Question no. 1

In series LR circuit $X_L = R$ and power factor of the circuit is P_1. When capacitor with capacitance C such that $X_L = X_C$ is put in series, the power factor becomes P_2. The ratio $\frac{P_1}{P_2}$ is:

(1) $\frac{1}{2}$

(2) $\frac{1}{\sqrt{2}}$

(3) $\frac{\sqrt{3}}{\sqrt{2}}$

(4) 2 : 1

LR →

$$P_1 = \cos\phi = \frac{R}{\sqrt{R^2 + X_L^2}}$$

$$P_1 = \frac{R}{R\sqrt{2}}$$

$$P_1 = \frac{1}{\sqrt{2}}$$

LCR →

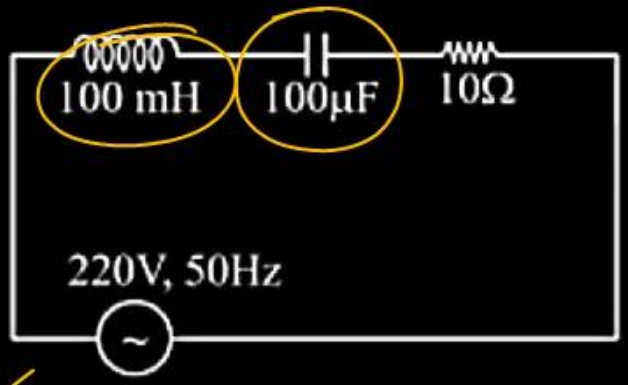
$$P_2 = \cos\phi = \frac{R}{\sqrt{R^2 + (X_L - X_C)^2}} \to 0$$

$$P_2 = 1$$

$$\frac{P_1}{P_2} = \frac{\frac{1}{\sqrt{2}}}{1} = \frac{1}{\sqrt{2}}$$

Question no. 2

In a series LCR circuit, the inductance, capacitance and resistance are L = 100 mH, C = 100 μF and R = 10Ω respectively. If a voltage source of 220 V and frequency of 50 Hz is connected in series. The approximate value of current in the circuit will be–



(1) 22 A

(2) 18 A

(3) 11 A

(4) 42 A

$Z = \sqrt{R^2 + (X_L - X_C)^2}$

$X_L = \omega L = 2\pi f \cdot L = 2\pi \times 50 \times 100 \times 10^{-3}$

$= 100\pi \times 100 \times 10^{-3}$

$X_L = 10\pi\ (\Omega)$

$X_C = \frac{1}{\omega C} \Rightarrow X_C = \frac{1}{2\pi f \times C}$

$X_C = \frac{1}{100\pi \times 100 \times 10^{-6}}$

$R = 10\Omega \qquad X_C = \frac{100}{\pi}\ (\Omega)$

$Z = \sqrt{(10)^2 + \left(10\pi - \frac{100}{\pi}\right)^2}$

$Z = \sqrt{100 + \left(\frac{100\pi^2 - 100}{\pi}\right)^2}$

$Z = \sqrt{100 + (100 - 100)^2}$

$Z = 10\Omega$

$V = IZ \Rightarrow 220 = 10 \times I$

$\Rightarrow I = 22$

Question no. 3

An AC current is given by $I = I_1 \sin \omega t + I_2 \cos \omega t$.

then the reading of a hot wire ammeter will be–

(1) $\sqrt{\frac{I_1^2 + I_2^2}{2}}$

(2) $\frac{I_1 + I_2}{\sqrt{2}}$

(3) $\frac{I_1 + I_2}{2\sqrt{2}}$

(4) $\sqrt{\frac{I_1^2 - I_2^2}{\sqrt{2}}}$

$A\sin\theta + B\cos\theta$

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

$A' = \sqrt{A^2 + B^2 + 2AB\cos\phi}$

$I_{RMS} = \frac{I_0}{\sqrt{2}}$

$I_{RMS} = \frac{\sqrt{I_1^2 + I_2^2}}{\sqrt{2}}$

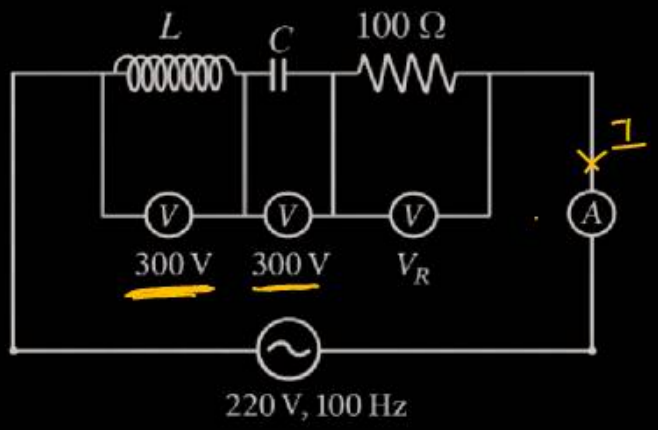
$= \sqrt{\frac{I_1^2 + I_2^2}{2}}$

$I_0 = \sqrt{I_1^2 + I_2^2 + 2 I_1 I_2 \cos\frac{\pi}{2}}$

$I_0 = \sqrt{I_1^2 + I_2^2}$

Question no. 4

In an LCR circuit shown in the following figure, what will be the readings of the voltmeter across the resistor and ammeter if an a.c. source of 220 V and 100 Hz is connected to it as shown?



(1) 800 V, 8A

(2) 110 V, 1.1 A

(3) 300 V, 3 A

(4) 220 V, 2.2 A

$V_S = \sqrt{V_R^2 + (V_L - V_C)^2}$

$220 = \sqrt{V_R^2 + (300 - 300)^2}$

$V_R = 220$ volt

$V = I \cdot Z$ → 100Ω

$220 = I \times 100$

$I = 2.2$ (A)

Question no. 5

The magnetic flux through a coil perpendicular to its plane is varying according to the relation $\phi = (5t^3 + 4t^2 + 2t - 5)$ Weber. If the resistant of the coil is 5 ohm, then the induced current through the coil at t = 2 sec will be:

(1) 15.6A

(2) 16.6 A

(3) 17.6 A

(4) 18.6 A

$$\mathcal{E} = \frac{d\phi}{dt}$$

$$\mathcal{E} = \frac{d}{dt}(5t^3 + 4t^2 + 2t - 5)$$

$$\mathcal{E} = 15t^2 + 8t + 2$$

$$\mathcal{E} = 15 \times (2)^2 + 8 \times 2 + 2$$

$$\mathcal{E} = 15 \times 4 + 16 + 2$$

$$\mathcal{E} = 60 + 18$$

$$\mathcal{E} = 78 \text{ Volt}$$

$$i = \frac{\mathcal{E}}{R} = \frac{78}{5} = 15.6 \text{ A}$$

Question no. 6

A closed coil of copper whose area is 1m × 1 m, is free to rotate about an axis. The coil is placed perpendicular to a magnetic field of 0.10 Wb/m^2. It is rotated through 180° in 0.01 second. The induced e.m.f. and induced current in the coil will respectively be – (The resistance of the coil is 2.0Ω)

(1) 20 V, 10 A

(2) 10 V, 20 A

(3) 10 V, 10A

(4) 20 V, 20 A

$B = 0.10 \frac{w}{m^2}$

$\Delta t = 0.01 sec$.

$\mathcal{E} = \frac{2BA}{\Delta t}$.

$\mathcal{E} = \frac{2 \times 0.10 \times 1}{0.01}$

$\mathcal{E} = 20 volt$.

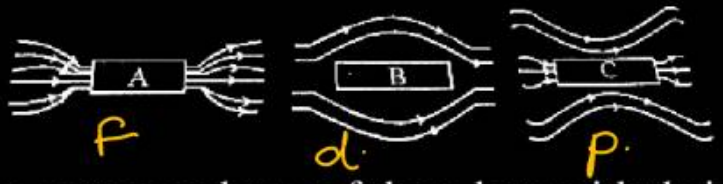
$i = \frac{\mathcal{E}}{R}$.

$i = \frac{20}{2}$

$i = 10A$

Question no. 7

Three identical bars A, B and C are made of different magnetic materials. When kept in a uniform magnetic field, the field lines around them loop as follows:



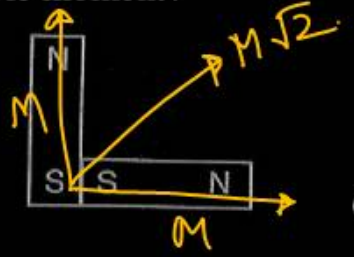
Make correspondence of these bars with their material being diamagnetic, ferromagnetic and paramagnetic :

	(A)	(B)	(C)
(1)	diamagnetic	ferromagnetic	paramagnetic
(2)	paramagnetic	ferromagnetic	diamagnetic
(3)	diamagnetic	paramagnetic	ferromagnetic
(4)	ferromagnetic	diamagnetic	paramagnetic

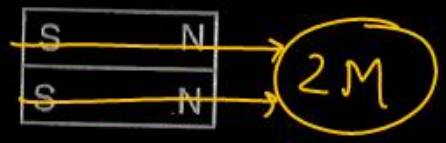
Question no. 8

Following figures show the arrangement of bar magnets in different configurations. Each magnet has magnetic dipole moment $\vec{M}$. arrange the following configuration in increasing order of their magnetic dipole moment?

(a)

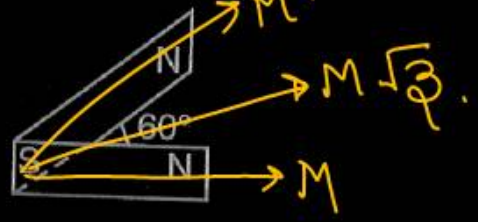


(b)



(c)

(d)



(1) d > b > c > a

(2) b > d > a > c

(3) c > a > d > b

(4) b > c > a > b

b > d > a > c

Question no. 9

The effective length of a magnet is 31.4 cm and its pole strength is 0.8 Am. The magnetic moment, if it is bent in the form of a semicircle is (in Am^2 unit)–

(1) 1.6

(2) 1.2

(3) 0.16

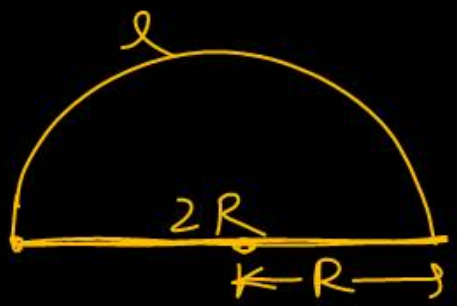
(4) 0.12

$m = 0.8\ (Am)$

$M = m \times l$

$\pi R = l$

$R = \frac{l}{\pi}$



$M' = m \times 2R$

$M' = \frac{2m \times l}{\pi}$

$M' = \frac{2}{\pi} \times 0.8 \times 31.4 \times 10^{-2}$

$M' = \frac{2 \times 0.8 \times 31.4}{3.14 \times 100}$

$= \frac{1.6}{10}$

$= 0.16\ (Am^2)$

Question no. 10

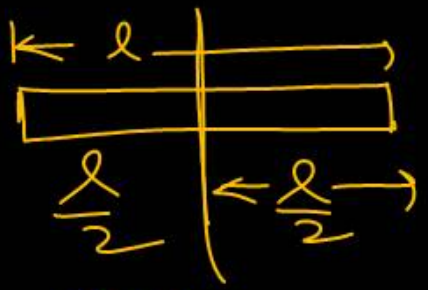
What happens with the magnetic pole strength (m), length (ℓ), magnetic moment (M), if a bar magnetic is cut into two equal pieces (i) transverse to its length (ii) along its length ?

(1) m, ℓ, M/2 and m, 2ℓ, M/2

(2) m, ℓ, M and m, 2, 2/ℓ M

(3) m, ℓ, M/2 and m/2,2ℓ, M/2

(4) m, ℓ, M/2 and m/2, ℓ, M/2



$\frac{M}{2}$

M

$M = m \times \ell$

$m \propto A$

$\frac{m}{2}$

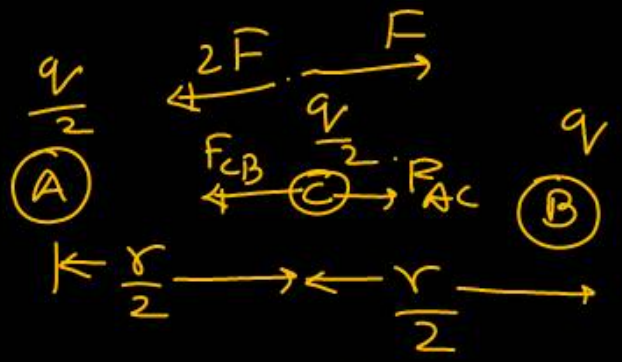
$M' = m \times \ell$ same

$= \frac{M}{2}$

Question no. 11

Two equally charged, identical metal spheres A and B repel each other with a force F. The sphere are kept fixed with a distance r between them. A third identical, but uncharged sphere C is brought in contact with A and then placed at the mid-point of the line joining A and B. The magnitude of the net electric force on C is:

(1) F
(2) F/4
(3) F/2
(4) 4F



$F_{CB} = \frac{kq^2}{\frac{2}{(\frac{r}{2})^2}}$

$F_{CB} = \frac{kq^2}{2} \times \frac{4}{r^2}$

$F_{CB} = 2\left(\frac{kq^2}{r^2}\right)$

$F_{CB} = 2F$

$F_{AC} = \frac{kq^2}{\frac{4}{(\frac{r}{2})^2}}$

$F_{Ae} = \frac{kq^2}{r^2}$

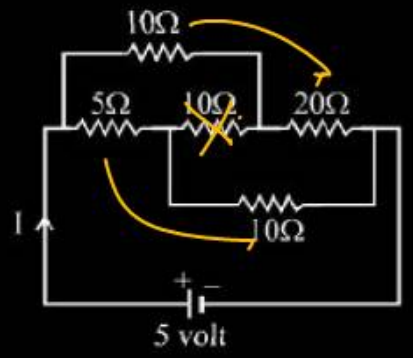
$F_{Ae} = F$

$F_{net} = 2F - F$

$= F$

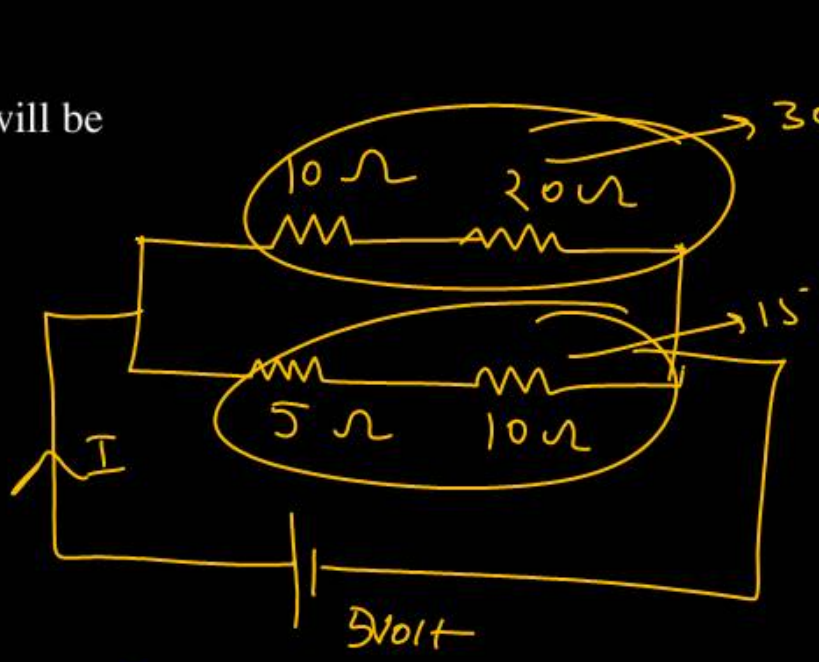
Question no. 12

The current I drawn from the 5 volt source will be



(1) 0.67 A (2) 0.17 A

(3) 0.33 A (4) 0.5 A



$R_{eq} = \frac{30 \times 15}{45}$

$= 10\ \Omega$

$V = IR_{eq}$

$5 = I \times 10$

$I = 0.5\ A$

Question no. 13

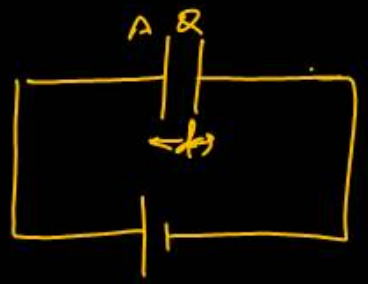
A parallel plate capacitor is charged and then disconnected from the charging battery. If the plates are now moved farther apart by pulling at them by means of insulating handles, then

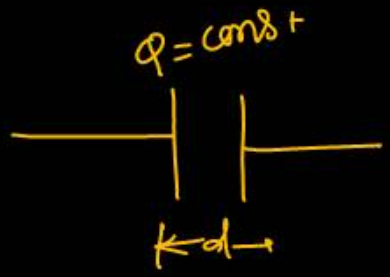
(1) the energy stored in the capacitor decreases

(2) the capacitance of the capacitor increases

(3) the charge on the capacitor decreases

(4) the voltage across the capacitor increases





$C = \frac{\varepsilon_0 A}{d}$

$C \propto \frac{1}{d}$ ↑

$Q = CV$

const = C · V ↑

Question no. 14

Magnetic field at the centre of a circular loop of area A is B. The magnetic moment of the loop will be

(1) $\frac{BA^2}{\mu_0\pi}$

(2) $\frac{BA^{3/2}}{\mu_0\pi}$

(3) $\frac{BA^{3/2}}{\mu_0\pi^{1/2}}$

(4) $\frac{2BA^{3/2}}{\mu_0\pi^{1/2}}$

$A = \pi r^2$

$r = \sqrt{\frac{A}{\pi}}$

$B = \frac{\mu_0 2\pi i}{4\pi r}$

$B = \frac{\mu_0 i}{2r}$

$i = \frac{2Br}{\mu_0}$

$M = i \cdot A$

$M = \frac{2Br}{\mu_0} \cdot A$

$B = \frac{2B}{\mu_0}\left(\frac{A}{\pi}\right)^{\frac{1}{2}} \cdot A$

$B = \frac{2B}{\mu_0 \pi^{\frac{1}{2}}} A^{\frac{1}{2}+1}$

$B = \frac{2B}{\mu_0 \pi^{\frac{1}{2}}} A^{\frac{3}{2}}$

Question no. 15

A magnetic needle suspended parallel to a magnetic field requires $\sqrt{3}$ J of work to turn it through 60°. The torque needed to maintain the needle in this position will be

(1) $2\sqrt{3}$ N-m

(2) 3 N-m

(3) $\sqrt{3}$ N-m

(4) $\frac{3}{2}$ N-m

$W = MB(1-\cos\theta)$

$\sqrt{3} = MB(1-\cos 60)$

$\sqrt{3} = \frac{MB}{2}$

$MB = 2\sqrt{3}$

$\tau = MB\sin\theta$

$\tau = MB\sin 60$

$\tau = MB \times \frac{\sqrt{3}}{2}$

$\tau = 2\sqrt{3} \times \frac{\sqrt{3}}{2}$

$\tau = 3$ Nm

Question no. 16

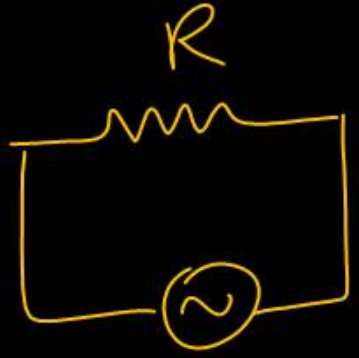
A resistance 'R' draws power 'P' when connected to an AC source. If an inductance is now placed is series with the resistance, such that the impedance of the circuit becomes 'Z', the power drawn will be

(1) $P\sqrt{\frac{R}{Z}}$

(2) $P\left(\frac{R}{Z}\right)$

(3) P

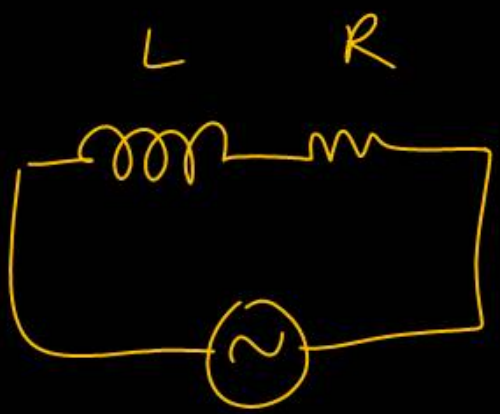
(4) $P\left(\frac{R}{Z}\right)^2$



$P = \frac{V_{rms}^2}{Z^2} \times R$

$(Z = R)$

$P = \frac{V_{rms}^2}{R}$



$P' = \frac{V_{rms}^2}{Z^2} \times R$

$P' = \frac{PR}{Z^2} \times R$

$= P(R/Z)^2$

4

Question no. 17

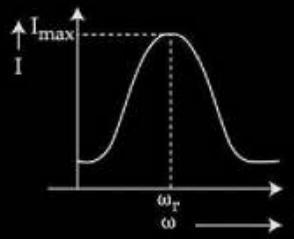
For a series LCR circuit, I vs ω curve is shown.

(a) To the left of ω_r, the circuit is mainly capacitive.

(b) To the left of ω_r, the circuit is mainly inductive.

(c) At ω_r, impedance of the circuit is equal to the resistance of the circuit.

(d) At ω_r, impedance of the circuit is 0.



