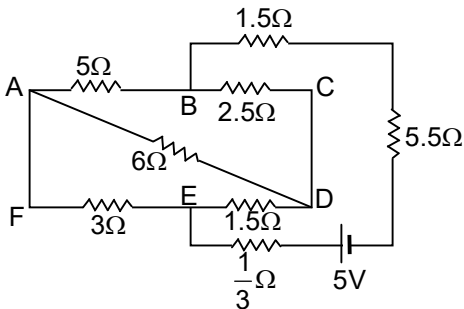


NEET (UG) – 2025

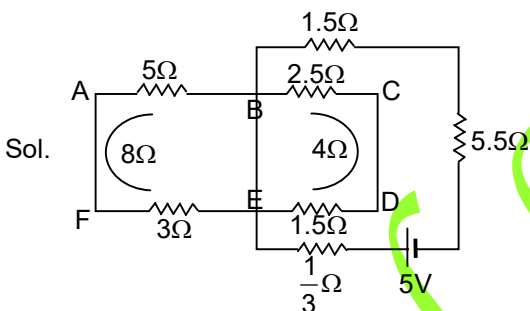
Code 47 – Question Paper with Key, Hints & Solutions

1. The current passing through the battery in the given circuit is



- (1) 1.5 A (2) 2.0 A
(3) 0.5 A (4) 2.5 A

Ans. (3)



Sol.

$$R_1 = \frac{8 \times 4}{8 + 4} = \frac{8}{3}$$

$$R_{eq} = \frac{8}{3} + 1.5 + 5.5 + \frac{1}{3}$$

$$= 3 + 7$$

$$R_{eq} = 10 \Omega$$

$$I = \frac{V}{R_{eq}} = \frac{5}{10} = 0.5 \text{ A}$$

2. The electric field in a plane electromagnetic wave is given by

$$E_z = 60 \cos(5x + 1.5 \times 10^9 t) \text{ V/m}$$

Then expression for the corresponding magnetic field is (here subscripts denote the direction of the field):

- (1) $B_y = 60 \sin(5x + 1.5 \times 10^9 t) \text{ T}$
(2) $B_y = 2 \times 10^{-7} \cos(5x + 1.5 \times 10^9 t) \text{ T}$
(3) $B_x = 2 \times 10^{-7} \cos(5x + 1.5 \times 10^9 t) \text{ T}$
(4) $B_z = 60 \cos(5x + 1.5 \times 10^9 t) \text{ T}$

Ans. (2)

Sol. $E_z = 60 \cos(5x + 1.5 \times 10^9 t) \text{ V/m}$

$$C = \frac{E_0}{B_0}$$

$$B_0 = \frac{E_0}{C} = \frac{60}{3 \times 10^8} = 20 \times 10^{-8}$$

$$B_0 = 2 \times 10^{-7} \text{ T}$$

$$B_y = 2 \times 10^{-7} \cos(5x + 1.5 \times 10^9 t) \text{ T}$$

3. A pipe open at both ends has a fundamental frequency f in air. The pipe is now dipped vertically in a water drum to half of its length. The fundamental frequency of the air column is now equal to

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

Ans. (3)

Sol. $f = \frac{V}{2\ell}$

$$f' = \frac{V}{4\left(\frac{\ell}{2}\right)}$$

$$f' = \frac{V}{2\ell}$$

$$f' = f$$

4. An electron (mass $9 \times 10^{-31} \text{ kg}$ and charge $1.6 \times 10^{-19} \text{ C}$) moving with speed $c/100$ ($c =$ speed of light) is injected into a magnetic field \vec{B} of magnitude $9 \times 10^{-4} \text{ T}$ perpendicular to its direction of motion. We wish to apply an uniform electric field \vec{E} together with the magnetic field so that the electron does not deflect from its path. Then (speed of light $c = 3 \times 10^8 \text{ ms}^{-1}$)

- (1) \vec{E} is parallel to \vec{B} and its magnitude is $27 \times 10^4 \text{ Vm}^{-1}$
(2) \vec{E} is perpendicular to \vec{B} and its magnitude is $27 \times 10^4 \text{ Vm}^{-1}$
(3) \vec{E} is perpendicular to \vec{B} and its magnitude is $27 \times 10^2 \text{ Vm}^{-1}$
(4) \vec{E} is parallel to \vec{B} and its magnitude is $27 \times 10^2 \text{ Vm}^{-1}$

Ans. (3)

Sol. $V = \frac{C}{100} \text{ m/s}$

$$B = 9 \times 10^{-4} \text{ T}$$

$$V = \frac{E}{B}$$

$$E = V \times B$$

$$E = \frac{3 \times 10^8}{10^2} \times 9 \times 10^{-4}$$

$$E = 27 \times 10^2 \text{ Vm}^{-1}$$

5. In a certain camera, a combination of four similar thin convex lenses are arranged axially in contact. Then the power of the combination and the total magnification in comparison to the power (p) and magnification (m) for each lens will be, respectively

- (1) p^4 and m^4
- (2) $4p$ and $4m$
- (3) p^4 and $4m$
- (4) $4p$ and m^4

Ans. (4)

Sol. $P = P_1 + P_2 + P_3 + P_4$
 $= P + P + P + P = 4P$

$$m_T = m_1 \times m_2 \times m_3 \times m_4$$

$$m_T = m \times m \times m \times m = m^4$$

6. A 2 amp current is flowing through two difference small circular copper coils having radii ratio 1 : 2. The ratio of their respective magnetic moments will be

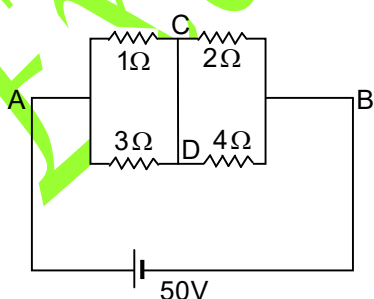
- (1) 4 : 1
- (2) 1 : 4
- (3) 1 : 2
- (4) 2 : 1

Ans. (2)

Sol. $M = iA$
 $M = i\pi r^2$

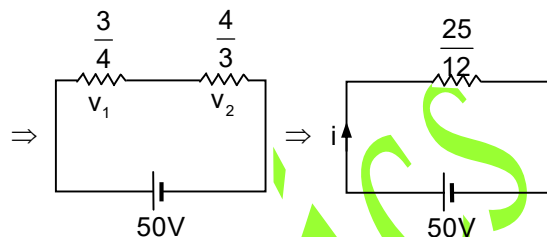
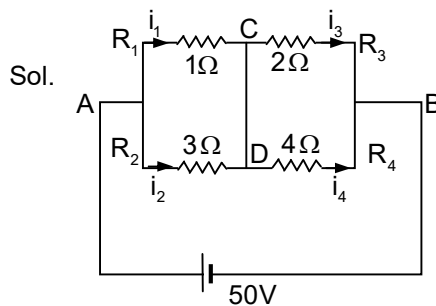
$$\frac{M_1}{M_2} = \left(\frac{r_1}{r_2}\right)^2 = \left(\frac{1}{2}\right)^2 = \frac{1}{4}$$

7. A constant voltage of 50V is maintained between the points A and B of the circuit shown in the figure. The current through the branch CD of the circuit is



- (1) 3.0 A
- (2) 1.5 A
- (3) 2.0 A
- (4) 2.5 A

Ans. (3)



$$i = 50 \times \frac{12}{25} = 24A$$

$$V_1 = 18 \text{ V}$$

$$V_2 = 32 \text{ V}$$

$$i_1 = 18 \text{ A}$$

$$i_2 = 6 \text{ A}$$

$$i_3 = 16 \text{ A}$$

$$i_4 = 8 \text{ A}$$

Current through CD = 2A from C to D

8. Two gases A and B are filled at the same pressure in separate cylinders with movable pistons of radius r_A and r_B , respectively. On supplying an equal amount of heat to both the systems reversibly under constant pressure, the pistons of gas A and B are displaced by 16cm and 9 cm, respectively. If the change in their internal energy is same, then the ratio $\frac{r_A}{r_B}$ is equal to

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

Ans. (3)

Sol. $Q_A = \Delta U_A + W_A$

$$Q_A = \Delta U_A + P\Delta V_A$$

$$\Delta V_A = \pi r_A^2 (\Delta h_A)$$

$$Q_A = \Delta U_A + P\pi r_A^2 \Delta h_A$$

Similarly $Q_B = \Delta U_B + P\pi r_B^2 \Delta h_B$

$$Q_A = Q_B, \Delta U_A = \Delta U_B$$

$$P\pi r_A^2 (\Delta h_A) = P\pi r_B^2 (\Delta h_B)$$

$$\frac{r_A^2}{r_B^2} = \frac{\Delta h_B}{\Delta h_A}$$

$$\frac{r_A}{r_B} = \sqrt{\frac{9}{16}} = \frac{3}{4}$$

9. A container has two chambers of volumes $V_1 = 2$ litres and $V_2 = 3$ litres separated by a partition made of the thermal insulator. The chambers contains $n_1 = 5$ and $n_2 = 4$ moles of ideal gas at pressure $p_1 = 1$ atm and $p_2 = 2$ atm, respectively. When the partition is removed, the mixture attains an equilibrium pressure of

- (1) 1.8 atm (2) 1.3 atm
- (3) 1.6 atm (4) 1.4 atm

Ans. (3)

Sol. Number of moles is conserved

$$n_1 + n_2 = n$$

$$\frac{P_1 V_1}{RT} + \frac{P_2 V_2}{RT} = \frac{PV_1}{RT} + \frac{PV_2}{RT}$$

$$P_1 V_1 + P_2 V_2 = P(V_1 + V_2)$$

$$(1)(2) + (2)(3) = P(2 + 3)$$

$$2 + 6 = 5P$$

$$P = \frac{8}{5} = 1.6 \text{ atm}$$

10. The radius of Martian orbit around the Sun is about 4 times the radius of the orbit of Mercury. The Martian year is 687 Earth days. Then which of the following is the length of 1 year on Mercury?

- (1) 124 earth days (2) 88 earth days
- (3) 225 earth days (4) 172 earth days

Ans. (2)

Sol. $r_{ma} = 4r_{me}$

$$T_{ma} = 687 \text{ days}$$

$$T_{me} = ?$$

According to Kepler's third law $T^2 \propto R^3$

$$\left(\frac{T_{ma}}{T_{me}}\right)^2 = \left(\frac{4r_{me}}{r_{me}}\right)^3$$

$$\frac{T_{ma}}{T_{me}} = (4)^{3/2}$$

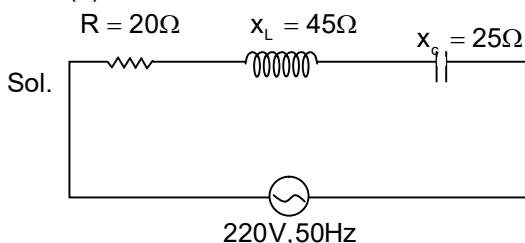
$$\frac{687}{T_{me}} = 8$$

$$T_{me} = 85.9 \text{ earth days}$$

11. To an ac power supply of 220 V at 50 Hz, a resistor of 20Ω , a capacitor of reactance 25Ω and an inductor of reactance 45Ω are connected in series. The corresponding current in the circuit and the phase angle between the current and the voltage is, respectively

- (1) 15.6 A and 45°
- (2) 7.8 A and 30°
- (3) 7.8 A and 45°
- (4) 15.6 A and 30°

Ans. (3)



Sol.

$$Z = \sqrt{(x_L - x_C)^2 + r^2}$$

$$= \sqrt{(45 - 25)^2 + 20^2}$$

$$Z = 28.28$$

$$V = I \times Z$$

$$I = \frac{V}{Z}$$

$$= \frac{220}{28.28} = 7.77 \approx 7.8 \text{ A}$$

Phase angle

$$\tan \phi = \frac{X_L - X_C}{R}$$

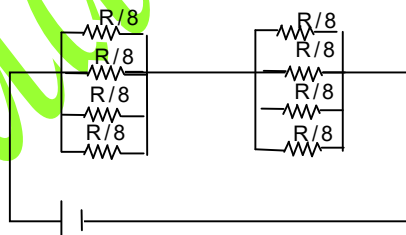
$$= \frac{45 - 25}{20} = 1$$

$$\phi = 45^\circ$$

12. A wire of resistance R is cut into 8 equal pieces. From these pieces two equivalent resistance are made by adding four of these together in parallel. Then these two sets are added in series. The net effective resistance of the combination

- (1) $\frac{R}{8}$ (2) $\frac{R}{64}$ (3) $\frac{R}{32}$ (4) $\frac{R}{16}$

Ans. (4)



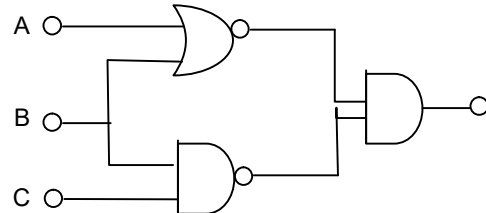
Sol.

$$R_{eq}(\text{parallel}) = \frac{R}{8 \times 4} = \frac{R}{32}$$

$$R_{eq}(\text{parallel}) = \frac{R}{8 \times 4} = \frac{R}{32}$$

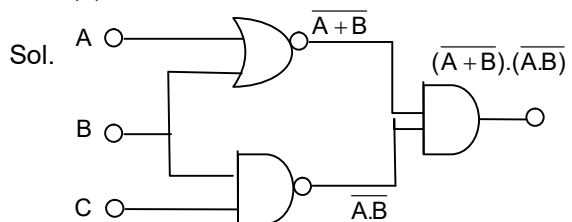
$$R_{eq}(\text{series}) = \frac{2R}{32} = \frac{R}{16}$$

13. The output (Y) of the given logic implementation is similar to the output of an/a ___ gate



- (1) NOR (2) AND
- (3) NAND (4) OR

Ans. (1)



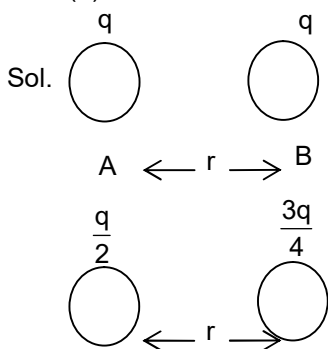
Sol.

By demorgan laws the circuit represents NOR gate

14. Two identical charged conducting spheres A and B have their centres separated by a certain distance. Charge on each sphere is q and the force of repulsion between them is F . A third identical uncharged conducting sphere is brought in contact with sphere A first and then with B and finally removed from both. New force of repulsion between spheres A and B (Radii of A and B are negligible compared to the distance of separation so that for calculating force between them they can be considered as point charges) is best given as

- (1) $\frac{3F}{8}$ (2) $\frac{3F}{5}$
 (3) $\frac{2F}{3}$ (4) $\frac{F}{2}$

Ans. (1)



$$F = \frac{kq^2}{r^2}$$

$$F_2 = \frac{kq \times \frac{3q}{4}}{\frac{2}{r^2}}$$

$$= \frac{kq^2}{r^2} \times \frac{3}{8}$$

$$F_2 = \frac{3}{8}F$$

15. Consider the diameter of a spherical object being measured with the help of a Vernier calipers. Suppose its 10 Vernier scale Divisions ($V>S>D$) are equal to its 9 main scale Divisions (M.S.D.) The least division in the M.S. is 0.1 cm and the zero of V.S. is at $x = 0.1$ cm when the jaws of Vernier calipers are closed.

