\pi \nu$$

$$\nu = 10^6 \text{ Hz}$$

$$v = \frac{c}{\sqrt{\mu_r \epsilon_r}} (\because \mu_r = 1)$$

$$= \frac{3 \times 10^8}{\sqrt{9}} = 10^8 \text{ m/s}$$

Then

$$\lambda = \frac{10^8}{10^6} = 100 \text{ m}$$

So  $\lambda$  is incorrect from given options.

23. A particle of mass  $M$  moves along a horizontal  $x$  axis from  $x = 0$  to  $x = L$ . The coefficient of kinetic friction varies as a function of  $x$  as  $\mu_k(x) = \mu_0 - \alpha x$ , where  $\mu_0, \alpha$  are constants of appropriate dimensions, so that  $\mu_k(L) = 0$ . The total work done by the frictional force during the motion is  $n\mu_0 MgL$ , where  $g$  is the acceleration due to gravity. The value of  $n$  is:

- (1)  $\frac{1}{2}$                       (2) 3  
 (3) 1                        (4)  $\frac{1}{3}$

Ans. (1)

Sol. Given  $\mu_k(L) = 0$

i.e.  $\mu_0 - \alpha L = 0$

$$\alpha = \frac{\mu_0}{L}$$

then

$$\mu_k = \left( \mu_0 - \frac{\mu_0}{L} x \right)$$

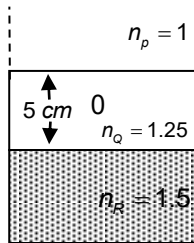
Work done

$$W = Mg \int_0^L \left( \mu_0 - \frac{\mu_0}{L} x \right) dx \Rightarrow W = \mu_0 Mg \left( x - \frac{x^2}{2L} \right)_0^L$$

$$= \mu_0 Mg \left( L - \frac{L^2}{2L} \right) = \mu_0 Mg \left( \frac{L}{2} \right)$$

$$W = \frac{L}{2} \mu_0 MgL \therefore n = \frac{1}{2}$$

24. Consider three media P, Q and R with refractive indices 1, 1.25, and 1.5, respectively. The medium Q having a thickness of 5 cm is placed between extended media P and R as shown in the figure. An object O is placed at the center of medium Q. If viewed from medium P near the normal direction, the apparent depth of O is  $h_1$ . For similar observation from medium R, the apparent depth is  $h_2$ . The value of  $|h_1 - h_2|$ , in cm, is:



- (1) 3 (2) 0  
(3) 1 (4) 2

Ans. (3)

Sol. If viewed from p

$$\mu = \frac{\text{Real depth}}{\text{Apparent depth}}$$

$$1.25 = \frac{2.5}{h_1}$$

$$h_1 = 2\text{cm.}$$

If viewed from R

$$\frac{\mu_Q}{\mu_R} = \frac{2.5}{h_2}$$

$$\frac{1.25}{1.5} = \frac{2.5}{h_2}$$

$$h_2 = 3\text{cm}$$

$$|h_1 - h_2| = 1 \text{ cm.}$$

25. Consider a fixed uniformly charged insulating sphere with radius R and total charge +Q. A point charge -q ( $q < Q$ ) with mass m is released from rest at a distance of 3R from the centre of the charged sphere. When the point charge reaches the surface of the sphere, its speed is:

( $\epsilon_0$  is the permittivity of vacuum, neglect gravitational forces).

(1)  $\sqrt{\frac{Qq}{4\pi\epsilon_0 mR}}$  (2)  $\sqrt{\frac{3Qq}{4\pi\epsilon_0 mR}}$

(3)  $\sqrt{\frac{2Qq}{3\pi\epsilon_0 mR}}$  (4)  $\sqrt{\frac{Qq}{3\pi\epsilon_0 mR}}$

Ans. (4)

Sol.  $U_i = \frac{1}{\mu\pi\epsilon_0} \frac{Q(-q)}{3R} = \frac{-Qq}{12\pi\epsilon_0 R}$

$$U_f = \frac{1}{\mu\pi\epsilon_0} \frac{Q(-q)}{3R} = \frac{-Qq}{4\pi\epsilon_0 R}$$

$$\Delta U = K.E$$

$$\frac{Qq}{\mu\pi\epsilon_0 R} - \frac{Qq}{12\pi\epsilon_0 R} = \frac{1}{2}mv^2$$

$$\frac{Qq}{6\pi\epsilon_0 R} = \frac{1}{2}mv^2$$

$$V = \sqrt{\frac{Qq}{3\pi\epsilon_0 mR}}$$

26. A car travels on a circular racetrack of radius 50 m, which is banked at an angle  $\theta$ . If the car travels at a speed 10  $\text{ms}^{-1}$ , then the wear and tear on its tyres is minimum. Taking the acceleration due to gravity to be 10  $\text{ms}^{-2}$ , the value of  $\theta$  is:

- (1)  $\tan^{-1}(2\sqrt{3})$  (2)  $\tan^{-1}\left(\frac{1}{5}\right)$   
(3)  $\tan^{-1}\left(\frac{2}{5}\right)$  (4)  $\tan^{-1}(\sqrt{3}/2)$

Ans. (2)

Sol. Radius of circular track

$$R = 50 \text{ m}$$

$$\text{Speed } v = 10 \text{ m/s}$$

$$g = 10 \text{ m/s}^2$$

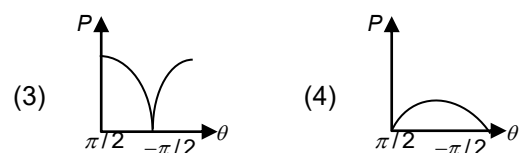
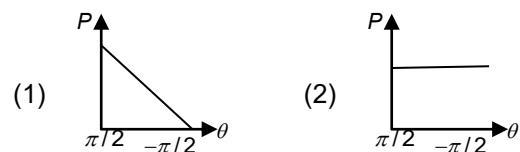
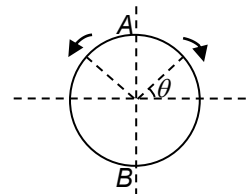
For minimum wear and tear

$$\rightarrow \text{no friction} = \tan\theta = \frac{v^2}{rg} = \frac{10^2}{50 \times 10} = \frac{1}{5}$$

$$\theta = \tan^{-1}\left(\frac{1}{5}\right)$$

27. A frictionless circular wire of unit radius is fixed on the horizontal plane. Two point particles of unit mass start moving simultaneously from point A ( $\theta = \frac{\pi}{2}$ ) with identical uniform angular speeds in opposite directions, and meet again at point B ( $\theta = -\frac{\pi}{2}$ ).

During this time, which of the following figures schematically represent the magnitude of the total linear momentum P of the system, as a function of  $\theta$ ?



Ans. (4)

Sol. Circular wire

$r = 1$  unit

Two particles

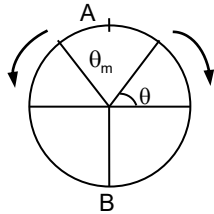
$M_1 = 1$  unit

$M_2 = 1$  unit

Moving from  $A \left( \theta = \frac{\pi}{2} \right)$

$B \left( \theta = -\frac{\pi}{2} \right)$

Magnitude of total linear momentum  $\rightarrow P = ?$



At any instant two particles are at angle  $\theta$  and  $(\pi - \theta)$

For ' $\theta$ ' angle

$\vec{V}_1 = v[-\cos\theta\hat{i} + \sin\theta\hat{j}]$

For  $(\pi - \theta)$  angle

$\vec{V}_2 = v[-\cos\theta\hat{i} - \sin\theta\hat{j}]$

Total momentum

$\vec{P} = m\vec{V}_1 + m\vec{V}_2$

$= m(-2V \cos\theta\hat{i})$

$P = 2V |\sin\theta|$

at  $\theta = \pi/2$

$P = 0$  minimum

At  $\theta = 0$

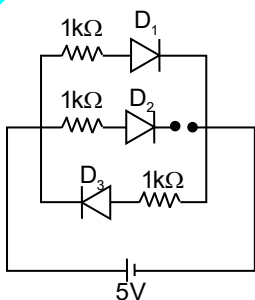
$P = 2V$  maximum

At  $\theta = \frac{-\pi}{2}$

$\therefore P = 0 \rightarrow$  minimum

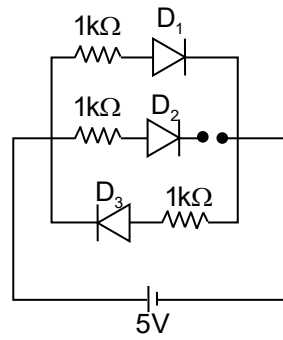
So, option (4)

28. Three identical p-n junction diodes  $D_1, D_2$  and  $D_3$  are connected across a battery as shown in the figure. If the width of the depletion regions of  $D_1, D_2$  and  $D_3$  are  $W_1, W_2$  and  $W_3$ , respectively, then the correct option is:



- (1)  $W_2 > W_1 = W_3$
- (2)  $W_1 > W_2 > W_3$
- (3)  $W_3 = W_1 > W_2$
- (4)  $W_3 > W_2 > W_1$

Ans. (4)



Sol.

3 diodes  $D_1, D_2, D_3$

$D_1$  and  $D_2 \rightarrow$  Forward bias

$D_3 \rightarrow$  Reverse bias

Forward bias

Depletion width decreases

Reverse bias

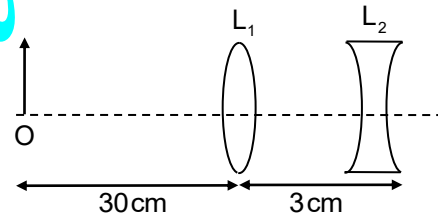
Depletion width increases

$D_2$  is opened so no change in width

and  $D_3 \rightarrow W_3 \rightarrow$  increases

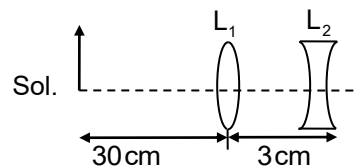
$\therefore W_3 > W_2 > W_1$

29. The lens combination as shown in the figure, consists of two lenses,  $L_1$  and  $L_2$ , of the focal lengths  $+10$  cm and  $-10$  cm, respectively. The position of the image formed is:



- (1) 60 cm to the right of the concave lens
- (2) 20 cm to the left of the concave lens
- (3) 60 cm to the left of the concave lens
- (4) 30 cm to the right of the concave lens

Ans. (3)



Sol.

$L_1 \rightarrow$  convex lens

$f_1 = + 10$  cm

$L_2 \rightarrow$  concave lens

$f_2 = - 10$  cm

$L_1, L_2$  separated by 3 cm

$\therefore d = 3$  cm

Object is at 30 cm from  $L_1$

$\therefore U = - 30$  cm

For  $L_1$ , lens formula

$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$

$$\frac{1}{10} = \frac{1}{V} - \left( \frac{1}{-30} \right)$$

$$= \frac{1}{V} + \frac{1}{30}$$

$$\frac{1}{V} = \frac{1}{10} - \frac{1}{30} = \frac{2}{30} = \frac{1}{15}$$

$$V = 15 \text{ cm}$$

Image is at 15 cm to right of L<sub>1</sub>

For lens L<sub>2</sub>

L<sub>2</sub> is 3 cm to the right of L<sub>1</sub>

$$u = 15 - 3 = 12 \text{ cm}$$

$$= + 12 \text{ cm}$$

This acts as virtual object to L<sub>2</sub>

$$\frac{1}{f} = \frac{1}{V} - \frac{1}{u}$$

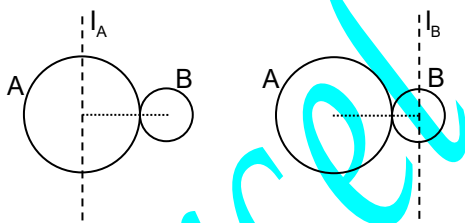
$$\frac{-1}{10} = \frac{1}{V} - \frac{1}{12}$$

$$\frac{1}{V} = \frac{-1}{10} + \frac{1}{12} = \frac{-1}{60}$$

$$\therefore V = - 60 \text{ cm}$$

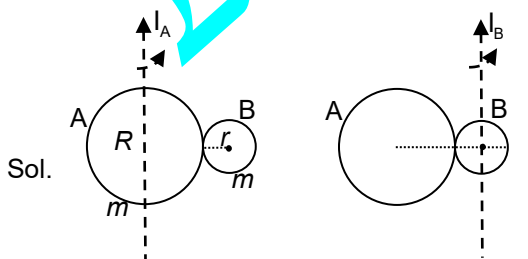
$\therefore$  60 cm left of the concave lens

30. A solid sphere A of radius R and mass M is attached at a point to a smaller solid sphere B is radius r < R and mass m < M. Assume that the line joining their centres lies along the horizontal. The moment of inertia of the system calculated about a vertical axis passing through the centre of A is I<sub>A</sub> and that calculated about a vertical axis passing through the centre of B is I<sub>B</sub>. The difference I<sub>A</sub> - I<sub>B</sub> is:



- (1) 0  
 (2) (M - m) (R + r)<sup>2</sup>  
 (3) (m - M) (R + r)<sup>2</sup>  
 (4) (m - M) (R - r)<sup>2</sup>