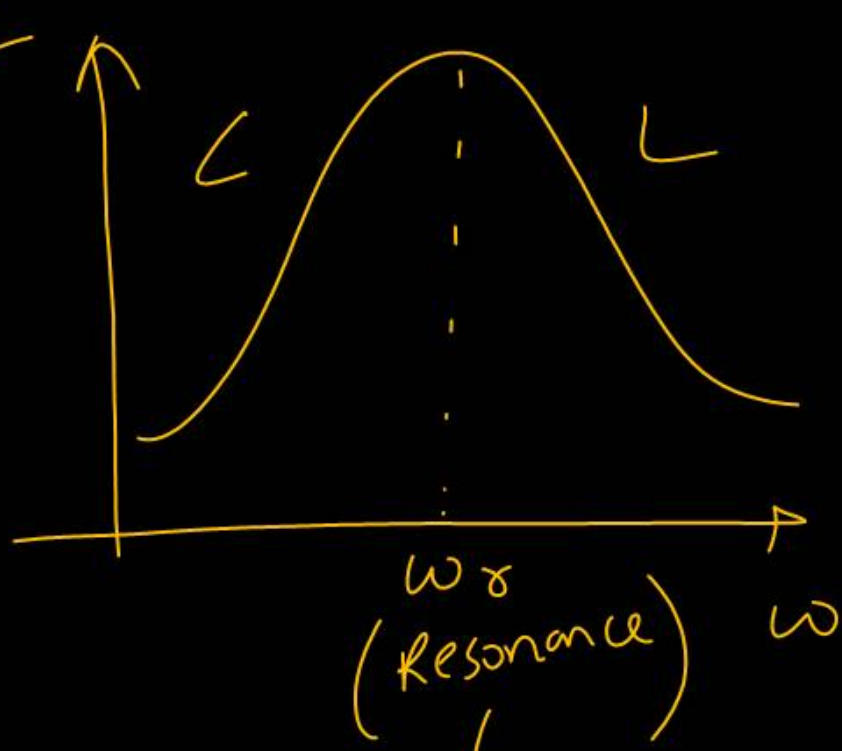
Choose the most appropriate answer from the options given below:

(1) (a) and (d) only

(2) (b) and (d) only

(3) (a) and (c) only

(4) (b) and (c) only



Question no. 18

In an a.c. circuit, the instantaneous e.m.f. and current are given by

$e = 100 \sin 30\,t$ & $i = 20 \sin\left(30t - \frac{\pi}{4}\right)$

In one cycle of a.c., the average power consumed by the circuit and the wattless current are, respectively:

(1) 50W, 10A

(2) $\frac{1000}{\sqrt{2}}$ W, 10A

(3) $\frac{50}{\sqrt{2}}$ W, 0

(4) 50W, 0

2

$\phi = \pi/4$

$P = V_{rms} I_{rms} \cos\phi$

$P = \frac{100}{\sqrt{2}} \times \frac{20}{\sqrt{2}} \cos\pi/4$

$\frac{2000}{2} \times \frac{1}{\sqrt{2}} = \frac{1000}{\sqrt{2}}$ W

$I_{rms} \sin\phi = \frac{20}{\sqrt{2}} \times \frac{1}{\sqrt{2}} = \frac{20}{2} = 10$ A

Question no. 19

$\omega = 2\pi(50)$

A resistance of 40Ω is connected to a source of alternating current rated 220 V, 50 Hz. Find the time taken by the current to change from its maximum value to rms value

(1) 2.5 ms (2) 1.25 ms

(3) 2.5 s (4) 0.25 s

(1)

$\frac{i_0}{\sqrt{2}} = i_0 \sin(100\pi t_1)$

$100\pi t_1 = \pi/4$

$t_1 = 1/400$ sec

$i_0 = i_0 \sin(100\pi t_2)$

$100\pi t_2 = \pi/2$

$t_2 = \frac{1}{200}$ sec

$\mathcal{E} = (220\sqrt{2}) \sin(100\pi t)$

$i = i_0 \sin(100\pi t)$

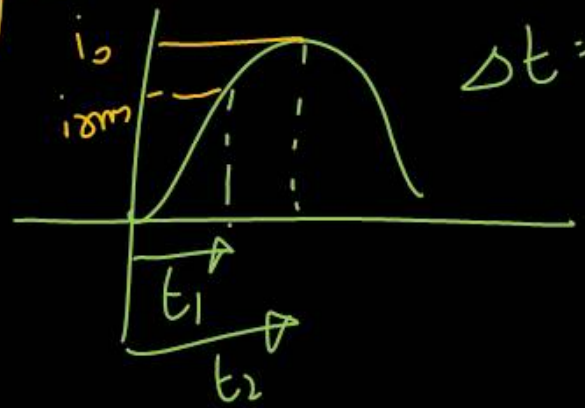
$\Delta t = \frac{1}{200} - \frac{1}{400}$

$= \frac{1}{100}\left(\frac{1}{2} - \frac{1}{4}\right)$

$= \frac{1}{4} \times 10^{-2}$

$= 0.25 \times 10^{-2}$

$= 2.5 \times 10^{-3}$



$\Delta t = t_2 - t_1$

Question no. 20

A power transmission line feeds input power at 2300 V to a step down transformer with its primary windings having 4000 turns. The output power is delivered at 230 V by the transformer. If the current in the primary of the transformer is 5A and its efficiency is 90%, the output current would be:

(1) 50 A (2) 45 A

(3) 35 A (4) 25 A

(2)

V_p i_p

$V_{in} = 2300\,V$ $i_{in} = 5A$

$V_{out} = 230\,V$ $i_s = ?$

V_s

$$\eta = \frac{P_{out}}{P_{in}} \times 100\,\%$$

$$\frac{90}{100} = \frac{V_s i_s}{V_p i_p}$$

$$\frac{9}{10} = \frac{230}{2300}\,\frac{i_s}{5}$$

$$i_s = 45A$$

Question no. 21

The electric current in a circuit given by $I = I_0 (t/T)$ for some time. Calculate the rms current for the period t = 0 to t = T.

(1) I_0

(2) $\frac{I_0}{\sqrt{2}}$

(3) $\sqrt{2}I_0$

(4) $\frac{I_0}{\sqrt{3}}$

$I = I_0 (t/T)$

$I_{rms} = \sqrt{\frac{\int_0^T i^2 dt}{\int_0^T dt}}$

$= \sqrt{\frac{\int_0^T I_0^2 \frac{t^2}{T^2} dt}{\int_0^T dt}}$

$i_{rms} = \sqrt{\frac{\frac{I_0^2}{T^2}\frac{T^3}{3}}{T}} = I_0/\sqrt{3}$

(4)

Question no. 22

A part of a complete circuit is shown in the figure. At some instant, the value of current I is 1 A and it is decreasing at a rate of 10^2 As^{-1} . The value of the potential difference $V_P - V_Q$, (in volts) at the instant, is

(1) 52 (2) 33

(3) 44 (4) 23

2

$i = 1A$

$\frac{di}{dt} = -10^2 A/sec$

Q → P

$V_Q - 1\times 2 + 30 - L\frac{di}{dt} = V_P$

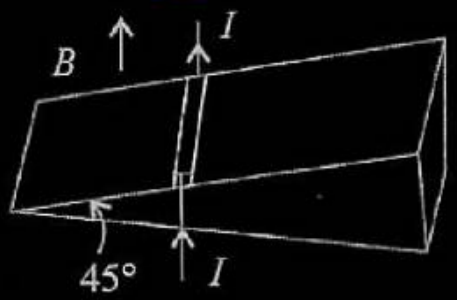
$V_Q + 28 - 50\times10^{-3}(-10^2) = V_P$

$V_Q + 28 + 5 = V_P$

$33V = V_P - V_Q$

Question no. 23

As shown in the figure, a metallic rod of linear density 0.45 kg m^{-1} is lying horizontally on a smooth incline plane which makes an angle of 45° with the horizontal. The minimum current flowing in the rod required to keep it stationary, when 0.15 T magnetic field is acting on it in the vertical upward direction, will be : (Use g = 10 m/s^2)



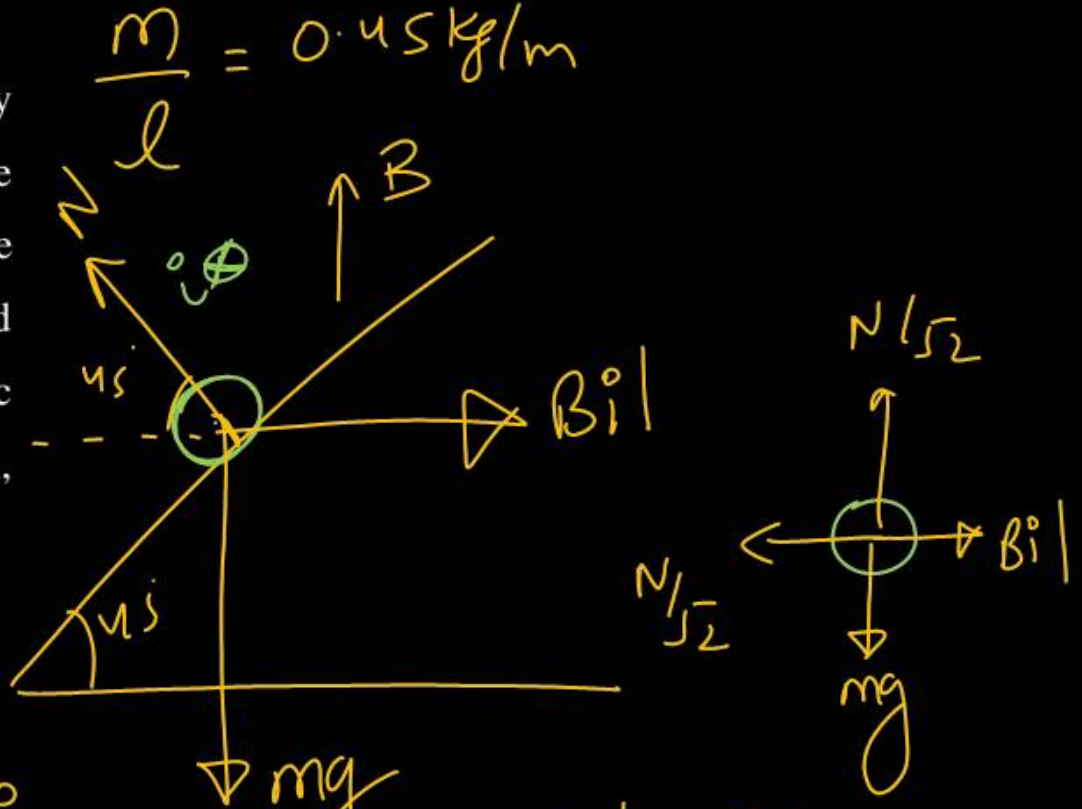
(1) 30 A

(2) 15 A

(3) 10 A

(4) 3 A

$\frac{m}{l} = 0.45 kg/m$



$Bil = mg$

$i = \frac{mg}{Bl}$

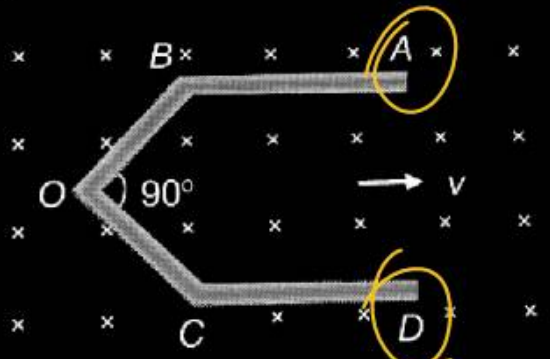
$= \frac{0.45 \times 10}{0.15} = 30A$

$N/\sqrt{2} = Bil$

$N/\sqrt{2} = mg$

Question no. 24

A conductor ABOCD moves along its bisector with a velocity of 1 m/s through a perpendicular magnetic field of 1 Wb/m^2, as shown in figure. If all the four sides are of 1 m length each, then the induced emf between points A and D is–

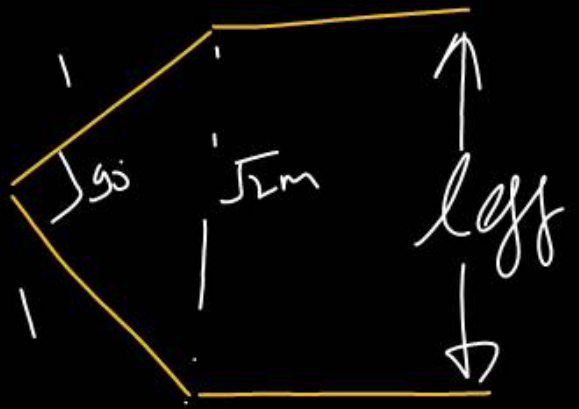


(1) 0

(2) 1.41 volt

(3) 0.71 volt

(4) 3.5 volt



$l_{eff} = \sqrt{2}\,m$

(2)

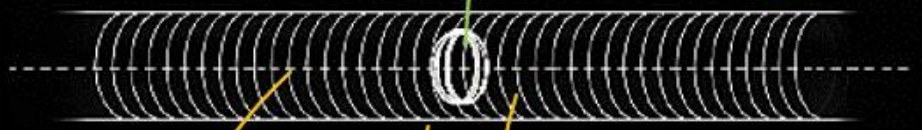
$\mathcal{E} = B v l_{eff}$

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

$= 1.41$ volt

Question no. 25

A circular coil with a cross – sectional area of 4 cm^2 has 10 turns. It is placed at the centre of a long solenoid that has 15 turns/cm and a cross–sectional area of 10 cm^2, as shown in the figure. The axis of the coil coincides with the axis of the solenoid. What is their mutual inductance?

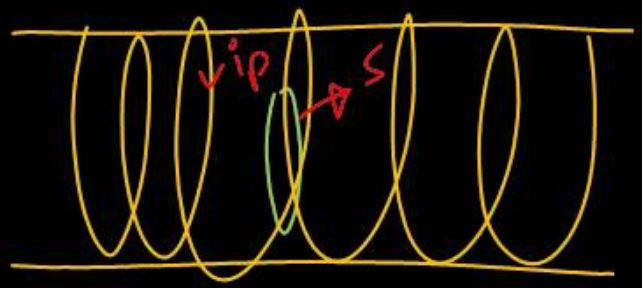


(1) 7.54 μH

(2) 8.54 μH

(3) 9.54 μH

(4) 10.54 μH



10 turns $A = 4cm^2$

$n = 15$ turn/cm

$A = 10cm^2$

$$M = \frac{\phi_S}{i_p} = \frac{N_S B_p A_S}{i_p}$$

$$= \frac{N_S (\mu_0 n i_p) A_S}{i_p}$$

$$= 10 \times 4\pi \times 10^{-7} \times 1500 \times 4 \times 10^{-4}$$

$$= 7.54 \mu H \quad (1)$$

Question no. 26

Lenz's law is a consequence of the law of conservation of

(1) charge

(2) energy

(3) induced emf

(4) induced current

Question no. 27

Given below are two statements:

Statement I: The electric force changes the speed of the charged particle and hence changes its kinetic energy: whereas the magnetic force does not change the kinetic energy of the charged particle.

Statement II: The electric force accelerates the positively charged particle perpendicular to the direction of electric field. The magnetic force accelerates the moving charged particle along the direction of magnetic field.

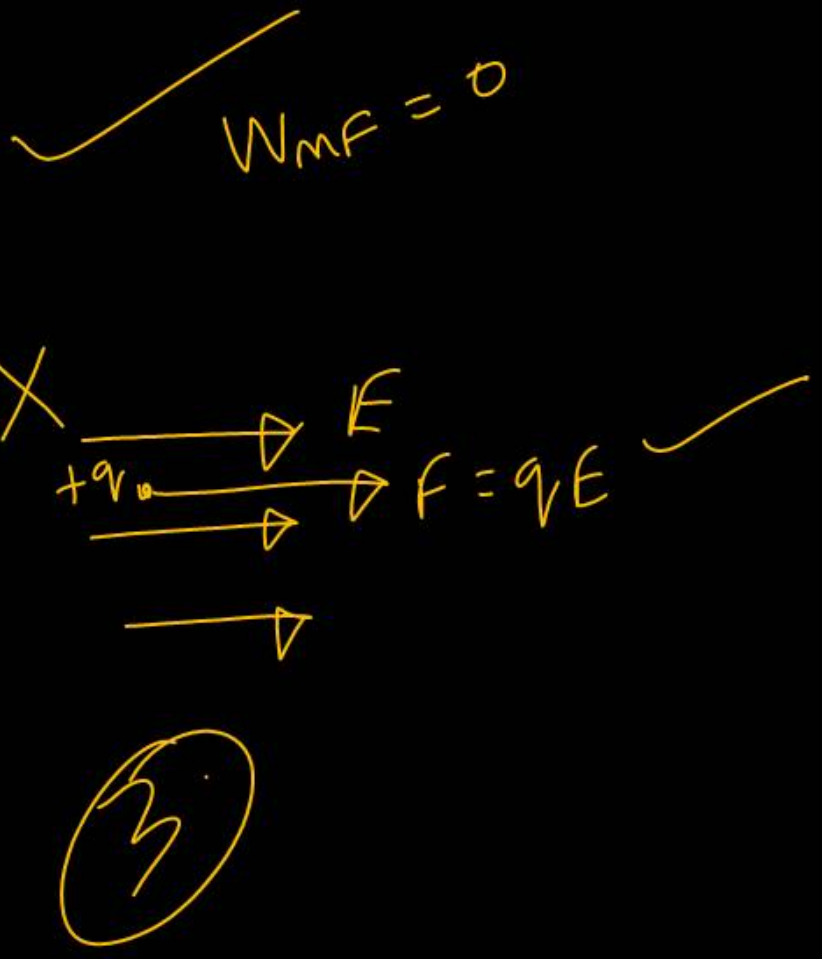
In the light of the above statements, choose the most appropriate answer from the options given below:

(1) Both Statement I and Statement II are correct.

(2) Both Statement I and Statement II are incorrect.

(3) Statement I is correct but II is incorrect.

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



Question no. 28

A non-conducting solid sphere of radius R is uniformly charged. The magnitude of the electric field due to the sphere at a distance r from its centre -

A. Increases as r increases for $r < R$.

B. Decreases as r increases for $0 < r < \infty$.

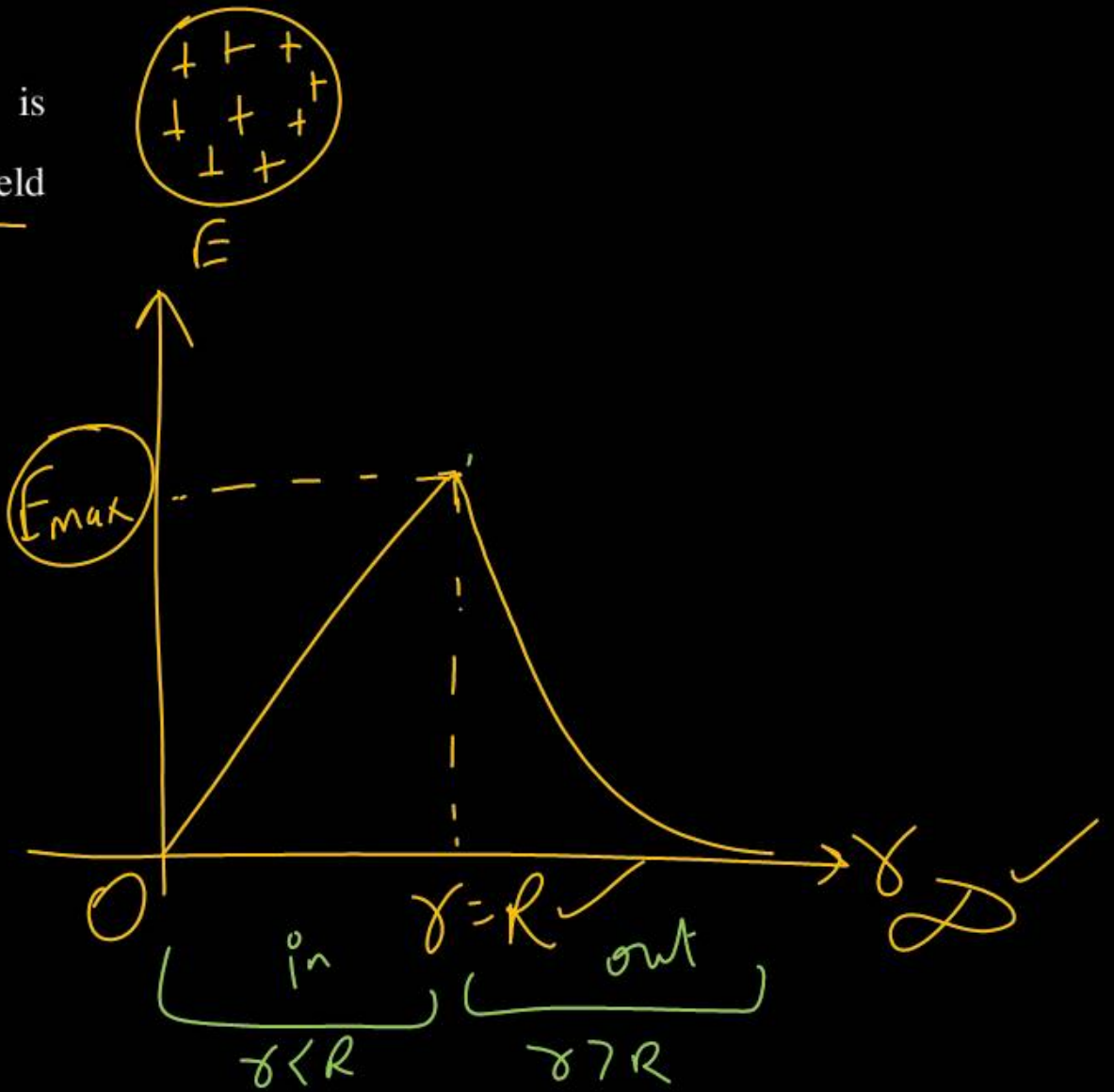
C. Decreases as r increases for $R < r < \infty$.

D. Is discontinuous at $r = R$.

Which of the above statement is correct.

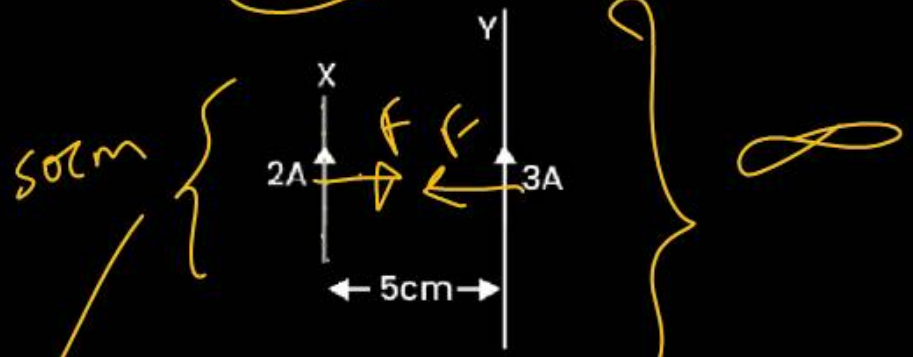
(1) A, C (2) A, D

(3) A, B (4) B, D



Question no. 29

A wire X of length 50 cm carrying a current of 2 A is placed parallel to a long wire Y. The wire Y carries a current of 3A. The distance between two wires is 5 cm and currents flow in the same direction. The force acting on the wire Y is:



(1) 1.2×10^{-5} N directed towards wire X.