If the main scale reading for the diameter is $M = 5$ cm and the number of coinciding vernier division is 8, the measured diameter after zero error correction, is

- (1) 5.00 cm
 (2) 5.18 cm
 (3) 5.08 cm
 (4) 4.98 cm

Ans. (4)

Sol. $R = M.S.R + (V.C \times L.C) - Z.E$

$$= 5 + 8 \times 0.01 - 0.1$$

$$= 4.98 \text{ cm}$$

16. In some appropriate units, time (t) and position (x) relation of a moving particle is given by $t = x^2 + x$. The acceleration of the particle is

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

Ans. (3)

Sol. $t = x^2 + x$

Now differentiate above equation w.r.t x

$$\frac{dt}{dx} = (2x + 1)$$

$$\frac{dx}{dt} = v = \frac{1}{2x+1}$$

$$v = (2x + 1)^{-1}$$

Now differentiate above equation w.r.t t

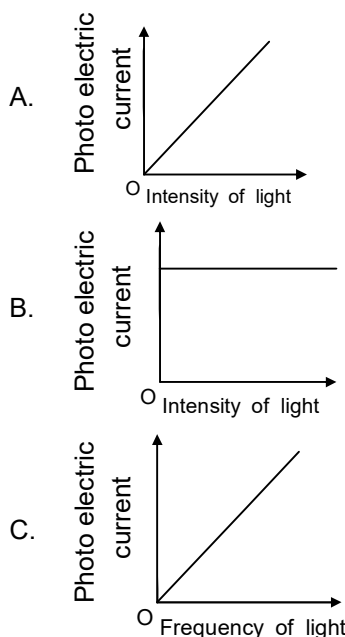
$$\frac{dv}{dt} = -1[2x + 1]^{-2} \times 2 \times \frac{dx}{dt}$$

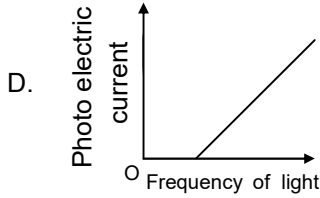
$$\frac{dv}{dt} = -1[2x + 1]^{-2} \times 2 \times v$$

$$a = -2[2x + 1]^{-2} \times \frac{1}{(2x + 1)}$$

$$\therefore a = -\frac{2}{[2x + 1]^3}$$

17. Which of the following options represent the variation of photoelectric current with property of light shown on the x-axis





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

Ans. (2)

Sol. Photocurrent \propto Intensity

18. A particle of mass m is moving around the origin with a constant force F pulling it towards the origin. If Bohr model is used to describe its motion, the radius r of the n^{th} orbit and the particle's speed v in the orbit depend on n as

- (1) $r \propto n^{4/3}; v \propto n^{-1/3}$
- (2) $r \propto n^{1/3}; v \propto n^{1/3}$
- (3) $r \propto n^{1/3}; v \propto n^{2/3}$
- (4) $r \propto n^{2/3}; v \propto n^{1/3}$

Ans. (4)

Sol. $F = \frac{mv^2}{r} \dots\dots(1)$

From Bohr's atomic model

$$mvr = \frac{nh}{2\pi}$$

$$v = \frac{nh}{2\pi mr} \dots\dots(2)$$

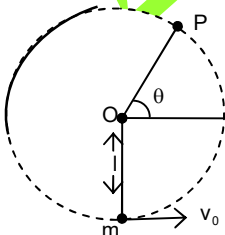
$$F = \frac{mn^2h^2}{4\pi^2m^2r^3} \Rightarrow r \propto n^{2/3}$$

Also $v \propto \frac{n}{r}$

$$\Rightarrow v \propto \frac{n}{n^{2/3}}$$

$$\therefore v \propto n^{1/3}$$

19. A bob of heavy mass m is suspended by a light string of length l . The bob is given a horizontal velocity v_0 as shown in figure. If the string gets slack at some point P making an angle θ from the horizontal, the ratio of the speed v of the bob at point P to its initial speed v_0 is



- (1) $\left(\frac{\sin \theta}{2 + 3 \sin \theta}\right)^{1/2}$
- (2) $(\sin \theta)^{1/2}$
- (3) $\left(\frac{1}{2 + 3 \sin \theta}\right)^{1/2}$
- (4) $\left(\frac{\cos \theta}{2 + 3 \sin \theta}\right)^{1/2}$

Ans. (1)

Sol. ACC to law of conservation of energy

$$E_{\text{lowest}} = E_p$$

$$\frac{1}{2}mv_0^2 = mgl(1 + \sin \theta) + \frac{1}{2}mv^2$$

$$\frac{v_0^2}{2} = gl(1 + \sin \theta) + \frac{v^2}{2}$$

$$v_0^2 = v^2 + 2gl(1 + \sin \theta) \dots\dots(1)$$

Also from given diagram tension at 'P'

$$T = mg \sin \theta - \frac{mv^2}{l}$$

$$0 = mg \sin \theta - \frac{mv^2}{l}$$

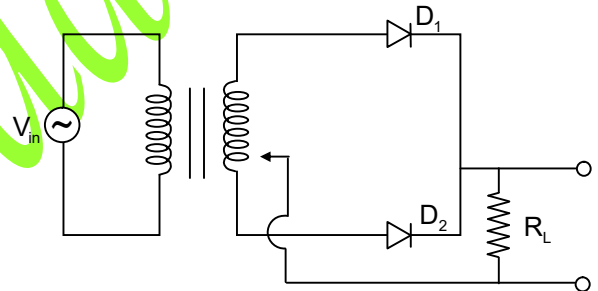
$$v^2 = gl \sin \theta \dots\dots(2)$$

From(1)and(2)

$$v_0^2 = gl(2 + 3 \sin \theta) \dots\dots(3)$$

$$\frac{(2)}{(3)} \Rightarrow \frac{v}{v_0} = \left(\frac{\sin \theta}{2 + 3 \sin \theta}\right)^{1/2}$$

20. A full wave rectifier circuit with diodes (D_1) and (D_2) shown in the figure. If input supply voltage $V_{in} = 220 \sin(100 \pi t)$ volt, then at $t = 15$ milli sec



- (1) D_1 and D_2 both are reverse biased
- (2) D_1 is forward biased, D_2 is reverse biased
- (3) D_1 is reverse biased, D_2 is forward biased
- (4) D_1 and D_2 both are forward biased

Ans. (3)

Sol. Given voltage $V_{in} = 220 \sin(100 \pi t)$

At $t = 15 \text{ms}$

$$V = 220 \sin(100 \pi \times 15 \times 10^{-3})$$

$$V = 220 \sin(3 \pi / 2)$$

From above equation $\phi = 3 \pi / 2$

At $\phi = 3 \pi / 2$

D_1 is negative and D_2 is positive.

D_1 is reverse biased and D_2 is forward biased

21. A balloon is made of a material of surface tension S and its inflation outlet (from where gas is filled in it) has small area A . It is filled with a gas of density ρ and takes a spherical shape of radius R . when the gas is allowed to flow freely out of it, its radius r changes from R to 0 (zero) in time T . If the speed $v(r)$ of gas coming out of the balloon depends on r as r^a and $T \propto S^a A^b \rho^c R^d$ then

$$(1) a = \frac{1}{2}, \alpha = \frac{1}{2}, \beta = -\frac{1}{2}, \gamma = \frac{1}{2}, \delta = \frac{7}{2}$$

(2) $a = \frac{1}{2}, \alpha = \frac{1}{2}, \beta = -1, \gamma = +1, \delta = \frac{3}{2}$

(3) $a = -\frac{1}{2}, \alpha = -\frac{1}{2}, \beta = -1, \gamma = -\frac{1}{2}, \delta = \frac{5}{2}$

(4) $a = -\frac{1}{2}, \alpha = -\frac{1}{2}, \beta = -1, \gamma = \frac{1}{2}, \delta = \frac{7}{2}$

Ans. (4)

Sol. Velocity from a balloon depends up on r as r^a .

$V \propto 1/\sqrt{r}$

$v \propto r^{-1/2}$

$a = -1/2$

$T \propto S \alpha A \beta \rho \gamma R \delta$

$T = [MT^{-2}] \alpha [L^2] \beta [ML^{-3}] \gamma L \delta$

After simplifying above equation

$\alpha = -1/2, \gamma = 1/2$

At $\beta = -1, \delta = 7/2$

22. A microscope as an objective of focal length 2cm , eyepiece of focal length 4cm and the tube length of 40cm . If the distance of distinct vision of eye 25cm , the magnification in the microscope is

- (1) 250
- (2) 100
- (3) 125
- (4) 150

Ans. (3)

Sol. Given :fo =2cm fe=4cm

D = 25cm L=40cm

$M = \frac{L}{f_0} \times \frac{D}{f_e} = \frac{40}{2} \times \frac{25}{4} = 125$

23. Two identical point masses P and Q ,suspended from two separate massless springs of spring constants k_1 and k_2 , respectively, oscillate vertically if there maximum speeds are same , the ratio (A_Q/A_P) of the amplitude A_Q of mass Q to the amplitude A_P of mass P is:

(1) $\sqrt{\frac{k_1}{k_2}}$

(2) $\frac{k_2}{k_1}$

(3) $\frac{k_1}{k_2}$

(4) $\sqrt{\frac{k_2}{k_1}}$

Ans. (1)

Sol. Given $m_p = m_Q$

$(V_P)_{max} = (V_Q)_{max}$

$V_{Qmax} = V_{Pmax}$

$A_Q \omega_Q = A_P \omega_P$

$A_Q \sqrt{\frac{k_1}{m_Q}} = A_P \sqrt{\frac{k_2}{m_P}}$

$\frac{A_Q}{A_P} = \sqrt{\frac{k_1}{k_2}}$

24. A parallel plate capacitor made of circular plates is being charged such that the surface charge density on its plates is increasing at a constant rate with time. The magnetic field arising due to displacement current is:

- (1) zero between the plates and non-zero outside
- (2) zero at all places
- (3) constant between the plates and zero outside the plate
- (4) non-zero everywhere with maximum at the imaginary cylindrical surface connecting peripheries of the plates

Ans. (4)

Sol. From ampere-Maxwell law

Magnetic field is non zero everywhere.

Inside the plates $B \propto r$.

Outside the plates $B \propto \frac{1}{r}$

Maximum at edge of the plates

25. An electric dipole with dipole moment 5×10^{-6} Cm is aligned with the direction of a uniform electric field of magnitude 4×10^5 N/C. The dipole is then rotated through an angle of 60° with respect to the electric field. The change in the potential energy of the dipole is

- (1) 1.5 J
- (2) 0.8 J
- (3) 1.0 J
- (4) 1.2 J

Ans. (3)

Sol. given $P = 5 \times 10^{-6}$ Cm

$E = 4 \times 10^5$ N/c

$\theta_1 = 0^\circ, \theta_2 = 60^\circ$

Formula $U_1 = -PE \cos \theta_1$

$= -5 \times 10^{-6} \times 4 \times 10^5 \cos 0^\circ$

$= -2$ J

And $U_2 = -PE \cos \theta_2$

$= -5 \times 10^{-6} \times 4 \times 10^5 \cos 60^\circ$

$= -1$ J

\therefore Change in potential energy $\Delta U = U_2 - U_1$

$= -1 - (-2)$

$= \Delta U = +1$ J.

26. There are two inclined surfaces of equal length (L) and same angle of inclination 45° with the horizontal. One of them is rough and the other is perfectly smooth. A given body takes 2 times as much time to slide down on rough surface than on the smooth surface. The coefficient of kinetic friction (μ_k) between the object and the rough surface is close to

- (1) 0.75
- (2) 0.25
- (3) 0.40
- (4) 0.5

Ans. (1)

Sol. Acceleration on the smooth surface

$$a_1 = g \sin \theta = g \sin 45^\circ = \frac{g}{\sqrt{2}}$$

Acceleration of rough surface

$$a_2 = g \sin \theta - \mu_k g \cos \theta = \frac{g}{\sqrt{2}} - \mu_k \frac{g}{\sqrt{2}}$$

$$\text{Time of slide } t = \sqrt{\frac{2l}{a}}$$

$$\text{Given } \sqrt{\frac{2l}{a_2}} = 2 \sqrt{\frac{2l}{a_1}}$$

$$\mu_k = 0.75$$

27. De-Broglie wavelength of an electron orbiting in the $n=2$ state of hydrogen atom is close to (Given Bohr radius = 0.052 nm)

- (1) 2.67 nm
- (2) 0.067 nm
- (3) 0.67 nm
- (4) 1.67 nm

Ans. (3)

Sol. Radius of orbit $r = n^2 r_0$

$$= 4 \times 0.052 = 0.208 \text{ nm}$$

De Broglie wave length $2\pi r = n\lambda$

$$\lambda = \frac{2\pi r}{n} = 0.67 \text{ nm}$$

28. The Sun rotates around its centre once in 27 days. What will be the period of revolution if the Sun were to expand to twice its present radius without any external influence? Assume the Sun to be a sphere of uniform density.

- (1) 108 days
- (2) 100 days
- (3) 105 days
- (4) 115 days

Ans. (1)

Sol. $T_2 = ?$

$$T_1 = 27 \text{ days} \quad r_2 = 2r \quad \omega = \frac{2\pi}{T}$$

$$r_1 = r \quad I_2 = \frac{2}{5} M (2r)^2$$

$$I_1 = \frac{2}{5} Mr^2 \quad I_2 = \frac{8}{5} Mr^2$$

Law of conservation of angular momentum

$$I_1 \omega_1 = I_2 \omega_2$$

$$\frac{2}{5} mr^2 \left(\frac{2\pi}{T_1} \right) = \frac{8}{5} mr^2 \left(\frac{2\pi}{T_2} \right)$$

$$T_2 = 4T_1$$

$$T_2 = 4(27 \text{ days})$$

$$T_2 = 108 \text{ days}$$

29. A physical quantity P is related to four observations a, b, c and d as follows

$$P = a^3 b^2 / c \sqrt{d}$$

The percentage errors of measurement in a, b, c and d are 1%, 3%, 2% and 4% respectively. The percentage error in the quantity P is

- (1) 15%
- (2) 10%
- (3) 2%
- (4) 13%

Ans. (4)

$$\text{Sol. } P = \frac{a^3 b^2}{c \sqrt{d}}$$

$$\frac{\Delta P}{P} \% = 3 \frac{\Delta a}{a} 100 + 2 \frac{\Delta b}{b} 100 + \frac{\Delta c}{c} 100 + \frac{1}{2} \frac{\Delta d}{d} 100$$

$$= 3(1)\% + 2(3)\% + 2\% + \frac{1}{2}(4)\%$$

$$= 3\% + 6\% + 2\% + 2\%$$

$$= 13\%$$

30. The plates of a parallel plate capacitor are separated by d. Two slabs of different dielectric constant K_1 and K_2 with thickness $\frac{3d}{8}$ and $\frac{d}{2}$ respectively are inserted in the capacitor. Due to this, the capacitance becomes two times larger than when there is nothing between the plates.