Ans. (3)



$$D = R + r$$

$$I_0 = \frac{2}{5} MR^2$$

$$I_A = I_0 + I_{\text{parallel}}$$

$$d = R + r$$

$$I_0 = \frac{2}{5} mr^2$$

$$I_B = I_0 + I_{\text{parallel}}$$

$$= \frac{2}{5} mR^2 + \frac{2}{5} mr^2 + md^2 = \frac{2}{5} mr^2 + \frac{2}{5} MR^2 + md^2$$

$$= \frac{2}{5} mR^2 + \frac{2}{5} mr^2 + m(R+r)^2 = \frac{2}{5} mr^2 + \frac{2}{5} MR^2 + M(R+r)^2$$

$$I_A - I_B = \frac{2}{5} MR^2 + \frac{2}{5} mr^2 + m(R+r)^2$$

$$- \left( \frac{2}{5} mr^2 + \frac{2}{5} MR^2 + M(R+r)^2 \right)$$

$$= \frac{2}{5} MR^2 + \frac{2}{5} mr^2 + m(R+r)^2 - \frac{2}{5} mr^2 - \frac{2}{5} MR^2 - M(R+r)^2$$

$$= m(R+r)^2 - M(R+r)^2$$

$$= (m - M) (R + r)^2$$

31. Consider that the electron is revolving in an excited state of Hydrogen atom with velocity  $\sqrt{25.6} \times 10^5 \text{ ms}^{-1}$ . The radius of the orbit is  $x \times 10^{-9} \text{ m}$ . The value of x is

[Take the mass of electron to be  $9 \times 10^{-31} \text{ kg}$ , charge of electron =  $-1.6 \times 10^{-19} \text{ C}$  and

$$\frac{1}{4\pi\epsilon_0} = 9 \times 10^9 \text{ Nm}^2\text{C}^{-2}]$$

(1) 1 (2) 4

(3) 3 (4) 2

Ans. (1)

Sol.  $\frac{mv^2}{r} = \frac{1}{4\pi\epsilon_0} \cdot \frac{e^2}{r^2}$

$$mv^2 = \frac{1}{4\pi\epsilon_0} \cdot \frac{e^2}{r}$$

$$r = \frac{ke^2}{mv^2}$$

$$= \frac{9 \times 10^9 \times [1.6 \times 10^{-19}]^2}{9 \times 10^{-31} \times 25.6 \times 10^{10}}$$

$$= \frac{2.56 \times 10^9 \times 10^{-38}}{10^{-31} \times 25.6 \times 10^{10}}$$

$$= \frac{2.56 \times 10^{-29} \times 10^{31} \times 10^{-10}}{25.6} = \frac{2.56}{25.6} \times 10^{-8}$$

$$= \frac{25.6}{25.6} \times 10^{-9} = 1 \times 10^{-9}$$

32. The mean free path of molecules in an ideal gas A is half that of another ideal gas B. The diameter of the spherical molecules of gas A is twice the diameter of the molecules of B. If number densities of the gases A and B are n<sub>A</sub> and n<sub>B</sub>, respectively, then the correct option is

(1) n<sub>A</sub> =  $\frac{1}{2}$  n<sub>B</sub>

(2) n<sub>A</sub> = n<sub>B</sub>

(3) n<sub>A</sub> = 2n<sub>B</sub>

(4) n<sub>A</sub> =  $\frac{1}{4}$  n<sub>B</sub>

Ans. (1)

Sol. Mean free path

$$\lambda_A = \frac{1}{2} \lambda_B$$

$$d_A = 2d_B$$

$$\lambda = \frac{1}{\sqrt{2\pi n d^2}}$$

$$n = \frac{1}{\sqrt{2\pi \lambda d^2}}$$

$$\frac{n_A}{n_B} = \frac{\lambda_B}{\lambda_A} \times \left[ \frac{d_B}{d_A} \right]^2$$

$$= \frac{\lambda_B}{\lambda_A} \times \left[ \frac{d_B}{2d_B} \right]^2 = 2 \times \frac{1}{4} = \frac{1}{2}$$

$$\frac{n_A}{n_B} = \frac{1}{2}$$

$$\therefore n_A = n_B \times \frac{1}{2}$$

33. A cylindrical cork of uniform density floats in a liquid of density  $\rho_1$ . If the cork is depressed slightly and released, it oscillates harmonically with time period  $T$ . If the same cork floats in another liquid of density  $\rho_2$ , then the similar oscillation has time period  $2T$ . The value of  $\rho_2/\rho_1$  is

- (1) 1/4 (2) 4  
(3) 2 (4) 1/2

Ans. (1)

Sol.  $F = -kx$

$$F = -Ax \rho q$$

$$\therefore k = A\rho q$$

$$T_1 = T$$

$$T_2 = 2T$$

$$T = 2\pi \sqrt{\frac{m}{k}} = 2\pi \sqrt{\frac{m}{A\rho q}}$$

$$T \propto \frac{1}{\sqrt{\rho}}$$

$$\frac{T_1}{T_2} = \sqrt{\frac{\rho_2}{\rho_1}}$$

$$\frac{T}{2T} = \sqrt{\frac{\rho_2}{\rho_1}}$$

$$\frac{1}{4} = \frac{\rho_2}{\rho_1}$$

34. For sound waves, if the number of nodes for the 5<sup>th</sup> harmonic of an open – ended pipe is 'n' and that for the 9<sup>th</sup> harmonic of the same pipe with one of its ends closed is m, the ratio  $\frac{n}{m}$  is :

- (1)  $\frac{3}{5}$  (2)  $\frac{5}{9}$   
(3)  $\frac{9}{5}$  (4) 1

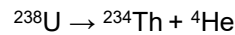
Ans. (4)

Sol. a : 5<sup>th</sup>  $\rightarrow n = 5$

b : 9<sup>th</sup>  $\rightarrow 1s^2$

$$\therefore \frac{n}{m} = \frac{5}{5} = 1$$

35. Consider the following nuclear reaction :



Take masses of  ${}^{238}\text{U}$ ,  ${}^{234}\text{Th}$  and  ${}^4\text{He}$  as 238.050 u, 234.043 u and 4.003 u, respectively. The Q value for the reaction, in keV, is :

[Given : 1 u = 931.5 MeV  $c^{-2}$ ]

- (1) 3740 (2) 3726  
(3) 3730 (4) 3736

Ans. (2)

Sol.  $\text{U}^{238} \rightarrow 238.050 \text{ u}$

$\text{Th}^{234} \rightarrow 234.043 \text{ u}$

$\text{He}^4 \rightarrow 4.003 \text{ u}$

$1 \text{ u} \rightarrow 931.5 \text{ MeV } c^{-2}$

$\text{U}^{238} \rightarrow \text{Th}^{234} + \text{He}^4$

$$\Delta m = m_U - [m_{\text{Th}} + m_{\text{He}}]$$

$$= 238.050 - [234.043 + 4.003]$$

$$= 238.050 - 238.0464$$

$$\therefore \Delta m = 0.004 \text{ u} = 0.004 \times 931.5 = 3.726 \text{ MeV}$$

$$= 3726 \text{ keV}$$

36. Which of the following measurements required 'index correction'?

- (1) Measurement of speed of sound using resonance tube  
(2) Measurement of resistance of a wire using meter bridge  
(3) Measurement of gravitational acceleration using simple pendulum  
(4) Measurement of focal length of lenses using optical bench

Ans. (4)

Sol. While using an optical bench to find the focal length of a lens. The index mark on the carriage often does not exactly coincide with the optical centre of the lens or the tip of the object / Image needles. The systematic error caused by this physical misalignment is called an index error.

37. In a solar system, the time – period of revolution of a planet tracing a circular orbit of radius R is proportional to :

- (1)  $R^3$  (2)  $R^{1/2}$   
(3)  $R^{3/2}$  (4)  $R^2$

Ans. (3)

Sol. According to Kepler's third law

$$T^2 \propto R^3$$

$$T \propto R^{3/2}$$

38. Consider that  $\sigma_s$ ,  $k_B$ , b represent Stefan – Boltzmann constant, Boltzmann constant and Wien's displacement law constant, respectively. The dimension of  $\sigma_s k_B^{-1} b$  is

- (1)  $[L^{-1}T^{-1}K^{-4}]$  (2)  $[L^{-1}T^{-1}K^{-2}]$   
(3)  $[L^{-1}K^{-2}]$  (4)  $[L^{-1}T^{-1}K^{-3}]$

Ans. (2)

Sol. The Dimensional formula

$$\sigma_s = [M T^{-3} K^{-4}]$$

$$K_B = ML^2 T^{-2} K^{-1}$$

$$K_B^{-1} = M^{-1} L^{-2} T^2 K$$

$$b = L^1 K^1$$

$$\alpha_s K_B^{-1} b = [M T^{-3} K^{-4}] [M^{-1} L^{-2} T^2 K] [L K]$$

$$= [L^{-1} T^{-1} K^{-2}]$$

39. A ray of light with wavelength  $\lambda$  is incident on three different photo- electric cells namely 1, 2 and 3. The threshold wavelength of these photo – electric cells are  $\lambda_1$ ,  $\lambda_2$  and  $\lambda_3$ , respectively and the magnitude of stopping potentials of these cells are  $V_1$ ,  $V_2$  and  $V_3$ , respectively. The relation between  $\lambda$  and threshold wavelengths are  $\lambda_1 < \lambda$ ,  $\lambda_2 > \lambda$  and  $\lambda_3 \gg \lambda$ . The correct option is :

- (1)  $V_1 < V_2$ ,  $V_3 = 0$       (2)  $V_1 = 0$ ,  $V_2 < V_3$   
 (3)  $V_1 = 0$ ,  $V_2 > V_3$       (4)  $V_1 > V_2$ ,  $V_3 = 0$

Ans. (2)

Sol.  $\lambda$  is the incident light wave length

$\lambda_1$ ,  $\lambda_2$ ,  $\lambda_3$  are the threshold wavelength

(i)  $\lambda_1 < \lambda$  ie threshold wavelength less than incident wave length. So,

Stopping potential is zero

$$V_1 = 0$$

(ii)  $\lambda_2 > \lambda$ , threshold wave length more than incident wave length so stopping potential  $V_2 \neq 0$

(iii)  $\lambda_3 \gg \lambda$ , threshold wavelength much more greater than incident wavelength. So stopping potential  $V_3 \neq 0$  and more than  $V_2$

$$\therefore V_1 = 0, V_2 < V_3$$

40. One main scale division of a Vernier calliper is equal to 1 mm and the number of divisions on the Vernier scale is 10. When both the jaws touch each other, the Vernier scale shifts to the left of zero of the main scale in such a way that 4<sup>th</sup> Vernier division coincides with a division of the main scale. If this Vernier calliper measures the length of a wire to be 1 cm, the actual length of the wire is :

- (1) 1.04 cm      (2) 0.60 cm  
 (3) 0.96 cm      (4) 1.00 cm

Ans. (1)

Sol. Least count = 0.01 cm

$$\text{Error} = -(N - V \cdot L) \times L \cdot C$$

$$= -(10 - 4) \times 0.01$$

$$= -6 \times 0.01$$

$$= -0.06$$

$$\text{Correction} = - \text{error}$$

$$= 0.06 \text{ cm}$$

$$\text{Total reading} = 1 \text{ cm}$$

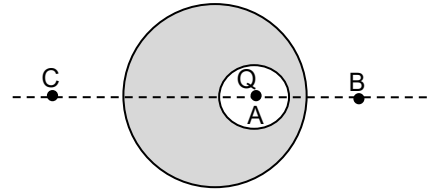
$$\text{Total correct reading} = T.R + \text{Correction}$$

$$= 1 + 0.06 = 1.06 \text{ cm}$$

The near answer is 1.04 cm

41. A point charge Q is placed inside a cavity within a solid isolated conducting sphere. Consider points A, B and C as shown in the figure, where the magnitudes of the electric fields are  $E_A$ ,  $E_B$  and  $E_C$ , respectively. The points B and C are at the same

distance from the center of the solid sphere. The correct option is

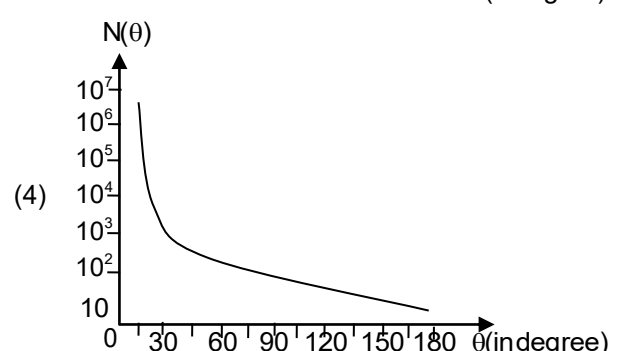
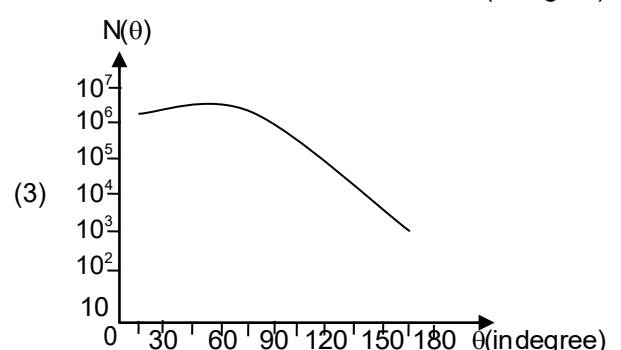
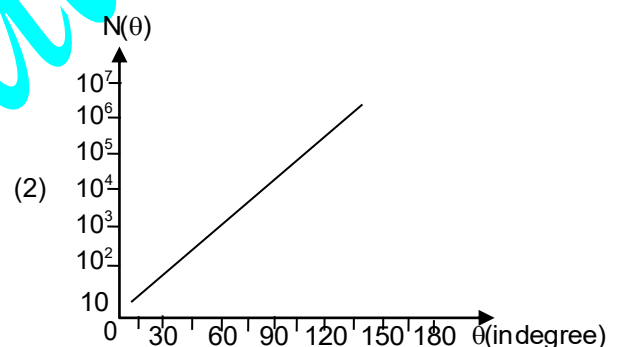
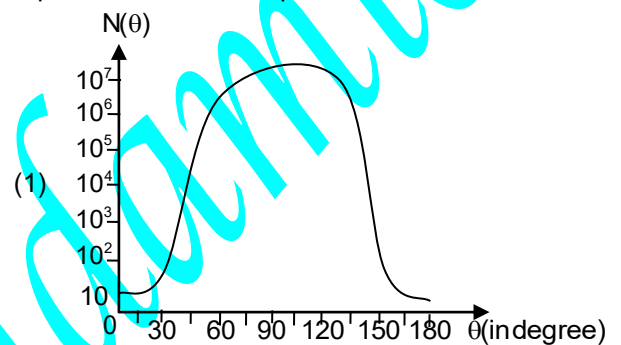


- (1)  $E_A \neq 0$ ,  $E_B < E_C$       (2)  $E_A = 0$ ,  $E_B = E_C$   
 (3)  $E_A \neq 0$ ,  $E_B = E_C$       (4)  $E_A = 0$ ,  $E_B > E_C$

Ans. (3)

Sol. At point 'A' electric field due to both 'Q' and induced charge. So,  $E_A \neq 0$  but  $E_B = E_C$

42. In Geiger – Marsden experiment, the number of scattered  $\alpha$ - particles  $N(\theta)$  is plotted as a function of scattering angle  $\theta$ . Which of the following options represents the correct plot?