(2) 1.2×10^{-4} N directed away from wire X.

(3) 1.2×10^{-4} N directed towards wire X.

(4) 2.4×10^{-5} N directed towards wire X.

Force on X due to Y

$F_x = B_y (2)(50cm)$

$F_x = \frac{\mu_0}{4\pi} \times \frac{2 \times 3}{5cm} \times 100/m$

$F_x = 10^{-7} \times 6 \times 20$

$= 120 \times 10^{-7}$

$= 1.2 \times 10^{-5} N$

(1)

Question no. 30

A proton and an α–particle, having kinetic energies K_p and K_α respectively, enter into a magnetic field at right angles. The ratio of the radii of trajectory of proton to that of α–particle is 2 :1. The ratio of K_p : K_α is:

(1) 1 : 8 (2) 8 : 1

(3) 1 : 4 (4) 4 : 1

$$\frac{r_p}{r_\alpha} = \frac{2}{1}$$

$$\frac{\frac{\sqrt{2m_pK_p}}{qB}}{\frac{\sqrt{2m_\alpha K_\alpha}}{2qB}} = 2$$

$$\sqrt{\frac{m_p}{m_\alpha}\frac{K_p}{K_\alpha}} = 2$$

$$\sqrt{\frac{m_p}{4m_p}\frac{K_p}{K_\alpha}} = 1$$

$$\frac{1}{4} \times \frac{K_p}{K_\alpha} = 1$$

$$\frac{K_p}{K_\alpha} = 4$$

Question no. 31

To increase resonant frequency is series LCR circuit,

(1) source frequency should be increased

(2) another resistance should be added in series with first resistance.

(3) another capacitor should be added in series with the first capacitor.

(4) the source frequency should be decreased

Question no. 32

A wheel with 20 metallic spokes each of length 0.8 m long is rotated with a speed of 120 revolution per minute in a plane normal to the horizontal component of earth magnetic field H at a place. If $H = 0.4 \times 10^{-4}$ T at the place, then induced emf between the axle and the rim of the wheel is

(1) 2.3×10^{-4} V (2) 3.1×10^{-4} V

(3) 2.9×10^{-4} V (4) 1.61×10^{-4} V

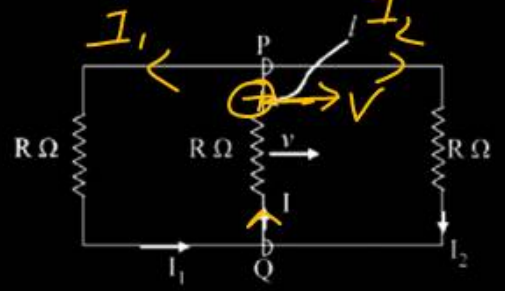
$f = \frac{120}{60} = 2$ Hz

$\omega = 2\pi f$

$\varepsilon = \frac{B\omega l^2}{2} = \frac{0.4 \times 10^{-4} \times 2\pi \times 2 \times 64}{100 \times 2}$

Question no. 33

A rectangular loop has a sliding connector PQ of length l and resistance $R\,\Omega$ and it is moving with a speed v as shown. The setup is placed in a uniform magnetic field going into the plane of the paper. The three currents I_1, I_2 and I are

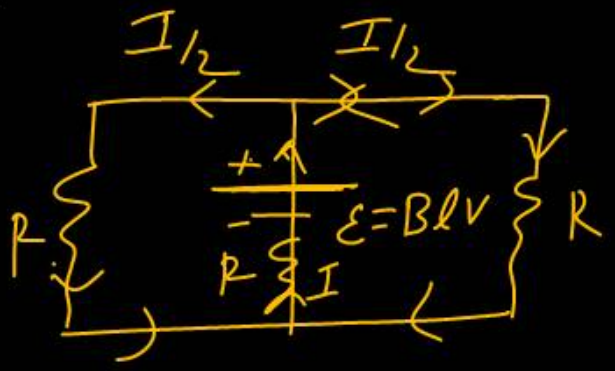


(1) $I_1 = -I_2 = \frac{Blv}{6R}$, $I = \frac{2Blv}{6R}$

(2) $I_1 = I_2 = \frac{Blv}{3R}$, $I = \frac{2Blv}{3R}$

(3) $I_1 = I_2 = I = \frac{Blv}{R}$

(4) $I_1 = I_2 = \frac{Blv}{6R}$, $I = \frac{Blv}{3R}$



$R_{eq} = \frac{R}{2} + R = \frac{3R}{2}$

$I = \frac{2\mathcal{E}}{3R} = \frac{2Blv}{3R}$

$I_1 = I_2 = \frac{Blv}{3R}$

Question no. 34

The self inductance L of a solenoid of length l & area of crosssection A, with a fixed turns N increases as

(1) l and A increase

(2) l decrease and A increase

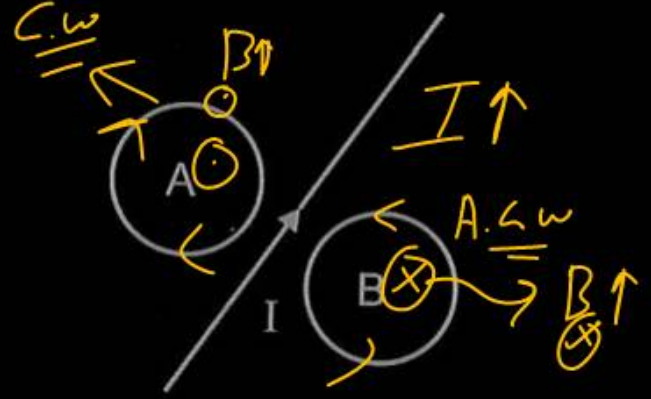
(3) l increases and A decreases

(4) both l and A decreases

$$L = \frac{\mu_0 N^2 A}{l}$$

Question no. 35

Consider the situation shown in figure. If the current I in the long straight wire XY is increased at a steady rate then the induced emf's in loops A and B will be –



(1) clockwise in A, anticlockwise in B

(2) anticlockwise in A, clockwise in B

(3) clockwise in both A and B

(4) anticlockwise in both A and B

Question no. 36

Match the Column I (types of magnetic materials) with Column II (their magnetic properties) and select the correct answer from the codes given below.

	Column I		Column II
A.	Diamagnetic	i.	$\mu >> \mu_0$, $\mu_r >> 1$ and $\chi >> 1$
B.	Paramagnetic	ii.	$-1 \le \chi < 0$, $0 \le \mu_r < 1$ and $\mu < \mu_0$
C.	Ferromagnetic	iii.	$0 < \chi < \varepsilon$, $1 < \mu_r < 1 + \varepsilon$ and $\mu > \mu_0 \varepsilon$ is a small and positive number

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

$0 < \chi_s < \phi$

$\chi_s = 1 + \chi$

$-1 < \chi < 0$ | $0 < \chi < 1$

Question no. 37

A bar magnet of length 3 cm has points A and B along its at distance of 24 cm and 48 cm on the opposite sides. Then the Ratio of magnetic fields at these points will be–

(1) 8

(2) 1/2

(3) 3

(4) 4

$B_0 = \frac{\mu_0}{4\pi} \times \frac{M}{d^3}$

$\frac{B_A}{B_B} = \left(\frac{r_B}{r_A}\right)^3 = \frac{8}{1}$

Question no. 38

the magnetic susceptibility of a paramagnetic substance at −173 °C is 1.5×10^{-2} then its value at −73 °C will be

(1) 7.5×10^{-1} (2) 7.5×10^{-2}

(3) 7.5×10^{-3} (4) 7.5×10^{-4}

$\chi \propto \frac{1}{T}$ | $\chi = \frac{C}{T}$

$\chi_1 = 1.5 \times 10^{-2} = \frac{C}{100}$

$\chi_2 = \frac{C}{200}$ | $\frac{1.5 \times 10^{-2}}{\chi_2} = \frac{2}{1}$

$\chi_2 = \frac{1.5 \times 10^{-2} \times 5 \times 10^{-3}}{7.5 \times 10^{-3}}$

Question no. 39

The magnetic moment of a magnet of mass 75 gm is 9×10^{-7} A-m^2. If the density of material of magnet is 7.5×10^3 kg/m^3 then intensity of magnetisation will be

(1) 0.9 A/m (2) 0.09 A/m

(3) 9 A/m (4) 90A/m

$M = 9 \times 10^{-7}$

$I = \frac{M}{V} = \frac{M\rho}{m}$

$V = \frac{m}{\rho}$

$I = \frac{9 \times 10^{-7} \times 7.5 \times 10^{3}}{7.5 \times 10^{-3} \times 10^{-2}}$

$I = 9 \times 10^{2} = 0.09$

Question no. 40

A conducting circular loop is placed in a uniform magnetic field, B = 0.025 T with its plane perpendicular to the loop. Their radius of the loop is made to shrink at a constant rate of 1 mm s^{-1}. The induced e.m.f. when the radius is 2 cm, is

(1) $2\pi\mu V$ (2) $\pi\mu V$

(3) $\frac{\pi}{2}\mu V$ (4) $2\mu V$

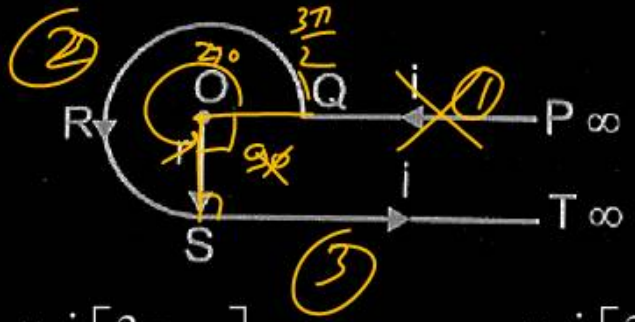
$\frac{d\gamma}{dt} = 1 \times 10^{-3}$

$\phi = B \times \pi\gamma^2$

$\frac{d\phi}{dt} = \mathcal{E} = B\pi \times \gamma \times 2 \times \frac{d\gamma}{dt}$

Question no. 41

A current i is flowing in a conductor shaped as shown in the figure. The radius of curved partis r and length of straight portions is very large. The value of magnetic field at the center will be –



(1) $\frac{\mu_0 i}{4\pi r}\left[\frac{3\pi}{2}+1\right]$

(2) $\frac{\mu_0 i}{4\pi r}\left[\frac{3\pi}{2}-1\right]$

(3) $\frac{\mu_0 i}{4\pi r}\left[\frac{\pi}{2}+1\right]$

(4) $\frac{\mu_0 i}{4\pi r}\left[\frac{\pi}{2}-1\right]$

$B_1 = 0$

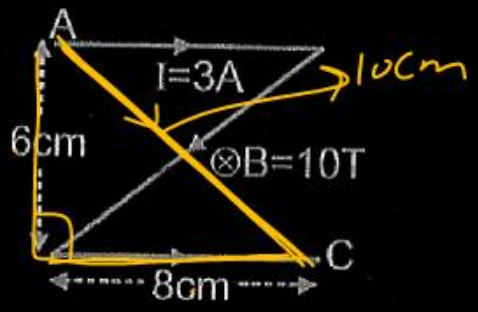
$B_2 = \frac{\mu_0 I}{4\pi r} \times \frac{3\pi}{2}$

$B_3 = \frac{\mu_0 I}{4\pi r} \times (0+1)$

$B_0 = \frac{\mu_0 I}{4\pi r}\left(\frac{3\pi}{2}+1\right)$

Question no. 42

A current carrying wire AC is placed in uniform transverse magnetic field then the force on wire AC:

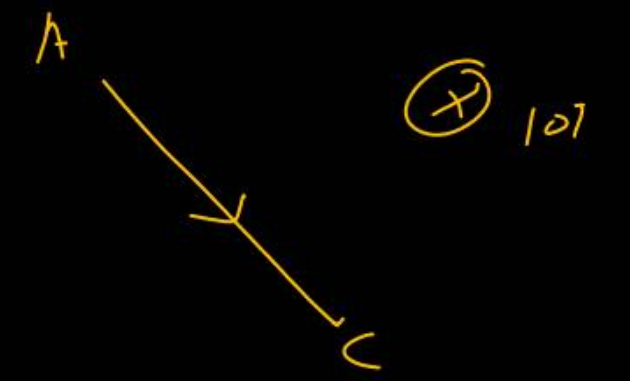


(1) 3 N

(2) 4.2 N

(3) 6 N

(4) 4 N



$F = 16 \times 3 \times 16 \times 10^{-2}$

$F = 3N$

Question no. 43

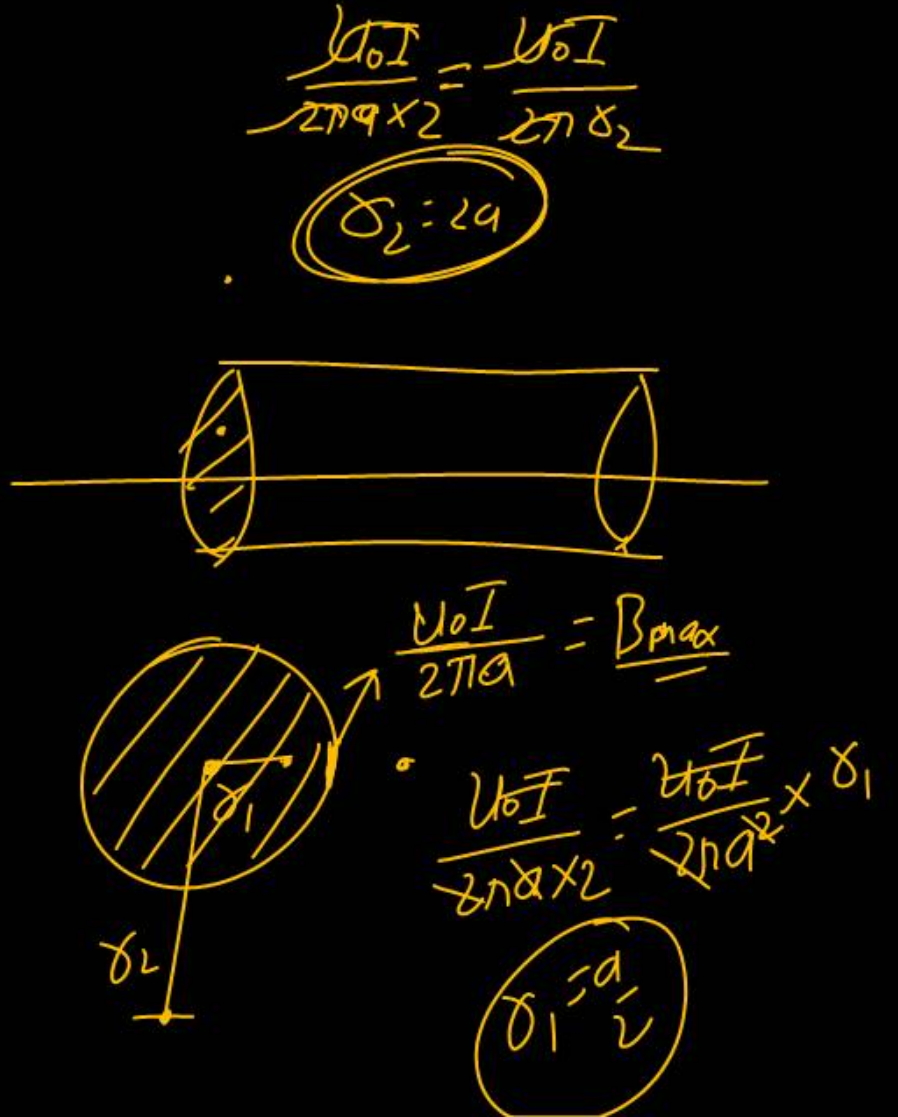
Consider a long straight wire of a circular cross-section (radius a) carrying a steady current I. The current is uniformly distributed across this cross-section. The distances from the centre of the wire's cross-section at which the magnetic field [inside the wire, outside the wire] is half of the maximum possible magnetic field, any where due to wire, will be

(1) $\left[\frac{a}{4}, \frac{3a}{2}\right]$

(2) $\left[\frac{a}{2}, 2a\right]$

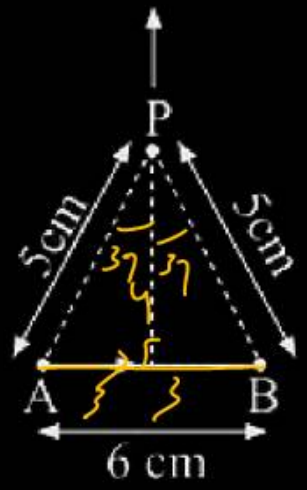
(3) $\left[\frac{a}{2}, 3a\right]$

(4) $\left[\frac{a}{4}, 2a\right]$



Question no. 44

Find the magnetic field at point P due to a straight line segment AB of length 6 cm carrying a current of 5A. (See figure) $\left(\mu_0 = 4\pi \times 10^{-7}\,\mathrm{N-A^{-2}}\right)$



(1) $2.0 \times 10^{-5}\,\mathrm{T}$

(2) $1.5 \times 10^{-5}\,\mathrm{T}$

(3) $3.0 \times 10^{-5}\,\mathrm{T}$

(4) $2.5 \times 10^{-5}\,\mathrm{T}$

$B = \frac{\mu_0 I}{4\pi d} \times (\sin\alpha + \sin\alpha)$

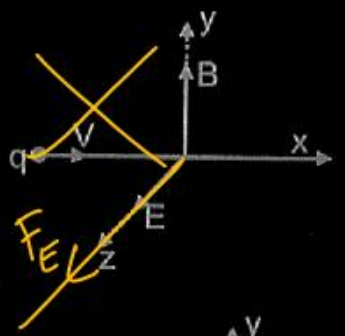
$B = \frac{10^{-7} \times 5}{4 \times 10^{-2}} \times 2 \times \frac{3}{5}$

$B = \frac{3}{2} \times 10^{-5}$

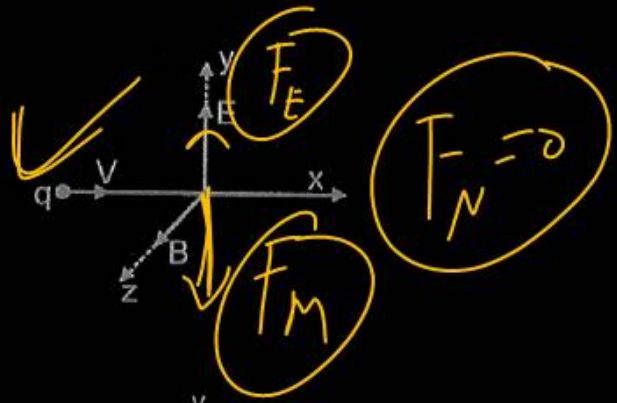
Question no. 45

A particle of charge q and mass m is moving along the x-axis with a velocity v and enters a region of electric field E and magnetic field B as shown in figure below. For which figure the net force on the charge may be zero :-

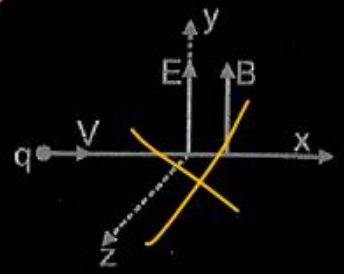
(1)



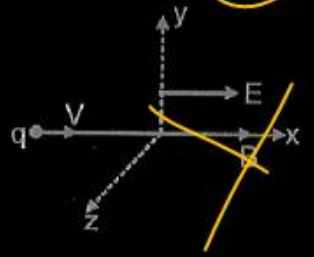
(2)



(3)



(4)



Question no. 46

The potential for the following cell will be –

$Cr \mid Cr^{3+}(0.1\ M) \parallel Fe^{2+}(0.01\ M) \mid Fe$

(Given $E^{\circ}_{Cr^{3+}/Cr} = -0.72V$, $E^{\circ}_{Fe^{2+}/Fe} = -0.42V$)

(1) –0.26V (2) 0.26V

(3) 0.339 V (4) – 0.339 V

$2Cr + 3Fe^{+2} \longrightarrow 2Cr^{+3} + 3Fe$ (n=6)

$E^{\circ}_{cell} = E^{\circ}_{C} - E^{\circ}_{A} = -0.42 - (-0.72)$

$E^{\circ}_{cell} = -0.42 + 0.72 = 0.3\ V$

$E_{cell} = E^{\circ}_{cell} - \frac{0.059}{n}\log_{10}\frac{[P]}{[R]}$

$E_{cell} = 0.3 - \frac{0.059}{6}\log_{10}\frac{[10^{-1}]^2}{[10^{-2}]^3}$

$= 0.3 - \frac{0.06}{6}\log\frac{10^{-x}}{10^{-6}}$ $\quad -4 = 10^{4}$

$= 0.3 - 0.01 \log 10^{4}$ $\quad \log 10^{4} = 4\log 10 = 4 \times 1$

$= 0.3 - 0.01 \times 4 \times 1$

$= 0.3 - 0.04$

$= +0.26V$

Question no. 47

Consider the following reduction processes:

$Zn^{2+} + 2e^- \rightarrow Zn(s)$; $E^\circ = -0.76$ V

$Ca^{2+} + 2e^- \rightarrow Ca(s)$; $E^\circ = -2.87$ V

$Mg^{2+} + 2e^- \rightarrow Mg(s)$; $E^\circ = -2.36$ V

$Ni^{2+} + 2e^- \rightarrow Ni(s)$; $E^\circ = -0.25$ V

The reducing power of the metals increases in the order

(1) Ca < Zn < Mg < Ni

(2) Ni < Zn < Mg < Ca

(3) Zn < Mg < Ni < Ca

(4) Ca < Mg < Zn < Ni

Electrochemical series (ECS)

Top ⟶ Bottom (Red^ potential)

EMF value ↑ Reducing power ↓

जो जितना -ve emf R.P. ↑

R.P. $Ca^{+2} > Mg^{+2} > Zn^{+2} > Ni^{+2}$

Ca > Mg > Zn > Ni

Question no. 48

Consider the statements S_1 and S_2 :

S_1: Conductivity always increases with decrease in the concentration of electrolyte

S_2: Molar conductivity always increases with decrease in concentration of electrolyte.

The correct option among the following is :

(1) Both S_1 and S_2 are correct

(2) S_1 is wrong and S_2 is correct

(3) S_1 is correct and S_2 is wrong

(4) Both S_1 and S_2 are wrong

$$\Lambda_m = \frac{K \times 1000}{M}$$

$$\Lambda_m \propto \frac{1}{M}$$

M ↑ Λ_m ↓

M ↓ Λ_m ↑

Question no. 49

What will be the emf for the given cell?