If $K_1 = 1.25 K_2$, the value of K_1 is

- (1) 1.33
- (2) 2.66
- (3) 2.33
- (4) 1.60

Ans. (2)

$$\text{Sol. } C_1 = \frac{K_1 \epsilon_0 A}{\frac{3d}{8}} = \frac{8K_1 \epsilon_0 A}{3d}$$

$$C_2 = \frac{K_2 \epsilon_0 A}{\frac{d}{2}} = \frac{2K_2 \epsilon_0 A}{d} = \frac{2K_2 \epsilon_0 A}{d} = \frac{8K_1 \epsilon_0 A}{5d}$$

$$C_3 = \frac{\epsilon_0 A}{\frac{d}{8}} = \frac{8 \epsilon_0 A}{d}$$

since all are in series

$$\frac{1}{C_s} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3}$$

$$\frac{1}{\frac{2 \epsilon_0 A}{d}} = \frac{1}{\frac{8K_1 \epsilon_0 A}{3d}} + \frac{1}{\frac{8K_1 \epsilon_0 A}{5d}} + \frac{1}{\frac{8 \epsilon_0 A}{d}}$$

$$\therefore K_1 = 2.66$$

31. A ball of mass 0.5 kg is dropped from a height of 40 m. The ball hits the ground and rises to a height of 10 m. The impulse imparted to the ball during its collision with the ground is (Take $g = 9.8 \text{ m/s}^2$)

- (1) 84 NS
- (2) 21 NS
- (3) 7 NS
- (4) 0

Ans. (2)

Sol. Impulse = change in the momentum

$$\text{impulse} = m(\sqrt{2gh_1} + \sqrt{2gh_2})$$

$$\text{impulse} = 0.5(\sqrt{2 \times 9.8 \times 40} + \sqrt{2 \times 9.8 \times 10})$$

$$\text{impulse} = 0.5(28 + 14)$$

$$\text{impulse} = 0.5(42)$$

$$\text{impulse} = 21\text{Ns}$$

32. Two cities X and Y are connected by a regular bus service with a bus leaving in either direction every T min. A girl is driving scooty with a speed of 60 km/h in the direction X to Y notices that a bus goes past her every 30 minutes in the direction of her motion, and every 10 minutes in the opposite direction. Choose the correct option for the period T of the bus service and the speed (assumed constant) of the buses.

- (1) 15 min, 120 km/h
- (2) 9 min, 40 km/h
- (3) 25 min, 100 km/h
- (4) 10 min, 90 km/h

Ans. (1)

Sol. Relative speed = $V_b - V_g$

Time taken by the bus to pass the girl is 30 min =

$$\frac{1}{2}\text{h}$$

$$V_b T = (V_b - V_g) t_1$$

$$V_b T = (V_b - 60) \frac{1}{2}$$

$$2V_b T = V_b - 60 \text{ Eq (i)}$$

The relative speed $V_b + V_g$

$$\text{Time taken } 10 \text{ min} = \frac{1}{6}\text{h}$$

$$V_b T = (V_b + V_g) t_2$$

$$V_b T = (V_b + 60) \frac{1}{6}$$

$$6V_b T = V_b + 60 \text{ Eq (ii)}$$

From Eq. (i) & (ii)

$$V_b = 120 \text{ kmph}$$

$$T = 15 \text{ min}$$

33. An oxygen cylinder of volume 30 litre has 18.20 moles of oxygen. After some oxygen is withdrawn from the cylinder, its gauge pressure drops to 11 atmospheric pressure at temperature 27°C. The mass of the oxygen withdrawn from the cylinder is nearly equal to

[Given, $R = \frac{100}{12} \text{ J mol}^{-1} \text{ K}^{-1}$, and molecular mass of

$$\text{O}_2 = 32,$$

$$1 \text{ atm pressure} = 1.01 \times 10^5 \text{ N/m}^2$$

- (1) 0.156 kg
- (2) 0.125 kg
- (3) 0.144 kg
- (4) 0.116 kg

Ans. (1)

Sol. $P = 11 \text{ atm} = 11 \times 1.01 \times 10^5 \text{ N/m}^2$

$$\text{Vol} = 30 \text{ lit} = 30 \times 10^{-3} \text{ m}^3$$

$$T = 300 \text{ K}$$

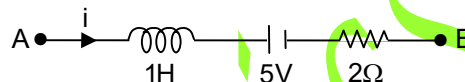
$$n_2 = \frac{PV}{RT} = 13.3$$

$$\Delta n = n_1 - n_2 = 18.20 - 13.30 = 4.9$$

$$\text{Mass expelled} = 4.9 \times 32 = 156 \text{ gm}$$

$$= 0.156 \text{ kg}$$

34. AB is a part of an electrical circuit (see figure). The potential difference " $V_A - V_B$ ", at the instant when current $I = 2\text{A}$ and is increasing at a rate of 1 amp / second is



- (1) 10 volt
- (2) 5 volt
- (3) 6 volt
- (4) 9 volt

Ans. (1)



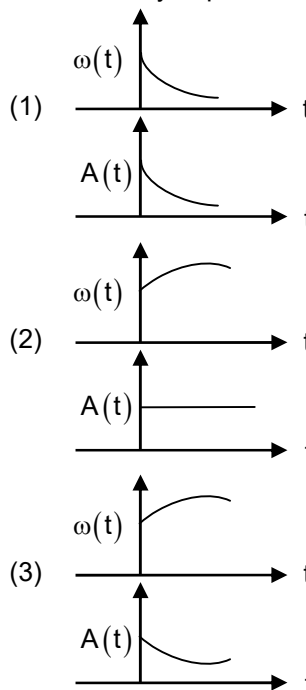
Sol.

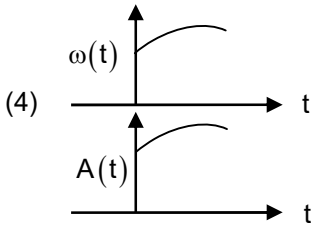
From KVL,

$$V_A - V_B = L \frac{di}{dt} + E + iR$$

$$V_A - V_B = (1)(1) + 5 + 2(2) = 1 + 5 + 4 = 10\text{V}$$

35. In an oscillating spring mass system, a spring is connected to a box filled with sand. As the box oscillates, sand leaks slowly out of the box vertically so that the average frequency $\omega(t)$ and average amplitude $A(t)$ of the system change with time t. Which one of the following options schematically depicts these changes correctly?





Ans. (3)

Sol. Angular frequency $\omega = \sqrt{\frac{k}{m}}$

Due to energy loss from the sand leaking (non-conservative process), system loses mechanical energy.

Amplitude decreased with time

' ω ' increases with time.

36. A model for quantized motion of an electron in a uniform magnetic field B states that the flux passing through the orbit of the electron is $n(h/e)$ where n is an integer, h is Planck's constant and e is the magnitude of electron's charge. According to the model, the magnetic moment of an electron in its lowest energy state will be (m is the mass of the electron)

(1) $\frac{heB}{2\pi m}$

(2) $\frac{he}{\pi m}$

(3) $\frac{he}{2\pi m}$

(4) $\frac{heB}{\pi m}$

Ans. (3)

Sol. $M = \frac{evr}{2}$

$\therefore \frac{mv^2}{r} = evB$

$\therefore v = \frac{eBr}{m}$

$\therefore M = \frac{e}{2} \frac{eBr}{m} \cdot r$

$M = \frac{e^2 Br^2}{2m}$

$\therefore M = \frac{eh}{2\pi m}$

37. A body weighs 48 N on the surface of the earth. The gravitational force experienced by the body due to the earth at a height equal to one-third the radius of the earth from its surface is

(1) 36 N

(2) 16 N

(3) 27 N

(4) 32 N

Ans. (3)

Sol. $w' = \frac{w}{\left(1 + \frac{h}{R}\right)^2}$

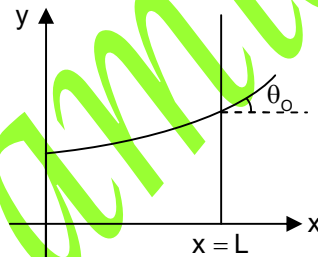
where R is radius of earth

$h = \frac{R}{3}$ given $w = 48$ N

$w' = \frac{48}{\left(1 + \frac{R}{3R}\right)^2} = \frac{48}{\frac{16}{9}}$

$w' = 27$ N

38. Consider a water tank shown in the figure. It has one wall at $x = L$ and can be taken to be very wide in the z direction. When filled with a liquid of surface tension S and density ρ , the liquid surface makes angle θ_0 ($\theta_0 \ll 1$) with the x -axis at $x = L$. If $y(x)$ is the height of the surface then the equation for $y(x)$ is



(take $\theta(x) = \sin \theta(x) = \tan \theta(x) = \frac{dy}{dx}$, g is the acceleration due to gravity)

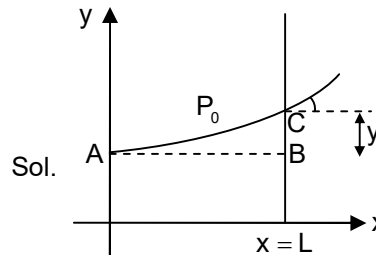
(1) $\frac{dy}{dx} = \sqrt{\frac{\rho g}{S}} x$

(2) $\frac{d^2y}{dx^2} = \frac{\rho g}{S} x$

(3) $\frac{d^2y}{dx^2} = \frac{\rho g}{S} y$

(4) $\frac{d^2y}{dx^2} = \sqrt{\frac{\rho g}{S}}$

Ans. (3)



Sol.

$P_A = P_B = P_0$

$P_C = P_0 - \rho gy$

$P_C = P_0 - \frac{S}{R}$

$\rho gy = \frac{S}{R}$

$\rho gy = S \frac{d^2y}{dx^2}$

$\frac{d^2y}{dx^2} = \frac{\rho gy}{S} = \frac{1}{R} \therefore dy/dx$ is very small

39. The intensity of transmitted light when a Polaroid sheet, placed between two crossed polaroids at 22.5° from the polarization axis of one of the Polaroid, is (I_0 is the intensity of polarised light after passing through the first Polaroid)

- (1) $\frac{I_0}{16}$
- (2) $\frac{I_0}{2}$
- (3) $\frac{I_0}{4}$
- (4) $\frac{I_0}{8}$

Ans. (4)

Sol. $I_1 = I_0 \cos^2(\theta)$
 $I_{\text{net}} = I_1 \cos^2(90 - \theta)$
 $I_{\text{net}} = I_0 \cos^2(\theta) \cos^2(90 - \theta)$
 $= I_0 \cos^2 \theta \sin^2 \theta$
 $= \frac{I_0}{4} (2 \sin \theta \cos \theta)^2$
 $= \frac{I_0}{4} (\sin 2\theta)^2, \theta = 22.5^\circ$
 $= \frac{I_0}{4} (\sin 45^\circ)^2$
 $= \frac{I_0}{4} \left(\frac{1}{\sqrt{2}}\right)^2$
 $= \frac{I_0}{8}$

40. A photon and an electron (mass m) have the same energy E . The ratio ($\lambda_{\text{photon}} / \lambda_{\text{electron}}$) of their de Broglie wavelength is: (c is the speed of light)

- (1) $\frac{1}{c} \sqrt{\frac{E}{2m}}$
- (2) $\sqrt{\frac{E}{2m}}$
- (3) $c \sqrt{2mE}$
- (4) $c \sqrt{\frac{2m}{E}}$

Ans. (4)

Sol. $\lambda_p = \frac{h}{\frac{E}{c}}$
 $\lambda_e = \frac{h}{\sqrt{2mE}}$
 $\frac{\lambda_p}{\lambda_e} = \frac{\frac{hc}{E}}{\frac{h}{\sqrt{2mE}}} = \frac{hc}{E} \times \frac{\sqrt{2mE}}{h}$
 $= c \sqrt{\frac{2m}{E}}$

41. An unpolarized light beam travelling in air is incident on a medium of refractive index 1.73 at Brewster's angle. Then

- (1) Transmitted light is completely polarized with angle of refraction close to 30°
- (2) Reflected light is completely polarized and the angle of reflection is close to 60°
- (3) Reflected light is partially polarized and the angle of reflection is close to 30°
- (4) Both reflected and transmitted light are perfectly polarized with angles of reflection and refraction close to 60° and 30° , respectively.

Ans. (2)

Sol. $\mu = \tan(\theta_B)$ (Brewster's Law) $\theta_B = \tan^{-1}(1.73)$
 $\theta_B = 60^\circ$

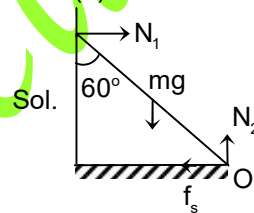
At Brewster's angle, reflected light is fully polarized and transmitted light is partially polarized.

Angle of surface = $\theta_B = 60^\circ$

42. A uniform rod of mass 20 kg and length 5 m leans against a smooth vertical wall making an angle of 60° with it. The other end rests on a rough horizontal floor. The friction force that the floor exerts on the rod is (take $g = 10 \text{ m/s}^2$)

- (1) $200\sqrt{3} \text{ N}$
- (2) 100N
- (3) $100\sqrt{3} \text{ N}$
- (4) 200N

Ans. (3)



Sol.

$mg = N_2$
 $f_s = N_1$ } balance of forces

balancing torque about O.

$N_1 \cos(60) \ell = mg \left(\frac{\ell}{2}\right) \sin(60)$

$f_s \left(\frac{1}{2}\right) \ell = mg \frac{\ell}{2} \frac{\sqrt{3}}{2}$

$f_s = \frac{(10 \times 20) \sqrt{3}}{2}$

$f_s = 100\sqrt{3} \text{ N}$

43. Three identical heat conducting rods are connected in series as shown in the figure. The rods on the sides have thermal conductivity $2K$ while that in the middle has thermal conductivity K . The left end of the combination is maintained at temperature $3T$ and the right end at T . The rods are thermally insulated from outside. In steady state, temperature at the left junction is T_1 and that at the right junction is T_2 . The ratio T_1/T_2 is

$$\text{Mass} = \rho \times \text{volume}$$

$$M_{\text{Original}} = \rho \times \frac{4}{3} \pi (2R)^3 = 8 \left(\frac{4}{3} \pi R^3 \rho \right)$$

$$M_{\text{Removed}} = \rho \times \frac{4}{3} \pi R^3 = \frac{M}{8}$$

$$I_{\text{Remaining}} = \frac{57}{40} MR^2$$

$$\frac{I_{\text{Small}}}{I_{\text{Remaining}}} = \frac{I_{\text{Removed}}}{I_{\text{Remaining}}} = \frac{\frac{7}{40} MR^2}{\frac{57}{40} MR^2} = \frac{7}{57}$$

46. If the molar conductivity (Λ_m) of a 0.050 mol L⁻¹ solution of a monobasic weak acid is 90 S cm² mol⁻¹ its extent (degree) of dissociation will be (Assume $\Lambda_+^0 = 349.6$ S cm² mol⁻¹ and $\Lambda_-^0 = 50.4$ S cm² mol⁻¹)

- (1) 0.215 (2) 0.115
(3) 0.125 (4) 0.225

Ans. (4)

$$\text{Sol. } \Lambda_m^0 = \Lambda_+^0 + \Lambda_-^0$$

$$= 349.6 + 50.4 = 400 \text{ S cm}^2 \text{ mol}^{-1}$$

$$\alpha = \frac{\Lambda_m}{\Lambda_m^0} = \frac{90}{400} = 0.225$$

47. Given below are two statements:

Statement I: A hypothetical diatomic molecule with bond order zero is quite stable.