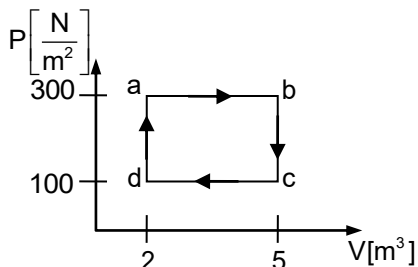


Ans. (4)

Sol. According to Geiger – Marsden experiment no of alpha particles scattered is inversely proportional to

$$\text{scattering angle } N(\theta) \propto \frac{1}{\sin^4\left(\frac{\theta}{2}\right)}$$

43. One mole of an ideal monoatomic gas undergoes a cyclic process as shown in the figure. The total heat supplied to the gas is :



- (1) 800 J                      (2) 400 J  
(3) 500 J                      (4) 600 J

Ans. (4)

Sol. According to law of thermodynamics

$$dQ = dU + dW$$

$$\text{In cyclic process } dU = 0$$

$$dQ = dW$$

$$dW = PdV = (300 - 100)(5 - 2)$$

$$= 200 \times 3$$

$$= 600 \text{ J}$$

$$\therefore dQ = 600 \text{ J}$$

44. Two infinitely long parallel conducting wires A and B carry currents I and 2I, respectively, in the same direction. The wire A has uniform mass per unit length  $\lambda$  and lies on an insulated floor. The wire B is kept fixed at a height h above the floor. The minimum magnitude of h so that the wire A does not rise from the floor is :

[g is the acceleration due to gravity and  $\mu_0$  is the permeability of free space.]

(1)  $\frac{4\mu_0 I^2}{\pi\lambda g}$                       (2)  $\frac{\mu_0 I^2}{2\pi\lambda g}$

(3)  $\frac{\mu_0 I^2}{\pi\lambda g}$                       (4)  $\frac{2\mu_0 I^2}{\pi\lambda g}$

Ans. (3)



Sol.

If the wire is fixed  
Weight = Force

$$Mg = \frac{\mu_0 I_1 I_2}{2\pi h} \times \ell$$

$$\left(\frac{M}{\ell}\right)g = \frac{\mu_0 I_1 I_2}{2\pi h}$$

$$\lambda g = \frac{\mu_0 I(2I)}{2\pi h}$$

$$h = \frac{\mu_0 I^2}{\lambda g \pi}$$

45. Consider a spring – mass simple harmonic oscillator in one dimension. The mass of the particle is m kg and the spring constant is k Nm<sup>-1</sup>. At a given instant, the extension of the spring is x meter and the speed of the particle is v ms<sup>-1</sup>. On the x – v plane, if the graph of v as a function of x is a circle, then the correct option is :

- (1)  $k = \sqrt{m}$                       (2)  $k = \frac{1}{m}$   
(3)  $k = m$                       (4)  $k = m^2$

Ans. (3)

Sol. According to Energy of SHM

$$E = PE + KE$$

$$E = \frac{1}{2}Kx^2 + \frac{1}{2}MV^2$$

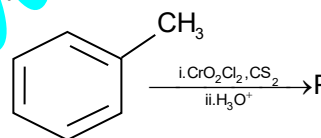
$$1 = \frac{1}{2} \frac{Kx^2}{E} + \frac{1}{2} \frac{MV^2}{E}$$

$$1 = \frac{kx^2}{2E} + \frac{MV^2}{2E}$$

This above equation represents circle and here All constant and denominates one equal on the X – V plane k must be equal m then only position

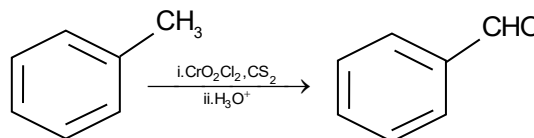
$$\therefore K = m$$

46. Consider the following reaction, and choose the correct option.

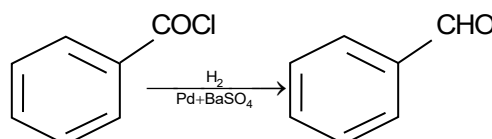


- (1) Compound P is obtained by the hydrogenation of benzoyl chloride with Pd on BaSO<sub>4</sub>.  
(2) On treating compound P with saturated NaHCO<sub>3</sub> solution, brisk effervescence is observed.  
(3) Compound P can be prepared by treating benzene with anhydrous AlCl<sub>3</sub> and CH<sub>3</sub>COCl.  
(4) On treatment with bromine water, compound P gives a white precipitate.

Ans. (1)

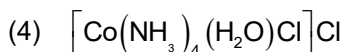


Sol.

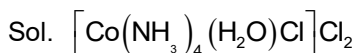


47. The formula of tetraamineaquachloridocobalt (III) chloride is

- (1)  $[\text{Co}(\text{NH}_3)_4(\text{H}_2\text{O})\text{Cl}]\text{Cl}_2$   
(2)  $[\text{Co}(\text{NH}_3)_4\text{Cl}_2] \times \text{H}_2\text{O}$   
(3)  $[\text{Co}(\text{NH}_3)_4]\text{Cl}_3 \times \text{H}_2\text{O}$



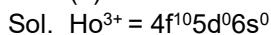
Ans. (1)



48. The lanthanide ion having four unpaired electrons is  
(Given: Atomic numbers of Ce = 58, Nd = 60, Tb = 65 and Ho = 67)

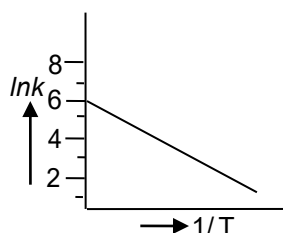
- (1)  $\text{Ho}^{3+}$                       (2)  $\text{Nd}^{3+}$   
(3)  $\text{Ce}^{3+}$                       (4)  $\text{Tb}^{3+}$

Ans. (1)



4 Unpaired electrons

49. For an elementary chemical reaction, The Arrhenius plot is given below



If the energy of activation is  $6.64 \text{ kJ mol}^{-1}$  and  $R = 8.3 \text{ JK}^{-1} \text{ mol}^{-1}$ , The temperature at which the rate constant becomes  $e^2 \text{ min}^{-1}$ , is

- (1) 250 K  
(2) 125 K  
(3) 150 K  
(4) 200 K

Ans. (4)

Sol. Arrhenius equation

$$K = A.e^{-E_a/RT}$$

$$\ln k = \ln A - \frac{E_a}{RT}$$

$$e^2 = A - \frac{E_a}{RT}$$

$$2 = 6 - \frac{E_a}{RT}$$

$$\frac{E_a}{RT} = 6 - 2$$

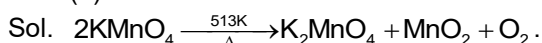
$$\frac{E_a}{RT} = 4$$

$$T = \frac{E_a}{4R} = \frac{6.64 \times 10^3}{4 \times 8.3} = 200 \text{ K}.$$

50. The green paramagnetic species formed by heating  $\text{KmnO}_4$  at 513 K is

- (1)  $\text{KO}_2$   
(2)  $\text{K}_2\text{MnO}_4$   
(3)  $\text{Mn}_3\text{O}_4$   
(4)  $\text{MnO}$

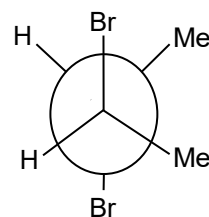
Ans. (2)



51. Given below are two statements:

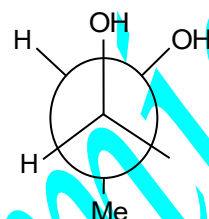
**Statement I:**

Trans-But-2-ene upon treatment with  $\text{Br}_2$  in  $\text{CCl}_4$  gives the following product



**Statement II:**

Cis-But-2-ene upon treatment with alkaline  $\text{KMnO}_4$  gives the following product



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

- (1) **Statement I** is incorrect but **Statement II** is correct  
(2) Both **Statement I** and **Statement II** are correct  
(3) Both **Statement I** and **Statement II** are incorrect  
(4) **Statement I** is correct but **Statement II** is incorrect

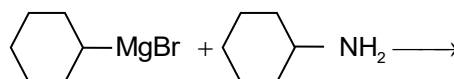
Ans. (1)

Sol. **Statement I**  $\text{Br}_2$  addition is anti addition

Trans alkene anti addition gives Meso compound

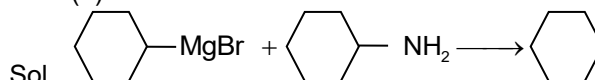
**Statement II**, Cisalkene anti addition gives Racemic mixture.

52. One of the products formed in the following reaction is



- (1)   
(2)   
(3)   
(4)

Ans. (1)



53. Given below are two statements:

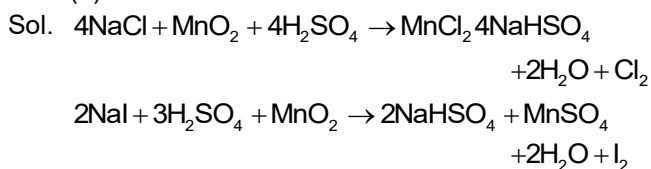
**Statement-I:** Heating  $\text{NaCl}$  with concentrated  $\text{H}_2\text{SO}_4$  and  $\text{MnO}_2$  results in oxidation of  $\text{MnO}_2$  reacts in oxidation of Mn.

**Statement-II:** Heating NaI with concentrated  $H_2SO_4$  and  $MnO_2$  results in reduction of Mn.

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

- (1) **Statement-I** is incorrect but **Statement-II** is correct.
- (2) Both **Statement-I** and **Statement-II** are correct.
- (3) Both **Statement-I** and **Statement-II** are incorrect.
- (4) **Statement-I** is correct but **Statement-II** is incorrect.

Ans. (1)



54. Among the following options, The correct trend in the electron gain enthalpy is

- (1)  $I > Br > Cl > F$
- (2)  $F > Cl > Br > I$
- (3)  $Br > Cl > F > I$
- (4)  $Cl > F > Br > I$

Ans. (4)

Sol. Order of electron gain enthalpy is  $Cl > F > Br > I$ .

55. Given below are two statements:

**Statement-I :**  $[\text{Fe}(\text{ox})_3]^{3-}$  is chiral.

**Statement-II :** trans-  $[\text{Cr}(\text{H}_2\text{O})_2(\text{ox})_2]^-$  is chiral.

(Given :  $\text{oxH}_2 = \text{HOOC} - \text{COOH}$ )

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

- (1) **Statement-I** is incorrect but **Statement-II** is correct.
- (2) Both **Statement-I** and **Statement-II** are correct.
- (3) Both **Statement-I** and **Statement-II** are incorrect.
- (4) **Statement-I** is correct but **Statement-II** is incorrect.

Ans. (4)

Sol. **Statement-I:**  $[\text{M}(\text{AA})_3]^{3-}$  is optically active

**Statement-II:** Only cis form optically active.

56. The correct statement about peptides and proteins is

- (1) In  $\alpha$ -helices, The polypeptide chain is twisted into a left-handed screw (helix) through intramolecular hydrogen bonds.
- (2) Tertiary structure of proteins has two or more polypeptide subunits.
- (3) Only the proteins having a quaternary structure are biologically active.
- (4) In  $\beta$ -pleated sheet structures, peptide chains are held together by intermolecular hydrogen bonds.

Ans. (4)

Sol. In  $\beta$ -pleated sheet structures, peptide chains are held together by intermolecular hydrogen bonds.

57. Given below are two statements:

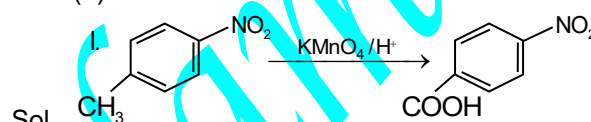
**Statement-I:** Oxidation of p - nitrotoluene with acidic  $\text{KMnO}_4$  gives an acid that is stronger than benzoic acid.

**Statement-II:** Reduction of p - nitrotoluene with  $\text{Sn}/\text{HCl}$  followed by neutralization gives an amine that is more basic than aniline.

In light of the above statements, Choose the **most appropriate** answer from the options given below.