$Pt \mid H_2(g, \overset{A}{P_1}) \mid H^+(aq) \overset{B}{\parallel} H_2(g, \overset{C}{P_2}) \mid Pt$

(1) $\frac{RT}{F}\ln\frac{P_1}{P_2}$

(2) $\frac{RT}{2F}\ln\frac{P_1}{P_2}$

(3) $\frac{RT}{F}\ln\frac{P_2}{P_1}$

(4) None of these

Anode → $H_2(g, P_1) \longrightarrow 2H^+_{(aq)} + 2e^-$

Cathode → $2H^+_{(aq)} + 2e^- \longrightarrow H_2(g, (P_2))$

(R) $H_2(g, P_1) \longrightarrow H_2(g, P_2)$ (P)

$E^\circ_{cell} = 0$

$E_{cell} = E^\circ_{cell} - \frac{0.059}{n}\log_{10}\frac{[P]}{[R]}$

$E_{cell} = 0 - \frac{RT}{nF}\log_e\frac{P_2}{P_1}$

$E_{cell} = -\frac{RT}{nF}\ln\frac{P_2}{P_1}$ $(n=2)$

$E_{cell} = \frac{RT}{2F}\ln\frac{P_1}{P_2}$

Question no. 50

The rate of reaction triple when its temperature changes from 300 K to 310 K. Activation energy of such a reaction will be:

($R = 2$ Cal K^{-1} mol^{-1})

(1) 20.5 kcal mol^{-1} (2) 40.0 kcal mol^{-1}

(3) 30.0 kcal mol^{-1} (4) 31.0 kcal mol^{-1}

$$\log \frac{k_2}{k_1} = \frac{E_a}{2.303R}\left[\frac{T_2 - T_1}{T_2 \times T_1}\right]$$

$$\log \frac{3}{1} = \frac{E_a}{2.303R}\left[\frac{310-300}{310\times300}\right]$$

$$0.5 = \frac{E_a}{2.303\times2}\left[\frac{10}{310\times300}\right]$$

$$E_a = \frac{0.5\times2.303\times2\times31\times300}{10}\ \text{Cal}$$

$$E_a = 20.5\ \text{kCal}$$

$$= 20500\ \text{Cal}$$

$$= 20.5\ \text{kCal}$$

Question no. 51

The commercial production of ammonia is represented by the equation.

$$N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$$

If the rate of disappearance of $H_2(g)$ is 1.2×10^{-3} mol/min, what is the rate of appearance of $NH_3(g)$?

(1) 2.4×10^{-3} mol/min (2) 1.8×10^{-3} mol/min

(3) 1.4×10^{-3} mol/min (4) 8.0×10^{-4} mol/min

$$ROR = +\frac{1}{2}\frac{d[NH_3]}{dt} = -\frac{d[N_2]}{dt} = -\frac{1}{3}\frac{d[H_2]}{dt}$$

$$+\frac{1}{2}\frac{d[NH_3]}{dt} = -\frac{1}{3}\frac{d[H_2]}{dt}$$

$$\frac{d[NH_3]}{dt} = \frac{2}{3}\frac{d[H_2]}{dt}$$ → given

$$= \frac{2}{3} \times 1.2 \times 10^{-3}$$

$$= 0.8 \times 10^{-3}$$

$$= 8 \times 10^{-4}$$

Question no. 52

Rate of general reaction A + B → products can be expressed as follows on the basis of collision theory $Z_{AB}e^{-Ea/RT}$. Which of the following statements is not correct for the above expression?

(1) Z is collision frequency and is equal to number of collisions per second per unit volume of the reaction mixture.

(2) $e^{-E_a/RT}$ is the fraction of molecules with kinetic energy equal to or greater then E_a.

(3) E_a is activation energy of the reaction.

(4) All the molecules which collide with one other are effective collisions.

Question no. 53

Molal depression constant for a solvent is 4.0 kg mol^{-1} The depression in freezing point of the solvent for 0.03 mol kg^{-1} solution of K_2SO_4 is : (Assume complete dissociation of the electrolyte)

(1) 0.012 K

(2) 0.36 K

(3) 0.18 K

(4) 0.24 K

$\Delta T_f = i\, k_f \times m$

$K_2SO_4 \rightarrow 2K^+ + SO_4^{-2}$ $n=3$

$\alpha = 100\%$ $i = n$

$\Delta T_f = i\, k_f \times m$

$= 3 \times 4 \times 0.03$

$\Delta T_f = 0.36\ K$

$i = (1-\alpha) + n\alpha$ $\alpha = 100\% = 1$

$= (1-1) + 3 \times 1$ $n=3$

$i = 3$

Question no. 54

6.0 g of urea (molecular weight = 60) was dissolved in 9.9 moles of water. If the vapour pressure of pure water is P°, the vapour pressure of solution is:

(1) 0.10P°

(2) 1.10P°

(3) 0.90 P°

(4) 0.99 P°

$n_B = \frac{6}{60} = 0.1 \text{ mol}$

$n_A = 9.9$ $n_{Total} = 9.9 + 0.1 = 10 \text{ mol}$

$P_S = P_A = P_A^0 X_A$

$P_S = P_A = P^0 \times 0.99$

$P_S = P_A = 0.99 P^0$

$X_A = \frac{n_A}{n_A + n_B} = \frac{9.9}{10} = 0.99$

Question no. 55

A gaseous mixture of two substances A and B, under a total pressure of 0.8 atm is in equilibrium with an ideal liquid solution. The mole fraction of substance A is 0.5 in the vapour phase and 0.2 in the liquid phase. The vapour pressure of pure liquid A is.

(1) 4 atm (2) 6 atm

(3) 0.5 atm (4) 2 atm

$Y_A = 0.5 \quad X_A = 0.2$

$P_T = P_S = 0.8$

$$Y_A = \frac{P_A^\circ X_A}{P_T \text{ or } P_S}$$

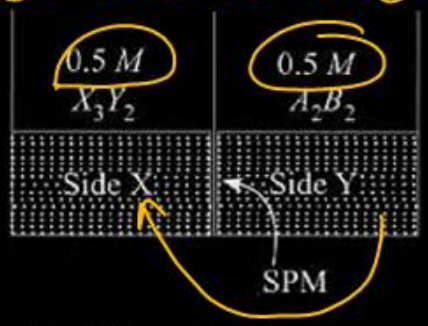
$$0.5 = \frac{P_A^\circ \times 0.2}{0.8}$$

$$2 = P_A^\circ$$

Question no. 56

Aqueous solution of electrolyte X_3Y_2 is separated from aqueous solution of another electrolyte A_2B_2 by semi permeable membrane then due to osmosis what will be direction of movement of water?

(Given – both electrolytes 100% ionized)



(1) From side X to side Y.

(2) From side Y to side X.

(3) In both direction X to Y and Y to X

(4) No movement of water will take place.

X_3Y_2

$\downarrow$

$3X^{+2} + 2Y^{-3}$

$n = 5$

Solvent $\downarrow$ low-high

$\alpha = 100\% = 1$

$i = (1-\alpha) + n\alpha$

$= (1-1) + 5 \times 1$

$i = 5$

$C_{eff} = C \times i$

$C_{eff} = 0.5 \times 5$

$= 2.5$

High Conc.

A_2B_2

$\downarrow$

$2A^{+} + 2B^{-}$

$n = 4$

$\alpha = 100\% = 1$

$i = (1-\alpha) + n\alpha$

$= (1-1) + 4 \times 1$

$i = 4$

$C_{eff} = C \times i$

$= 0.5 \times 4$

$= 2$

$\downarrow$

Low Conc.

Question no. 57

If the shortest wavelength of spectral line of H-atom in Lyman series is x, then match the following for Li^{2+} and select the correct code.

	Column I		Column II
A.	Shortest wavelength in Lyman series	p.	$\frac{4x}{5}$
B.	Longest wavelength in Lyman series	q.	$\frac{4x}{9}$
C.	Shortest wavelength in Balmer series	r.	$\frac{x}{9}$
D.	Longest wavelength in Balmer series	s.	$\frac{4x}{27}$

(1) A – q, B – s, C – p, D – r

(2) A – r, B – s, C – q, D – p

(3) A – r, B – s, C – p, D – q

(4) A – q, B – p, C – s, D – r

(A) $\lambda_{LS} = \frac{n_1^2}{RZ^2} = \frac{1^2}{R\times 3^2} = \frac{1}{9R} = \frac{x}{9}$ (shortest)

(B) $\lambda_{LS} = \frac{n_1^2 \times n_2^2}{n_2^2 - n_1^2} \times \frac{1}{RZ^2} = \frac{1^2 \times 2^2}{2^2 - 1^2} \times \frac{1}{R\times 3^2}$ (longest)

$= \frac{4}{27R} = \frac{4}{27}x$

(C) $\lambda_{BS} = \frac{n_1^2}{RZ^2} = \frac{2^2}{R\times 3^2} = \frac{4}{9R} = \frac{4}{9}x$ (shortest)

(D) $\lambda_{BS} = \frac{n_1^2 \times n_2^2}{n_2^2 - n_1^2} \times \frac{1}{RZ^2} = \frac{2^2 \times 3^2}{3^2 - 2^2} \times \frac{1}{R\times 3^2}$ (longest)

$= \frac{4\times 9}{9-4} \times \frac{1}{9R} = \frac{4}{5R} = \frac{4}{5}x$

$\lambda_{LSH} = \frac{n_1^2}{RZ^2} = \frac{1^2}{R\times 1^2} = \frac{1}{R} = x$

A → r C – q

B → s & D – p

Question no. 58

The molar conductivities Λ°_{NaOAc} and Λ°_{HCl} at infinite dilution in water at 25° C are 91.0 and426.2 S cm^2/mol respectively. To calculate Λ°_{HOAc} the additional value required is:

(1) $\Lambda^{\circ}_{H_2O}$

(2) Λ°_{KCl}

(3) Λ°_{NAOH}

(4) Λ°_{NaCl}

$\Lambda^{\circ}_{HOAc} = \Lambda^{\circ}_{NaOAc} + \Lambda^{\circ}_{HCl} - \Lambda^{\circ}_{NaCl}$

Λ°_{HOAc}

Question no. 59

4.5g of aluminium (at mass 27amu) is deposited at cathode from Al^{3+} solution by a certain quantity of electric charge. The volume of hydrogen produced at STP from H^+ ions in solution by the same quantity of electric charge will.

(1) 22.4 L
(2) 444.8 L
(3) 5.6 L
(4) 11.2 L

$\frac{W_1}{E_1} = \frac{W_2}{E_2}$

$H_2 \longrightarrow 2H^+ + 2e^-$

Eq. Al = Eq. H_2

$\frac{4.5}{27/3} = \frac{W_2}{2/2}$

$W_2 = \frac{4.5}{9} = 0.5$ gm

$\text{mol} = \frac{wt}{Mw} = \frac{0.5}{2} = 0.25$

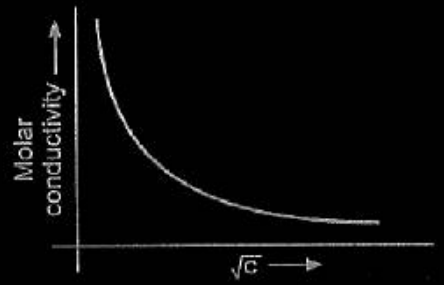
$V_{H_2} = \text{mol} \times 22.4$

$= 0.25 \times 22.4$

$= 5.6$ lit

Question no. 60

The variation of molar conductivity with concentration of an electrolyte (X) in aqueous solutions is shown in the given figure



The electrolyte is :

(1) CH_3COOH (2) KNO_3

(3) HCl (4) NaCl

weak electrolytes

Question no. 61

Consider the reaction, $2A + B \rightarrow$ products. When concentration of B alone was doubled, the half–life did not change. When the concentration of A alone was doubled, the rate increased by two times. The unit of rate constant for this reaction is

(1) s^{-1}

(2) $L\ mol^{-1}s^{-1}$

(3) no unit

(4) $mol\ L^{-1}\ s^{-1}$

1st 1st

1st order

Rate $= K[A]^1[B]^1$

Order $= 2$

$K =$ lit mol^{-1} sec^{-1}

Question no. 62

90% of a first order reaction was completed in 6 min.

When will 99% of the reaction complete?

(1) 12 min (2) 18 min

(3) 20 min (4) 24 min

$t_{90\%} = \frac{10}{3} t_{1/2}$

$6 = \frac{10}{3} t_{1/2}$

$\frac{18}{10} = t_{1/2}$

$t_{99\%} = \frac{20}{3} t_{1/2} = \frac{\cancel{20}^{2}}{\cancel{3}} \times \frac{\cancel{18}^{6}}{\cancel{10}}$

$= 12$ min

Question no. 63

The data for the reaction A + B → C is

EXp.	$[A]_0$	$[B]_0$	Initial rate
1	0.012	0.035	0.10
2	0.024	0.035	0.80
3	0.012	0.070	0.10
4	0.024	0.070	0.80

(1) $r = k [B]^3$ (2) $r = k [A]^3$

(3) $r = k [A] [B]^4$ (4) $r = k [A]^2[B]^2$

Rate ∝ Conc

Rate = (Conc)$^{\text{order}}$

8 = (2)$^{\text{order}}$

$2^3 = (2)^{\text{order}}$

Order = 3

Rate = $k[A]^3[B]^0$

Order = 3

Rate = $k[A]^3$

Question no. 64

Assertion : Order of the reaction can be zero or fractional.

Reason : We cannot determine order from balanced chemical equation.

(1) Both assertion and reason are correct and the reason is the correct explanation of assertion.

(2) Both assertion and reason are correct but reason does not explain assertion.

(3) Assertion is correct but the reason is incorrect.

(4) Assertion is incorrect but the reason is correct.

Question no. 65

Which one of the following statement regarding Henry's law is NOT correct?

(1) The value of K_H increases with function of pressure of the gas.

(2) Higher the value of K_H at a given pressure, higher is the solubility of the gas in a liquid.

(3) The partial pressure of the gas in vapour phase is proportional to the mole fraction of the gas in the solution.

(4) Different gases have different K_H (Henry's law constant) values at the same temperature.

$$\text{Solubility of gas} \propto \frac{1}{K_H}$$

$K_H \uparrow$ Solubility $\downarrow$

Question no. 66

Which of the following liquid pairs shows a positive deviation from Raoult's law?

(1) Water – hydrochloric acid – ve

(2) Benzene - methanol + ve

(3) Water – nitric acid – ve

(4) Acetone – chloroform – ve

Question no. 67

100 mL of 0.3N HCl is mixed with 200 mL of0.6 N H_2SO_4. The final normality of the resulting solution will be

(1) 0.3 N (2) 0.2 N

(3) 0.5 N (4) 0.1 N

$$N_R = \frac{N_1V_1 + N_2V_2}{V_1 + V_2}$$

$$= \frac{0.3 \times 100 + 0.6 \times 200}{300}$$

$$= \frac{30 + 120}{300} = \frac{150}{300}$$

$$= 1/2$$

$$N_R = 0.5$$

Question no. 68

The mole fraction of a solvent in aqueous solution of a solute is 0.8. The molality (in mol kg^{-1}) of the aqueous solution is

$\hookrightarrow X_A = 0.8, X_B = 0.2$

(1) 13.88×10^{-3} (2) 13.88×10^{-1}

(3) 13.88×10^{-2} (4) 13.88

$$m = \frac{X_B \times 1000}{X_A \times M_A}$$

$$= \frac{0.2 \times 1000}{0.8 \times 18}$$

$$= \frac{1000}{4 \times 18} \quad 250$$

$$m = 13.88$$

Question no. 69

The standard reduction potential for Fe^{2+}/Fe and Sn^{2+}/Sn electrodes are – 0.44 and – 0.14 volt respectively. For the given cell reaction

$Fe + Sn^{+2} \rightarrow Fe^{+2} + Sn$, the standard EMF is:

(1) +0.30V (2) -0.58V

(3) + 0.58V (4) -0.30V

Anode

Cathode

Standard reduction potential

ECS

जो ज्यादा -ve Anode

$E^\circ_{cell} = E^\circ_C - E^\circ_A$

$= -0.14 - (-0.44)$

$E^\circ_{cell} = +0.30V$

Question no. 70

For a cell reaction involving two electron change, the standard EMF of the cell is 0.295V at 2°C. The equilibrium constant of the reaction at 25°C will be:

(1) 29.5×10^{-2}

(2) 10

(3) 1×10^{10}

(4) 2.95×10^{-10}

E°_{cell}

at eqm condition $E_{cell}=0$

$E_{cell} = E^\circ_{cell} - \frac{0.059}{n}\log K_{eq}$

0

$E^\circ_{cell} = \frac{0.059}{n}\log K_{eq}$

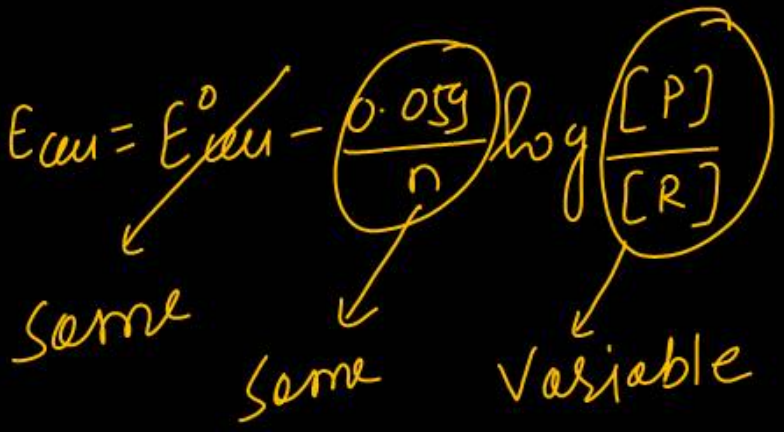
$0.295 = \frac{0.059}{2}\log K_{eq}$

$0.295 = 0.0295 \log K_{eq}$

$10 = \log K_{eq}$

$K_{eq} = 10^{10}$

Question no. 71



The e.m.f. of the following galvanic cells:

i. $Zn \mid Zn^{2+}$ (1 M) $\| Cu^{2+}$ (1M) $\mid Cu$

ii. $Zn \mid Zn^{2+}$ (0.1 M) $\| Cu^{2+}$ (1M) $\mid Cu$

iii. $Zn \mid Zn^{2+}$ (1 M) $\| Cu^{2+}$ (0.1M) $\mid Cu$

iv. $Zn \mid Zn^{2+}$ (0.1 M) $\| Cu^{2+}$ (0.1M) $\mid Cu$

are represented by E_1, E_2, E_3 and E_4 respectively.

Which of the following statement is true?

(1) $E_1 > E_2 > E_3 > E_4$ (2) $E_3 > E_2 > E_1 > E_4$

(3) $E_3 > E_1 > E_4 > E_2$ (4) $E_2 > E_1 > E_4 > E_3$

Question no. 72

Consider a first order gas phase decomposition reaction given below:

$$A(g) \rightarrow B(g) + C(g)$$

The initial pressure of the system before decomposition of A was p_i. After' lapse of time 't, total pressure of the system increased by x units and became 'p_t'. The rate constant k for the reaction is given as:

(1) $k = \frac{2.303}{t} \log \frac{p_i}{p_i - x}$

(2) $k = \frac{2.303}{t} \log \frac{p_i}{2p_i - p_t}$

(3) $k = \frac{2.303}{t} \log \frac{p_i}{2p_i + p_t}$

(4) $k = \frac{2.303}{t} \log \frac{p_i}{p_i + x}$

$$A(g) \longrightarrow B(g) + C(g)$$

P_i°	0	0
$P_i - P$	P	P
$P_i - x$		

$P_t = P_i^\circ + P$, $P = x$

$P_t = P_i^\circ + x$

$x = P_t - P_i$

$$k = \frac{2.303}{t} \log_{10} \frac{P_i^\circ}{P_i - x}$$

$$= \frac{2.303}{t} \log_{10} \frac{P_i^\circ}{P_i - (P_t - P_i^\circ)}$$

$$k = \frac{2.303}{t} \log_{10} \frac{P_i^\circ}{2P_i^\circ - P_t}$$

Question no. 73

The rate of reaction is expressed in different ways as follows:

$$+\frac{1}{2}\frac{d[C]}{dt} = -\frac{1}{3}\frac{d[D]}{dt} = +\frac{1}{4}\frac{d[A]}{dt} = -\frac{d[B]}{dt}$$

P R P R

$B + 3D \longrightarrow 2C + 4A$

The reaction is:

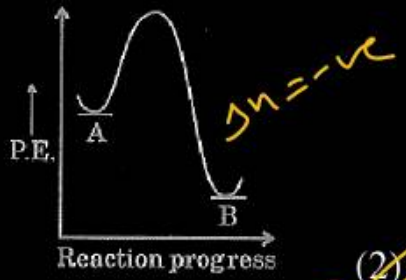
(1) $4A + B \rightarrow 2C + 3D$ (2) $B + 3D \rightarrow 4A + 2C$

(3) $A + B \rightarrow C + D$ (4) $B + D \rightarrow A + C$

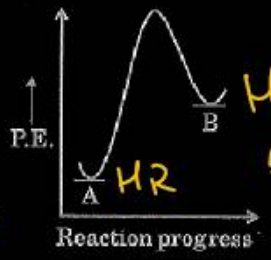
Question no. 74

For a reaction A → B $E_a = 10$ kJ mol^{-1}, $\Delta H = 5$ kg mol^{-1}. Thus potential energy profile for this reaction is:

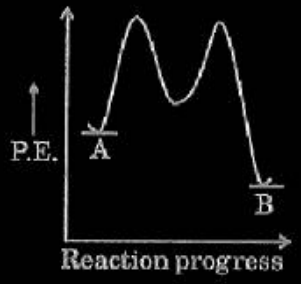
(1)



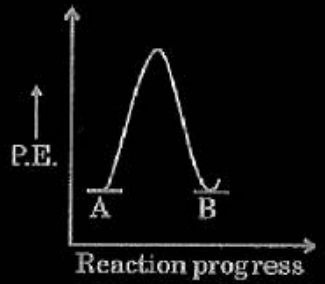
(2)



(3)

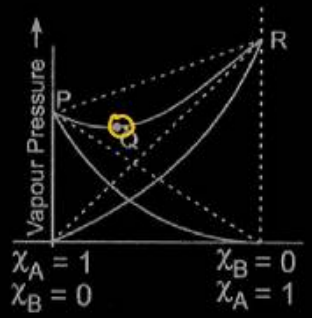


(4)



Question no. 75

Which of the following options is correct w.r.t the graph shown?