Statement II: As bond order increases, the bond length increases.

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

- (1) Statement I is false 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 true but Statement II is false.

Ans. (3)

Sol. Statement I: If bond order is zero, the molecule is unstable.

Statement II: If bond order increases, bond length decreases

∴ Both Statement I and II are false.

48. The ratio of the wavelengths of the light absorbed by a Hydrogen atom when it undergoes $n=2 \rightarrow n=3$ and $n=4 \rightarrow n=6$ transitions, respectively is

- (1) $\frac{1}{4}$ (2) $\frac{1}{36}$
(3) $\frac{1}{16}$ (4) $\frac{1}{9}$

Ans. (1)

$$\text{Sol. } \frac{\bar{\nu}_1}{\bar{\nu}_2} = \frac{\left[\frac{1}{2^2} - \frac{1}{3^2} \right]}{\left[\frac{1}{4^2} - \frac{1}{6^2} \right]} = \frac{\left[\frac{1}{4} - \frac{1}{9} \right]}{\left[\frac{1}{16} - \frac{1}{36} \right]}$$

$$\frac{\bar{\nu}_1}{\bar{\nu}_2} = \frac{4}{1}$$

$$\frac{\lambda_2}{\lambda_1} = \frac{4}{1}$$

$$\frac{\lambda_1}{\lambda_2} = \frac{1}{4}$$

49. The correct order of the wavelength of light absorbed by the following complexes is

- A. $[\text{Co}(\text{NH}_3)_6]^{3+}$
B. $[\text{Co}(\text{CN})_6]^{3-}$
C. $[\text{Cu}(\text{H}_2\text{O})_4]^{2+}$
D. $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$

Choose the correct answer from the options given below:

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

Ans. (3)

Sol. Strength of ligand $\text{CN}^- > \text{NH}_3 > \text{H}_2\text{O}$

$$\text{Wavelength} \propto \frac{1}{\text{strength of ligand}}$$

Order of wavelength = B < A < D < C

50. If the rate constant of a reaction is 0.03 s⁻¹, how much time does it take for 7.2 mol L⁻¹ concentration of the reactant to get reduced to 0.9 mol L⁻¹?

(Given: log 2 = 0.301)

- (1) 21.0 s
(2) 69.3 s
(3) 23.1 s
(4) 210 s

Ans. (2)

$$\text{Sol. } K = \frac{2.303}{t} \log \frac{[A]_0}{[A]}$$

$$t = \frac{2.303}{0.03} \log \left(\frac{7.2}{0.9} \right)$$

$$t = \frac{2.303}{0.03} \log 8 = 69.3 \text{ sec}$$

51. Match List I with List II.

	List - I (Mixture)		List - II (Method of separation)
A.	$\text{CHCl}_3 + \text{C}_6\text{H}_5\text{NH}_2$	I.	Distillation under reduced pressure
B.	Crude oil in petroleum industry	II.	Steam distillation
C.	Glycerol from spent-lye	III.	Fractional distillation
D.	Aniline-water	IV.	Simple distillation

Choose the correct answer from the options given below:

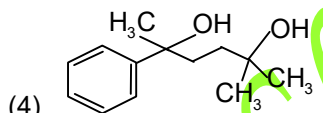
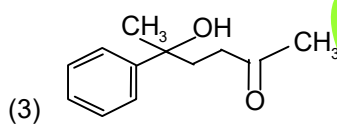
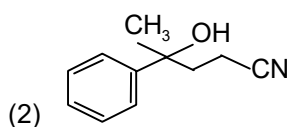
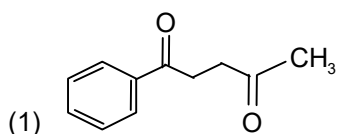
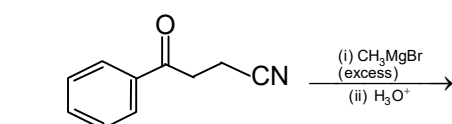
- (1) A-III, B-IV, C-II, D-I
- (2) A-IV, B-III, C-I, D-II
- (3) A-IV, B-III, C-II, D-I
- (4) A-III, B-IV, C-I, D-II

Ans. (2)

Sol.

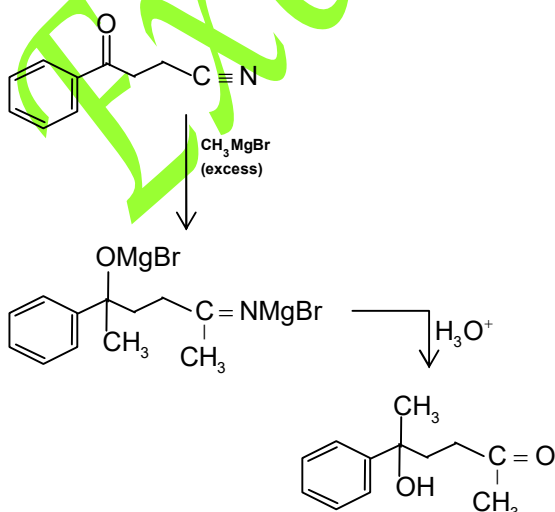
List – I (Mixture)		List – II (Method of separation)	
A.	$\text{CHCl}_3 + \text{C}_6\text{H}_5\text{NH}_2$	IV.	Simple distillation
B.	Crude oil in petroleum industry	III.	Fractional distillation
C.	Glycerol from spent-lye	I.	Distillation under reduced pressure
D.	Aniline-water	II.	Steam distillation

52. The major product of the following reaction is



Ans. (3)

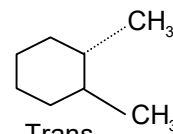
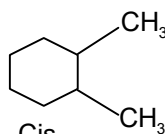
Sol.



53. Which one of the following compounds can exist as cis-trans isomers?

- (1) 1,2-Dimethylcyclohexane
- (2) Pent-1-ene
- (3) 2-Methylhex-2-ene
- (4) 1,1-Dimethylcyclopropane

Ans. (1)



Sol.

Cis
1, 2 – dimethyl
cyclohexane

Trans
1, 2 – dimethyl
cyclohexane

54. Among the following, choose the ones with equal number of atoms.

- A. 212g of Na_2CO_3 (s) [molar mass = 106 g]
- B. 248 g of Na_2O (s) [molar mass = 62 g]
- C. 240g of NaOH (s) [molar mass = 40g]
- D. 12g of H_2 (g) [molar mass = 2g]
- E. 220g of CO_2 (g) [molar mass = 44g]

Choose the correct answer from the options given below:

- (1) B, D, and E only
- (2) A, B and C only
- (3) A, B and D only
- (4) B, C and D only

Ans. (3)

Sol. (A) 212 g of Na_2CO_3

$$\text{No. of moles} = \frac{212}{106} = 2$$

$$\text{No. of atoms} = 2 \times 6 \times N_A = 12 N_A$$

(B) 248 g of Na_2O

$$\text{No. of moles} = \frac{248}{62} = 4$$

$$\text{No. of atoms} = 4 \times 3 \times N_A = 12 N_A$$

(C) 240 g of NaOH

$$\text{No. of moles} = \frac{240}{40} = 6$$

$$\text{No. of atoms} = 6 \times 3 \times N_A = 18 N_A$$

(D) 12 g of H_2

$$\text{No. of moles} = \frac{12}{2} = 6$$

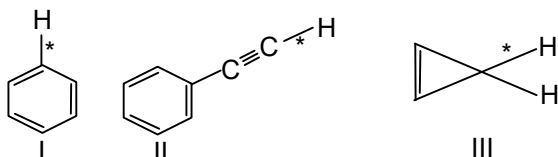
$$\text{No. of atoms} = 6 \times 2 \times N_A = 12 N_A$$

(E) 220 g of CO_2

$$\text{No. of moles} = \frac{220}{44} = 5$$

$$\text{No. of atoms} = 5 \times 3 \times N_A = 15 N_A$$

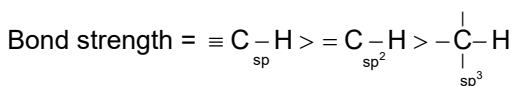
55. Among the given compounds I-III, the correct order of bond dissociation energy of C-H bond marked with * is



- (1) II > III > I
 (2) II > I > III
 (3) I > II > III
 (4) III > II > I

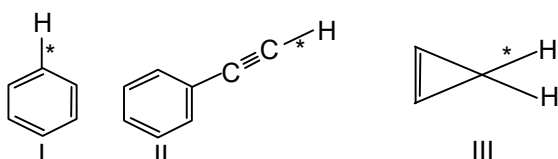
Ans. (2)

Sol. Bond dissociation energy \propto s-character.



B.D.E \propto Bond strength

Order of B.D.E = II > I > III



56. The standard heat of formation, in kcal/mol of Ba^{2+} is

(Given: standard heat of formation of SO_4^{2-} ion (aq) = -216 kcal/mol, standard heat of crystallization of BaSO_4 = -4.5 kcal/mol, standard heat of formation of BaSO_4 (S) = -349 kcal/mol)

- (1) +220.5
 (2) -128.5
 (3) -133.0
 (4) +133.0

Ans. (2)

Sol.

$$\Delta H_f(\text{BaSO}_4) = \Delta H_f(\text{Ba}^{2+}) + \Delta H_f(\text{SO}_4^{2-}) + \Delta H_{\text{Cryst}}(\text{BaSO}_4)$$

$$-349 = \Delta H_f(\text{Ba}^{2+}) - 216 - 4.5$$

$$\Delta H_f(\text{Ba}^{2+}) = -349 + 216 + 4.5$$

$$= -128.6 \text{ kcal / mole}$$

57. Consider the following compounds :



The oxidation states of the underlined elements in them are, respectively.

- (1) +4, -4, and +6
 (2) +1, -1, and +6
 (3) +2, -2, and +6
 (4) +1, -2, and +4

Ans. (2)

Sol. $\text{KO}_2 \rightarrow \text{K} = +1$ (Oxidation state)

$\text{H}_2\text{O}_2 \rightarrow \text{O} = -1$ (Oxidation state)

$\text{H}_2\text{SO}_4 \rightarrow \text{S} = +6$ (Oxidation state)

58. Out of the following complex compounds, which of the compound will be having the minimum conductance in solution?

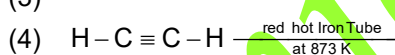
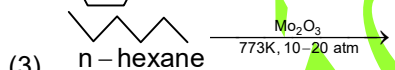
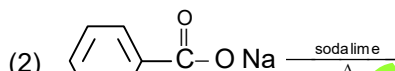
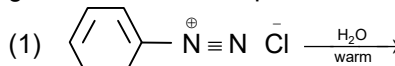
- (1) $[\text{Co}(\text{NH}_3)_5\text{Cl}]\text{Cl}$

- (2) $[\text{Co}(\text{NH}_3)_3\text{Cl}_3]$
 (3) $[\text{Co}(\text{NH}_3)_4\text{Cl}_2]$
 (4) $[\text{Co}(\text{NH}_3)_6]\text{Cl}_3$

Ans. (2)

Sol. $[\text{Co}(\text{NH}_3)_3\text{Cl}_3]$ has all three Cl atoms present in both 1° and 2° valency

59. Which one of the following reactions does NOT give benzene as the product?



Ans. (1)



60. Which of the following are paramagnetic?

- A. $[\text{NiCl}_4]^{2-}$ B. $\text{Ni}(\text{CO})_4$
 C. $[\text{Ni}(\text{CN})_4]^{2-}$ D. $[\text{Ni}(\text{H}_2\text{O})_6]^{2+}$
 E. $\text{Ni}(\text{PPh}_3)_4$

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

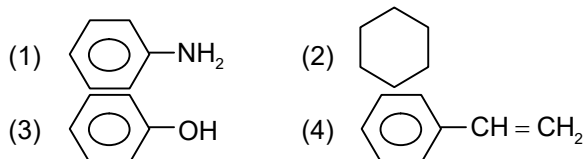
- (1) A, D and E only (2) A and C only
 (3) B and E only (4) A and D only

Ans. (4)

Sol. $[\text{NiCl}_4]^{2-}$ has weak field ligand of Cl^- the complex is paramagnetic

$[\text{Ni}(\text{H}_2\text{O})_6]^{2+}$ has weak field ligand of H_2O the complex is paramagnetic

61. Which one of the following compounds does not decolourize bromine water?



Ans. (2)

Sol. Cyclohexane is a Saturated hydro carbon it will not decolorize bromine water.

62. Match List-I with List-II

List - I		List - II	
A.	Haber process	I.	Fe catalyst
B.	Wacker oxidation	II.	PdCl_2
C.	Wilkinson catalyst	III.	$[(\text{PPh}_3)_3\text{RhCl}]$
D.	Ziegler catalyst	IV.	TiCl_4 with $\text{Al}(\text{CH}_3)_3$

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

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

Ans. (4)

Sol. Haber process - Fe catalyst

Wacker oxidation - PdCl₂

Wilkinson catalyst - [(PPh₃)₃RhCl]

Ziegler catalyst - TiCl₄ with Al(CH₃)₃

63. Match List I with List II

List – I (Name of Vitamin)		List – II (Deficiency disease)	
A.	Vitamin B ₁₂	I.	Cheilosis
B.	Vitamin D	II.	Convulsions
C.	Vitamin B ₂	III.	Rickets
D.	Vitamin B ₆	IV.	Pernicious anaemia

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

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

Ans. (3)

Sol. Vitamin B₁₂ → Pernicious anaemia

Vitamin D → Rickets

Vitamin B₂ → Cheilosis

Vitamin B₆ → Convulsions

64. Given below are two statements:

Statement I : Ferromagnetism is considered as an extreme form of paramagnetism.