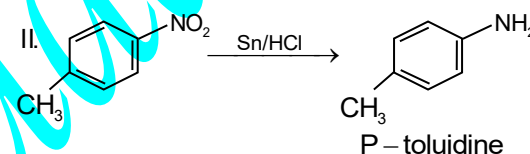
- (1) **Statement-I** is incorrect but **Statement-II** is correct.
- (2) Both **Statement-I** and **Statement-II** are correct.
- (3) Both **Statement-I** and **Statement-II** are incorrect.
- (4) **Statement-I** is correct but **Statement-II** is incorrect.

Ans. (2)



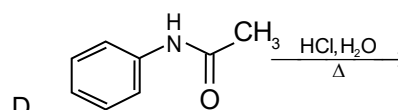
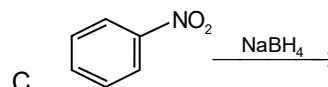
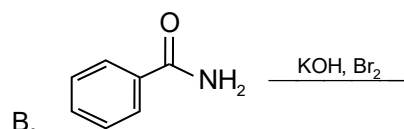
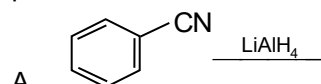
Sol.

$\text{NO}_2$  increases acidity, It is stronger than benzoic acid.



$\text{CH}_3$  increase electron density on the nitrogen, Making more basic than aniline.

58. Identify the reactions which give aniline as the major product.

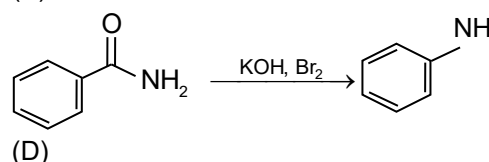


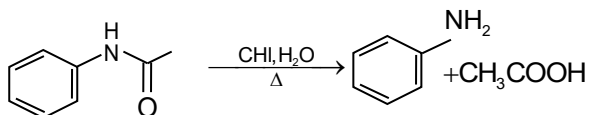
Choose the correct answer from the options given below:

- (1) C and D Only
- (2) A and B Only
- (3) B and D Only
- (4) A and C Only

Ans. (3)

Sol. (B) - Hoffmann bromide:





59. Two moles of an ideal gas undergo free expansion from 10 L to 100 L at 300K. The values of  $\Delta S_{\text{system}}$  and  $\Delta S_{\text{surroundings}}$  are

(R is universal gas constant)

- (1)  $\Delta S_{\text{system}} = 4.606$ ;  $\Delta S_{\text{surroundings}} = 0$
- (2)  $\Delta S_{\text{system}} = 0$ ;  $\Delta S_{\text{surroundings}} = 0$
- (3)  $\Delta S_{\text{system}} = 4.606R$ ;  $\Delta S_{\text{surroundings}} = -4.606R$
- (4)  $\Delta S_{\text{system}} = 0$ ;  $\Delta S_{\text{surroundings}} = 4.606R$

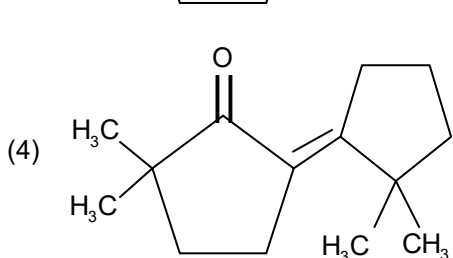
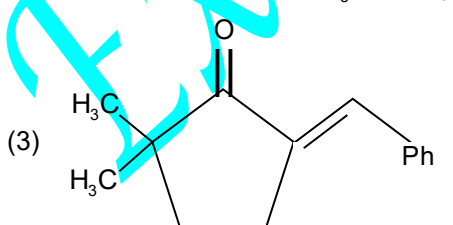
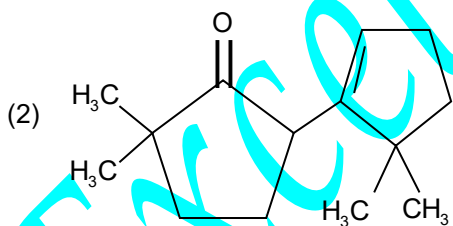
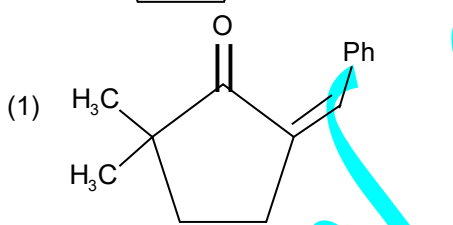
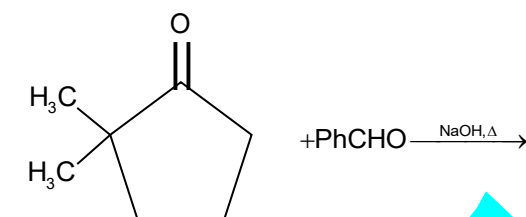
Ans. (1)

Sol.  $\Delta S_{\text{surroundings}} = 0$ , Because no heat is exchanged with surroundings ( $q = 0$ )

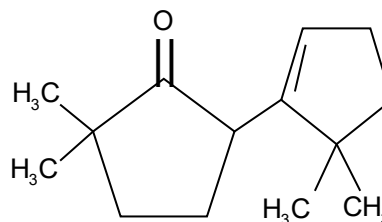
$$\Delta S_{\text{system}} = nR \ln(V_2/V_1)$$

$$\begin{aligned} \Delta S_{\text{system}} &= 2 \times R \times \ln(10) \\ &= 2 \times R \times 2.303 \\ &= 4.606R \end{aligned}$$

60. The compound that CANNOT be obtained from the aldol condensation reaction shown below, is



Ans. (2)



Sol.

Its not a standard product of this specific reaction mechanism,

In aldol condensation the double bond must be conjugated with the carbonyl.

61. The complex which has *facial* and *meridional* isomers is

[Given : 'py' = pyridine and 'en' =  $\text{H}_2\text{N}-\text{CH}_2-\text{CH}_2-\text{NH}_2$ ]

- (1)  $[\text{Ni}(\text{en})_2(\text{H}_2\text{O})_2]^{2+}$
- (2)  $[\text{Cr}(\text{py})_3(\text{Cl})_3]$
- (3)  $[\text{Cr}(\text{H}_2\text{O})_6]^{3+}$
- (4)  $[\text{Co}(\text{NH}_3)_4(\text{H}_2\text{O})_2]^{3+}$

Ans. (2)

Sol.  $[\text{Cr}(\text{py})_3(\text{Cl})_3]$  is  $[\text{Ma}_3\text{b}_3]$ -type of complex will exhibit *facial* and *meridional* isomers.

62. The numbers 17.0145 and 21.0235 were rounded to three figures after the decimal point. The resulting numbers respectively, are

- (1) 17.015 and 21.024
- (2) 17.014 and 21.023
- (3) 17.015 and 21.023
- (4) 17.014 and 21.024

Ans. (4)

$$\text{Sol. } 17.0145 \xrightarrow[\text{3rd digit}]{\text{even number}} = 17.014$$

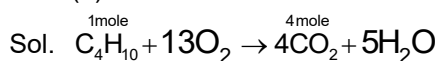
$$21.02135 = \xrightarrow[\text{3rd digit}]{\text{odd number}} = 21.024$$

63. The amount of carbon dioxide evolved upon complete combustion of 116 g of n-butane is

(Given: atomic mass in amu H = 1, C = 12 and O = 16)

- (1) 362 g
- (2) 352 g
- (3) 322 g
- (4) 176 g

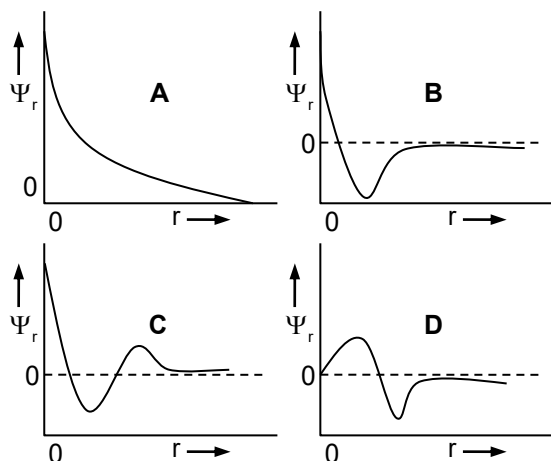
Ans. (2)



$$56\text{g of C}_4\text{H}_{10} \longrightarrow 4 \times 44\text{g CO}_2$$

$$\therefore 116\text{g} \longrightarrow ? \frac{4 \times 44}{58} \times 116 = 352\text{g CO}_2$$

64. Consider the following schematic plots of orbital wavefunction ( $\psi_r$ ) against distance ( $r$ ) from the nucleus.

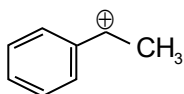


- (1) D
- (2) A
- (3) B
- (4) C

Ans. (4)

Sol. The number of radial nodes =  $(n-l-1)$  from graph 'C' consist of two radial nodes intersecting of radial axis at two points.

65. The following carbocation is stabilized by the interaction of the empty p orbital with



- (1) empty  $\sigma^*$  and empty  $\pi^*$  orbitals
- (2) filled  $\sigma$  and filled  $\pi$  orbitals
- (3) empty  $\sigma$  and filled  $\pi^*$  orbitals
- (4) empty  $\sigma^*$  and filled  $\pi$  orbitals

Ans. (4)

Sol. Due to Hyper conjugation effect of empty  $\sigma^*$  and filled  $\pi$  - orbital stabilization occurring of  $C^{\oplus}$ .

66. A 1 : 3 electrolyte in an aqueous solution is

- (1)  $[Co(NH_3)_3(NO_2)_3]$
- (2)  $[CoCl_2(NH_3)_4]Cl$
- (3)  $[CoCl(NH_3)_5]Cl_2$
- (4)  $[Co(NH_3)_6]Cl_3$

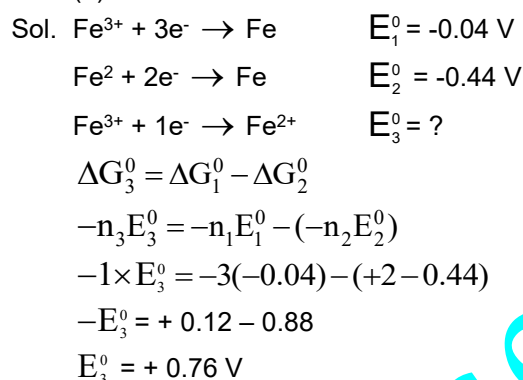
Ans. (4)

Sol.  $[Co(NH_3)_6]Cl_3 \rightarrow [Co(NH_3)_6]^{+3} + 3Cl^-$   
Produces one cation and three anions.

67. The standard electrode potential ( $E^0$ ) for the half-cell reaction  $Fe^{3+} + e^- \rightarrow Fe^{2+}$  at 298 K is

- (Given :  $E^0(Fe^{3+}/Fe) = -0.04$  V and  $E^0(Fe^{3+}/Fe) = -0.44$  V at 298 K)
- (1) + 0.92 V
  - (2) + 0.40 V
  - (3) + 0.76 V
  - (4) - 0.48 V

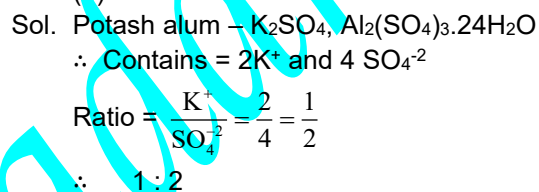
Ans. (3)



68. In potash alum, the ratio of  $K^+$  and  $SO_4^{2-}$  ions is

- (1) 3 : 2
- (2) 1 : 2
- (3) 2 : 1
- (4) 2 : 3

Ans. (2)



69. Consider the following statements about the solutions formed by mixing two liquids.

- A. An ideal solution thus formed obeys Raoult's law throughout the composition range.
  - B. Mixture of chloroform and acetone shows negative deviation from Raoult's law.
  - C. Mixture of aniline and phenol shows positive deviation from Raoult's law.
- (1) A and C only
  - (2) A and B only
  - (3) B and C only
  - (4) A only

Ans. (2)

Sol. Statement - A follows Raoult's law  
 Statements - B : Solutions shows -ve deviation from Raoult's law.

70. For a salt XY, which is a strong electrolyte, the plot of  $\Lambda_m$  versus  $\sqrt{c}$  has a slope of  $-90.0$  S  $cm^2$   $mol^{-3/2}$   $L^{1/2}$  at 298 K. At 0.01 M concentration of XY, the value of  $\Lambda_m$  is  $145.0$  S  $cm^2$   $mol^{-1}$ . The limiting molar conductivity of  $Y^-$  ion ( $\lambda_{Y^-}^0$ , in S  $cm^2$   $mol^{-1}$ ) at 298 K will be

- (Given:  $\lambda_{X^+}^0 = 74.0$  S  $cm^2$   $mol^{-1}$ )
- (1) 76.0
  - (2) 80.0
  - (3) 100.0
  - (4) 90.0

Ans. (2)

Sol. According to DHO Equation  $\lambda_m = \lambda_m^0 - A\sqrt{C}$

$$\therefore \text{Slope} - A = -90$$

$$A = 90$$

$$\sqrt{C} = \sqrt{0.01} \quad \therefore C = 0.1$$

$$\text{Hence } \lambda_m = \lambda_m^0 - A\sqrt{C}$$

$$145 = \lambda_m^0 - (90.0 \times 0.1)$$

$$\lambda_m^0 = 154 \text{ Scm}^2 \text{ mol}^{-1}$$

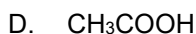
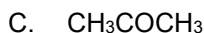
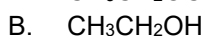
$$\therefore \lambda_m^0 = \lambda_{x^+}^0 + \lambda_{y^-}^0$$

$$\lambda_{y^-}^0 = \lambda_m^0 - \lambda_{x^+}^0$$

$$= 154 - 74$$

$$\lambda_{y^-}^0 = 80 \text{ Sm}^{-2} \text{ mol}^{-1}$$

71. Arrange the following compounds in the increasing order of polarity



Choose the correct answer from the options given below.