(I) The graph shows negative deviation from Raoult's law.

(II) Q stands for maximum boiling azeotrope.

(III) A – B interactions are weaker than A – A or B – B interactions.

(1) Only (I) is wrong

(2) Only (III) is wrong

(3) (II) and (III) are wrong

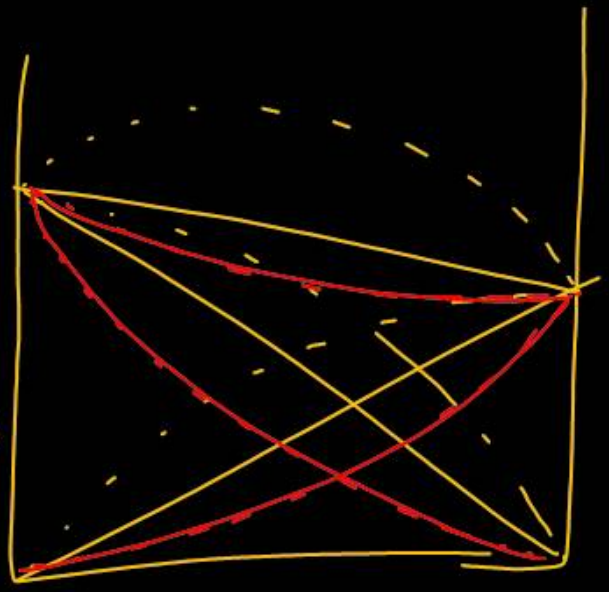
(4) All (I), (II) and (III) wrong

A-A FOA

B-B FOA

A-B FOA

A-B > A-A, B-B



Question no. 76

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

(1) 0.01 M Na_2SO_4 (2) 0.015 M glucose

(3) 0.015 M urea (4) 0.001NaCl

$i = 3$

Cepective $= C \times i$

highest

(1) $0.01 \times 3 = 0.03$

(2) $0.015 \times 1 = 0.015$

(3) $0.015 \times 1 = 0.015$

(4) $0.001 \times 2 = 0.002$

Question no. 77

An aqueous solution contains 3% and 1.8 % by wt. urea and glucoses respectively. What is the freezing point of solution? ($K_f = 1.86°$ C/m)

(1) –1.172°C (2) –2.27°C

(3) –1.5°C (4) None of these

$W_A = 100 - 3 = 97$

3 gm solute in 100 gm soln

1.8 gm solute in 100 gm soln

$\Delta T_f = i K_f \times m$ ($i = 1$)

$\Delta T_f = (K_f \times m)_{glucose} + (K_f \times m)_{urea}$

$\Delta T_f = 1.86 \left[\frac{3 \times 1000}{60 \times 97} + \frac{1.8 \times 1000}{180 \times 98.2} \right]$

$\Delta T_f = 1.86 \left[\frac{1}{2} + \frac{1}{98.2} \right]$

$= 1.86 [0.5 + 0.1]$

$= 1.86 \times 0.6$

$\Delta T_f = 1.1172$

f.p. $= -1.116$

Question no. 78

Match the columns.

	Column I (Ratio of i)		Column II
A.	Urea, glucose, fructose	p.	1:0.8:1
B.	$NaCl$, $MgCl_2$, K_2SO_4	q.	1:2:3
C.	$Al_2(SO_4)_3$, Na_3PO_4, $K_4[Fe(CN)_6]$	r.	1:1:1
D.	Glucose, $NaCl$, $CaCl_2$	s.	2:3:3

(1) A – r, B – q, C – s, D – p

(2) A – r, B – s, C – p, D – q

(3) A – p, B – q, C – r, D – s

(4) A – s, B – r, C – q, D – p

5 : 4 : 5

= 1 : 0.8 : 1

A → r

B → s

C → p

d → q

Question no. 79

The correct expression relating molality (m), molarity (M), density of solution (d) and molar mass (M_2) of solute is:

(1) $m = \dfrac{M}{d + MM_2} \times 1000$

(2) $m = \dfrac{M}{1000d - MM_2} \times 1000$

(3) $m = \dfrac{d + MM_2}{M} \times 1000$

(4) $m = \dfrac{1000d - MM_2}{M} \times 1000$

$m = \dfrac{1000 \times M}{1000 \times d - M M_B}$

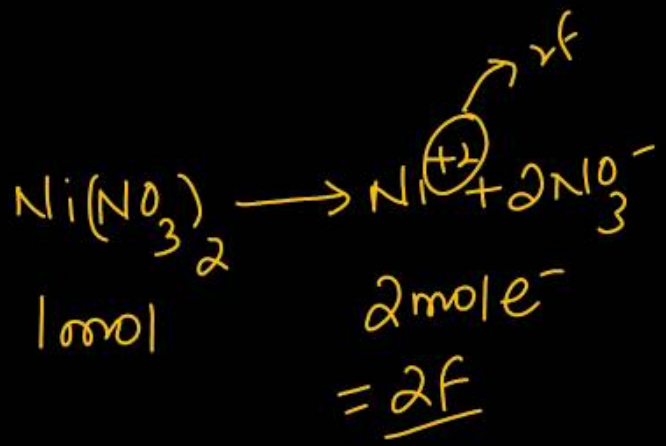
$\hookrightarrow M_2 = M_B$

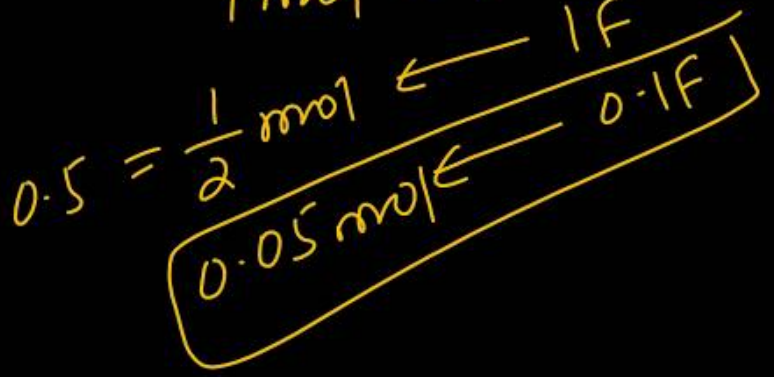
Question no. 80

A solution of $Ni(NO_3)_2$ is electrolyzed between platinum electrodes using 0.1 Faraday electricity. How many mole of Ni will be deposited at the cathode:

(1) 0.20 (2) 0.05

(3) 0.10 (4) 0.15





Question no. 81

Resistance of a conductivity cell filled with 0.1 mol L^{-1} KCl solution is 100Ω and conductivity is 1.29 S m^{-1}. If the resistance of the same cell when filled with 0.02 M KCl is 520Ω, the conductivity of this solution will be:

(1) 0.842 S nT^{-1}

(2) 0.248 S m^{-1}

(3) 0.428 S m^{-1}

(4) 0.482 S m^{-1}

$$K = \frac{1}{R} \times l/a$$

$$1.29 = \frac{1}{100} \times l/a$$

$$\frac{100}{1.29} = l/a \quad \text{(cell const)}$$

$$K = \frac{1}{R} \cdot l/a$$

$$K = \frac{1}{520} \times \frac{100}{1.29} = 0.24$$

$$K = \frac{1}{5.2 \times 1.29}$$

Question no. 82

Match List-I with List-II.

	List-I		List-II
A.	$Cd(s) + 2Ni(OH)_3(s) \rightarrow CdO(s) + 2Ni(OH)_2(s) + H_2O(l)$	i.	Primary battery
B.	$Zn(Hg) + HgO(s) \rightarrow ZnO(s) + Hgl(l)$	ii.	Discharging of secondary battery
C.	$2PbSO_4(s) + 2H_2O(l) \rightarrow Pb(s) + PbO_2(s) + 2H_2SO_4(aq)$	iii.	Fuel cell
D.	$2H_2(g) + O_2(g) \rightarrow 2H_2O(l)$	iv.	Charging of secondary battery

Choose the correct answer from options given below:

(1) A – iv, B – iii, C – ii, D – i

(2) A – i, B – iii, C – ii, D – iv

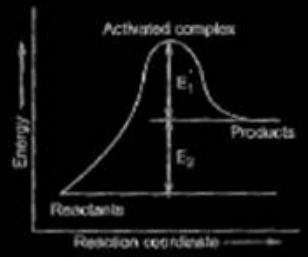
(3) A – ii, B – i, C – iv, D – iii

(4) A – ii, B – i, C – iii, D – iv

D – iii
C – iv
A – ii
B – i

Question no. 83

Consider Fig. and mark the correct option :

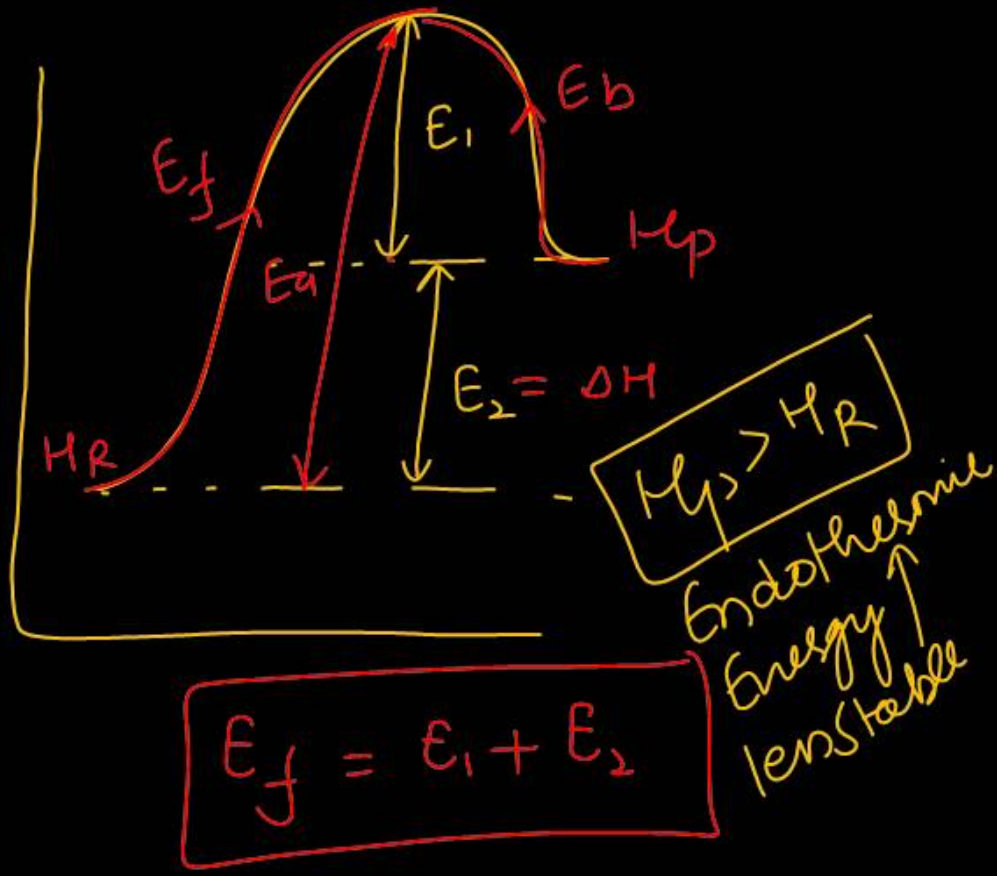


(1) Activation energy of forward reaction is E_1+E_2 and product is less stable than reactant.

(2) Activation energy of forward reaction is E_1+E_2 and product is more stable than reactant.

(3) Activation energy of both forward and backward reaction is E_1+E_2 and reactant is more stable than product.

(4) Activation energy of backward reaction is E_1 and product is more stable than reactant.

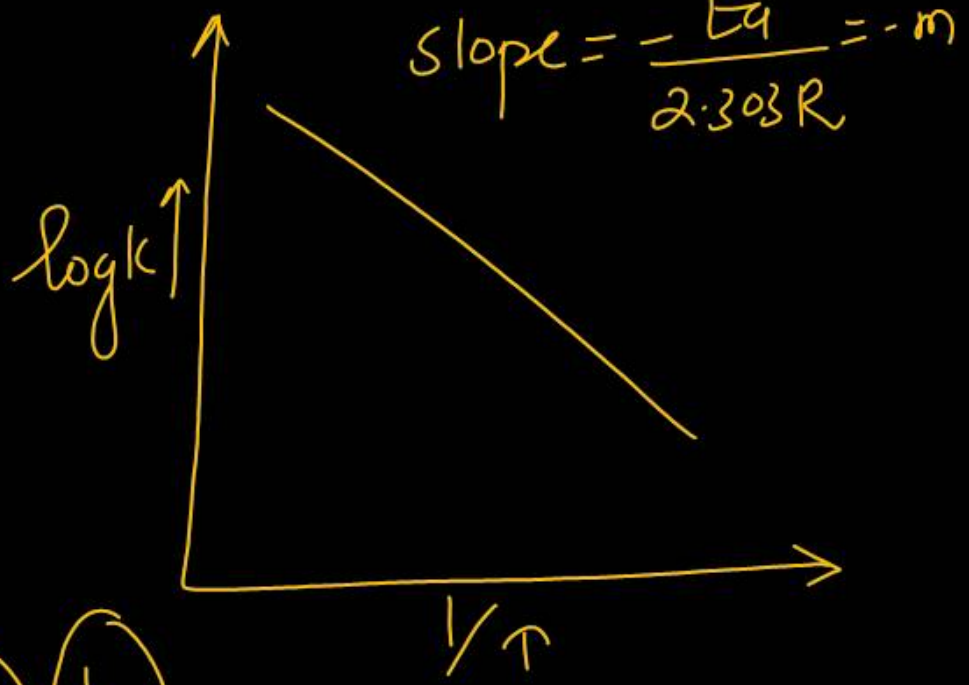


Question no. 84

The plot of $\log_{10} k$ versus $\frac{1}{T}$ is linear with slope of

(1) $\frac{-E_A}{R}$ (2) $\frac{+E_A}{R}$

(3) $\frac{E_A}{2.303R}$ (4) $\frac{-E_A}{2.303R}$



$$\text{slope} = \frac{-Ea}{2.303R} = -m$$

$$\log k = \log A - \frac{Ea}{2.303R}\cdot\frac{1}{T}$$

$y \quad c \quad -m \quad x$

Question no. 85

The reaction, $X + 2\,Y + Z \rightarrow N$ occurs by the following mechanism:

(P) $X + Y \rightleftharpoons M$ (rapid equilibrium)

(Q) $M + Z \rightarrow P$ (slow)

(R) $O + Y + P \rightarrow N$ (veru fast)

What is the rate law for this reaction?

(1) Rate = K [Z]

(2) Rate = K [X] $[Y]^2$ [Z]

(3) Rate = K [N]

(4) Rate = K [X] [Y] [Z]

$R = K[M]^x[Z]^y$

Rate $= K[M]^1[Z]^1$

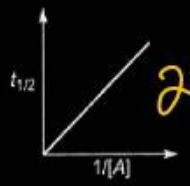
$K_{eq} = \dfrac{[M]}{[X][Y]}$

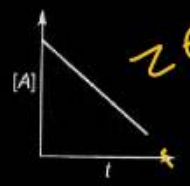
$K_{eq}[X][Y] = [M]$

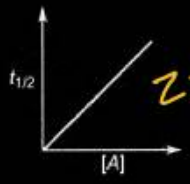
Rate = K [X] [Y] [Z]

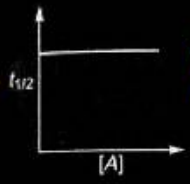
Question no. 86

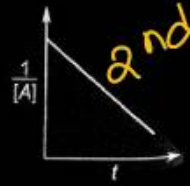
From the given graph identify the order of reaction.

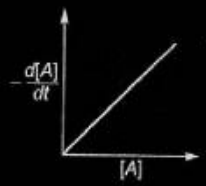
i. 

ii. 

iii. 

iv. 

v. 

vi. 

	Zero order	First order	Second order
(1)	i, iv	v, vi	ii, iii
(2)	ii, iii	vi, iv	v, i
(3)	ii, vi	i, v	iii, iv
(4)	ii, v	vi, iv	i, iii

$$t_{1/2} \propto (a_0)^{1-n}$$

$$\frac{1}{a_t} = \frac{1}{a_0} + kt$$

V, I – 2nd

IV, VI – 1st

II, III – zero

Question no. 87

The osmotic pressure of a dilute solution of an ionic compound *XY* in water is four times that of a solution of 0.01 M $BaCl_2$ in water. Assuming complete dissociation of given ionic compounds in water, the concentration of *XY* (in mol L^{-1}) in solution is :

(1) 6×10^{-2} (2) 4×10^{-4}

(3) 16×10^{-4} (4) 4×10^{-2}

$\pi = i^{\circ} CRT$

$(\pi)_{XY} = 4(\pi)_{BaCl_2}$

$(i^{\circ} CRT)_{XY} = 4(i^{\circ} CRT)_{BaCl_2}$

$1 \times C \times RT = 2 \times (3 \times 0.01 \times RT)$

$C = 2 \times 3 \times 0.01$

$C = 0.06$

$C = 6 \times 10^{-2}$

$BaCl_2 \rightarrow i = n = 3$

$XY \rightarrow i = n = 2$

Question no. 88

If the elevation in boiling point of a solution of non-volatile, non-electrolytic and non-associating solute in solvent (K_b = x K. kg. mol^{-1})is y K, then the depression in freezing (K_f of the solvent = z K. kg. mol^{-1})

(1) $\frac{2xz}{y}$

(2) $\frac{yz}{x}$

(3) $\frac{xz}{y}$

(4) $\frac{yz}{2x}$

$\Delta T_b = K_b \times m$ $(i=1)$

$y = x \times m$

$m = y/x$

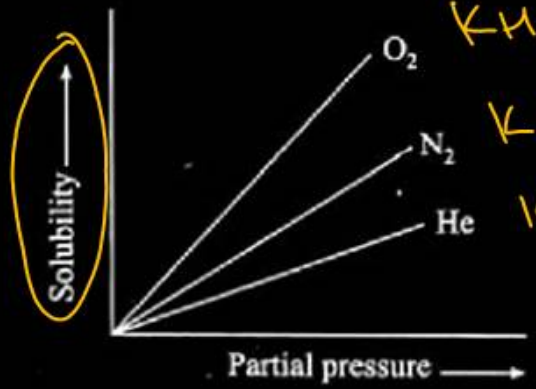
$\Delta T_f = K_f \times m$

$\Delta T_f = z \times y/x$

$\Delta T_f = \frac{yxz}{x}$

Question no. 89

Molar solubility of helium, nitrogen and oxygen are plotted against partial pressure of the gas at constant temperature.



K_H least

K_H less

Can move

Henry's law constant for these gases will lie in the following sequence?

→ K_H

(1) $O_2 > N_2 > He$

(2) $O_2 < N_2 < He$

(3) $O_2 = N_2 = He$

(4) $O_2 > N_2 < He$

From Henry law

K_H ↑ solubility ↓

Solubility high → K_H low

Solubility order = $O_2 > N_2 > He$

K_H order = $O_2 < N_2 < He$

Question no. 90

Which one of the following pairs of gases contains the same number of molecules?

(1) 16 g of O_2 and 14 g of N_2.

(2) 8 g of O_2 and 22 g of CO_2.

(3) 28 g of N_2 and 22 g of CO_2.

(4) 32 g of CO_2 and 32 g of N_2.

mole $= \frac{16}{32} = 1/2$ mol

mol $= \frac{14}{28} = 1/2$ mol

mol same = molecule same

molecule = mol $\times N_A$

8/32 = 1/4

22/44 = 1/2

28/28 = 1

22/44 = 1/2

32/64

32/28

Question no. 91

Biological method of control of pests and disease relies on

(1) Interspecific competition

(2) Intraspecific competition

(3) Natural predation

(4) Use of advanced chemicals

Question no. 92

Match the following columns.

	Column I		Column II
A.	Without distillation	i	Wine
B.	By distillation	ii	Beer
		iii	Whisky
		iv	Brandy
		v.	Rum

(1) A-i,ii B-iii,iv,v

(2) A-iii,iv B-i,ii,v

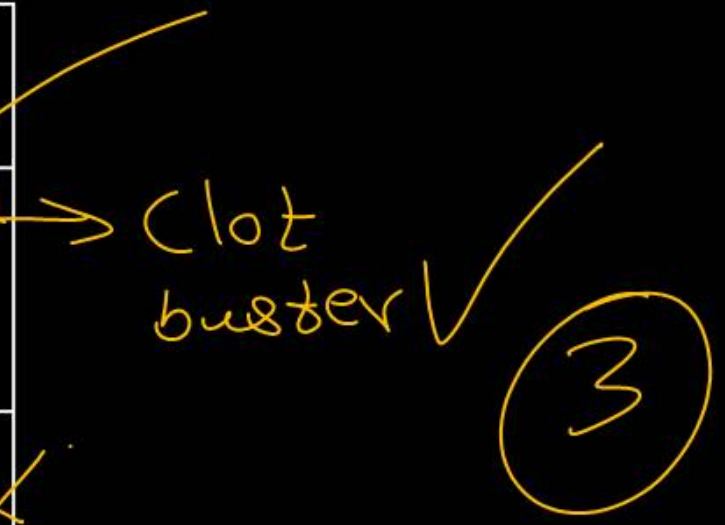
(3) A-ii,iii B-i,ii,v

(4) A-iii,v B-i,ii,iv

Question no. 93

Identify the entry in the table which is wrongly matched, .

(1)	Monascus Purpureus	Statins	Lowers blood Cholesterol
(2)	Streptococcus	Strepto–kinase	Removes clots from blood vessels
(3)	Clostridium acetobutylicum	Lipase	Oil stain removal
(4)	Trichoderma polysporum	Cyclos–porin–A	Immunosuppre–ssive drug



Question no. 94

Among the following pairs of microbes, which pair has both the microbes that can be used as biofertilisers?

(1) Aspergillus and Cyanobacteria

(2) Aspergillus and Rhizopus

(3) Rhizobium and Rhizopus

(4) Cyanobacteria, and Rhizobium

4

Question no. 95

Statement I: Predators in nature act as "biological control agents" by regulating preypopulations.

Statement II: Absence of predators in ahabitat often leads to overpopulation of preyspecies and ecological imbalance.