Statement II : The number of unpaired electrons in a Cr²⁺ ion (Z=24) is the same as that of a Nd³⁺ ion (Z=60)

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

- (1) Statement I is false 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 true but Statement II is false

Ans. (4)

Sol. Ferromagnetic substance has unpaired electrons, attracted by magnetic field and retain the magnetization even after the external magnetic field removed

Paramagnetic substance does not retain magnetization after removal of magnetic field

Cr²⁺ → 3d⁴ (4 unpaired electrons)

Nd → 4f⁴ 6s²

Nd³⁺ → 4f³ (3 unpaired electrons)

65. If the half-life (t_{1/2}) for a first order reaction is 1 minute, then the time required for 99.9% completion of the reaction is closest to:

- (1) 10 minutes
- (2) 2 minutes
- (3) 4 minutes
- (4) 5 minutes

Ans. (1)

$$\text{Sol. } K_{99.9\%} = K_{50\%}$$

$$\frac{2.303}{t_{99.9\%}} \log \frac{100}{0.1} = \frac{2.303}{t_{50\%}} \log \frac{100}{50}$$

$$\frac{3}{t_{99.9\%}} = \frac{1}{1} \log_{10} 2$$

$$t_{99.9\%} = 10 \text{ minutes}$$

66. The correct order of decreasing basic strength of the given amines is:

- (1) benzenamine > ethanamine > N-methylaniline > N- ethylethanamine
- (2) N-methylaniline > benzenamine > ethanamine > N- ethylethanamine
- (3) N- ethylethanamine > ethanamine > benzenamine > N-methylaniline
- (4) N- ethylethanamine > ethanamine > N- methylaniline > benzenamine

Ans. (4)

Sol. Basic nature of amines α No. of Electron donating groups

Aliphatic amines are more basic than aromatic amines

67. Match List – I with List – II

List – I (Ion)		List – II (Group Number in cation analysis)	
A	Co ²⁺	I	Group I
B	Mg ²⁺	II	Group III
C	Pb ²⁺	III	Group IV
D	Al ³⁺	IV	Group VI

Choose the correct answer from the options given below

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

Ans. (3)

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

Co ²⁺	Group III (III)
Mg ²⁺	Group VI (IV)
Pb ²⁺	Group I (I)
Al ³⁺	Group III (II)

68. Phosphoric acid ionizes in three steps with their ionization constant values

K_{a_1} , K_{a_2} and K_{a_3} respectively

While K is the overall ionization constant.

Which of the following statements are true?

- A. $\log K = \log K_{a_1} + \log K_{a_2} + \log K_{a_3}$
- B. H_3PO_4 is a stronger acid than $H_2PO_4^-$ and HPO_4^{2-}
- C. $K_{a_1} > K_{a_2} > K_{a_3}$
- D. $K_{a_1} = \frac{K_{a_3} + K_{a_2}}{2}$

Choose the correct answer from the options given below

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

Ans. (1)

Sol. A) $K = K_1 \times K_2 \times K_3$

$$\log(K) = \log k_1 + \log k_2 + \log k_3 \text{ (True)}$$

B) H_3PO_4 is stronger acid than $H_2PO_4^-$ and HPO_4^{2-}

Highest K_a value for K_{a_1} (True)

C) $K_{a_1} > K_{a_2} > K_{a_3}$ ' first ionization step is more favourable than second which is more favorable than third (True)

D) $K_{a_1} = \frac{K_{a_3} + K_{a_2}}{2}$ This is (False)

b_3 'overall ionization constant is product of the individual ionization constants not their sum

69. Which of the following statement are true?

- A. Unlike Ga that has a very high melting point. Cs has very low melting point.
- B. On Pauling scale, the electro negativity values of N and Cl are not the same.
- C. Ar, K^+ , Cl^- , Ca^{2+} and S^{2-} are isoelectronic species.
- D. The correct order of first ionization enthalpies of Na, Mg, Al, and Si is $Si > Al > Mg > Na$.
- E. The atomic radius of Cs is greater than that of Li and Rb.

Choose the correct answer from the options given below

- (1) A, C, and E only
 (2) A, B, and E only
 (3) C and E only
 (4) C and D only

Ans. (3)

Sol. Ar, K^+ , Cl^- , Ca^{2+} and S^{2-} all are have 18 electrons.

70. Given below are two statements :

Statement I : Like nitrogen that can form ammonia, arsenic can form arsine.

Statement II : Antimony cannot form antimony pentoxide.

In the light of the above statement, 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. Nitrogen can form ammonia (NH_3). Arsenic can also form arsine (AsH_3).

Antimony can form antimony pentoxide (Sb_2O_5)

71. Which of the following aqueous solution will exhibit highest boiling point?

- (1) 0.015 M $C_6H_{12}O_6$
 (2) 0.01 M Urea
 (3) 0.01 M KNO_3
 (4) 0.01 M Na_2SO_4

Ans. (4)

Sol. Boiling point is proportional to number of solute particle in solution (i.e Van't Hoff factor i). Among the given option Na_2SO_4 has highest i (i.e i = 3)

72. Given below are two statements

Statement I: Benzenediazonium salt is prepared by the reaction of aniline with nitrous acid at 273 – 278 K. It decomposes easily in the dry state.

Statement II: Insertion of iodine into the benzene ring is difficult and hence iodobenzene is prepared through the reaction of benzenediazonium salt with KI.

In the light of the above statement , choose the most appropriate answer from the option given below:

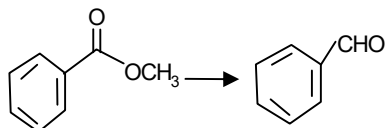
- (1) Statement I is incorrect but Statement II is correct
- (2) Both statement I and statement II are correct
- (3) Both statement I and statement II are incorrect
- (4) Statement I is correct but Statement II is incorrect

Ans. (2)

Sol. S-I: Benzenediazonium salt is prepared by the reaction of aniline with nitrous acid at 273 – 278 K. It decomposes easily in the dry state.

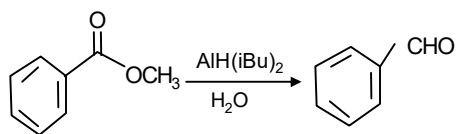
S-II: Direct iodination of benzene is difficult and hence iodobenzene is prepared through the reaction of benzenediazonium salt with KI.

73. Identify the suitable reagent for the following conversion



- (1) $\text{H}_2 / \text{pd} - \text{BaSO}_4$
 (2) (i) LiAlH_4 , (ii) $\text{H}^+ / \text{H}_2\text{O}$
 (3) (i) $\text{AlH}(\text{iBu})_2$ (ii) H_2O
 (4) (i) NaBH_4 , (ii) $\text{H}^+ / \text{H}_2\text{O}$

Ans. (3)



Sol.

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

Assertion (A): undergoes $\text{S}_{\text{N}}2$ reaction faster than Cl

Reason (R): Iodine is a better leaving group because of its large size.

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

- (1) A is false but R is true.
 (2) Both A and R are true 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. $\text{S}_{\text{N}}2$ order $1^\circ > 2^\circ > 3^\circ$

Given alkyl halides both are 1° then rate depends on leaving group and incoming nucleophile.

I^- is a better leaving group

75. The correct order of decreasing acidity of the following aliphatic acids is

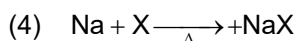
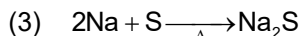
- (1) $\text{HCOOH} > (\text{CH}_3)_3\text{CCOOH} > (\text{CH}_3)_2\text{CHCOOH} > \text{CH}_3\text{COOH}$
 (2) $(\text{CH}_3)_3\text{CCOOH} > (\text{CH}_3)_2\text{CHCOOH} > \text{CH}_3\text{COOH} > \text{HCOOH}$
 (3) $\text{CH}_3\text{COOH} > (\text{CH}_3)_2\text{CHCOOH} > (\text{CH}_3)_3\text{CCOOH} > \text{HCOOH}$
 (4) $\text{HCOOH} > \text{CH}_3\text{COOH} > (\text{CH}_3)_2\text{CHCOOH} > (\text{CH}_3)_3\text{CCOOH}$

Ans. (4)

Sol. Acidic strength inversely proportional to electron donating groups.

76. Which one of the following reactions does NOT belong to 'Lassaigne's test'?

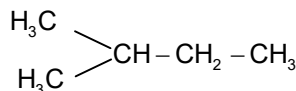
- (1) $2\text{CuO} + \text{C} \xrightarrow{\Delta} 2\text{Cu} + \text{CO}_2$
 (2) $\text{Na} + \text{C} + \text{N} \xrightarrow{\Delta} \text{NaCN}$



Ans. (1)

Sol. CuO using in Liebig's test to confirmation of carbon, hydrogen.

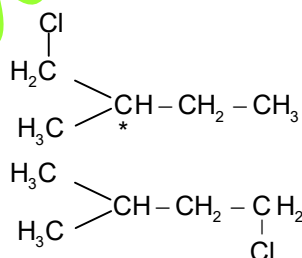
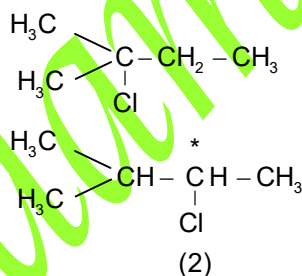
77. How many products (including stereoisomers) are expected from monochlorination of the following compound?



- (1) 6
 (2) 2
 (3) 3
 (4) 5

Ans. (1)

Sol. The number of monochlorinated products depends on the number of type of H which are in different chemical environments.



78. Sugar 'X'

- A. is found in honey.
 B. is a keto sugar.
 C. exists in α and β -anomeric forms.
 D. is laevorotatory.

'X' is

- (1) Sucrose
 (2) D-Glucose
 (3) D-Fructose
 (4) Maltose

Ans. (3)

Sol. (A) In Honey (Glucose & Fructose)
 (B) Fructose is keto sugar
 (C) Fructose can exist in α and β -anomeric forms.
 (D) D-fructose is a leavo-rotatory sugar.

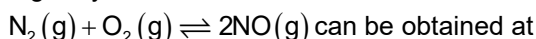
79. Dalton's atomic theory could not explain which of the following?

- (1) Law of gaseous volume
 (2) Law of conservation of mass
 (3) Law of constant proportion
 (4) Law of multiple proportion

Ans. (1)

Sol. Dalton's atomic theory could not explain:
Gaylussac's law of combining volumes

80. Higher yield of NO in



$[\Delta H \text{ of the reaction} = + 180.7 \text{ kJ mol}^{-1}]$

- A. Higher temperature
B. Lower temperature
C. Higher concentration of N_2
D. Higher concentration of O_2

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

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

Ans. (1)



i.e endothermic reaction;

The higher yield of No favours:

- A. Higher temperature
C. Higher concentration of N_2
D. Higher concentration of O_2

81. Match List – I with List – II

List – I		List – II	
A	XeO_3	I	Sp^3d ; linear
B	XeF_2	II	Sp^3 ; pyramidal
C	XeOF_4	III	Sp^3d^3 ; distorted octahedral
D	XeF_6	IV	Sp^3d^2 ; square pyramidal

Choose the correct answer from the options given below

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

Ans. (2)

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

XeO_3	Sp^3d ; pyramidal
XeF_2	Sp^3 ; linear
XeOF_4	Sp^3d^2 ; square pyramidal
XeF_6	Sp^3d^3 ; distorted octahedral

82. Match List – I with List – II

List – I (Example)		List – II (Type of solution)	
A	Humidity	I	Solid in solid
B	Alloys	II	Liquid in gas
C	Amalgams	III	Solid in gas
D	Smoke	IV	Liquid in solid

Choose the correct answer from the options given below

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

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

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

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

Ans. (3)

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

Humidity	Liquid in gas
Alloys	Solid in solid
Amalgams	Liquid in solid
Smoke	Solid in gas

83. Energy and radius of first Bohr orbit of He^+ and Li^{2+} are

(Given $R_H = 2.18 \times 10^{-18} \text{ J}$, $a_0 = 52.9 \text{ pm}$)

(1) $E_n(\text{Li}^{2+}) = - 8.72 \times 10^{-16} \text{ J}$

$r_n(\text{Li}^{2+}) = 17.6 \text{ pm}$

$E_n(\text{He}^+) = -19.62 \times 10^{-16} \text{ J}$;

$r_n(\text{He}^+) = 17.6 \text{ pm}$

(2) $E_n(\text{Li}^{2+}) = - 19.62 \times 10^{-18} \text{ J}$

$r_n(\text{Li}^{2+}) = 17.6 \text{ pm}$

$E_n(\text{He}^+) = -8.72 \times 10^{-18} \text{ J}$;

$r_n(\text{He}^+) = 26.4 \text{ pm}$

(3) $E_n(\text{Li}^{2+}) = - 8.72 \times 10^{-18} \text{ J}$

$r_n(\text{Li}^{2+}) = 26.4 \text{ pm}$

$E_n(\text{He}^+) = -19.62 \times 10^{-18} \text{ J}$;

$r_n(\text{He}^+) = 17.6 \text{ pm}$

(4) $E_n(\text{Li}^{2+}) = - 19.62 \times 10^{-16} \text{ J}$

$r_n(\text{Li}^{2+}) = 17.6 \text{ pm}$

$E_n(\text{He}^+) = -8.72 \times 10^{-16} \text{ J}$;

$r_n(\text{He}^+) = 26.4 \text{ pm}$

Ans. (2)

Sol. For He^+

$$E_1 = \frac{-2.18 \times 10^{-18} \times (2)^2}{(1)^2}$$

$$= -8.72 \times 10^{-18} \text{ J}$$

$$r_1 = \frac{52.9 \times (1)^2}{2}$$

$$= 26.45 \text{ pm}$$

For Li^{2+}

$$E_1 = \frac{-2.18 \times 10^{-18} \times 3^2}{1^2}$$

$$= -19.62 \times 10^{-18} \text{ J}$$

$$r_1 = \frac{52.9 \times (1)^2}{3}$$

$$= 17.63 \text{ pm}$$

84. Which among the following electronic configurations belong to main group elements?

A. $[\text{Ne}]3s^1$ B. $[\text{Ar}]3d^3 4s^2$

C. $[\text{Kr}]4d^{10} 5s^2 5p^5$ D. $[\text{Ar}]3d^{10} 4s^1$

E. $[\text{Rn}]5f^0 6d^2 7s^2$

Choose the correct answer from the option given below

- (1) A,C and D only (2) B and E only
(3) A and C only (4) D and E only

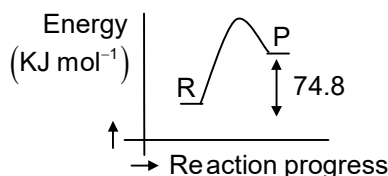
Ans. (3)

- Sol. A. (Ne) $3s^1$ = Sodium (Na) (Z = 11)
 B. (Ar) $3d^3 4s^2$ = Vanadium (V) Z = 23
 C. (Ke) $4d^{10} 5s^2 4s^1$ = Copper (Cu) Z = 29
 D. (Ar) $3d^{10} 4s^1$ = Copper (Cu) Z = 29
 E. (Rn) $5f^0 6d^2 7s^2$ = Thorium (Th) Z = 90
 Main Group elements are S & P block elements

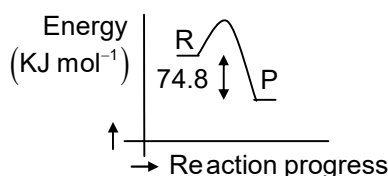
85. $C(s) + 2H_2(g) \rightarrow CH_4(g); \Delta H = -74.8 \text{ kJ mol}^{-1}$

Which of the following diagrams gives an accurate representation of the above reaction?