(1)  $A < C < B < D$       (2)  $A < B < C < D$

(3)  $C < A < D < B$       (4)  $C < A < B < D$

Ans. (1)

Sol. A. Diethyl ether : - Least polar

While the C - O bonds are polar, the molecule is relatively symmetrical. (Hydrogen bonding is absent)

B. Ethanol : Highly polar due to the hydroxy group (-OH), which allows for strong hydrogen bonding.

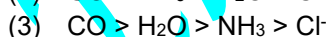
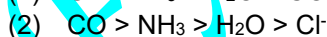
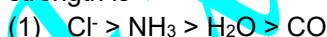
C. Acetone : contains highly polar (C=O) group.

D. Ethanoic acid : The most polar. It contains both (C = O) and hydroxyl group.

It allows very strong H-bonding and dimeritatin.

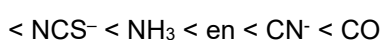
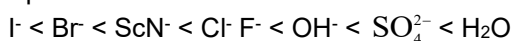
It has highest dipolemoment.

72. According to crystal field theory, the correct order of ligands with respect to their decreasing order of field strength is



Ans. (2)

Sol. Spectrochemical series.



73. The amino acid that gives a red-blood colour on treating its sodium fusion extract with sodium nitroprusside is

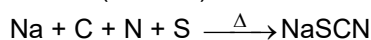


Ans. (4)

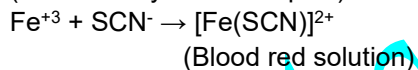
Sol. 1. Methionine contains both 'N' & 'S'

Chemical formula :  $\text{CH}_3 - \text{S} - \text{CH}_2 - \text{CH}_2 - \text{CH}(\text{NH}_2) - \text{COOH}$

2. Lassaigne's Test : Organic compound containing both 'N' and 'S' react with sodium metal to form (NaSCN)



→ The sodium fusion extract is treated with ferric chloride ( $\text{FeCl}_3$ ) produces blood red colour action (Ferric thiocyanate complex)



74. In an acidic medium, 10 mL of 0.25 M oxalic acid is titrated with  $\text{KMnO}_4$  solution. If the volume of  $\text{KMnO}_4$  solution required to reach end point is 10 mL, the strength of the  $\text{KMnO}_4$  solution is

(1) 0.15 M                      (2) 0.10 M

(3) 0.20 M                      (4) 0.25 M

Ans. (2)

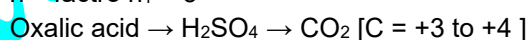
$$\text{Sol. } m_1 \times 5 \times 10 = 0.25 \times 2 \times 10$$

$$m_1 \times 50 = 5$$

$$m_1 = \frac{5}{50} = 0.10 \text{ m}$$

Note : In acidic medium  $\text{MnO}_4^- \rightarrow \text{Mn}^{+2}$  (mn = +7 to +2)

$$n - \text{factor } n_1 = 5$$



$$n - \text{factor, } n_2 = 1 \times 2 \text{ (2 - carbon atoms)} = 2$$

75. The correct statement is

(1) Aluminium has five valence orbitals.

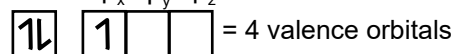
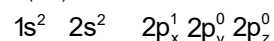
(2) Boron has a maximum covalency of four.

(3) Beryllium has three valence orbitals.

(4) Magnesium has covalency of four. a maximum

Ans. (2)

Sol.  $B_{(z=5)}$



Due to the absence of d-orbitals it cannot expand its coordination shell beyond 4, means maximum covalency restricted to 4.

76. Among the following, the compound having conjugated double bonds is

(1) hepta -1, 6 - diene

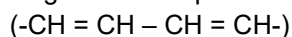
(2) hepta -1,3 - diene

(3) hepta - 1, 4 - diene

(4) hepta - 1, 5 - diene

Ans. (2)

Sol. Conjugate system requires alternating double and single bonds separates by exactly one single bond



Hept - 1, 3 - diene

$\text{CH}_2 = \text{CH} - \text{CH} = \text{CH} - \text{CH}_2 - \text{CH}_3$  two double bonds are conjugated.

Other options 1, 4 diene, 1,5 diene, 1, 6 diene have isolated double bonds not conjugated.

77.  $2A \xrightarrow{k} B$  is a zero-order reaction, where  $k = 1.0 \text{ mol L}^{-1} \text{ min}^{-1}$ . If the initial concentration of A is  $2 \text{ M}$ , then the time taken to complete 75% of the reaction will be

- (1) 2.0 min (2) 1.5 min  
(3) 0.75 min (4) 1.0 min

Ans. (2)

Sol. Given  $\text{Rec}^n$



Rate constant (K) =  $1.0 \text{ mol L}^{-1} \text{ min}^{-1}$

Initial conc  $[R]_0 = 2 \text{ M}$

To find time (t) for 75% completion

Amount of A reacted ( $\Delta[A] = 0.75 \times 2 \text{ M} = 1.5 \text{ M}(x)$ )

Substitute into rate equation.

$$-\frac{\Delta[A]}{\Delta t} = k \quad (\Delta t = t) \quad (\Delta A = x)$$

$$x = k \cdot t \quad 1.5 = 1.0 t$$

$$\text{time} = 1.5 \text{ min}$$

78. The correct order of solubility of the given salts in water at 298 K is

Salt	$K_{sp}$ at 298 K
AgBr	$5.0 \times 10^{-13}$
$\text{Zn}(\text{OH})_2$	$1.0 \times 10^{-15}$
$\text{Hg}_2\text{Cl}_2$	$1.3 \times 10^{-18}$

- (1)  $\text{Zn}(\text{OH})_2 > \text{AgBr} > \text{Hg}_2\text{Cl}_2$   
(2)  $\text{Hg}_2\text{Cl}_2 > \text{Zn}(\text{OH})_2 > \text{AgBr}$   
(3)  $\text{AgBr} > \text{Zn}(\text{OH})_2 > \text{Hg}_2\text{Cl}_2$   
(4)  $\text{Hg}_2\text{Cl}_2 > \text{AgBr} > \text{Zn}(\text{OH})_2$

Ans. (1)

Sol. Solubility order of the given salts in water at 298K

AgBr ( $k_{sp} = 5.0 \times 10^{-13}$ )

$\text{Zn}(\text{OH})_2$  ( $k_{sp} = 1.0 \times 10^{-15}$ )

$\text{Hg}_2\text{Cl}_2$  ( $k_{sp} = 1.3 \times 10^{-18}$ )

Relation between solubility (S) and solubility product ( $k_{sp}$ )

For AgBr  $S = 7.07 \times 10^{-7} \text{ M}$

For  $\text{Zn}(\text{OH})_2$   $S = 6.30 \times 10^{-6} \text{ M}$

For  $\text{Hg}_2\text{Cl}_2$   $S = 6.88 \times 10^{-7} \text{ M}$

The correct order of solubility of given salts are  $\text{Zn}(\text{OH})_2 > \text{AgBr} > \text{Hg}_2\text{Cl}_2$

(The substance that reaches a higher concentration at its saturation point is more soluble)

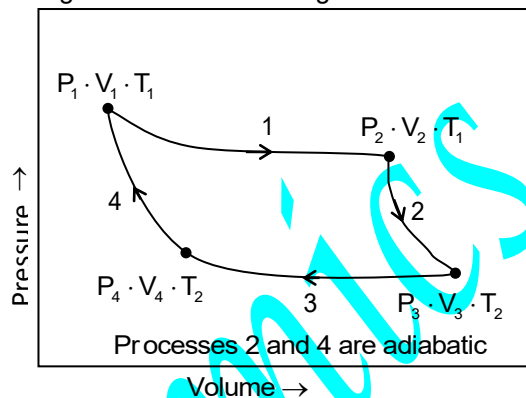
79. The correct decreasing order of oxidation state of the underlined atom in each molecule is

- (1)  $\underline{\text{P}}_4\text{O}_6 > \underline{\text{Cl}}_2\text{O}_7 > \underline{\text{Al}}\text{H}_3$   
(2)  $\underline{\text{P}}_4\text{O}_{10} > \underline{\text{S}}\text{O}_3 > \underline{\text{H}}_2\underline{\text{O}}$   
(3)  $\underline{\text{N}}_2\text{O}_5 > \underline{\text{Al}}\text{O}_3 > \underline{\text{H}}_2\underline{\text{S}}$   
(4)  $\underline{\text{Pb}}\text{O}_2 > \underline{\text{N}}_2\text{O}_3 > \underline{\text{S}}\text{O}_3$

Ans. (3)

Sol. In  $\text{N}_2\text{O}_5$  Oxidation state of N = 5  
In  $\text{Al}_2\text{O}_3$  Oxidation state of Al = 3  
In  $\text{H}_2\text{S}$  Oxidation state of S = -2  
Then the decreasing order of oxidation state is  $\underline{\text{N}}_2\text{O}_5 > \underline{\text{Al}}\text{O}_3 > \underline{\text{H}}_2\underline{\text{S}}$

80. Consider the reversible processes for 1.0 mol of an ideal gas as shown in the figure.



$w_1, w_2, w_3$  and  $w_4$  represent work done (in calories) in the processes 1, 2, 3 and 4, respectively;  $\Delta U_2$  and  $\Delta U_4$  are changes in the internal energy for the processes 2 and 4, respectively. [Use  $R = 2 \text{ cal K}^{-1} \text{ mol}^{-1}$ ] The correct option is

(1)  $w_1 + w_2 + w_3 + w_4 = 0$

(2)  $w_1 + w_3 = -2T_1 \ln \frac{V_2}{V_1} - 2T_2 \ln \frac{V_4}{V_3}$

(3)  $w_2 + w_4 = \Delta U_2 - \Delta U_4$

(4)  $w_1 + w_2 = 2T_1 \ln \frac{V_2}{V_1}$

Ans. (2)

Sol.  $w_1 = -nRT_1 \ln \frac{V_2}{V_1}$  (Isothermal expansion)

$w_2 = 0$  (adiabatic process)

$w_3 = +nRT_2 \ln \frac{V_3}{V_4} \Rightarrow w_3 = -nRT_2 \ln \frac{V_4}{V_3}$  (Isothermal

compression)

$w_4 = 0$  (adiabatic process)

Number of moles  $n = 1$  &  $R = 2 \text{ cal}$

Sum of work done

$$\Rightarrow w_1 + w_3 = -2T_1 \ln \frac{V_2}{V_1} - 2T_2 \ln \frac{V_4}{V_3}$$

81. **Assertion A**: For an ideal solution formed by mixing liquids **P** and **Q**,  $\Delta_{\text{mix}} H = 0$  and  $\Delta_{\text{mix}} V = 0$

**Reason R**: No interactions occur between **P** and **Q**

In the light of the above statements.

choose the most appropriate answer from the options given below.

- (1) **A** is not correct but **R** is correct  
(2) Both **A** and **R** are correct and **R** is the correct explanation of **A**  
(3) Both **A** and **R** are correct but **R** is **NOT** the correct explanation of **A**  
(4) **A** is correct but **R** is not correct

Ans. (4)

Sol. Intermolecular attractions in **P** and **Q** before mixing and after mixing same.

82. Among the species given below, the spin – only magnetic moment is highest for

(Given : Atomic of  $T_1 = 22$ ,  $Mn = 25$ ,  $Fe = 26$  and  $Co = 27$ )

- (1)  $[Ti(H_2O)_6]^{3+}$                       (2)  $[Mn(CN)_6]^{3-}$   
 (3)  $[Fe(CN)_6]^{3-}$                       (4)  $[Co(NH_3)_6]^{3+}$

Ans. (2)

Sol.  $[Mn(Cn)_6]^{-3}$

$$Mn^{+3} = 1s^2 2s^2 2p^6 3s^2 3p^6 3d^4$$

Number of unpaired electrons two, because  $(CN^-)$

Strong field ligand.

$$u_s = \sqrt{n(n+2)}$$

$$= \sqrt{2(2+2)}$$

$$= 2.83 \text{ BM}$$

83. A protein undergoes reversible thermal denaturation from its initial state **N** to denatured state **D** according to  $N \rightleftharpoons D$ . At  $60^\circ C$ , the concentrations of both **N** and **D** are equal at equilibrium, and the standard enthalpy change of denaturation is  $666 \text{ kJ mol}^{-1}$ . The standard entropy change ( $\Delta S^\circ$  in  $\text{kJ K}^{-1} \text{ mol}^{-1}$ ) of the protein upon denaturation at  $60^\circ C$  is closest to

- (1) 11.1                                      (2) 2.0  
 (3) 2000.0                                  (4) 333.0

Ans. (2)

Sol.  $\Delta H^\circ = 666 \text{ KJ mol}^{-1}$

$$T = 60^\circ C + 273 = 333 \text{ K}$$

$$\Delta s^\circ = \frac{\Delta H^\circ}{T}$$

$$\Delta S^\circ = \frac{666}{333} = 2.0 \text{ KJ K}^{-1} \text{ mol}^{-1}$$

84. Given below are two statements : One is labelled as **Assertion A** and the other is labelled as **Reason R**

**Assertion A** : Generally,  $3d$  transition metals have high melting points.

**Reason R** : Involvement of  $3d$  –electrons in addition to  $4s$  – electrons in the interatomic metallic bonding.

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

- (1) **A** is not correct but **R** is correct.  
 (2) Both **A** and **R** are correct and **R** is the correct explanation of **A**.  
 (3) Both **A** and **R** are correct and **R** is **NOT** the correct explanation of **A**.  
 (4) **A** is correct but **R** is not correct.