(1) Both statements are true

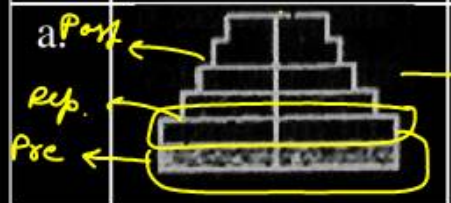
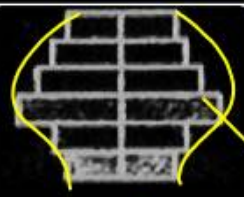
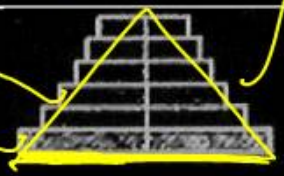
(2) Both statements are false

(3) Statement I is true, while statement II is false

(4) Statement I is false, while statement II is true

Question no. 96

Match the columns I and II, and choose the correct combination from the options given.

	Column I		Column II
a.		I	Stable Population
b.		II	Expanding Population
c.		III	Declining Population

(1) a-1,b-2, c-3 (2) a-3,b-l,c-2

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

Compare

Rep. & Pre-Repro.

↓

More / सटीक

↓

Use

Question no. 97

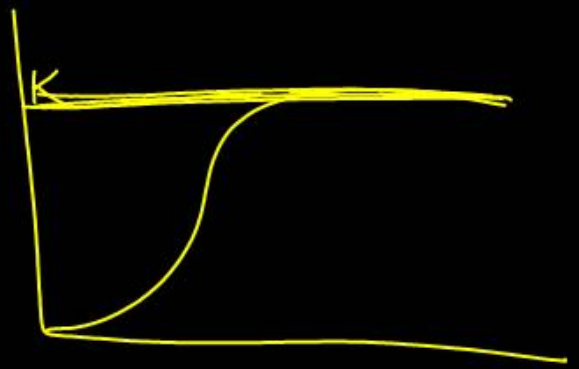
Carrying capacity is

(1) the capacity of an individual to produce young ones

(2) availability of resources in a given habitat to support a certain number of individuals of population, beyond which no further growth is possible

(3) gene frequency from one generation to next

(4) gene frequency in same generation



Question no. 98

Sigmoid/logistic growth curve is represented by :

(1) $\frac{dN}{dt} = rN$

(2) $\frac{dN}{dt} = rN(1 - N/k)$

(3) $N_t = N_o + B + I - D - E$

(4) $\frac{dN}{dt} = 1 - \frac{N}{K}$ → rN

$$\frac{dN}{dt} = rN\left(\frac{K - N}{K}\right)$$

$$= rN\left(1 - \frac{N}{K}\right)$$

Question no. 99

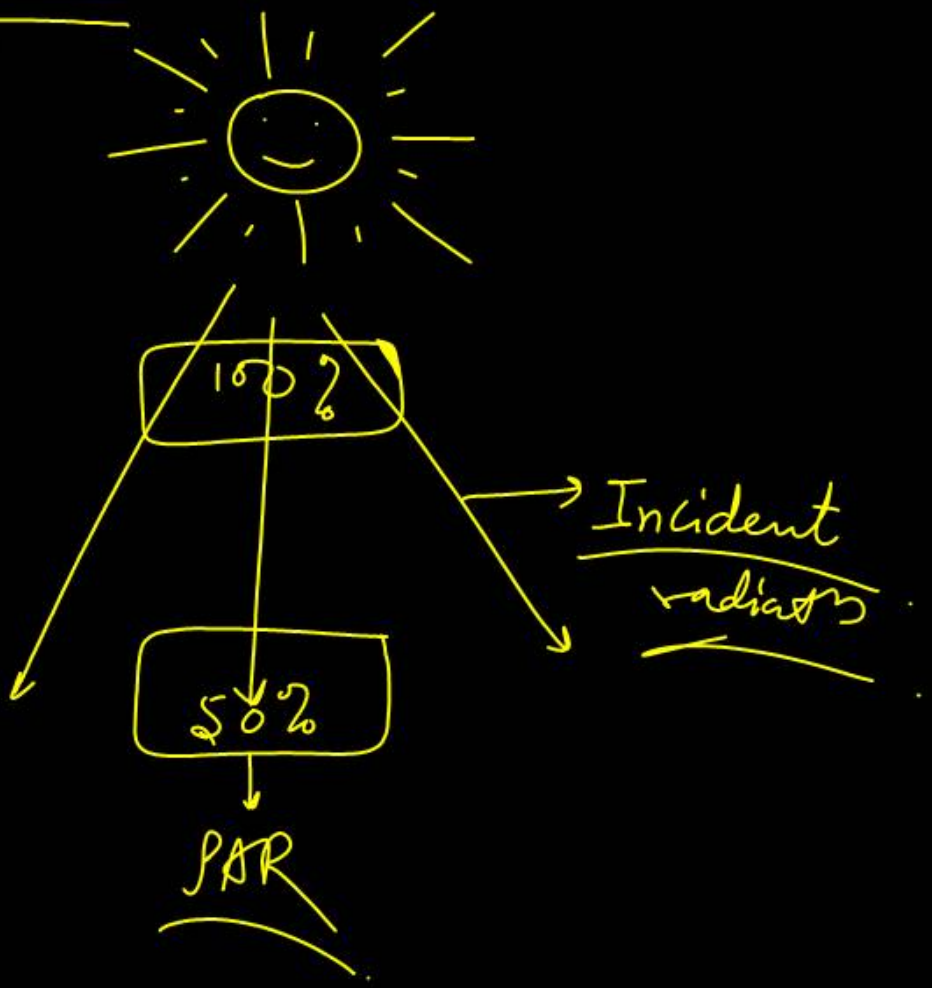
What is the percentage of photosynthetically active radiation (PAR) in the incident solar radiation?

(1) 100 %

(2) 50 %

(3) 1–5 %

(4) 2–10%



Question no. 100

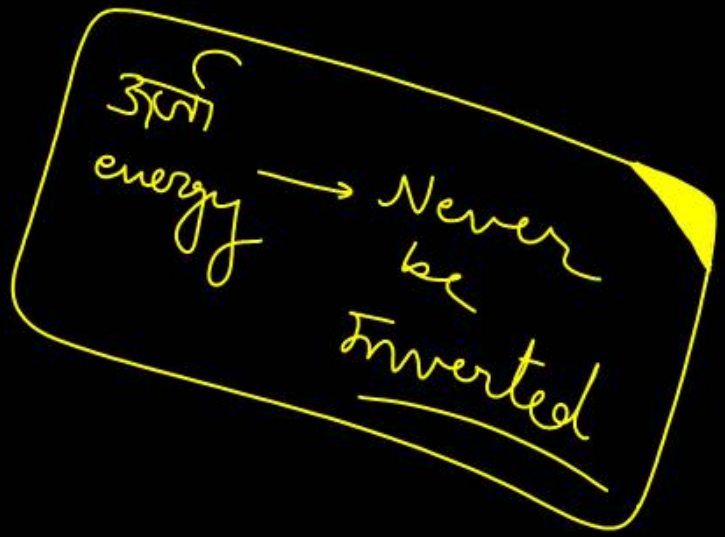
Which of the following ecological pyramid are always inverted?

(1) Pyramid of number in parasitic food chain and pyramid ofbiomass in pond ecosystem

(2) Pyramid of number in pond ecosystem and pyramid ofbiomass in pond ecosystem

(3) Pyramid of number in parasitic food chain and pyramid of number in pond ecosystem

(4) All of the above



Question no. 101

Assertion: Pyramid of energy can never be inverted.

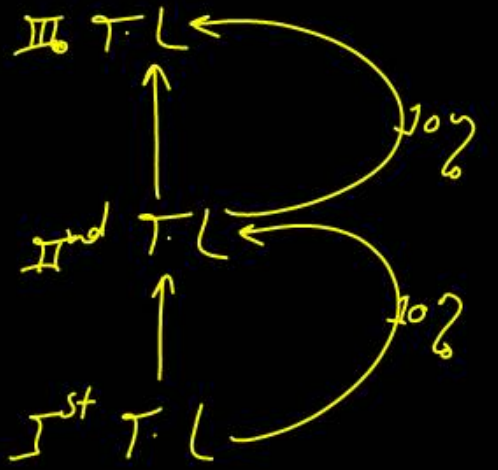
Reason: When energy flows from one trophic level, some energy is always lost as heat at each step.

(1) Both Assertion (A) and Reason (R) are the true and Reason (R) is a correct explanation of Assertion (A).

(2) Both Assertion (A) and Reason (R) are the true but Reason (R) is not a correct explanation of Assertion (A).

(3) Assertion (A) is true and Reason (R) is false.

(4) Assertion (A) is false and Reason (R) is true

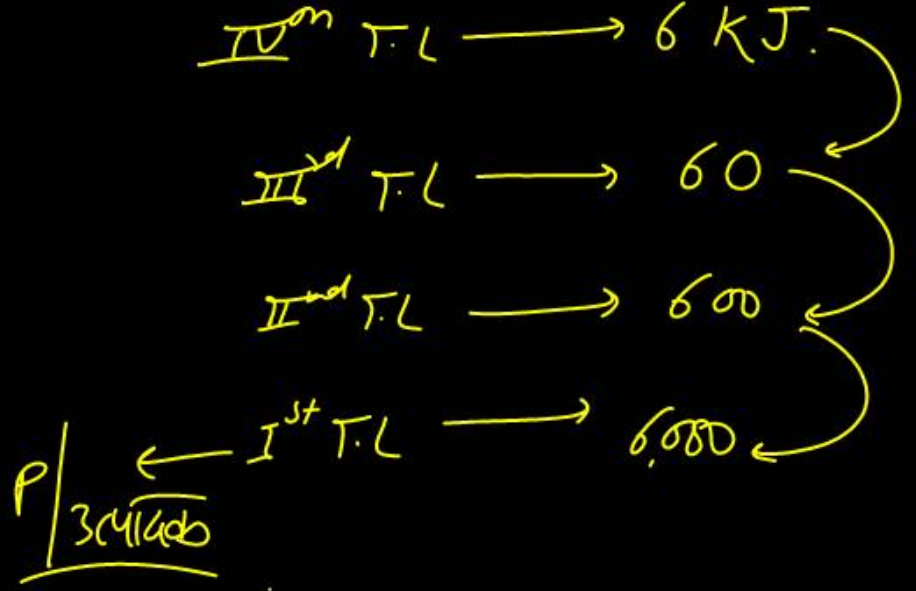


Question no. 102

In a given food chain, suppose the amount of energy at the fourth tropic level is 6 kJ. What will be the energy availableat producer level?

(1) 0.6 kJ (2) 60 kJ

(3) 600 kJ (4) 6000 kJ

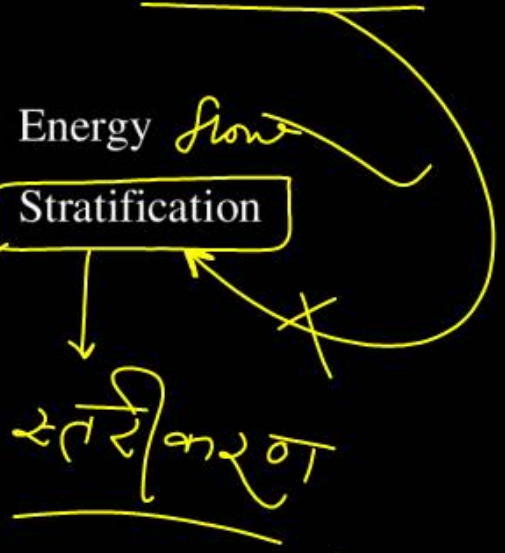


Question no. 103

Find the odd one out with respect to the functions of an ecosystem.

(1) Nutrient cycling (2) Energy flow

(3) Decomposition (4) Stratification



Question no. 104

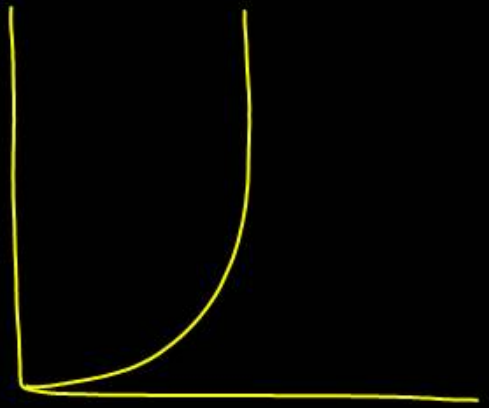
Exponential growth

(1) Occurs under limited resources

(2) Shows a natural limit of population density for every species, called the carrying capacity

(3) Is influenced by environmental resistance over biotic potential

(4) Results in J–shaped growth curve



Question no. 105

Read the following statement.

"Nature's biological library is burning evenbefore we catalogued the titles of all the books stocked there".

What is the context of above statement?

(1) The diversity of plants and animals is not uniform

(2) Rich biodiversity is essential for ecosystem health

(3) A large fraction of species faces the threat of becoming extinct even before we discover them

(4) All of the above

Question no. 106

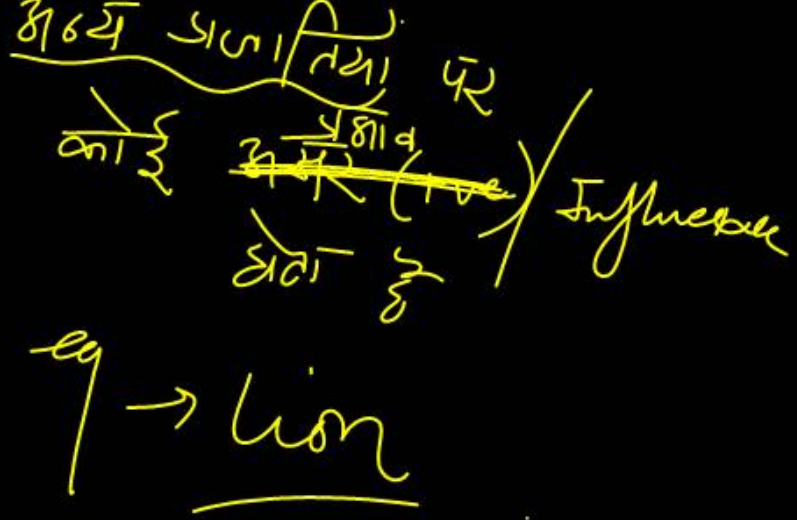
Keystone species should be protected as they

(1) Are capable of surviving in harsh conditions of environment

(2) Indicate presence of certain minerals in the soil

(3) Have become rare due to over-exploitation

(4) Play an important role in supporting other species



Question no. 107

Greater biological diversity of tropics than temperate regions is due to

(1) Presence of more seasonal environment

(2) Frequent glaciations in the past

(3) Highly variable climate and availability of less solar energy in the past

(4) Availability of more solar energy which contributes to higher productivity

Question no. 108

In Rivet Popper hypothesis, rivets of wings are considered as

(1) Dominant species
(2) Critical link species
(3) Rare species
(4) Key stone species

Question no. 109

Read the following statemens and select the correct option.

A. Species richness increases with increasing explored area, but only up to a limit.

B. Dodo, Quagga, Thylacine and Steller's sea cow are some examples of recent extinctions.

C. Tropical latitude had a long evolutionary time for species diversification.

D. The amount of genetic variation is not the basis of speciation.

(1) Only (A) and (B)

(2) Only (A), (B) and (C)

(3) Only (B) and (C)

(4) (A), (B), (C), (D)

are correct

Evolution & Speciation

Question no. 110

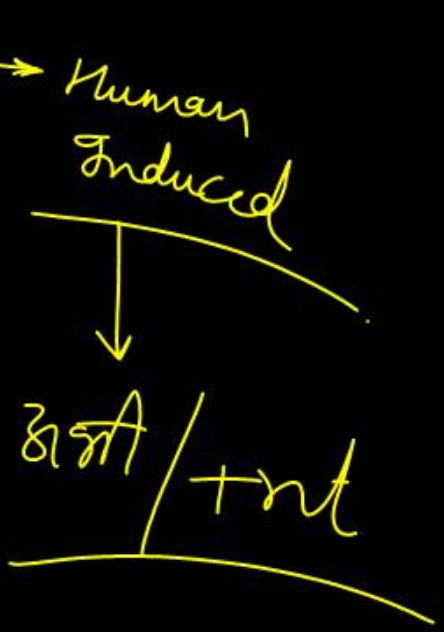
Anthropogenic extinction is called

(1) Third extinction

(2) Fourth extinction

(3) Sixth mass extinction

(4) Seventh mass extinction



Question no. 111

Mitosis is responsible of

A. Growth of multicellular organisms

B. Cell repair

C. Formation of four haploid cells

D. Healing and regeneration of cells

Choose the correct option:

(1) A and B only

(2) Only C

(3) A, B, C and D

(4) A, B and D

Question no. 112

Which of the following is true for telophase?

(1) Chromosomes lose their identity as discrete elements.

(2) Chromosomes cluster at opposite spindle poles.

(3) Nuclear envelope, nucleolus, Golgi complex and ER reform

(4) All of these

Question no. 113

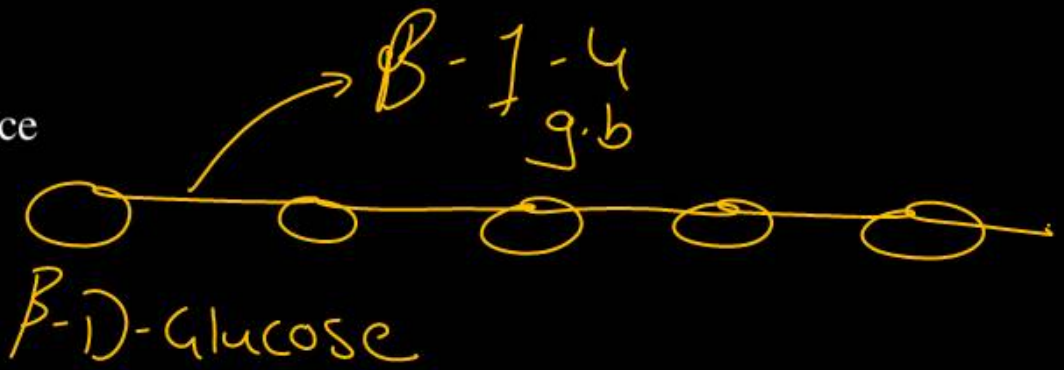
Cellulose does not from blue colour with iodine because

(1) It is a helical molecule.

(2) It does not contain complex helices and hence cannot hold iodine molecules.

(3) It breaks down when iodine reacts with it.

(4) It is a disaccharide.



2

Question no. 114

Consider the following statements -

I. Biochemical Oxygen Demand (BOD) represents the amount of dissolved oxygen that would be consumed if all the organic matter in 1L of water were oxidized by microorganism

II. Low value of BOD means the water is either normal or less polluted by organic matter

III. High value of BOD means the water in highly polluted by organic matter

Which of the statements given above are correct?

(1) I and II

(2) I and III

(3) II and III

(4) I, II and III

↑ O_2 : ↑ waste.

↓ O_2 = ↓ organic waste.

4

Question no. 115

Which of the following statements regarding Baculoviruses as bio-control agents is/are **correct?**

A. Baculoviruses are pathogens that attack insects and other arthropods.

B. Most of these biocontrol agents belong to the group nucleopolyhedrovirus.

C. They do not harm plants, mammals, birds, fish and other non-target insects.

D. Baculoviruses are helpful in Integrated Pest Management (IPM) programme, in which beneficial insects are conserved.

E. They have species-specific, narrow spectrum insecticidal application.

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

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

Biocontrol

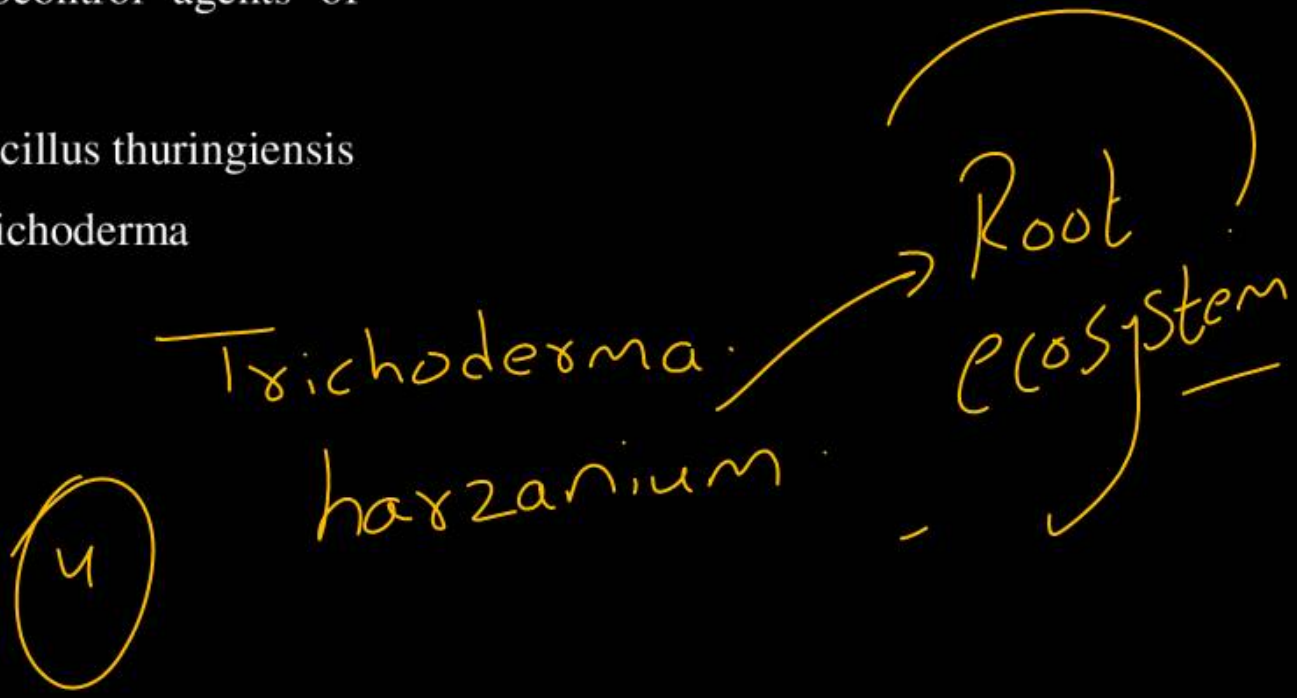
2

Question no. 116

Which organisms is used as biocontrol agents of several plants pathogens?