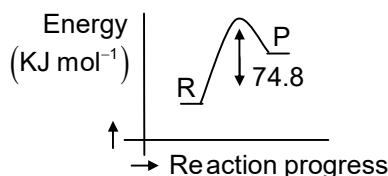
[R → reactants; P → Products]



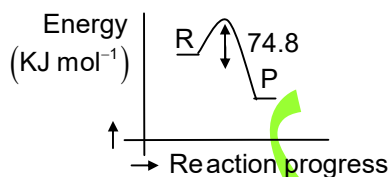
(1)



(2)



(3)



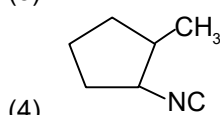
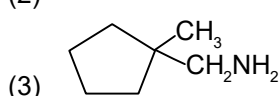
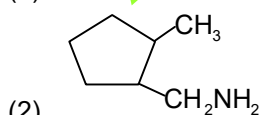
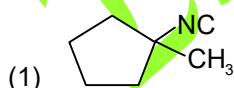
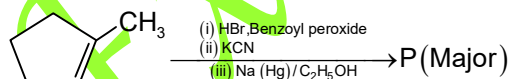
(4)

Ans. (2)

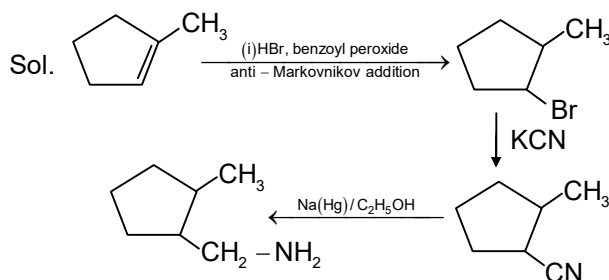
Sol. $\Delta H = -74.8 \text{ KJ/mole}$ \therefore Reaction is exothermic

$\therefore (E_a)_{\text{forward}} - (E_a)_{\text{backward}} = \Delta H$
 $= -74.8 \text{ KJ / mole}$

86. Predict the major product 'P' in the following sequence of reaction –



Ans. (2)



87. Identify the correct orders against the property mentioned

- A. $H_2O > NH_3 > CHCl_3$ dipole moment
 B. $XeF_4 > XeO_3 > XeF_2$ number of lone pairs on central atom
 C. $O-H > C-H > N-O$ Bond length
 D. $N_2 > O_2 > H_2$ Bond enthalpy

Choose the correct answer from the options given below

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

Ans. (2)

Sol. A. $H_2O > NH_3 > CHCl_3$
 $1.84 \text{ D} > 1.4 \text{ D} > 1.08 \text{ D}$

B. XeF_4 XeO_3 XeF_2
 2 lp 1 lp 3 lp
 $XeF_2 > XeF_4 > XeO_3$

C. $N-O > O-H > C-H \rightarrow$
 Bond length

N has 3 lone pair in N – O

O has 2 lone pair in O – H

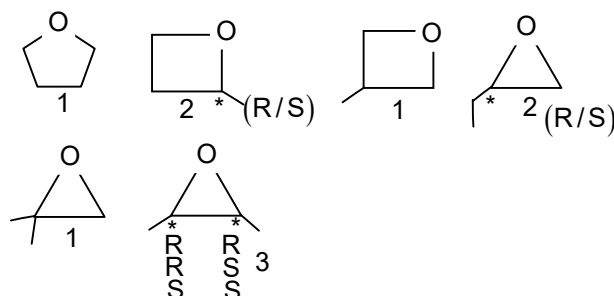
In N- O bond, lp – lp repulsion is more than L.P – B.P repulsion of O-H bond

D. $N \equiv N$ Bond order = 3
 $O = O$ Bond order = 2
 $H - H$ Bond order = 1
 $N_2 > O_2 > H_2$

Bond enthalpy \propto Bond order88. Total number of possible isomers (both structural as well as stereoisomers) of cyclic ethers of molecular formula C_4H_8O is

- (1) 11
 (2) 6
 (3) 8
 (4) 10

Ans. (4)

Sol. C_4H_8O - Cyclic ether isomers

89. For the reaction $A(g) \rightleftharpoons 2B(g)$, the backward reaction rate constant is higher than the forward reaction rate constant by a factor of 2500, at 1000K

[Given : $R=0.0831 \text{ L atm mol}^{-1}\text{K}^{-1}$]

- (1) 0.021
- (2) 83.1
- (3) 2.077×10^5
- (4) 0.033

Ans. (4)

$$\text{Sol. } K_C = \frac{K_f}{K_b}$$

$$K_b = 2500 \times K_f \\ = 0.0004 \rightarrow 4 \times 10^{-5}$$

$$K_p = K_C (RT)^{\Delta n} \\ = 4 \times 10^{-5} \times 0.083 \times 1000 \\ = 0.033$$

90. 5 moles of liquid X and 10 moles of liquid Y make a solution having a vapour pressure of 70 torr. The vapour pressure of pure X and Y are 63 torr and 78 torr respectively. Which of the following is true regarding the described solution?

- (1) The solution has volume greater than the sum of individual volumes.
- (2) The solution shows positive deviation.
- (3) The solution shows negative deviation.
- (4) The solution is ideal.

Ans. (3)

$$\text{Sol. } P_X = \frac{\text{no of moles of 'X'}}{\text{Total no of moles}} \times \text{V.P.}$$

$$= \frac{5}{15} \times 63 \\ = 31.5$$

$$P_Y = \frac{\text{no of moles of 'Y'}}{\text{Total no of moles}} \times \text{V.P.}$$

$$= \frac{5}{15} \times 70 = 35$$

$$\text{Total pressure} = 31.5 + 35 \\ = 66.5 \text{ torr}$$

Solution shows -ve Deviation

91. Which of the following is the unit of productivity of an Ecosystem?

- (1) $(\text{KCal m}^{-2})\text{yr}^{-1}$
- (2) gm^{-2}
- (3) KCal m^{-2}
- (4) KCal m^{-3}

Ans. (1)

Sol. The rate of biomass production is called productivity

It is expressed in terms of gm^{-2} or $(\text{KCal m}^{-2})\text{yr}^{-1}$

92. The first menstruation is called

- (1) Ovulation
- (2) Menopause
- (3) Menarche
- (4) Diapause

Ans. (3)

Sol. The first menstruation begins at puberty and is called menarche

93. Given below are two statements: one is labeled as Assertion (A) and the other is labeled as Reason (R)

Assertion (A): All vertebrates are chordates but all chordates are not vertebrate.

Reason (R): The members of subphylum vertebrata possess notochord during the embryonic period, the notochord is replaced by a cartilaginous or bony vertebral column in adults.

- (1) A is false but R is true
- (2) Both A and R are true but 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. Both A and R are true but R is the correct explanation of A

94. Genes R and Y follow independent assortment. If RRYy produce round yellow seeds and rryy produce wrinkled green seeds. What will be the phenotypic ratio of the F2 generation?

- (1) Phenotypic ratio – 9:7
- (2) Phenotypic ratio – 1:2:1
- (3) Phenotypic ratio – 3:1
- (4) Phenotypic ratio – 9:3:3:1

Ans. (4)

Sol. In dihybrid cross phenotypic ratio is 9:3:3:1

95. Given below are two statements:

Statement I: The DNA fragments extracted from gel electrophoresis can be used in construction of recombinant DNA.

Statement II: Smaller size DNA fragments are observed near anode while larger fragments are found near the wells in an agarose gel.

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

96. What is the main function of the spindle fibers during mitosis?

- (1) To regulate cell growth
- (2) To separate the chromosomes
- (3) To synthesize new DNA

- (4) To repair damaged DNA
- Ans. (2)
- Sol. Spindle fibers are microtubules which get attached to centromeres of chromosomes and help splitting two sister chromatids apart
97. How many meiotic and mitotic divisions need to occur for the development of a mature female gametophyte from the megaspore mother cell in an angiosperm plant?
- (1) No meiosis and 2 Mitosis
 (2) 2 Meiosis and 3 Mitosis
 (3) 1 Meiosis and 2 Mitosis
 (4) 1 Meiosis and 3 Mitosis
- Ans. (4)
- Sol. 1 meiosis to form 4 megaspores only 1 will survive the surviving megaspore undergoes 3 mitotic division to form 8 – nucleate embryo sac
98. Identify the statement that is **NOT** correct.
- (1) Constant region of heavy and light chains are located at C–terminus of antibody molecules.
 (2) Each antibody has two light and two heavy chains.
 (3) The heavy and light chains are held together by disulfide bonds.
 (4) Antigen binding site is located at C–terminal region of antibody molecules.
- Ans. (4)
- Sol. The antigen binding site is found in the variable region at the N–terminal end, not the C–terminal so, the statement is incorrect.
99. Consider the following:
- A) The reductive division for the human female gametogenesis starts earlier than that of the male gametogenesis.
 B) The gap between the first meiotic division and the second meiotic division is much shorter for males compared to females.
 C) The first polar body is associated with the formation of the primary oocyte.
 D) Luteinizing hormone (LH) surge leads to disintegration of the endometrium and onset of menstrual bleeding
- Choose the correct answer from the options given below:
- (1) B and C are true
 (2) A and B are true
 (3) A and C are true
 (4) B and D are true
- Ans. (2)
- Sol. A) The reductive division for the human female gametogenesis starts earlier than that of the male gametogenesis.
 B) The gap between the first meiotic division and the second meiotic division is much shorter for males compared to females.
 C) The first polar is associated with the formation of the secondary oocyte.

D) Luteinizing hormone (LH) surge leads to ovulation and formation of corpus luteum

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

Assertion (A): Cells of the tapetum possess dense cytoplasm and generally have more than one nucleus.

Reason (R): Presence of more than one nucleus in the tapetum increases the efficiency of nourishing the developing microspore mother cells. In the light of the above statements, choose the **most appropriate** answer from the options given below

- (1) A is false but R is true
 (2) Both A and R are true but 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. Presence of multinucleate condition provide nutrition to developing MMC

101. The blue and white selectable markers have been developed which differentiate recombinant colonies from non–recombinant colonies on the basis of their ability to produce colour in the presence of a chromogenic substrate.

Given below are two statements about this method:

Statement I: The blue coloured colonies have DNA insert in the plasmid and they are identified as recombinant colonies.

Statement II: The colonies without blue colour have DNA insert in the plasmid and are identified as recombinant colonies.

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. The blue coloured colonies indicate non–recombinants

102. In bryophytes, the gemmae help in which one of the following?

- (1) Gaseous exchange
 (2) Sexual reproduction
 (3) Asexual reproduction
 (4) Nutrient absorption

Ans. (3)

Sol. Gemmae help in asexual reproduction

103. Match List I with List II

List - I		List - II	
A.	Adenosine	I.	Nitrogen base
B.	Adenylic acid	II.	Nucleotide
C.	Adenine	III.	Nucleoside
D.	Alanine	IV.	Amino acid

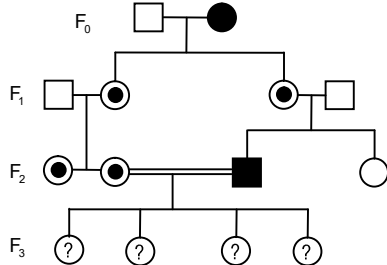
Choose the option with **all correct** matches.

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

Ans. (4)

Sol. Matching type

104. With the help of given pedigree, find out the probability for the birth of a child having no disease and being a carrier (has the disease mutation in one allele of the gene) in F₃ generation.



- Unaffected male
- Affected male
- Carrier female
- Unaffected female
- Affected female

- (1) Zero
- (2) 1/4
- (3) 1/2
- (4) 1/8

Ans. (2)

Sol. In the given pedigree the parents for F₃ generation is

- a) Female (Mother) is carrier X^CX
- b) Male (Father) is affected X^CY

The cross is

	X ^C	Y
X ^C	X ^C X ^C	X ^C Y
X	X ^C X	XY

So 25% (1/4 of child carrier)

105. Consider the following statements regarding function of adrenal medullary hormones

- A. It causes pupillary constriction
- B. It is a hyperglycemic hormone
- C. It causes piloerection
- D. It increases strength of heart contraction

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

- (1) D Only
- (2) C and D Only

- (3) B, C and D only
- (4) A, C and D only

Ans. (3)

Sol. a) Adrenal medullary hormones are adrenaline, nor adrenaline
b) Adrenaline causes pupillary dilation

106. Which of the following is an example of a zygomorphic flower?

- (1) Chilli
- (2) Petunia
- (3) Datura
- (4) Pea

Ans. (4)

Sol. Pea plant has zygomorphic flower

107. Who proposed that the genetic code for amino acid should be made up of three nucleotides?

- (1) Franklin Stahl
- (2) George Gamow
- (3) Francis Crick
- (4) Jacques Monod

Ans. (2)

Sol. The genetic code for amino acid should be made up of three nucleotides was given by George Gamow

108. Given below are two statements :

Statement I : In ecosystem, there is unidirectional flow of energy of sun from producers to consumers.

Statement II : Ecosystems are exempted from 2nd law of thermodynamics.

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. Statement I is correct but statement II is incorrect
Ecosystems are not exempted from 2nd law of thermodynamics.

109. Sweet potato and potato represent a certain type of evolution. Select the correct combination of terms to explain the evolution.

- (1) Analogy, divergent
- (2) Analogy, convergent
- (3) Homology, divergent
- (4) Homology, convergent

Ans. (2)

Sol. Sweet potato and potato represents Analogy, Convergent evolution

110. All living members of the class Cyclostomata are:

- (1) Ectoparasite
- (2) Free living
- (3) Endoparasite
- (4) Symbiotic

Ans. (1)

Sol. All living members of the class Cyclostomata are Ectoparasites

111. Histones are enriched with -

- (1) Phenylalanine & Arginine
- (2) Lysine & Arginine
- (3) Leucine & Lysine
- (4) Phenylalanine & Leucine

Ans. (2)

Sol. Histones are enriched with basic proteins Lysine & Arginine

112. Which one of the following equations represent the Verhulst-Pearl Logistic Growth of population?

- (1) $\frac{dN}{dt} = N \left(\frac{r-K}{K} \right)$
- (2) $\frac{dN}{dt} = r \left(\frac{K-N}{K} \right)$
- (3) $\frac{dN}{dt} = rN \left(\frac{K-N}{K} \right)$
- (4) $\frac{dN}{dt} = rN \left(\frac{N-K}{K} \right)$

Ans. (3)

Sol. The formula for logistic growth is $\frac{dN}{dt} = rN \left(\frac{K-N}{K} \right)$

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

Assertion (A) : The primary function of the Golgi apparatus is to package the materials made by the endoplasmic reticulum and deliver it to intracellular targets and outside the cell.

Reason (R) : Vesicles containing materials made by the endoplasmic reticulum fuse with the cis face of the Golgi apparatus, and they are modified and released from the trans face of the Golgi apparatus.

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

- (1) **A** is false but **R** is true
- (2) Both **A** and **R** are true 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. Both **A** and **R** are true and **R** is the correct explanation of **A**

114. Which of the following statements about RuBisCO is true?

- (1) It catalyzes the carboxylation of RuBp.
- (2) It is active only in the dark.
- (3) It has higher affinity for oxygen than carbon dioxide.
- (4) It is an enzyme involved in the photolysis of water.

Ans. (1)

Sol. RuBisCO is active in both light and dark, It has higher affinity to CO₂ than O₂ and it is an enzyme involved in dark reaction.