Ans. (2)

Sol. Since involvement of  $3d$  electrons leads strong bonding so that transition metals exhibits high melting points.

85. Given below are two statements : One is labelled as **Assertion A** and the other is labelled as **Reason R**.

**Assertion A** : The first ionization enthalpy of O is lower than that of N and F.

**Reason R**: The loss of an electron from O leads to stable half – filled  $p$  orbital.

In light of the above statements,

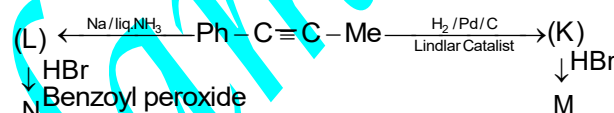
Choose the **most appropriate** answer from the options given below:

- 1) **A** is not correct but **R** is correct.  
 (2) Both **A** and **R** are correct and **R** is the correct explanation of **A**.  
 (3) Both **A** and **R** are correct and **R** is **NOT** the correct explanation of **A**.  
 (4) **A** is correct but **R** is not correct.

Ans. (2)

Sol. Oxygen =  $1s^2 2s^2 2p^4$  so that Oxygen by losing one electron, it will get stability so that first ionisation enthalpy value is lower than nitrogen and flourine.

86. Consider the following reaction sequences and choose the correct option.



- (1) **M** and **N** are stereoisomers  
 (2) **K** and **L** are geometrical isomers  
 (3) **K** and **L** are enantiomers  
 (4) **M** and **N** are geometrical isomers

Ans. (2)

Sol.  $(L) \xleftarrow{Na/liq.NH_3} Ph-C \equiv C-Me \xrightarrow[\text{Lindlar Catalyst}]{H_2/Pd/C} (K)$

trans isomers

cis isomer

87. The highest occupied molecular orbital for  $Ne_2$  is

- (1)  $\sigma_{2p}^*$   
 (2)  $\pi_{2p}$   
 (3)  $\sigma_{2p}$   
 (4)  $\pi_{2p}^*$

Ans. (1)

Sol. Higher occupied molecular orbital which accomodates 20th electron is  $\sigma_{2p}^*$

88. Match the species in **List I** with their geometry in **List II**

List I		List II	
A	$PCl_5$	I	Tetrahedral
B	$BrF_5$	II	Square Planar
C	$BF_4$	III	Trigonal bipyramidal
D	$[Ni(CN)_4]^{2-}$	IV	Square pyramidal

Choose the **correct** answer from the options given below:

- (1) A – III, B – II, C – I, D – IV  
 (2) A – IV, B – III, C – I, D – II  
 (3) A – III, B – IV, C – I, D – II  
 (4) A – III, B – I, C – II, D – IV

Ans. (3)

Sol.

	List I	List II
A	PCl <sub>5</sub>	Trigonal bipyramidal
B	BrF <sub>5</sub>	Square pyramidal
C	BF <sub>4</sub>	Tetrahedral
D	[Ni(CN) <sub>4</sub> ] <sup>2-</sup>	Square Planar

89. Match the vitamins in **List I** with their sources in **List II**

	List I	List II
A	Vitamin A	I Meat
B	Vitamin B <sub>12</sub>	II Sunflower oil
C	Vitamin E	III Green leafy vegetables
D	Vitamin K	IV Carrots

Choose the correct answer from the options given below.

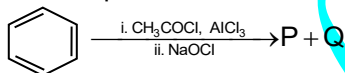
- (1) A – III, B – I, C – IV, D - II  
 (2) A – II, B – III, C – IV, D - I  
 (3) A – IV, B – I, C- II, D - III  
 (4) A – IV, B – II, C – I, D - III

Ans. (3)

Sol.

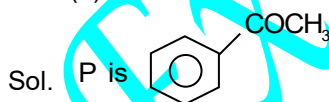
	List I	List II
A	Vitamin A	Carrots
B	Vitamin B <sub>12</sub>	Meat
C	Vitamin E	Sunflower oil
D	Vitamin K	Green leafy vegetables

90. For the following reaction sequence, choose the correct options



- (1) Both **P** and **Q** are carbonyl compounds.  
 (2) If **P** is the sodium salt of a carboxylic acid, **Q** is a primary alcohol.  
 (3) **P** and **Q** are aromatic compounds.  
 (4) If **P** gives a carboxylic acid on acidification, **Q** gives a poisonous gas on exposure to air and light.

Ans. (4)

Q is CHCl<sub>3</sub>

91. Given below are two statements.

**Statement I:** The class name Reptilia refers to creeping or crawling mode of locomotion

**Statement II:** All organisms belonging to Reptilia have three chambered heart.

In the light of the above statements, choose the **most appropriate** answer from the options give below.

- (1) **Statement I** is incorrect but **Statement II** is correct  
 (2) Both **Statement I** and **Statement II** are correct

(3) Both **Statement I** and **Statement II** are incorrect

(4) **Statement I** is correct but **Statement II** is incorrect

Ans. (4)

Sol. Statement I is true: The word Reptilia originates from the Latin words *reperere* or *reptum*, which literally translate to "creep" or "crawl". This accurately describes the creeping or crawling mode of locomotion characteristic of organisms in this class.

Statement II is false: While most organisms in the class Reptilia have a three- chambered heart (consisting of two atria and one ventricle). This is not true for all, Crocodiles, for example, are reptiles but possess a four- chambered heart.

92. How many turns of Calvin cycle are required for the formation of three molecules of glucose?

- (1) 18 (2) 6  
 (3) 3 (4) 1

Ans. (1)

Sol. For one glucose 6 turns required so for 3 glucose = 18 cycles

93. Photorespiration reaction catalyzed by RuBisCO is shown below:



Identify "X" from the given options:

- (1) Malate  
 (2) Phosphoenolpyruvate  
 (3) 2-Phosphoglycolate  
 (4) Oxaloacetate

Ans. (3)

Sol. In photorespiration one 3 carbon compound and one 2 carbon compound formed (2- phosphoglycolate)

94. Given below are two statements.

**Statement I :** In gymnosperms, the male and female gametophytes remain within the sporangia

**Statement II :** In gymnosperms, seeds are not covered

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

(1) **Statement I** is incorrect but **Statement II** is correct

(2) Both **Statement I** and **Statement II** are correct

(3) Both **Statement I** and **Statement II** are incorrect

(4) **Statement I** is correct but **Statement II** is incorrect

Ans. (2)

Sol. Both **Statement I** and **Statement II** are correct

95. How many molecules of pyruvic acid are produced at the end of glycolysis from 206 molecules of glucose?

- (1) 412 (2) 206  
 (3) 309 (4) 103

Ans. (1)

Sol. One glucose gives 2 pyruvic acids so 206 glucose gives 412 pyruvates

96. Match **List – I** with List – II

<b>List – I</b>	<b>List – II</b>
A. Fusion of protoplasts between gametes	I. Meiosis
B. Fusion of two nuclei	II. Plasmogamy
C. Generation of haploid spores	III. Karyogamy

Choose the correct answer from the options given below

- (1) A-I, B-III, C-II      (2) A-II, B-III, C-I  
(3) A-II, B-I, C-III      (4) A-III, B-II, C-I

Ans. (2)

Sol. A-II, B-III, C-I

97. Mitochondrial inner membrane encloses.....

- (1) Aqueous humor      (2) Matrix  
(3) Cytosol              (4) Mucus

Ans. (2)

Sol. Matrix

98. Phyllotaxy is the pattern of arrangement of.....

- (1) Sepals  
(2) Leaves  
(3) Flowers  
(4) Fruits

Ans. (2)

Sol. Leaves

Phyllotaxy = arrangement of leaves on the stem or branch

(Examples = Alternate – China rose, Opposite – Calotropis, Whorled – Alstonia)

99. Mad cow disease is caused by

- (1) Mycoplasma sp.  
(2) Prions  
(3) Viroids  
(4) Aspergillus sp.

Ans. (2)

Sol. The most notable Disease caused by Prions ( which are infectious misfolded proteins) are Bovine Spongiform Encephalopathy, BSE commonly called Mad cow disease in cattle and its analogous variant Cr- Jacob disease (CJD) in humans.

100. Cell theory was formulated by.....

- (1) Antonie Von Leeuwenhoek  
(2) Schleiden and Schwann  
(3) Robert Brown  
(4) Singer and Nicolson

Ans. (2)

Sol. Cell theory formulated by Scheiden and schwann.

101. Which of the following plant growth regulators promotes internode elongation prior to flowering in cabbage?

- (1) Ethephon  
(2) Abscisic acid  
(3) Gibberellin  
(4) Indole butyric acid

Ans. (3)

Sol. Gibberellins promotes internodal elongation and promotes bolting in rosette type of plants like Cabbage and cauliflower

102. Which pigment has absorption peak at 700 nm in the photosynthetic reaction centre PS I ( P 700 ) ?

- (1) Carotenoids  
(2) Chlorophyll b  
(3) Chlorophyll a  
(4) Xanthophylls

Ans. (3)

Sol. Chl-a is a pigment located in reaction centre. PS-I chl-a excites at 700 nm

103. Sphenopsida class belongs to .....

- (1) Pteridophytes  
(2) Bryophytes  
(3) Angiosperms  
(4) Gymnosperms

Ans. (1)

Sol. Pteridophytes are classified into psilopsida, sphenopsida, lopsida, pteropsida

104. Which of the following represents the correct sequence of arrangement of bones in the lower limb of humans?

- (1) Femur- tarsal- patella- tibia  
(2) Femur- tibia – patella - tarsal  
(3) Patella – femur – tibia - tarsal  
(4) Femur – patella – tibia - tarsal

Ans. (4)

Sol. Femur- Patella – Tibia + Fibula – Tarsals – meta tarsals - phalanges

105. Which of the following plant growth regulators is used as herbicide?

- (1) Gibberellin  
(2) 2, 4- D  
(3) Kinetin  
(4) Abscisic acid

Ans. (2)

Sol. 2-4-D majorly called as Herbicide that will commonly used in Lawns to control dicot crops

106. Genus represents \_\_\_\_\_

- (1) a group of closely related families  
(2) an individual plant or animal  
(3) a population of plants and animals  
(4) a group of closely related species

Ans. (4)

Sol. A group of closely related species

107. The plastid that stores xanthophyll is known as \_\_\_\_\_

- (1) Amyloplast  
(2) chloroplast  
(3) chromoplast  
(4) aleuroplast

Ans. (3)

Sol. Chromoplast

108. In water, frogs respire using \_\_\_\_\_

- (1) trachea  
(2) skin  
(3) buccal cavity  
(4) lungs

Ans. (2)

Sol. In water, frogs respire using skin

109. Which of the following is not a characteristic of chordates ?

- (1) Presence of post anal part (tail)
- (2) Presence of notochord
- (3) Central nervous system is dorsal
- (4) Absence of gills

Ans. (4)

Sol. Presence of Pharyngeal gill slits

110. Smooth endoplasmic reticulum \_\_\_\_

- (1) is a site for the Synthesis of carbohydrates
- (2) has ribosomes attached to its surface
- (3) is the major site for the synthesis of lipids
- (4) is actively involved in protein synthesis

Ans. (3)

Sol. SER is the major site for the synthesis of lipids

111. Which of the following are characteristics of prokaryotic cells?

- (a) Ribosomes are made of 50S and 30 S subunits
- (b) They can have plasmids
- (c) They contain mesosome
- (d) They have peroxisomes

Choose the correct answer from the options given below:

- 1) (a), (b) and (c) only
- 2) (b) and (c) only
- 3) (a) and (c) only
- 4) (a), (c) and (d) only

Ans. (1)

Sol. Prokaryotic cell contain 70s ribosomes plasmids and mesosomes.

112. Match List - I with List-II

List - I	List - II
A Cristae	I Flat membrane sacs in stroma of Chloroplast
B Chloroplast	II Infolding in mitochondria
C Thylakoids	III Cell membrane
D Phospholipid	IV Disc shaped sacs in the golgi Apparatus

Choose the correct answer from the options given below:

- (1) A-IV, B-III, C-I, D-II
- (2) A-III, B-IV, C-I, D-II
- (3) A-II, B-IV, C-I, D-III
- (4) A-II, B-IV, C-III, D-I

Ans. (3)

Sol. Cristae – infoldings in mitochondria

Cisternae - Disc shaped sacs in the Golgi apparatus

Thylakoids – Flat membrane sacs in stroma of chloroplast

Phospholipid – Cell membrane

113. Which of the following statements related to pituitary gland are correct?

- (a) It is divided anatomically into

adenohypophysis and neurohypophysis

- (b) It secretes follicle stimulating hormones
- (c) It secretes melanocyte stimulating hormone
- (d) It does not secrete prolactin

Choose the correct answer from the options given below:

- (1) (b) and (c) only
- (2) (a) and (b) only
- (3) (a), (b) and (c) only
- (4) (c) and (d) only

Ans. (3)

Sol. (a), (b) and (c) only

114. Which of the following statements regarding photorespiration are correct?

- (a) Do not occur in C3 plants
- (b) CO<sub>2</sub> is consumed and O<sub>2</sub> is generated
- (c) Phosphoglycolate is formed
- (d) No synthesis of ATP and NADPH

Choose the correct answer from the options given below:

- (1) (a) and (b) only
- (2) (a) and (d) only
- (3) (c) and (d) only
- (4) (b) and (d) only

Ans. (3)

Sol. During photorespiration phosphoglycolate is formed no synthesis of ATP and NADPH

115. Which of the following statements is incorrect?

- (1) Fibrinogen is produced from fibrin
- (2) Blood coagulates in response to an injury
- (3) Blood clot consists of fibrins
- (4) Fibrin is produced from fibrinogen

Ans. (1)

Sol. Fibrinogen is produced from fibrin

116. Arrange the following taxonomic categories in ascending order.

- (a) Genus (b) Class (c) Order (d) Phylum
- (e) Family (f) Kingdom (g) Species

Choose the correct answer from the options below:

- (1) (f), (c), (b), (g), (d), (e), (a)
- (2) (g), (a), (e), (c), (b), (d), (f)
- (3) (a), (c), (d), (g), (f), (b), (e)
- (4) (g), (c), (d), (b), (e), (a), (f)

Ans. (2)

Sol. Species - genus – family – order – class – phylum – kingdom.