(1) Baculoviruses (2) Bacillus thuringiensis

(3) Dragon flies (4) Trichoderma

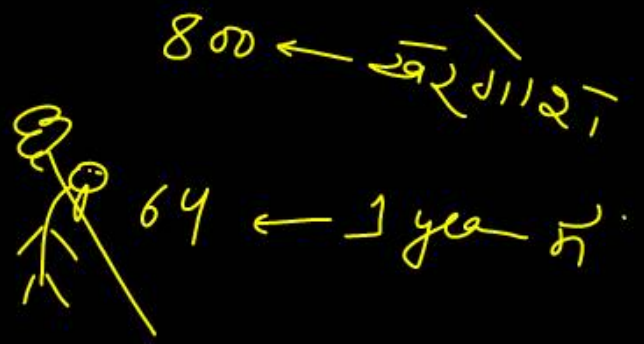


Question no. 117

In a grassland, a rabbit population had 800individuals at the beginning of the year. Duringthe year, 64 rabbits died due to predation anddisease. If there was no migration, what will bethe death rate of this population (per individualper year)?

(1) 0.04 (2) 0.08

(3) 0.064 (4) 0.16



Question no. 118

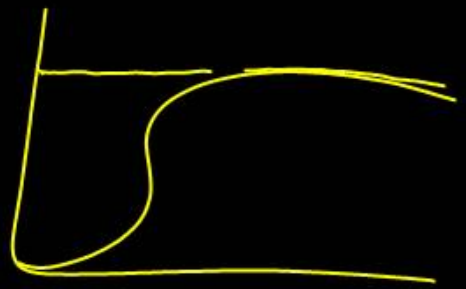
Human population shows

(1) J-shaped growth curve

(2) Z-shaped growth curve

(3) S-shaped growth curve / Sigmoid

(4) All of the above



Question no. 119

Which is a correct matching set.

Interspecific population ineractions		
Species A	**Species B**	**Nature ofineractions**
+	+	a
–	–	b
+ (Predator)	– (Prey)	d
+ (Parasite)	– (Host)	c
+	0	e
–	0	f

(1) a - competition, b - predation,
c -commensalism, d - parasitism,
e -amensalism, f-mutualism

(2) b - competition, c - predation, f-commensalism,
d - parasitism, e -amensalism, a - mutualism

(3) b - competition, d - predation,
e -commensalism, c - parasitism,
f -amensalism, a - mutualism

(4) b - competition, d - predation,
c -commensalism, e - parasitism,
f -amensalism, a - mutualism

Question no. 120

If birth rate = B, Death rate= D, Emigration = E, Immigration = I, then choose the correct match from among the following.

	Column I		Column II
a	Population is stable	i.	B +I > D + E
b	Population is increasing	ii.	B + I = D + E
c	Population is decreasing	iii.	B + I < D + E

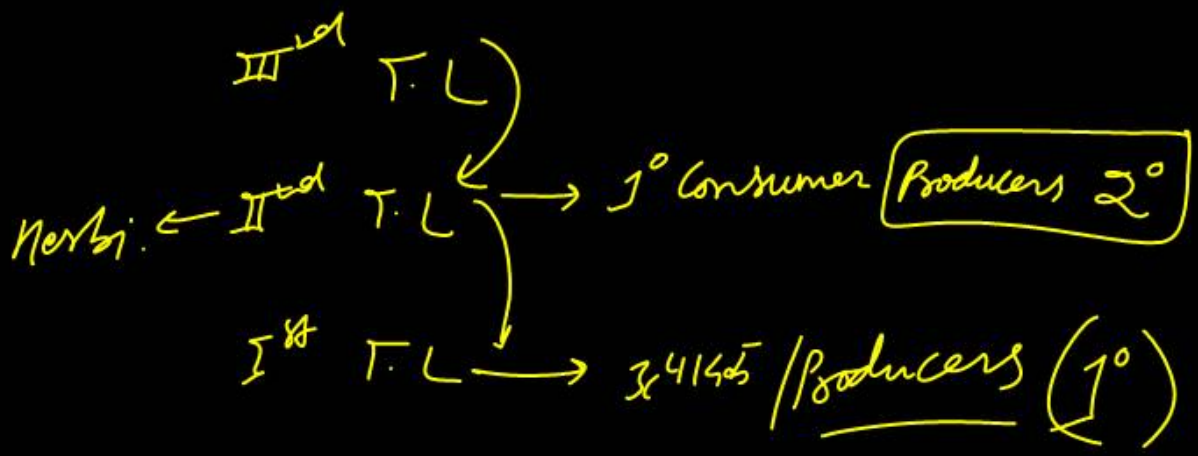
	a	b	c
(1)	ii	i	iii
(2)	ii	iii	i
(3)	i	iii	ii
(4)	i	ii	iii

Question no. 121

Secondary producers are

(1) Herbivores (2) Plants

(3) Carnivores (4) Decomposers



Question no. 122

An ecosystem is

(1) An assemblage of plants, animals and their surroundings

(2) A localised assemblage of several plants and animals

(3) Different communities of plants and microbes interact with their physico-chemical environments

(4) Different communities of plants, animals and microbes interact together with their physico-chemical environments

ABIOTIC + BIOTIC components

Question no. 123

Match the trophic levels with their correct species examples in grassland ecosystem.

Match the following columns

	Column - I		Column - II
a.	Fourth trophic level	i.	Crow
b.	Second trophic level	ii.	Vulture
c.	First trophic level	iii.	Rabbit
d.	Third trophic level	iv.	Grass

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

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

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

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

VULTURE

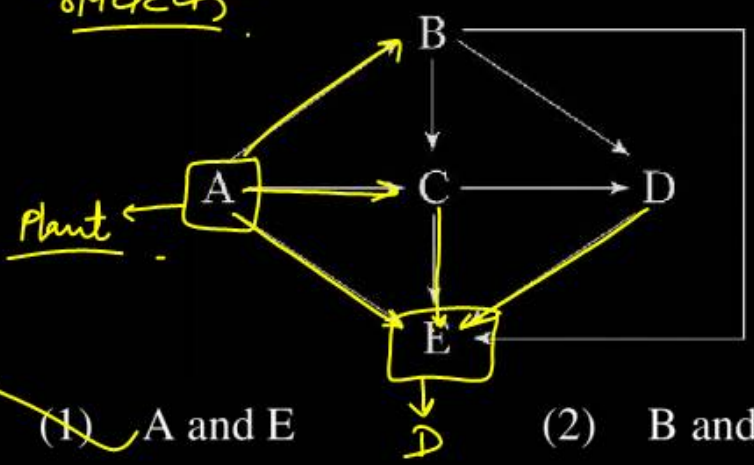
CROW

RABBIT

GRASS

Question no. 124

Examine the food web for a particular terrestrial ecosystem.Which species is autotrophic and decomposer respectively?



(1) A and E

(2) B and E

(3) C and A

(4) E and A

Question no. 125

The basic unit of study in ecology is

(1) population

(2) Organism

(3) Community

(4) Species

Question no. 126

Penicillium secrets penicillin that inhibits the growth of large number of bacteria. This type of interaction is

(1) Amensalism (2) Parasitism

(3) Competition (4) Predation

PENICILLIUM (0)

BACTERIA (−)

Question no. 127

Which of the following statements regarding biodiversity hotspots are incorrect?

A. High endemism

B. High level of species richness

C. Total number is 34 in the world

D. Five of these occur in India.

E. High alien species invasion

(1) A and B only

(2) D and E only

(3) B and E only

(4) C, D and E only

Question no. 128

Biodiversity loss occurs due to the reasons given in below.

(i) Habitat loss and fragmentation

(ii) Co-extinction

(ii) Over-exploitation

(iv) Alien species invasion

Identify the correct reasons.

(1) (i) and (ii)

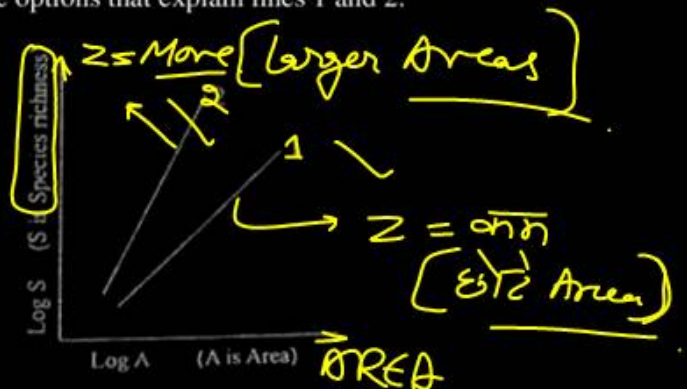
(2) (i), (ii), (iii) and (iv)

(3) (ii), (iii) and (iv)

(4) (i), (ii) and (iv)

Question no. 129

Observe the graph of area versus species richness and select the options that explain lines 1 and 2.



Z = More [larger Areas]

1 → Z = कम [छोटे Area]

Z = Slope of line (रेखा की ढलान)

(1) 1-Molluscs in New York state (small area)
2– plants in Britain

(2) 1-Plants in Britain
2 - birds in California (Z = same)

(3) 1-Frugivorous birds and mammals in the tropical forests of different continents → large
2 - plants in Britain

(4) 1-Molluscs in New York state [small area] Z = 0·1 – 0·2 (कम) → Slope
2-frugivorous birds and mammals in the tropical forests of different continents [large area] Z = 0·6 – 1·2 ज्यादा → steeper

Question no. 130

Mango, a popular fruit of India is found with many variations in flavours, colours, fibre content, sugar content including shelf life. The reason for such a huge variation is

(1) Species diversity

(2) Ecological diversity

(3) Genetic diversity

(4) Hybridization

Question no. 131

Which one of the following shows maximum genetic diversity in India?

(1) Mango → 10,000

(2) Neem →

(3) Rice → 50,000

(4) Maize →

Question no. 132

Read the following statements and state true (T) or false (F).

A. Species diversity decreases as we move from equator to poles.

B. Tropical Amazon rain forest in South America has the greatest biodiversity on earth.

C. A very high number of amphibian species are endemic to Western Ghats.

D. Plant diversity is more than the animal diversity.

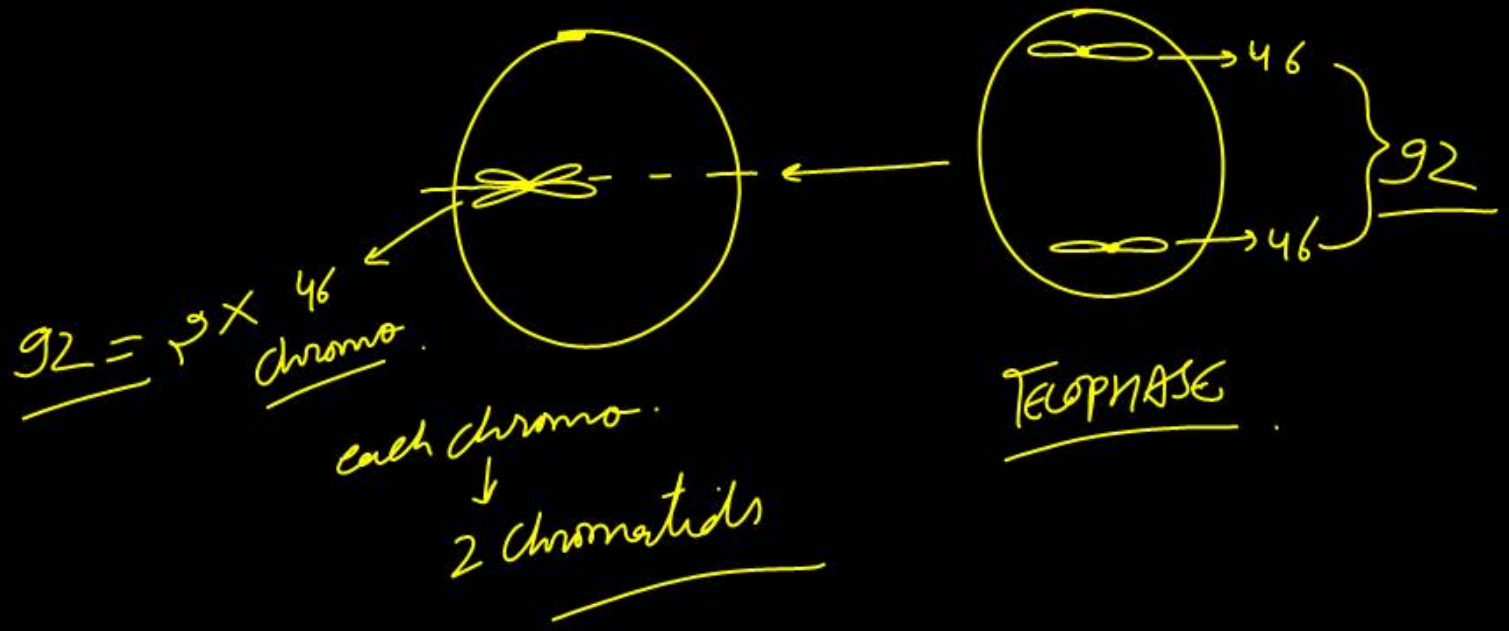
	A	B	C	D
(1)	T	T	F	F
(2)	T	T	F	T
(3)	F	F	T	F
(4)	F	T	T	F

Question no. 133

A cell has 46 chromosomes at each pole in mitotic telophase. In this division the number of chromatids at the metaphase was :-

(1) 23 (2) 46

(3) 92 (4) 69



Question no. 134

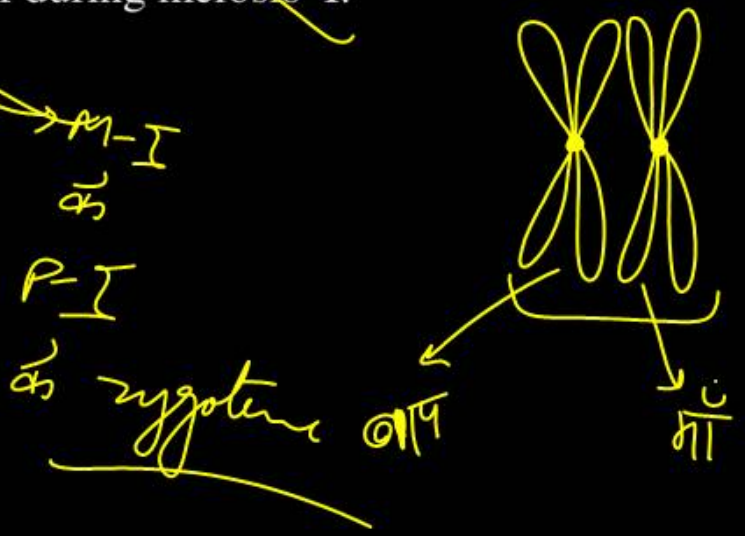
Which of the following statement is not true for homolgous chromosome pairs?

(1) They come from only one of the parents.

(2) They usually contain slightly different versions of the same genetic information.

(3) They segregate from each other during meiosis–I.

(4) They synapse during meiosis.



Question no. 135

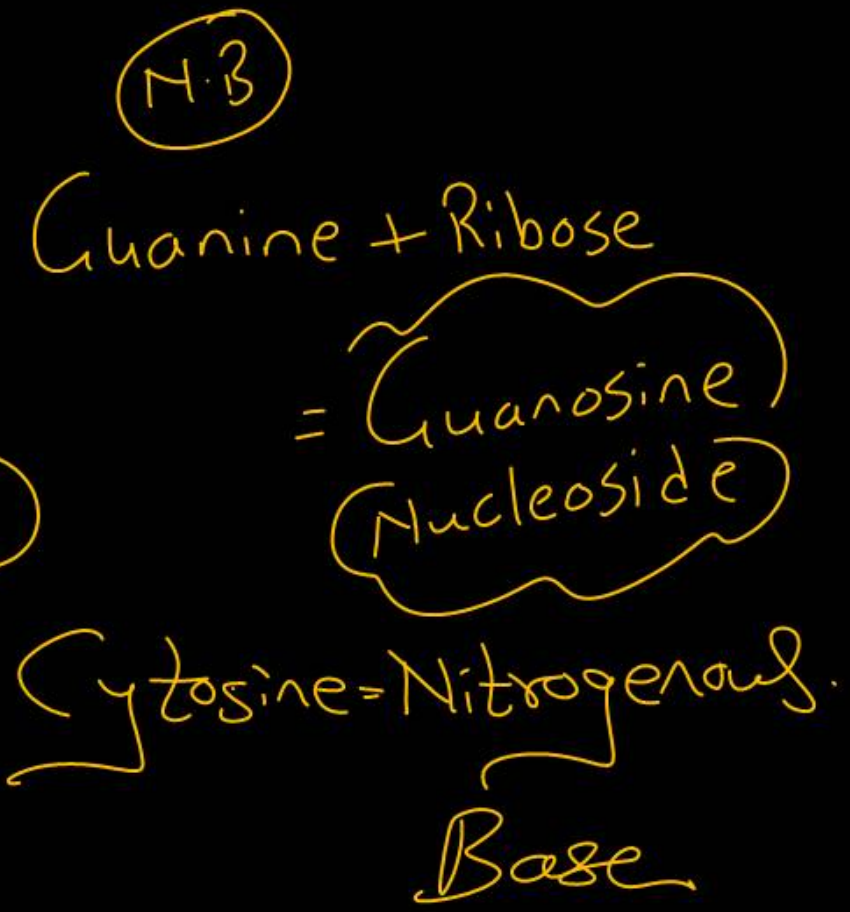
Which of the following is correct w.r.t the difference between guanosine and cytosine?

(1) Guanosine is a nucleoside, while cytosine is a nucleotide.

(2) Guanosine is an nitrogen base, while cytosine is a nucleoside.

(3) Guanosine is a nucleoside, while cytosine is a nitrogen base.

(4) Guanosine has deoxyribose sugar, while cytosine has ribose sugar.



Question no. 136

The technology of biogas production was developed in India mainly due to efforts of

(1) ICAR and IARI (2) KVIC and NEERI

(3) ISRO and NEERI (4) IARI and KVIC

4

Question no. 137

Consider the following statements

I. Ladybird beetle and dragon flies are used to get ridof aphids and mosquitoes respectively.

II. The bacteria Bacillus thuringiensis (Bt) are used to control butterfly caterpilar

III. Trichoderma species are free living fungi, are present in root ecosystems where they act against several plant pathogens

IV. Rhizobium is a freeliving nitrogen fixing bacterium.

Which of the statements given above are correct?

(1) I, II and III (2) I, III and IV

(3) II, III and IV (4) II and IV

Question no. 138

The primitive prokaryotes responsible for the production of biogas from the dung of ruminant animals include the

(1) Methanogens
(2) Methanotrophs
(3) Organotrophs
(4) Eubacteria

Question no. 139

Identify the set which has all organisms used in biological control of pests.

(1) Trichoderma, Nucleopolyhedrovirus, Bacillus thuringiensis, Ladybird.

(2) Dragonfly, Bacillus thuringiensis, Ladybird, Aphids,

(3) Ladybrid, penicillium, Baculoviruses, Aspergillus.

(4) Trichoderma, Aspergillus, Bacillus thuringiensis, Nucleopolyhedrovirus.

Question no. 140

A population has certain attributes that anindividual organism does not. These are

a. Birth rate
b. Death rate
c. Sex ratio
d. Age distribution

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

Question no. 141

Read the following statements and find out the in correct statement(s).

a. Parasitic mode of life ensures free lodgingand meals so parasitism has evolved in somany taxonomic groups from plants tohigher vertebrates.

b. Many parasites have evolved to be hostspecific, i.e. they can parasitise only asingle species of host.

c. The life-cycle of parasites are often complex, involving one or two intermediate host or vectors to facilitate parasitisation of its secondary host.

d. Parasites harm the host.

e. Lice on dogs and ticks on humans arefamiliar examples of endoparasites.

(1) b an dc (2) c and e

(3) d and e (4) b and d

Question no. 142

In the equation, $dN/dt = rN$

(1) 'r' is called the 'intrinsic rate of natural increase'.

(2) 'r' is the parameter chosen for assessing impacts of anybiotic factor on population growth.

(3) 'r' is the parameter chosen for assessing impacts of anabiotic factor on population growth.

(4) All of these

Question no. 143

The second trophic level in a lake is

(1) Phytoplankton (2) Zooplankton

(3) Benthos (4) Fishes

→ Zoo.

Aquatic Ecosystem → Phyto.

Question no. 144

Mycorrhizae are the example of

(1) Amensalism (2) Antibiosis

(3) Mutualism (4) fungistasis

(+, +)

Fungus + Roots of Higher plants

Question no. 145

The process of accumulation of a dark coloured amorphous substance that is highly resistant tomicrobial action and undergoes decomposition at anextremely slow rate is called

NCERT

(1) Mineralisation (2) Humification

(3) Organisation (4) Transformation

Question no. 146

Read the below given statements with respect to three important steps of decomposition: fragmentation, leaching and catabolism.

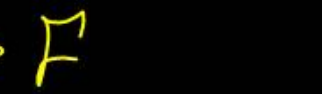
Select the correct option from the following.

(i) Detritivores (earthworm) breakdown detritus intosmaller particles.

(ii) Water soluble inorganic nutrients go down into soil horizon and get precipitated as unavailable salts.

(iii) Decomposers (e.g., bacteria and fungi) secrete digestiveenzymes and degrade detritus into simpler inorgani csubstances.

	Leaching	Fragmentation	Catabolism
(1)	(i)	(ii)	(iii)
(2)	(iii)	(ii)	(i)
(3)	(ii)	(i)	(iii)
(4)	(ii)	(iii)	(i)



Question no. 147

Identify the correct set of statements:

A. The movement of energy is always unidirectionalfrom lower trophic level to higher trophic level inan ecosystem.

B. Vertical distribution of different species occupying different levels is called stratification.

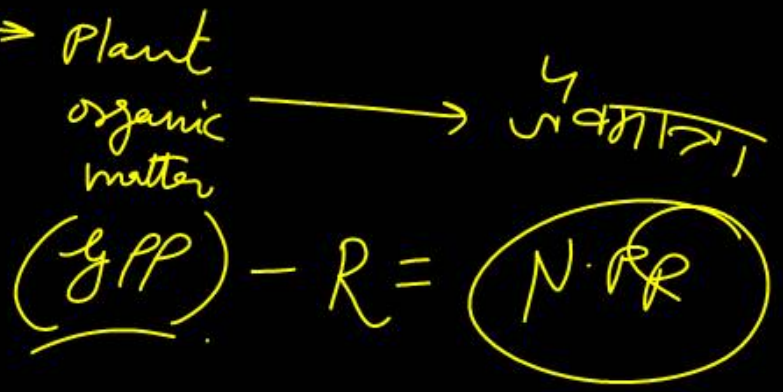
C. All the organic matter produced by the plant is converted into biomass.