115. Match **List-I** with **List-II**.

List – I		List – II	
A.	Progesterone	I.	Pars intermedia
B.	Relaxin	II.	Ovary
C.	Melanocyte stimulating hormone	III.	Adrenal Medulla
D.	Catecholamines	IV.	Corpus luteum

Choose the correct answer from the options given below.

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

Ans. (2)

Sol. Matching type

116. The protein portion of an enzyme is called :

- (1) Prosthetic group
- (2) Cofactor
- (3) Coenzyme
- (4) Apoenzyme

Ans. (4)

Sol. The protein portion of an enzyme is called Apoenzyme

117. Which of the following enzyme(s) are **NOT** essential for gene cloning?

- A. Restriction enzymes
- B. DNA ligase
- C. DNA mutase
- D. DNA recombinase
- E. DNA polymerase

Choose the correct answer from the options given below :

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

Ans. (2)

Sol. DNA mutase and DNA recombinase are **NOT** essential for gene cloning

118. Which of the following type of immunity is present at the time of birth and is a non specific type of defences in the human body?

- (1) Humoral Immunity

- (2) Acquired Immunity
 (3) Innate Immunity
 (4) Cell-mediated Immunity

Ans. (3)

Sol. Innate immunity is the first line defense of body, present from birth and it responds to a wide range of pathogens without being specific to any particular pathogen

119. Which factor is important for termination of transcription?

- (1) γ (gamma)
 (2) α (alpha)
 (3) σ (sigma)
 (4) ρ (rho)

Ans. (4)

Sol. ρ (rho) factor is crucial protein in prokaryotes responsible for termination of transcription (Rho dependent terminators)

120. Which of the following hormones released from the pituitary is actually synthesized in the hypothalamus?

- (1) Adenocorticotrophic hormone (ACTH)
 (2) Luteinizing hormone (LH)
 (3) Anti-diuretic hormone (ADH)
 (4) Follicle-stimulating hormone FSH

Ans. (3)

Sol. The hormones oxytocin and Anti-diuretic hormone (ADH) are synthesized in hypothalamus and they are stored and released in the posterior pituitary gland.

121. Which of the following microbes is **NOT** involved in the preparation of household products?

- A. *Aspergillus niger*
 B. *Lactobacillus*
 C. *Trichoderma polysporum*
 D. *Saccharomyces cerevisiae*
 E. *Propionibacterium sharmanii*

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

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

Ans. (3)

Sol. *Aspergillus niger*, *Trichoderma polysporum* Generally not used in preparation of household products.

122. Given below are two statements:

Statement I : Fig fruits is a non-vegetarian fruit as it has enclosed fig wasps in it.

Statement II : Fig wasps and fig tree exhibit mutual relationship as fig wasps completes its life cycle in fig fruit and fig fruit get pollinated by fig wasp.

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. Fig plants (fruit) are not consider as non-vegetarian fruit because they depend on wasp for pollination but not for nutrition.

The wasp pollinates the fig inflorescence but not fruit.

123. Role of the water vascular system in Echinoderms is:

- A. Respiration and Locomotion
 B. Excretion and Locomotion
 C. Capture and transport of food
 D. Digestion and respiration
 E. Digestion and Excretion

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

- (1) B, D and E only
 (2) A and B only
 (3) A and C only
 (4) B and C only

Ans. (3)

Sol. Role of the water vascular system in Echinoderms is Respiration and Locomotion, Capture and transport of food.

124. After maturation, in primary lymphoid organs, the lymphocytes migrate for interaction with antigens to secondary lymphoid organ(s) / tissue(s) like :

- A. thymus B. bone marrow
 C. spleen D. lymph nodes
 E. Peyer's patches

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

- (1) C, D, E only
 (2) B, C, D only
 (3) A, B, C only
 (4) E, A, B only

Ans. (1)

Sol. Spleen, lymph nodes and Peyer's patches are secondary lymphoid organ(s)

125. Match **List-I** with **List-II**

List – I		List – II	
A.	The Evil Quartet	I.	Cryopreservation
B.	Ex situ conservation	II.	Alien species invasion
C.	Lantana camara	III.	Causes of biodiversity losses

D.	Dodo	IV.	Extinction
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Choose the option with all correct matches.

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

Ans. (3)

Sol. Matching type

126. Read the following statements on plant growth and development

- A. Parthenocarpy can be induced by auxins.
- B. Plant growth regulators can be involved in promotion as well as inhibition of growth.
- C. Dedifferentiation is a pre-requisite for re-differentiation.
- D. Abscisic acid is a plant growth promoter.
- E. Apical dominance promotes the growth of lateral buds.

- (1) B, D, E only
- (2) A, B, C only
- (3) A, C, E only
- (4) A, D, E only

Ans. (2)

Sol. Abscisic acid is a plant growth inhibitor, Apical dominance inhibits the growth of lateral buds.

127. Match List I with II.

List I

- A. Pteridophyte
- B. Bryophyte
- C. Angiosperm
- D. Gymnosperm

List II

- I. *Salvia*
- II. *Ginkgo*
- III. *Polytrichum*
- IV. *Salvinia*

Choose the option with all correct matches

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

Ans. (3)

Sol. Pteridophyte Example- *Salvinia*

Bryophyte Example- *Polytrichum*

Angiosperm example- *Salvia*

Gymnosperm example- *Ginkgo*

128. Why can't insulin be given to orally to diabetic patients?

- (1) Its bioavailability will be increased
- (2) Human body will elicit strong immune response
- (3) It will be digested in Gastro-Intestinal (GI) tract
- (4) Because of structural variation

Ans. (3)

Sol. Insulin is a proteinaceous enzyme which can be digested by Proteolytic enzymes produced in stomach, so Insulin must be taken through injection into blood stream directly.

129. Which one of the following is characteristic feature of gymnosperms?

- (1) Gymnosperms have flowers for reproduction.
- (2) Seeds are enclosed in fruits.
- (3) Seeds are naked.
- (4) Seeds are absent.

Ans. (3)

Sol. Gymnos means Naked,

Gymnosperms are seed plants but do not produce any flowers, Their seeds and ovules are not enclosed by any fruit wall or ovary wall but they are naked.

130. Frogs respire in water by skin and buccal cavity and on land by skin, buccal cavity and lungs

Choose the **correct** answer from the following:

- (1) The statement is false for both the environment
- (2) The statement is true for water but false for land
- (3) The statement is true for both the environment
- (4) The statement is false for water but true for land

Ans. (4)

Sol. Frogs breathe through their skin in both water and on land. Additionally, on land, they also use their buccal cavity and lungs for respiration.

131. Silencing of specific mRNA is possible via RNAi because of

- (1) Non-complementary ssRNA
- (2) Complementary dsRNA
- (3) Inhibitory ssRNA
- (4) Complementary tRNA

Ans. (2)

Sol. Silencing of specific mRNA is possible via RNA because of Complimentary dsRNA.

132. Twins are born to a family that lives next door to you. The twins are a boy and a girl. Which of the following must be true?

- (1) They have 75% identical genetic content.
- (2) They are monozygotic twins
- (3) They are fraternal twins
- (4) They were conceived through invitro fertilization

Ans. (3)

Sol. If the twins are a boy and a girl, then they are fraternal twins, this is because Fraternal twins develop from separate fertilized eggs, meaning they can have different sexes.

133. Match List –I with List – II.

List-I		List-II	
A.	Scutellum	I.	Persistent nucellus
B.	Non-albuminous seed	II.	Cotyledon of monocot seed
C.	Epiblast	III.	Groundnut
D.	Perisperm	IV.	Rudimentary

			cotyledon
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Choose the correct answer from the options given below

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

Ans. (2)

Sol. Scutellum – Cotyledon of monocot seed,
Non-albuminous seed – Groundnut
Epiblast – Rudimentary cotyledon
Perisperm – Persistent nucellus

134. In frog, the renal portal system is special venous connection that acts to link:

- (1) Kidney and lower part of body
- (2) Liver and intestine
- (3) Liver and kidney
- (4) Kidney and intestine

Ans. (1)

Sol. In frog, the renal portal system is special venous connection that exists in between Kidneys and lower part of body

135. Match List – I with List – II.

List-I		List-II	
A.	Heart	I.	Erythropoietin
B.	Kidney	II.	Aldosterone
C.	Gastro-intestinal tract	III.	Atrial natriuretic factor
D.	Adrenal Cortex	IV.	Secretin

Choose the correct answer from the options given below

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

Ans. (1)

Sol. Matching type

136. Cardiac activities of the heart are regulated by

- A. Nodal tissue
- B. A special neural centre in the medulla oblongata
- C. Adrenal medullary hormones
- D. Adrenal cortical hormones

Choose the correct answer from the options given below:

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

Ans. (2)

Sol. Cardiac activities of the heart are regulated by

- A. Nodal tissue
- B. A special neural centre in the medulla oblongata
- C. Adrenal medullary hormones

137. Streptokinase produced by bacterium Streptococcus is used for

- (1) Removing clots from blood vessels
- (2) Curd production
- (3) Ethanol production
- (4) Liver disease treatment

Ans. (1)

Sol. Streptokinase produced by bacterium Streptococcus is used for Removing clots from blood vessels

138. Who is known as the father of Ecology in India?

- (1) Birbal Sahni
- (2) S. R. Kashyap
- (3) Ramdeo Misra
- (4) Ram Udar

Ans. (3)

Sol. Father of Ecology in India is Ramdeo Misra

139. Given below are two statements : One is labelled as Assertion (A) and the other is labelled as Reason (R). Assertion (A) : A typical unfertilized, angiosperm embryo sac at maturity is 8 nucleate and 7-celled.

Reason (R) : The egg apparatus has 2 polar nuclei.

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

- (1) A is false but R is true
- (2) Both A and R are true 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. (4)

Sol. A is true but R is false, egg apparatus do not contain polar nuclei

140. Neoplastics of cells refer to :

- A. A mass of proliferating cell
- B. Rapid growth of cells
- C. Invasion and damage to the surrounding tissue
- D. Those confined to original location

Choose the correct answer from the options given below:

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

Ans. (3)

Sol. All are correct expect D

Neoplastic characteristics of cells are not confined to original location. They are spread to other parts of the body

141. Given below are the stages in the life cycle of pteridophytes. Arrange the following stages in the correct sequence.

- A. Prothallus stage
- B. Meiosis in spore mother cells

- C. Fertilisation
 D. Formation of archegonia and antheridia in gametophyte.
 E. Transfer of antherozoids to the archegonia in presence of water.

Choose the correct answer from the options given below:

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

Ans. (2)

Sol. B. Meiosis in spore mother cells

- A. Prothallus stage
 D. Formation of archegonia and antheridia in gametophyte.
 E. Transfer of antherozoids to the archegonia in presence of water.
 C. Fertilisation

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

Assertion (A) : Both wind and water pollinated flowers are not very colourful and do not produce nectar.

Reason (R) : The flowers produce enormous amount of pollen grains in wind and water pollinated flowers.

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

- (1) A is false but R is true
 (2) Both A and R are true 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. Both A and R are true and R is the correct explanation of A

143. Which one of the following enzymes contains 'Haem' as the prosthetic group?

- (1) Catalase
 (2) RuBisCo
 (3) Carbonic anhydrase
 (4) Succinate dehydrogenase

Ans. (1)

Sol. 'Haem' as the prosthetic group for catalase and Peroxidase.

144. Match List – I with List – II

List – I	List – II
A. Emphysema	I. Rapid spasms in muscle due to low Ca^{++} in body fluid
B. Angina Pectoris	II. Damaged alveolar walls and decreased respiratory surface

- C. Glomerulonephritis III. Acute chest pain when not enough oxygen is reaching to heart muscle
 D. Tetany IV. Inflammation of glomeruli of kidney

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

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

Ans. (1)

Sol. A – II, B – III, C – IV, D – I

145. Find the statement that is NOT correct with regard to the structure of monocot stem

- (1) Phloem parenchyma is absent
 (2) Hypodermis is parenchymatous
 (3) Vascular bundles are scattered
 (4) Vascular bundles are conjoint and closed

Ans. (2)

Sol. Hypodermis is pharenchymotous

146. Which of the following statement is **correct** about location of the male frog copulatory pad?

- (1) First digit of the fore limb
 (2) First and Second digit of fore limb
 (3) First digit of hind limb
 (4) Second digit of fore limb

Ans. (1)

Sol. First digit of fore limb

147. Given below are two statements:

Statement I : The primary source of energy in an ecosystem is solar energy

Statement II : The rate of production of organic matter during photosynthesis in an ecosystem is called net primary productivity (NPP)

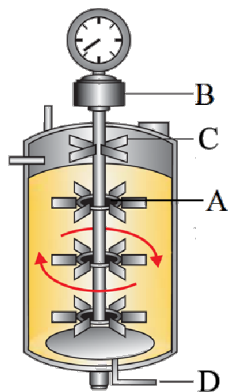
In the light the above statements, choose the **most appropriate** answer from the options given below

- (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)

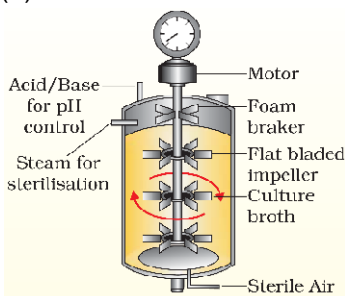
Sol. Statement I is correct, but statement II is incorrect
 The rate of production of organic matter during photosynthesis in an ecosystem is called GPP (Gross primary productivity)

148. Identify the part of a bio-reactor which is used as a foam braker from the given figure



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

Ans. (1)



Sol.

149. Polymerase chain reaction (PCR) amplifies DNA following the equation

- (1) $2N^2$
- (2) N^2
- (3) 2^n
- (4) $2n + 1$

Ans. (3)

Sol. 2^n (where n = number of cycles)

150. Match List – I with List – II

- | List – I | List – II |
|-----------------|----------------------|
| A. Head | I. Enzymes |
| B. Middle piece | II. Sperm motility |
| C. Acrosome | III. Energy |
| D. Tail | IV. Genetic material |

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

Ans. (2)

Sol. A – IV, B – III, C – I, D – II

151. Given below are two statements:

Statement I : In a floral formula \oplus stands for zygomorphic nature of the flower, and \underline{G} stands for inferior ovary.

Statement II : In a floral formula \oplus stands for actinomorphic nature of the flower and \underline{G} stands for superior ovary.

In the light of the above statements, choose the correct 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. In a floral formula, the symbol \oplus stands for actinomorphic (radially symmetrical) nature of the flower. The symbol " \underline{G} " represents a superior ovary. Therefore statement II is correct.

152. From the statements given below choose the **correct** option:

- A. The eukaryotic ribosomes are 80S and prokaryotic ribosomes are 70S.
- B. Each ribosome has two sub-units
- C. The two sub-units of 80S ribosomes are 60S and 40S while that of 70S are 50S and 30S.
- D. The two sub-units of 80S ribosomes are 60S and 20S and that of 70S are 50S and 20S.
- E. The two sub-units of 80S are 60S and 30S and that of 70S are 50S and 30S.