117. Select the correct sequence of experiments that led to a gradual understanding of photosynthesis in green plants.

- (1) Production of glucose - role of air – release of oxygen – absorption spectra of chlorophyll a and b
- (2) Absorption spectra of chlorophyll a and b – production of glucose – release of oxygen – role of air
- (3) Role of air – release of oxygen – production of glucose – absorption spectra of chlorophyll a and b
- (4) Release of oxygen – production of glucose – absorption spectra of chlorophyll a and b – role of air

Ans. (3)

Sol. Role of air – release of oxygen – production of glucose – absorption spectra of chlorophyll a and b

118. Match List -I with List-II

List - I	List - II
A. Starch	I. Fights infection
B. Antibody	II. Energy storage
C. Concavalin	III. Glucose transport
D. Glut-4	IV. Lectin

(1) A-I, B-II, C-III, D-IV

(2) A-I, B-II, C-IV, D-III

(3) A-II, B-I, C-IV, D-III

(4) A-II, B-I, C-III, D-IV

Ans. (3)

Sol. A-II, B-I, C-IV, D-III

119. The number of vertebrae in a human is \_\_\_\_\_

(1) 206 (2) 7 (3) 12 (4) 26

Ans. (4)

Sol. The number of vertebrae in a human is 26

120. Endomembrane system includes \_\_\_\_\_

- (1) Golgi complex, chloroplast, peroxisomes and vacuole
- (2) endoplasmic reticulum, Golgi complex, Lysosomes and vacuole
- (3) Endoplasmic reticulum, chloroplast, peroxisomes and vacuole
- (4) Mitochondria, chloroplast, peroxisomes and vacuole

Ans. (2)

Sol. Endomembrane system includes ER, Golgi complex, Lysosomes and vacuole.

121. Length of the stem at time 0 is 20 cm. The arithmetic growth rate is 30 cm per day. What is the length of the stem at the end of the 7th day ?

- (1) 460 cm (2) 50 cm
- (3) 170 cm (4) 230 cm

Ans. (4)

Sol.  $L_t = L_0 + r(30)t(7)$

122. Match List-I with List-II

List-I	List-II
A. Spherical	I. Vibrio
B. Rod	II. Cocci
C. Comma	III. Spirilla
D. Spirillum	IV. Bacilli

Choose the correct answer from the options given below:

(1) A-II, B-IV, C-I, D-III

(2) A-I, B-III, C-II, D-IV

(3) A-III, B-II, C-I, D-IV

(4) A-II, B-I, C-IV, D-III

Ans. (1)

Sol. Matching type

123. The number of action potentials generated by sino-atrial node (SAN) in a healthy human is \_\_\_\_\_ per minute

- (1) 120-140 (2) 28-30
- (3) 70-75 (4) 100-110

Ans. (3)

Sol. The number of action potential generated by sino atrial node is 70-75 times per minute.

124. Match List-I with List-II

List-I	List-II
A. Family	I. Sapindales
B. Genus	II. Dicotyledonae
C. Class	III. Anacardiaceae
D. Phylum	IV. Angiospermae
E. Order	V. Mangifera

Choose the correct answer from the options given below:

(1) A-III, B-V, C-II, D-IV, E-I

(2) A-I, B-V, C-II, D-IV, E-III

(3) A-II, B-I, C-III, D-IV, E-V

(4) A-II, B-III, C-V, D-I, E-IV

Ans. (1)

Sol. Matching type

125. Which of the following is not a part of human central neural system?

- (1) Pericardium (2) Arachnoid
- (3) Dura mater (4) Pia mater

Ans. (1)

Sol. Pericardium is not a part of human central neural system

126. Given below are two statements:

Statement I: Chromosomes are fully condensed at the end of prophase I.

Statement II: Meiosis I resembles mitosis.

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

- (1) Statement I is incorrect, but Statement II is true.
- (2) Both Statement I and Statement II are true
- (3) Both Statement I and Statement II are false
- (4) Statement I is correct, but Statement II is false.

Ans. (4)

Sol. Statement II is false, Meiosis-I resembles reduction division. Meiosis-II resembles Mitosis

127. Match List-I with List-II

List-I	List-II
A. Marginal Placentation	I. Argemone
B. Axile placentation	II. Tomato
C. Parietal placentation	III. Primrose
D. Free Central Placentation	IV. Pea

Choose the correct answer from the options given below:

(1) A-IV, B-II, C-I, D-III

(2) A-II, B-IV, C-I, D-III

(3) A-IV, B-II, C-III, D-I

(4) A-IV, B-III, C-I, D-II

Ans. (1)

Sol. Marginal placenta- Pea, Axile Placenta-Tomato, Parietal Placentation-Argemone, Free Central Placentation-Primerose

128. Symbiotic association between fungi and algae are called \_\_\_\_\_.

- (1) Chrysophytes
- (2) Lichens
- (3) Sponges
- (4) Mycorrhiza

Ans. (2)

Sol. Symbiotic association between fungi and algae are called lichens

129. Which of the following is not a prokaryote ?

- (1) Fungi
- (2) Bacteria
- (3) Blue green algae
- (4) Mycoplasma

Ans. (1)

Sol. Fungi-Eukaryotic organism

130. Arrange the following elements in descending order of their contribution to percentage weight of the human body.

- |              |              |
|--------------|--------------|
| (a) Oxygen   | (b) Carbon   |
| (c) Hydrogen | (d) Nitrogen |

Choose the correct answer from the options given below:

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

Ans. (2)

Sol. Carbon – 18.5%, Hydrogen – 0.5% Oxygen – 65% Nitrogen – 3.3 – Indescending order

131. Which one of the following statements is incorrect

- (1)  $\beta$ -cells of pancreas secrete insulin
- (2)  $\alpha$ -cells of pancreas secrete glucagon
- (3)  $\alpha$ -cells of pancreas secrete insulin
- (4) Glucagon stimulates glycogenolysis

Ans. (3)

Sol. alpha cells of pancreas secrete glucagon

132. Which one of the following are characteristic features of Solanaceae family ?

- (a) Flowers are bisexual and actinomorphic
- (b) Calyx have five sepals and are united
- (c) Androecium have five stamens and are epipetalous
- (d) Ovary is inferior

Choose the correct answer from the options given below:

- (1) (b), (c) and (d) only
- (2) (a), (b) and (c) only
- (3) (d) only
- (4) (a) and (b) only

Ans. (2)

Sol. Ovary is superior in solanaceae

133. Given below are two statements:

**Statement I:** When any plane passing through the central axis of the body divides the organism into two identical halves, it is called radial symmetry.

**Statement II:** In phylum Echinodermata, both adults and larvae are radially symmetrical.

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

- (1) Statement I is incorrect but Statement II is correct.
- (2) Both Statement I and Statement II are correct
- (3) Both Statement I and Statement II are incorrect
- (4) Statement I is correct but Statement II is correct

Ans. (4)

Sol. In Phylum Echinodermata larval stages exhibit bilateral symmetry but adult stages exhibit radial symmetry

134. The correct sequence of adult cell cycle phases is \_\_\_\_\_.

- (1) S-M-G2-G1
- (2) G1-G2-S-M
- (3) G1-M-G2-S
- (4) G1-S-G2-M

Ans. (4)

Sol. G1-S-G2-M

135. In frogs, the number of pairs of cranial nerves arising from the brain are \_\_\_\_\_.

- (1) 12
- (2) 9
- (3) 6
- (4) 10

Ans. (4)

Sol. In frogs the number of pairs of cranial nerves arising from the brain are 10 pairs.

136. Given below are two statements one is labelled as Assertion A and the other is labelled as Reason R

**Assertion A :** In recombinant DNA technology, lysozyme is used for disrupting bacterial cells while cellulase is for plant cells.

**Reason R :** Isolation of genetic material needs disruption of cells.

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

- (1) A is not correct but R is correct
- (2) Both A and R are correct and R is the correct explanation of A
- (3) Both A and R are correct but R is not the correct explanation of A
- (4) A is correct but R is not correct

Ans. (2)

Sol. Both A and R are correct and R is the correct explanation of A

137. The method of directly of injecting a sperm into ovum in assisted reproductive technology is called

- (1) Embryo transfer (ET)
- (2) Gamete intra fallopian transfer (GIFT)
- (3) Zygote intra fallopian transfer (ZIFT)
- (4) Intra cytoplasmic sperm injection (ICSI)

Ans. (4)

Sol. The method of directly of injecting a sperm into ovum in assisted reproductive technology is called Intra cytoplasmic sperm injection (ICSI)

138. Adaptive radiation in placental mammals and Australian Marsupials leading to similarity between distant species is an example of \_\_\_\_\_

- (1) Genetic drift
- (2) Divergent evolution
- (3) Convergent evolution
- (4) Founder effect

Ans. (3)

Sol. Adaptive radiation in placental mammals and Australian Marsupials leading to similarity between distant species is an example of Convergent evolution

139. Given below are two statements one is labelled as Assertion A and the other is labelled as Reason R and the other is labelled as Reason R

**Assertion A :** In an experiment, Mendel observed that the F<sub>1</sub> progeny plants are all tall and none are dwarf.

**Reason R :** Stem height is contrasting trait. With tall being dominant and dwarf being recessive. In the light of the above statements, choose the most appropriate answer from the options given below

- (1) A is not correct but R is correct
- (2) Both A and R are correct and R is the correct explanation of A
- (3) Both A and R are correct but R is not the correct explanation of A
- (4) A is correct but R is not correct

Ans. (2)

Sol. Both A and R are correct and R is the correct explanation of A

140. Arrange the following in descending order of number of species in the Amazonian rain forest

- (a) Plants
- (b) Birds
- (c) Fishes
- (d) Invertebrates
- (e) Mammals

Choose the correct answer from the options given below

- (1) (b) > (a) > (d) > (c) > (e)
- (2) (c) > (b) > (d) > (e) > (a)
- (3) (d) > (a) > (c) > (b) > (e)
- (4) (e) > (b) > (a) > (c) > (d)

Ans. (3)

Sol. (d) > (a) > (c) > (b) > (e)

141. Sponges exchange O<sub>2</sub> with CO<sub>2</sub> by \_\_\_\_\_

- (1) Gills
- (2) Simple diffusion over their entire body surfaces
- (3) Moist cuticle
- (4) Tracheal tubes

Ans. (2)

Sol. Sponges exchange O<sub>2</sub> with CO<sub>2</sub> by simple diffusion over their entire body surfaces

142. For a person with blood group "O", which of the following is not a possible combination of parents blood group genotypes?

- (1) Father : I<sup>A</sup>I<sup>B</sup> and Mother : I<sup>A</sup>i

(2) Father : I<sup>A</sup>i and Mother : I<sup>B</sup>j

(3) Father : I<sup>A</sup>i and Mother : I<sup>A</sup>i

(4) Father : I<sup>B</sup>j and Mother : I<sup>B</sup>j

Ans. (1)

Sol. Father : I<sup>A</sup>I<sup>B</sup> and Mother : I<sup>A</sup>i

143. Given below are two statements

**Statement I :** Modern *Homo sapiens* arose in Australia and moved across continents.

**Statement II :** *Homo sapiens* arose around 75000 to 10000 year ago In the light of the above statements. Choose the most appropriate answer from the options given below

- (1) Statement I is incorrect but Statement II is correct
- (2) Both Statement I and Statement II are correct
- (3) Both Statement I and statement II are incorrect
- (4) Statement I is correct but Statement II is incorrect

Ans. (1)

Sol. Modern *Homo sapiens* arose in Africa and moved across continents.

144. Which of the following is used as an effective sedative and painkiller for treating post-surgery patients ?

- (1) Anti-retroviral drugs
- (2) Interferon
- (3) Antibiotics
- (4) Morphine

Ans. (4)

Sol. Morphine is used as an effective sedative and painkiller for treating post-surgery patients

145. Which of the following plant produces non-albuminous seeds ?

- (1) Pea
- (2) Wheat
- (3) Maize
- (4) Barley

Ans. (1)

Sol. Pea seeds are non albuminous

146. Given below are two statements : one is labelled as assertion A and the other is labelled as Reason R.

**Assertion A :** Abingdon tortoise in Galapagos islands became extinct within a decade after goats were introduced.

**Reason R :** Goats were more efficient at browsing than Abingdon tortoise.

In the light of the above statements. Choose the most appropriate answer from the options given below :

- (1) A is not correct but R is correct
- (2) Both A and R are correct and R is the correct explanation of A
- (3) Both A and R are correct but R is not the correct explanation of A
- (4) A is correct but R is not correct

Ans. (2)

Sol. Both A and R are correct and R is the correct explanation of A

147. The covering of ovum at ovulation is \_\_\_\_\_

- (1) Chorion
- (2) Endometrium
- (3) Zona radiata
- (4) Zona pellucida

Ans. (4)

Sol. The covering of ovum at ovulation is zona pellucida

148. Which of the following is used as a clot buster ?

- (1) Statins
- (2) Streptokinase
- (3) Penicillin
- (4) Cyclosporin A

Ans. (2)

Sol. Streptokinase is used as a clot buster

149. Which of the following structure is not a part of the male reproductive system ?

- (1) Infundibulum
- (2) Rete testis
- (3) Epididymis
- (4) Vasa efferentia

Ans. (1)

Sol. Infundibulum is a female reproductive part

150. Given below are two statements :

**Statement I :** Ovulation is caused by LH surge leading to rupture of Graafian follicles.

**Statement II :** Graafian follicle remaining after ovulation transform into corpus luteum and secretes large amount of estrogen.