D. NPP is the available biomass for the consumptionto heterotrophs.

Choose the correct answer from option given below.

(1) B, C and A (2) B and D only

(3) A, B and D (4) B andC only



Question no. 148

What type of ecological pyramid would be obtained with the following data?

Secondary consumer : 120 g

Primary consumer : 60 g

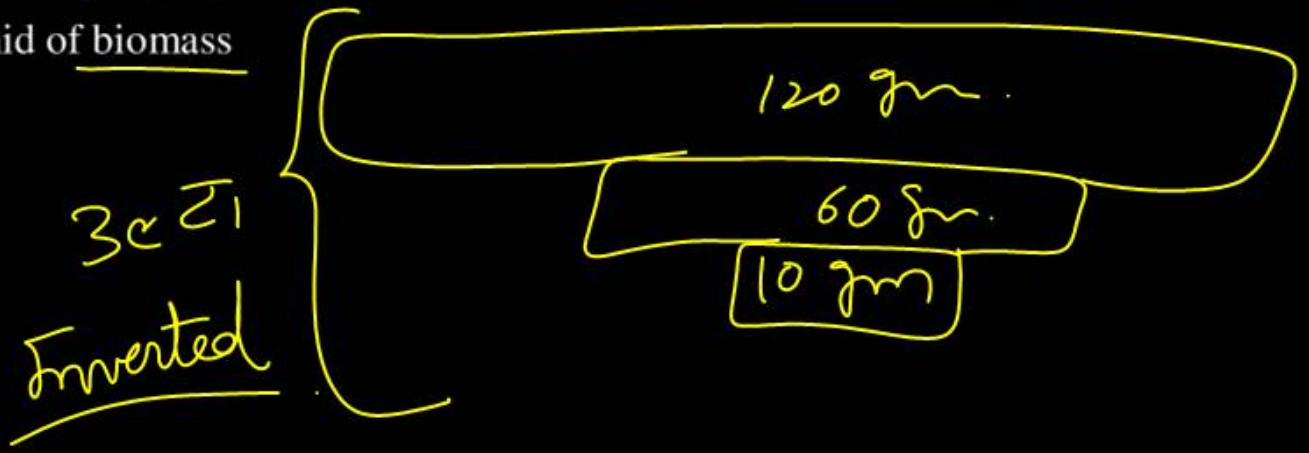
Primary producer : 10 g

(1) Upright pyramid of numbers

(2) Pyramid of energy

(3) Inverted pyramid of biomass

(4) Upright pyramid of biomass



Question no. 149

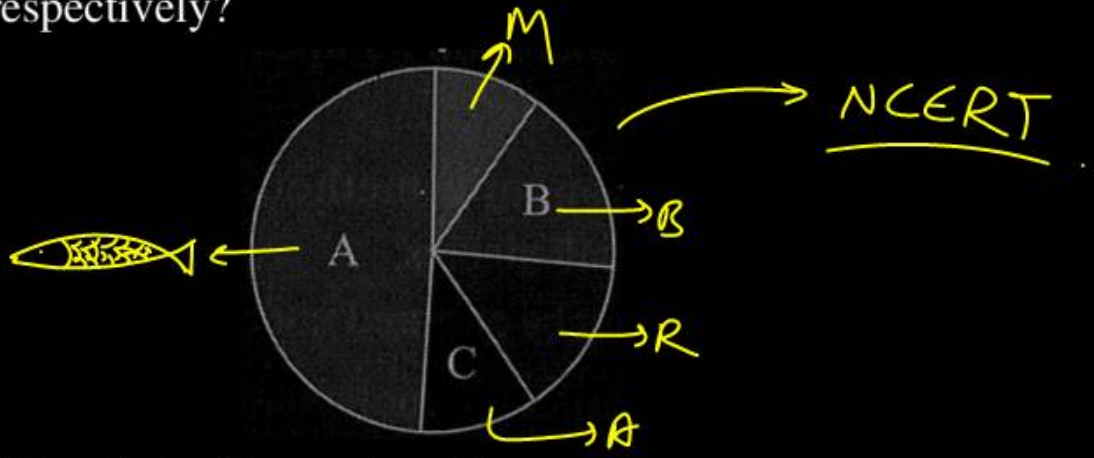
In the equation GPP–R = NPP, R represents–

(1) Radiant energy (2) Retardation factor

(3) Environmental factor (4) Respirtory losses

Question no. 150

In the following pie chart of global vertebrates' diversity, what does A, B and C represent respectively?



(1) Birds, Fishes, Amphibians

(2) Mammals, Reptiles, Birds

(3) Fishes, Birds Amphibians

(4) Amphibians, Fishes, Reptiles

Question no. 151

Statement I: Species diversity increases as we gofrom low latitude to high latitude.

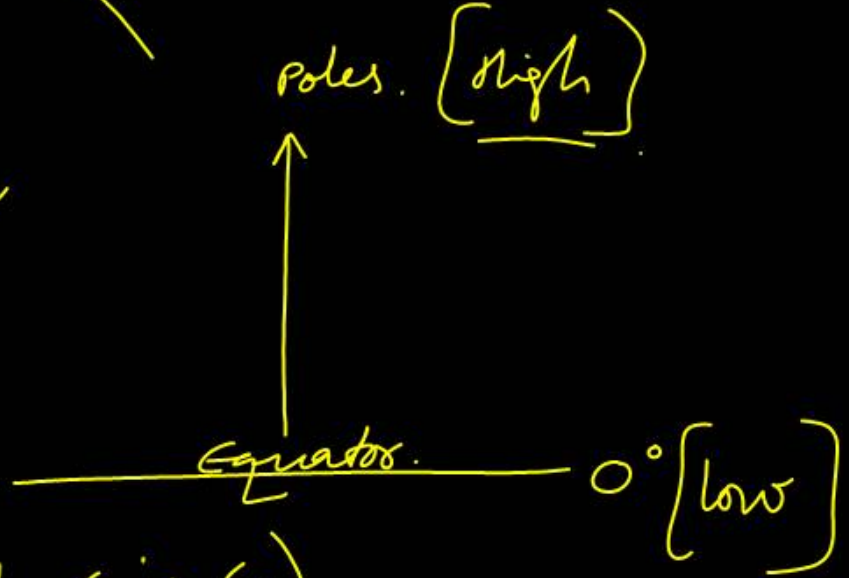
Statement II: Species diversity increases as wego from high altitude to low altitude.

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

(2) Statement I is incorrect but statement II is correct

(3) Both Statements are correct.

(4) Both Statements are incorrect.



High Altitude (उच्चाई) → Temp cold.
→ other conditi
↓
Not so moderate.

Sp. richness (कम)

Question no. 152

Match Column I with Column II and select the correct option from the codes given below.

	Column I		Column II
A	Rivet Popper hypothesis	i.	Paul Ehrlich
B	Long-term ecosystem experiments	ii.	David Tilman
C	Species-area relationships	iii.	Alexander Humboldt

	A	B	C
(1)	(iii)	(i)	(ii)
(2)	(i)	(ii)	(iii)
(3)	(i)	(iii)	(ii)
(4)	(ii)	(iii)	(i)

Question no. 153

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

Assertion (A) : In sigmoid growth curve, population finally stabilises itself.

Reason (R) : Finally, the death rate increases than the birth rate.

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

(1) Both Assertion (A) and Reason (R) are the true and Reason (R) is a correct explanation of Assertion (A).

(2) Both Assertion (A) and Reason (R) are the true but Reason (R) is not a correct explanation of Assertion (A).

(3) Assertion (A) is true and Reason (R) is false.

(4) Assertion (A) is false and Reason (R) is true

Question no. 154

Biosphere reserves differ from National park and wild life sanctuaries because in the former

(1) Human activities are not allowed

(2) People are an integral part of the system

(3) Plants are paid greater attention than the animals

(4) Living organisms are brought from all over the world and preserved

Question no. 155

How many of the following organisms do not have nuclear membrane?

Yeast, Fungi, Bacteria, Mycoplasma, Blue green algae, Chlamydomonas, Amoeba

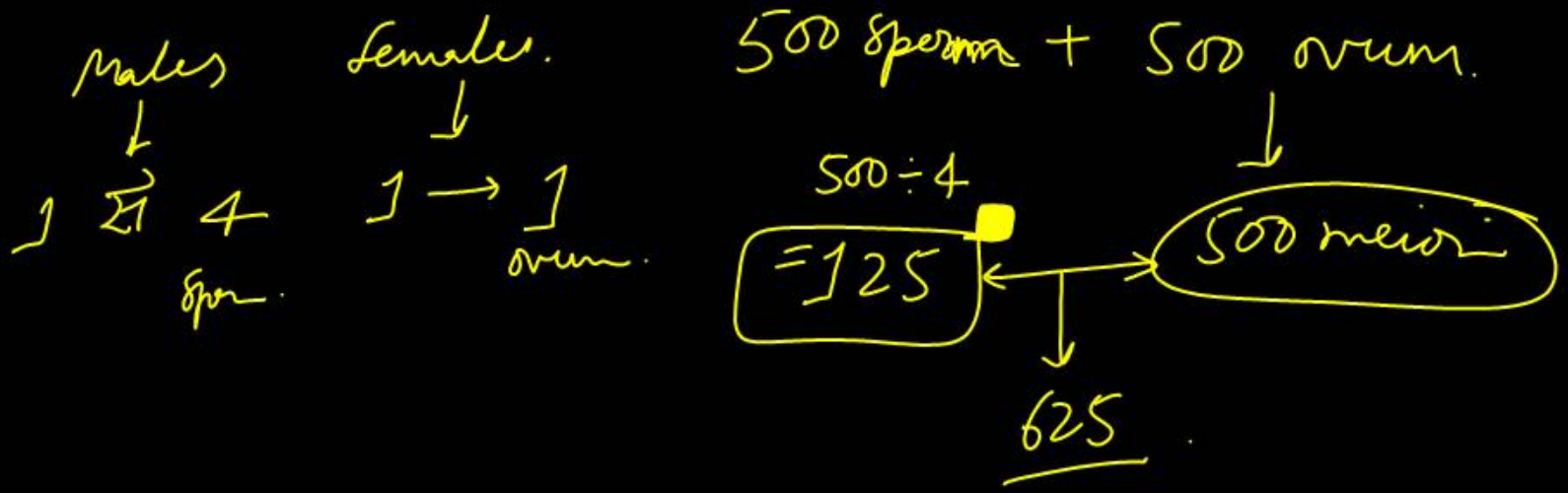
(1) Four
(2) Three
(3) Five
(4) Six

PROKARYOTIC CELLS

Question no. 156

How many meiotic divisions are required during the formation of 500 zygotes, if in males one meiotic division results in formation of four male gametes and in females one meiotic division results in formation of one female gamete?

(1) 625
(2) 500
(3) 1000
(4) 2500



Question no. 157

"Ramachandran plot" is used to confirm the structure of

(1) RNA

(2) Triacylglycerides

(3) Proteins

(4) DNA

3

α - helix.
β. Pleated Sheet.

Question no. 158

All of the following are essentially present in all the chromosomes of a normal human cell except

(1) Primary constriction

(2) Secondary constriction

(3) Kinetochore

(4) Centromere

Question no. 159

A factory wants to manufacture citric acid using microbes. The manager mistakenly use Acetobacter aceti instead of Aspergillus niger. Which of the following is the most likely outcome?

(1) Production of lactic acid instead of citric acid

(2) Production of butyric acid instead of citric acid

(3) Production of acetic acid instead of citric acid

(4) No acid production will take place

Question no. 160

Match List–I with List–II.

	List–I		List–II
A.	Saccharomyces cerevisiae	I.	Production of Immunosuppressive agent
B.	Monascus purpureus	II.	Ripening of Swiss cheese
C.	Trichoderma Polysporum	III.	Commercial production of ethanol
D.	Propionibacterium sharmanii	IV.	Production of blood cholestrol lowering agents

Choose the correct answer from the options given below:

(1) A–IV; B–III; C–II; D–I

(2) A–IV; B–II; C–I; D–III

(3) A–III; B–I; C–IV; D–II

(4) A–III; B–IV; C–I; D–II

Question no. 161

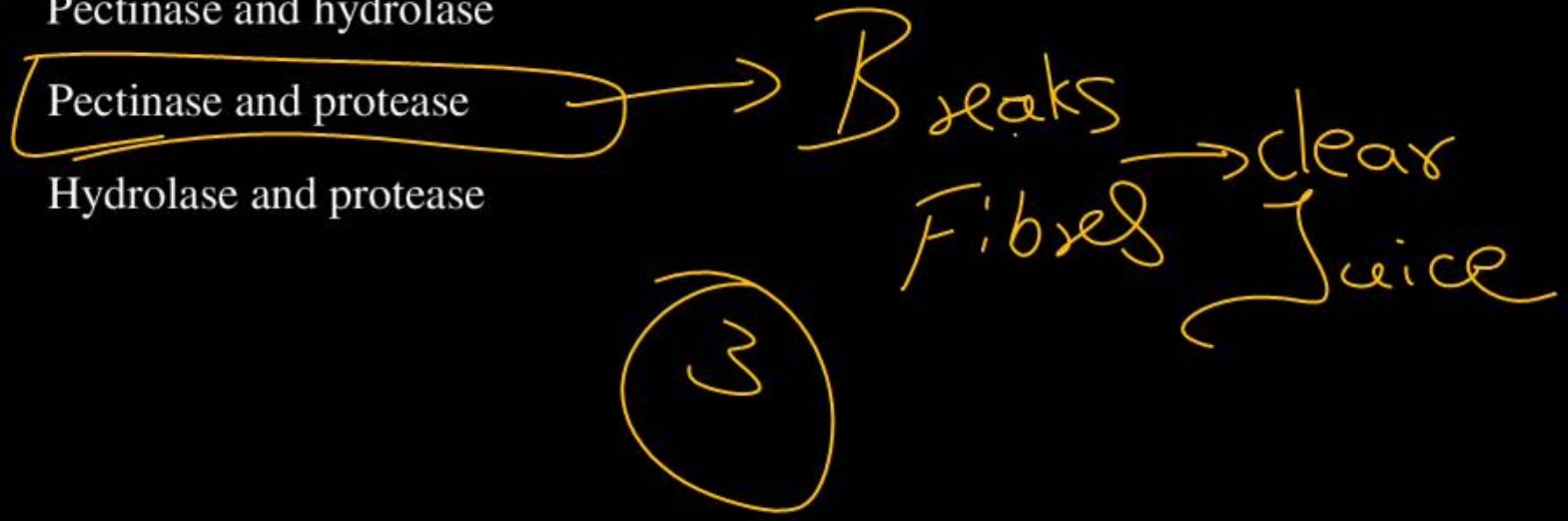
The fruit juices available commercially are clearer than ones which are homemade. Which ingredient is added in commercially available fruit juices?

(1) Lipase and protease

(2) Pectinase and hydrolase

(3) Pectinase and protease

(4) Hydrolase and protease



Question no. 162

Which one of the following helps in absorption of phosphorus from soil by plants?

(1) Anabaena

(2) Golmus

(3) Rhizobium

(4) Frankia

2

Question no. 163

Which of the following example signifies apopulation?

a. All the cormorants (a type of bird) in a wetland

b. Rats in an abandoned dwelling

c. Teakwood trees in a forest tract

d. Bacteria in a culture plate

e. All the animals in a forest

f. Lotus plants in a pond

(1) a, b, c, d and f (2) a, b, c, d and e

(3) a, b, c, d, e and f (4) b, d, e and f

Question no. 164

According to the principle of competitive release, which situation is the most accurate?

(1) When one competing species is removed, the surviving species can occupy a broaderrealized niche than before.

(2) When one competing species is removed, the surviving species contracts its fundamental nichedue to reducedinterspecific competition.

(3) When two competing species coexist, both expand their realized niches simultaneously to utilize more resources.

(4) When a stronger competitor is removed,the weaker competitorgoes extinct because it cannot survive withoutcompetition.

Question no. 165

Which of the following is an example of resourcepartitioning?

(1) Disappearance of Abingdon tortoise from Galapagosislandafter introduction of goat.

(2) Five closely related species of warblers living on thesame tree.

(3) The human liver fluke and a snail or a fish.

(4) The cattle egret birds and grazing cattle.

Question no. 166

Match the association in Column I with the type of interaction given in Column II and mark the correct option :

	Column I		Column II
A.	Barnacles on whale	I.	Predation
B.	Butterfly and birds	II.	Parasitism
C.	Goats and tortoise	III.	Competition
D.	Ticks on dogs	IV.	Commensalism

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

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

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

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

Question no. 167

Which one of the following has the largest population in a food chain?

(1) Producers

(2) Primary consumers

(3) Secondary consumers

(4) Decomposers

सबसे ज्यादा

Question no. 168

Consider the following statements about food chain

I. The transfer of energy from producers to top consumers through a series of organisms is called food chain.

II. A food chain is always straight and proceedsin a progressive straight line.

III. In a food chain, there is unidirectional flow of energy from sun to producers and subsequently to series of different types of consumers.

Which of the statements given above are correct?

(1) 1 and II (2) I and III

(3) II and III (4) I, II and III

Question no. 169

The rate at which new tissues are formed in producers is the ecosystem's

(1) Net primary productivity

(2) Gross primary productivity

(3) Net secondary productivity

(4) Gross secondary productivity

Question no. 170

Which of the following is expected to have the highest value in an ecosystem?

(1) Tertiary production

(2) Gross productivity

(3) Net productivity

(4) Secondary productivity

producers [GPP - R = NPP]

Question no. 171

Which one of the following is correct about concept of species area relationship?

(1) The number of species in an area increases with the size of the area

(2) Larger species require larger habitat areas than do smaller species.

(3) Most species within any given area are endemic.

(4) The larger the area, the greater the extinction rate.

Question no. 172

A population X was reported with following data:

A. No. of pre–reproductive individuals = 18, 960

B. Number of reproductive individuals = 11,500

C. Number of post–reproductive individuals = 9745

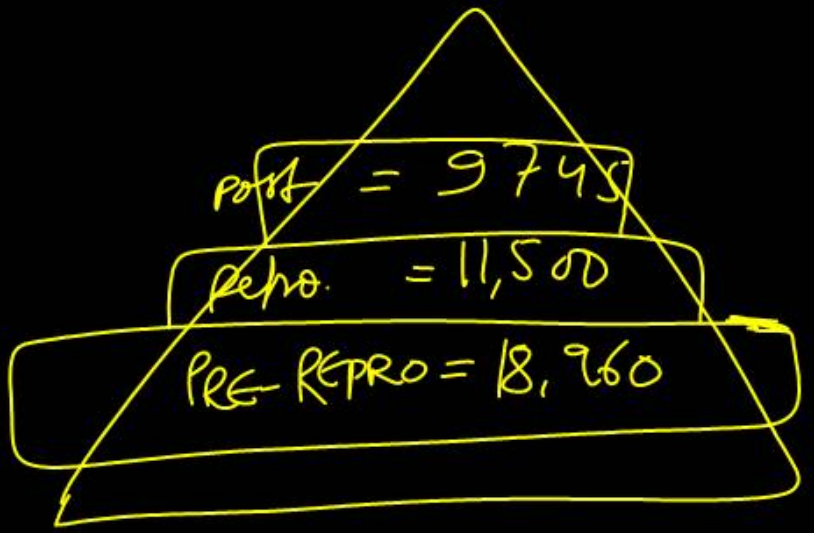
Which of the following conclusions can be withdrawn from the above data?

(1) Above population will decline with time

(2) This is a stable population

(3) This populations will keep on growing

(4) Such population shows U–shaped pyramid



Question no. 173

Wildlife safari park, National park, Zoological Park, Botanical garden, Sacred grooves, Biosphere reserves, Sanctuaries, Biodiveristy hotspots, Seed banks, Cryopreservation.

Out of the given methods how many are ex–situ conservation methods.

(1) 4 (2) 3

(3) 5 (4) 6

Question no. 174

Match the following and choose the correct option.

	Column - I		Column - II
a.	Narrowly utilitarian argument	i.	Conserving biodiversity for major ecosystem services
b.	Broadly utilitarian argument	ii.	Conserving biodiversity for philosophical or spiritual need to realize that every species has intrinsic value and moral duty to pass our biological legacy in good order to future generation.
c.	Ethical argument	iii.	Conserving biodiversity for direct economic benefits like food, medicine, industrial products etc.

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

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

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

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

Question no. 175

The evil quartet represents

(1) Four major causes of biodiversity losses

(2) Four major causes of ozone depletion

(3) Four major causes of global warming

(4) Four major causes of water pollution

Question no. 176

Which of the following equation correctly represents species area relationship?

(1) $\log C = \log S + Z \log A$

(2) $\log A = \log C + Z \log S$

(3) $\log A = \log S + Z \log C$

(4) $\log S = \log C + Z \log A$

Question no. 177

Biodiversity is determined by

(1) Number of individuals in an area

(2) Species richness

(3) Species evenness

(4) Both (2) and (3)

Question no. 178

The earth summit held in Rio de Janeiro in 1992 was called for

(1) For conservation of biodiversity and sustainable utilization of its benefits

(2) To assess threat posed to native species by invasive weed species

(3) For immediate steps to discontinue use of CFCs that were damaging the ozone layer

(4) To reduce CO_2 emissions and global warming

Question no. 179

Find the correctly matched pairs and choose the correct option.

A. Zygotene – Pairing of homolgous chromosomes

B. Pachytene–Dissolution of the complex synaptonemal takes place

C. Diplotene–Bivalent chromosomes appear as tetrads

D. Diakinesis–Terminalization of chiasmata takes place

(1) A and C

(2) A and D

(3) A and B

(4) B and C

Question no. 180

Refer to the following statements describing prophase-I of meiosis.

(i) Thin thread-like chromosomes with a beaded appearance.

(ii) Appearance of recombination nodules.

(iii) Formation of bivalents/tetrads.

(iv) Terminalisation of chiasmata.

(v) Appearance of chiasmata

Arrange the given statements in the correct sequence of their occurrence during prophase-I.

(1) (i) → (iii) → (ii) → (v) → (iv)

(2) (i) → (ii) → (iii) → (iv) → (v)

(3) (i) → (iv) → (v) → (ii) → (iii)

(4) (i) → (iii) → (ii) → (iv) → (v)