- (1) B, D, E are true
- (2) A, B, C are true
- (3) A, B, D are true
- (4) A, B, E are true

Ans. (2)

Sol. Prokaryotic ribosomes are 70S, sub-units are 50S and 30S
Eukaryotic ribosomes are 80S, sub-units are 60S and 40S.

153. Each of the following characteristics represent a Kingdom proposed by Whittaker. Arrange the following in increasing order of complexity of body organization.

- A. Multicellular heterotrophs with cell wall made of chitin.
- B. Heterotrophs with tissue/organ/ organ system level of body organization.
- C. Prokaryotes with cell wall made of polysaccharides and amino acids.
- D. Eukaryotic autotrophs with tissue/organ level of body organization.
- E. Eukaryotes with cellular body organization.

Choose the correct answer from the options given below:

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

Ans. (3)

Sol. C. Prokaryotes with cell wall made of polysaccharides and amino acids seen in Monera
E. Eukaryotes with cellular body organization seen in Protista

- A. Multicellular heterotrophs with cell wall made of chitin seen in Fungi
 D. Eukaryotic autotrophs with tissue/organ level of body organization seen in plants
 B. Heterotrophs with tissue/organ/organ system level of body organization seen in Animalia
 Order of Kingdoms evolution is Monera-Protista-Mycota-Plantae-Animalia.

154. The correct sequence of events in the life cycle of bryophytes is

- A. Fusion of antherozoid with egg.
 B. Attachment of gametophyte to substratum.
 C. Reduction division to produce haploid spores.
 D. Formation of sporophyte
 E. Release of antherozoids into water.

Choose the correct answer from the options given below :

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

Ans. (4)

Sol. In Bryophytes main plant body is Gametophyte with reproductive organs like antheridium and archegonium once plant is well established in suitable habitat will release Antherozoids (male gametes).

They will fuse with Egg located in archegonium results zygote (2n),

Zygote develops into Sporophyte which is differentiates into foot, seta, capsule,

Capsule containing sporogenous tissue divides meiotically and produces haploid spores,

Spores release from capsule and germinates in favourable conditions like a new gametophyte.

155. Which are correct :

- A. Computed tomography and magnetic resonance imaging detect cancers of internal organs.
 B. Chemotherapeutic drugs are used to kill non-cancerous cells.
 C. α interferon activate the cancer patients immune system and helps in destroying the tumour.
 D. Chemotherapeutic drugs are biological response modifiers.
 E. In the case of leukaemia blood cell counts are decreased.

Choose the correct answer from the option given below:

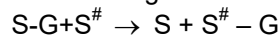
- (1) A and C only
 (2) B and D only
 (3) D and E only
 (4) C and D only

Ans. (1)

Sol. 1. CT-Scan, MRI-scan for cancer diagnosis of internal organs.

2. α interferon activate the cancer patients Immune system and helps in destroying the tumour.

156. Name the class of enzyme that usually catalyze the following reaction:



Where, G \rightarrow a group other than hydrogen

S \rightarrow a substrate

S[#] \rightarrow another substrate

- (1) Ligase (2) Hydrolase
 (3) Lyase (4) Transferase

Ans. (4)

Sol. Enzymes catalyzing a transfer of a group G (other than hydrogen) between pair of substrates S and S[#]

157. Find the correct statements:

- A. In human pregnancy, the major organ systems are formed at the end of 12 weeks
 B. In human pregnancy the major organ systems are formed at the end of 8 weeks
 C. In human pregnancy heart is formed after one month of gestation
 D. In human pregnancy, limbs and digits develop by the end of second month
 E. In human pregnancy the appearance of hair is usually observed in the fifth month

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

- (1) A, C, D and E only (2) A and E only
 (3) B and C only (4) B, C, D and E only

Ans. (1)

Sol. A. In human pregnancy, the major organ systems are formed at the end of 12 weeks

- C. In human pregnancy heart is formed after one month of gestation
 D. In human pregnancy, limbs and digits develop by the end of second month
 E. In human pregnancy the appearance of hair is usually observed in the fifth month

158. Which of the following is an example of non-distilled alcoholic beverage produced by yeast?

- (1) Rum (2) Whisky
 (3) Brandy (4) Beer

Ans. (4)

Sol. Beer is an example of non-distilled alcoholic beverage produced by yeast

159. Given below are two statements:

Statement I: In the RNA world, RNA is considered the first genetic material evolved to carry out essential life processes. RNA acts as a genetic material and also as a catalyst for some important biochemical reactions in living systems, Being reactive, RNA is instable.

Statement II: DNA evolved from RNA and is a more stable genetic material. Its double helical

strands being complementary, resists changes by evolving repairing mechanism.

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

160. Given below are two statements :

Statements I : Transfer RNAs and ribosomal RNA do not interact with mRNA

Statements II : RNA interference (RNAi) takes place in all eukaryotic organisms as a method of cellular defence.

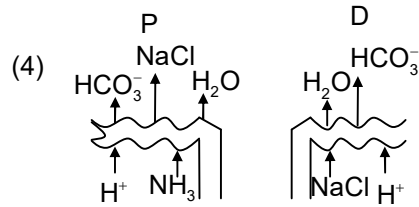
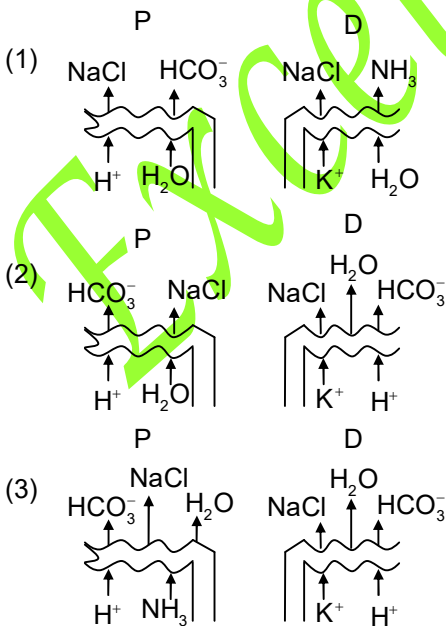
In the light of the above statements, choose the **most appropriate** answer from the options given below :

- (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. Transfer RNAs and ribosomal RNA interacts with mRNA during translation.

161. Which of the following diagram is correct with regard to the proximal (P) and distal (D) tubule of the Nephron.



Ans. (3)

Sol. K^+ is reabsorbed in PCT, K^+ is secreted in DCT

162. What is the pattern of inheritance for polygenic trait?

- (1) X-linked recessive inheritance pattern
- (2) Mendelian inheritance pattern
- (3) Non-mendelian inheritance pattern
- (4) Autosomal dominant pattern

Ans. (3)

Sol. The pattern of inheritance for polygenic trait is Non-mendelian inheritance pattern

163. In the seeds of cereals, the outer covering of endosperm separates the embryo by a protein-rich layer called :

- (1) Aleurone layer
- (2) Coleoptile
- (3) Coleorhiza
- (4) Integument

Ans. (1)

Sol. In the seeds of cereals, the outer covering of endosperm separates the embryo by a protein-rich layer called Aleurone layer

164. Match List I with List II

List – I		List – II	
A.	Chlorophyll a	I.	Yellow-green
B.	Chlorophyll b	II.	Yellow
C.	Xanthophylls	III.	Blue-green
D.	Carotenoids	IV.	Yellow to Yellow-orange

Choose the option with all **correct** matches.

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

Ans. (3)

Sol. Matching type

165. Which of the following generically engineered organisms was used by Eli Lilly to prepare human insulin?

- (1) Phage
- (2) Bacterium
- (3) Yeast
- (4) Virus

Ans. (2)

Sol. Bacterium (E. coli)

The genetically engineered organism used by Eli Lilly to prepare human insulin is Escherichia coli (E. coli). Eli Lilly used recombinant DNA technology to insert the human insulin gene into E. coli, which then produced synthetic "human" insulin, marketed as Humulin—the first genetically engineered drug approved for human use

166. Which of the following are the post-transcriptional events in an eukaryotic cell?

- Transport of pre-mRNA to cytoplasm prior to splicing
- Removal of introns and joining of exons
- Addition of methyl group at 5' end of hnRNA
- Base pairing of two complementary RNAs

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

- C, D, E only
- A, B, C only
- B, C, D only
- B, C, E only

Ans. (3)

Sol. B C D only

The correct post-transcriptional events in a eukaryotic cell are:

- Removal of introns and joining of exons
- Addition of methyl group at 5' end of hnRNA (capping)
- Addition of adenine residue at 3' end of hnRNA (polyadenylation)

A is incorrect: Pre-mRNA is not transported to the cytoplasm before splicing—splicing happens in the nucleus.

E is not a typical post-transcriptional modification of mRNA in eukaryotes—it refers more to RNA interference or siRNA activity.

167. Match List – I with List – II

List – I		List – II	
A	Centromere	I	Mitochondrion
B	Cilium	II	Cell division
C	Cristae	III	Cell movement
D	Cell membrane	IV	Phospholipid Bilayer

Choose the correct answer from the options given below :

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

Ans. (1)

Sol. Centromere is crucial for accurate chromosome segregation during cell division

Cilium has locomotion and sensing function which facilitates cell movement

Cristae are the inner folding of inner mitochondrial membrane which increases surface area for ETC and ATP synthesis

Cell membranes fundamental structure is the phospholipid bilayer which acts as barrier between aqueous compartment

168. Match List I with List II :

List – I		List – II	
A	Alfred Hershey and Martha Chase	I	Streptococcus pneumonia
B	Euchromatin	II	Densely packed and light-stained
C	Frederick Griffith	III	Loosely packed and dark-stained
D	Heterochromatin	IV	DNA as genetic material confirmation

Choose the correct answer from the option given below:

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

Ans. (4)

Sol. A. Hershey and chase experiment where pivotal to establish DNA as genetic material

B. Euchromatin is generally less condensed and contain most actively transcribed genes

C. Frederick Griffith demonstrated that genetic information could be transferred between bacterial strains

D. Heterochromatin is darkly stained under microscope found near centromeres and telomeres

169. Which chromosome in the human genome has the highest number of genes?

- Chromosome 10
- Chromosome X
- Chromosome Y
- Chromosome 1

Ans. (4)

Sol. Chromosome 1 has the highest number of genes (2968) and Chromosome Y has fewest number of genes (231).

170. What are the potential drawbacks in adoption of the IVF method?

- High fatality risk to mother
- Expensive instruments and reagents
- Husband/wife necessary for being donors
- Less adoption of orphans
- Not available in India
- Possibility that the early embryo does not survive

Choose the correct answer from the options given below:

- A, B, C, E, F only
- B, D, F only
- A, C, D, F only
- A, B, C, D, only

Ans. (2)

Sol. B. Expensive instruments and reagents

D. Less adoption of orphan,

F. Possibility that the early embryo does not survive

171. Which one of the following is an example of ex-situ conservation?

- Protected areas
- National Park
- Wildlife Sanctuary
- Zoos and botanical gardens

Ans. (4)

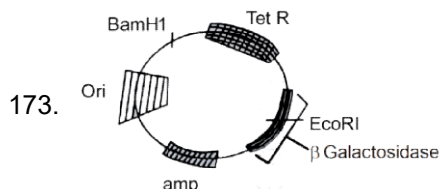
Sol. Zoos and botanical gardens are included under ex-situ conservation

172. A specialised membranous structure in a prokaryotic cell which helps in cell wall formation, DNA replication and respiration is

- (1) Endoplasmic Reticulum
- (2) Mesosome
- (3) Chromatophores
- (4) Cristae

Ans. (2)

Sol. Mesosomes are the specialized membranous structure in a prokaryotic cell which helps in cell wall formation, DNA replication and respiration.



In the above represented plasmid an alien piece of DNA is inserted at EcoRI site. Which of the following strategies will be chosen to select the recombinant colonies?

- (1) Blue color colonies grown on ampicillin plates can be selected
- (2) Using ampicillin & tetracyclin containing medium plate
- (3) Blue color colonies will be selected
- (4) White color colonies will be selected

Ans. (4)

Sol. In the above represented plasmid an alien piece of DNA is inserted at EcoRI site. White color colonies will be selected in the given plasmid diagram, a foreign DNA fragment is inserted at the EcoRI site, which lies within the β -galactosidase gene (often used in blue-white screening). This gene allows colonies to turn blue in the presence of X-gal only if it is functional. Insertion of DNA at the EcoRI site disrupts this gene, resulting in white colonies.

174. What is the name of the blood vessel that carries deoxygenated blood from the body to the heart in a frog?

- (1) Vena cava
- (2) Aorta
- (3) Pulmonary artery
- (4) Pulmonary vein

Ans. (1)

Sol. The blood vessel that carries deoxygenated blood from the body to the heart in a frog is called the precaval vein (also known as the anterior vena cava) and the postcaval vein (posterior vena cava). These veins bring deoxygenated blood into the right atrium of the frog's three-chambered heart

175. Which of following organisms cannot fix nitrogen?

- A. *Azotobacter*
- B. *Oscillatoria*
- C. *Anabaena*
- D. *Volvox*
- E. *Nostoc*

Choose the correct answer from the options given below:

- (1) E only
- (2) A only
- (3) D only
- (4) B only

Ans. (3)

Sol. *Volvox* is green algae won't fix nitrogen.

176. While trying to find out the characteristic of a newly found animal, a researcher did the histology of adult animal and observed a cavity with presence of mesodermal tissue towards the body wall but no mesodermal tissue was observed towards the alimentary canal. What could be the possible coelome of that animal?

- (1) Spongocoelomate
- (2) Acoelomate
- (3) Pseudocoelomate
- (4) Schizocoelomate

Ans. (3)

Sol. The observation suggests that the animal has a pseudocoelom, a body cavity that is: lined by mesoderm only on the outer side (towards the body wall) Not lined by mesoderm on the inner side (towards the gut)

177. Which one of the following statements refers to Reductionist Biology?

- (1) Behavioural approach to study and understand living organisms
- (2) Physico-chemical approach to study and understand living organisms
- (3) Physiological approach to study and understand living organisms
- (4) Chemical approach to study and understand living organisms

Ans. (2)

Sol. Reductionist Biology is primarily physico-chemical approach. It involves explaining biological phenomena in terms of their underlying physical and chemical properties, often down to the molecular and even atomic level.

178. Epiphytes that are growing on a mango branch is an example of which of the following?

- (1) Amensalism
- (2) Commensalism
- (3) Mutualism
- (4) Predation

Ans. (2)

Sol. Commensalism : This is the interaction in which one species gets benefited and the other is neither benefited nor harmed.

179. Which one of the following phytohormones promotes nutrient mobilization which helps in the delay of leaf senescence in plants?

- (1) Cytokinin
- (2) Ethylene
- (3) Abscisic acid
- (4) Gibberellin

Ans. (1)

Sol. Cytokinin promotes nutrient mobilisation which helps in the delay of leaf senescence in plants

180. The complex II of mitochondrial electron transport chain is also known as

- (1) NADH dehydrogenase
- (2) Cytochrome bc_1
- (3) Succinate dehydrogenase
- (4) Cytochrome c oxidase

Ans. (3)

Sol. The complex II of Mitochondrial electron transport chain is also known as succinate dehydrogenase