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

- (1) Statement I is incorrect but Statement II is correct
- (2) Both Statement I and Statement II are correct
- (3) Both Statement I and Statement II are incorrect
- (4) Statement I is correct but Statement II is incorrect

Ans. (4)

Sol. Graafian follicle remaining after ovulation transform into corpus luteum and secretes large amount of progesterone

151. The opening between the right atrium and the right ventricle is guarded by

- (1) Sino-atrial node
- (2) Bicuspid valve
- (3) Tricuspid valve
- (4) Semilunar valve

Ans. (3)

Sol. The opening between the right atrium and the right ventricle is guarded by a valve formed of three muscular flaps or cusps, the tricuspid valve.

152. Which of the following in **not** evidence for evolution?

- (1) Divergent evolution of anatomical structures such as forelimbs
- (2) Convergent evolution of traits like wings of birds and butterflies
- (3) Paleontological evidence from fossil records

(4) Embryological support for evolution as proposed by Ernst Haeckel

Ans. (4)

Sol. Because Ernst Haeckel proposed that an organism during embryonic development mimics the adult evolutionary stages of its ancestors. However, this hypothesis was strongly disapproved and rejected by Karl Ernst von Baer. Von Baer observed that embryos never pass through the adult stages of other animals.

153. The inactive form of Bt toxin is converted to the active form in the insect gut\_\_\_\_\_.

- (1) By nucleases
- (2) Due to alkaline pH
- (3) Due to acidic pH
- (4) By proteases

Ans. (2)

Sol. The inactive protoxin crystals produced by *Bacillus thuringiensis* are solubilized and converted into an active toxin specifically by the highly alkaline pH found within the insect's gut. This active toxin then binds to the midgut wall, creating pores that ultimately lead to the insect's death.

154. Colostrum, secreted by mother during initial days of lactation, is abundant in

- (1) IgD
- (2) IgG
- (3) IgM
- (4) IgA

Ans. (4)

Sol. The yellowish fluid colostrum secreted by mother during the initial days of lactation has abundant antibodies (IgA) to protect the infant.

155. Which of the following in female gametophyte of an angiosperm helps in guiding the pollen tube for fertilizing the eggs?

- (1) Polar nucleus
- (2) Antipodals
- (3) Synergids
- (4) Central cells

Ans. (3)

Sol. Synergids helps in guiding the pollen tube for fertilizing the eggs

156. Which of the following disease is **not** sexually transmitted?

- (1) Genital warts
- (2) Syphilis
- (3) Tuberculosis
- (4) Gonorrhoea

Ans. (3)

Sol. This is a bacterial infection caused by *Mycobacterium tuberculosis*. It primarily affects the lungs and spreads through the air via respiratory droplets when an infected person coughs or sneezes. It is not a sexually transmitted infection (STI)

157. Which of the following statements about lac-operon is **correct** ?

- (1) Galactose can act as an inducer of lac operon
- (2) Gene *i* is constitutively expressed
- (3) Lactose activates repressor to bind to the operator
- (4) Genes *i*, *z*, *y* and a share single common promoter

Ans. (2)

Sol. Gene *i* is constitutively expressed. The *i* gene codes for the repressor protein of the lac-operon. This gene is expressed continuously (constitutively) at a constant, basal rate to ensure that the repressor protein is always present inside the cell to control transcription.

158. Match List-I with List-II.

List-I	List-II
A. Transformation	I. Restriction enzyme
B. Cloning site	II. Transfer DNA to host bacteria
C. Selection	III. Replication
D. Ori	IV. Antibiotic

Choose the correct answer from the option given below :

- (1) A-IV, B-I, C-III, D-II
- (2) A-II, B-I, C-IV, D-III
- (3) A-I, B-II, C-IV, D-III
- (4) A-III, B-IV, C-II, D-I

Ans. (2)

Sol. A) Transformation-Transfer Dna to host bacteria  
 B) Cloning site-Restriction enzyme  
 C) Selection-Antibiotic  
 D) Ori-Replication

159. A population of diploid organisms is not Hardy-Weinberg equilibrium. If the frequency of allele A is 0.1, The frequency of AA is \_\_\_\_\_.

- (1) 0.99
- (2) 0.01
- (3) 0.02
- (4) 0.10

Ans. (2)

Sol. Frequency of allele A ( $p$ ) = 0.1  
 Calculate the frequency of AA = ?  
 The frequency of AA =  $p^2$   
 Frequency of AA =  $(0.1)^2 = 0.01$

160. Sperm motility is due to \_\_\_\_\_.

- (1) Muscular movement
- (2) Flagellar movement
- (3) Ciliary movement
- (4) Amoeboid movement

Ans. (2)

Sol. Flagellar movement helps in the swimming of spermatozoa

161. Consider a population of 10 million cells. Given the per-capita birth rate of 0.002 (per unit time) and the

per-capita death rate of 0.002 (per unit time), the expected number of cells after 10 generations is—.

- (1) 100 million
- (2) 1 million
- (3) 5 million
- (4) 10 million

Ans. (4)

Sol. Initial Population (No): 10 million cells.

Per-capita Birth Rate ( $b$ ): 0.002

Per-capita Death Rate ( $d$ ): 0.002

Growth Rate ( $r$ ):  $r = b - d = 0.002 - 0.002 = 0$

**Conclusion:** since the growth rate is zero, the population size does not change regardless of the number of generations. The population remains exactly 10 million.

162. Given below are two statements: one is labelled as **Assertion A** and the other is labelled as **Reason R**.

**Assertion A** : Forelimbs human and bats are homologous.

**Reason R**: Forelimbs of humans and bats have similar anatomical structure.

- (1) **A** is false but **R** is true
- (2) Both **A** and **R** are correct and **R** is the correct explanation of **A**
- (3) Both **A** and **R** are true, but **R** is not the correct explanation of **A**
- (4) **A** is true but **R** is false

Ans. (2)

Sol. Bats and Human share similarities in the pattern of bones of forelimbs. Though these forelimbs perform different functions in these animals, they have similar anatomical structure – all of them have humerus, radius, ulna, carpals, metacarpals and phalanges in their forelimbs.

163. Muscle contraction is initiated by a signal sent by the central nervous system by the release of—.

- (1) Cyclic adenine monophosphate
- (2) Acetyl choline
- (3) Acetyl coenzyme A
- (4) Cyclic guanine monophosphate

Ans. (2)

Sol. Muscle contraction is initiated by a signal from the Central Nervous System (CNS) via a motor neuron. When the signal reaches the neuromuscular junction, it triggers the release of a neurotransmitter called acetylcholine

This chemical binds to receptors on the muscle fiber's membrane, causing depolarization and ultimately leading to the contraction of the muscle.

164. Which of the following hormone is **not** secreted by human placenta?

- (1) LH
- (2) hCG
- (3) Estrogen
- (4) Progesterone

Ans. (1)

Sol. LH (Luteinizing Hormone): This is secreted by the anterior pituitary gland, not the placenta. Its primary

role is to trigger ovulation and develop the corpus luteum.

165. Which of the following statement is **correct** about Plasmodium?

- (1) Fertilization takes place in mosquito gut
- (2) Reproduces sexually in liver cells
- (3) Reproduces sexually in RBCs
- (4) Gametocytes develop in mosquito gut

Ans. (1)

Sol. Female mosquito takes up gametocytes with blood meal.

Fertilization and development take place in the mosquito's gut.

166. Which of the following or primary consumers in a food chain?

- (1) Carnivores
- (2) Parasites
- (3) Predators
- (4) Herbivores

Ans. (4)

Sol. Herbivores are primary consumers in food chain

167. Which of the following statement about the reabsorption process in Henle's or correct?

- a. The descending limb of Henle's loop is permeable to water but almost impermeable to electrolytes.
- b. Urine gets concentrated in Henle's loop
- c. Reabsorption of  $\text{Na}^+$  and water takes place in Henle's loop
- d. Active or passive transport of electrolytes occurs in the ascending limb of Henle's loop

Choose the correct answer from the options given below

- (1) a, b and d only
- (2) a and b only
- (3) b, c and d only
- (4) a, b, and c only

Ans. (1)

Sol. Sodium ions is re absorbed in the ascending limb, the ascending limb is impermeable to water. Therefore reabsorption of sodium and water doesn't occur simultaneously throughout the loop

168. Given below are two statements one is labelled as assertion A and the other is labelled as reason R

Assertion (A): The logistic growth model of populations is considered more realistic than the exponential growth model.

Reason (R): Resources are finite.

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

- (1) A is not correct but R is correct
- (2) Both A and R are correct and R is the correct explanation of A
- (3) Both A and R are correct but R is not the correct explanation of A
- (4) A is correct but R is not correct

Ans. (2)

Sol. Both A and R are correct and R is the correct explanation of A

169. Which of the following is the correct order of arrangement of vertebrate column from the head to toe?

- (1) Cervical vertebra, thoracic vertebra, lumbar vertebra, sacrum
- (2) Cervical vertebra, thoracic vertebra, sacrum, lumbar vertebra
- (3) Sacrum, lumbar vertebra, thoracic vertebra, cervical vertebra
- (4) Cervical vertebra, lumbar vertebra, thoracic vertebra sacrum

Ans. (1)

Sol. Cervical vertebrae , thoracic vertebrae , lumbar vertebrae, sacrum ,coccyx

170. Match list - I with list - II

List I		List II	
A	Both species are harmed	I	Predation
B	One species is harmed and the other is benefited	II	Mutualism
C	Both species are benefited	III	Competition
D	One is benefited while the other has no effect	IV	Commensalism

Choose the correct answer from the options given below

- (1) A-III, B-I, C-II, D-IV
- (2) A-III, B-IV, C-II, D-I
- (3) A-I, B-II, C-III, D-IV
- (4) A-II, B-I, C-IV, D-II

Ans. (1)

Sol. Matching type

171. If the diploid chromosome number of typical angiosperm is 36 what would be chromosome number in its endosperm ?

- (1) 72
- (2) 18
- (3) 36
- (4) 54

Ans. (4)

Sol. Endosperm is  $3n=54$

172. Which of the following enzymes synthesizes precursor mRNA ?

- (1) DNA polymerase
- (2) RNA polymerase I
- (3) RNA polymerase II
- (4) RNA polymerase III

Ans. (3)

Sol. RNA pol – II synthesises hnRNA

173. Given below are two statements

**Statement I** : Plasmids are autonomously replicating DNA

**Statement II** : Plasmids are extrachromosomal DNA  
In light of the above statements choose the most appropriate answer the options given below

- (1) Statement I is incorrect but Statement II is correct
- (2) Both Statement I and Statement II are correct
- (3) Both Statement I and Statement II are incorrect
- (4) Statement I is correct but Statement II is incorrect

Ans. (2)

Sol. Both the statements are correct

174. How many theca are present in each lobe of the typical bilobed angiosperm anther?

- (1) 12
- (2) 2
- (3) 6
- (4) 8

Ans. (2)

Sol. Each lobe have two theca

175. Natural selection can lead to

- (a) Stabilisation
- (b) Genetic drift
- (c) Directional change
- (d) Disruption

Choose the correct answer from the options given below

- (1) a and c only
- (2) a only
- (3) a, c and d only
- (4) a, b, c and d

Ans. (3)

Sol. Natural selection lead to stabilisation, directional and disruptive

176. Which of the following statements are correct?

- (a) Energy flow from producers to consumers is unidirectional
- (b) Energy pyramid can never be inverted
- (c) Transfer of energy follows the 1% law

Choose the correct answer from the options given below

- (1) b and c only
- (2) a, b and c
- (3) a and b only
- (4) a and c only

Ans. (3)

Sol. Transfer of energy follows 10% law

177. Match list I with list II

**List - I**

- a) Excess growth hormone
- b) Luteinizing hormone
- c) Vasopressin
- d) Oxytocin

**List - II**

- i) Reabsorption of water and electrolytes in kidney
- ii) Contraction of uterus during child birth
- iii) Acromegaly
- iv) Ovulation

Choose the correct answer from the options given below

- (1) A-IV, B-III, C-I, D-II
- (2) A-III, B-IV, C-II, D-I
- (3) A-III, B-IV, C-I, D-II
- (4) A-II, B-IV, C-I, D-III

Ans. (3)

Sol. Matching type

178. Which of the following are secondary lymphoid organs?

- (a) Bone marrow
- (b) Tonsils
- (c) Spleen
- (d) Thymus

Choose the correct answer from the options given below

- (1) a and d only
- (2) a and b only
- (3) b and c only
- (4) b and d only

Ans. (3)

Sol. Tonsils and spleen both are secondary lymphoid organs

179. During PCR primers bind to the DNA stand in the \_\_\_\_\_ steps.

- (1) Ligation
- (2) Denaturation
- (3) Extension
- (4) Annealing

Ans. (4)

Sol. Primer binds during annealing

180. Given below are two statements

**Statement I** : Down's syndrome is caused by the absence of one of the X - chromosomes

**Statement II** : Turner's syndrome is caused by the presence off an additional copy of the chromosomes  
In the light of the above statements choose the correct answer from the options given below

- (1) Statement I is in correct but Statement II is correct
- (2) Both Statement I and statement II are correct
- (3) Both statement I and statement II are in correct
- (4) Statement I is correct but statement II is in correct

Ans. (3)

Sol. Down's syndrome is caused by trisomy of 21  
Turner's syndrome is caused by absence of X chromosome