Question no. 1

A resistance R draws power P when connected to an ac source. If an inductance is now placed in 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) $P\left(\frac{R}{Z}\right)$

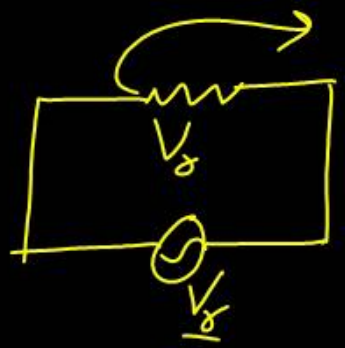
(3) P

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

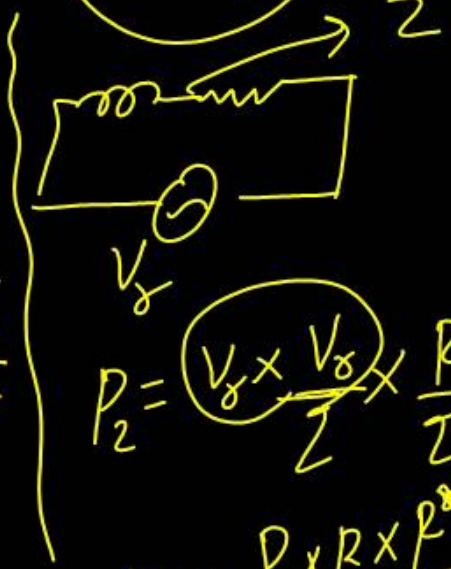
$\langle P \rangle = V_{rms} I_{rms} \cos\phi$

$P = V_{rms} \times \frac{V_{rms}}{R} \times 1$

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



$Z = R \rightarrow \phi = 0$



$P_2 = \frac{V_{rms} \times V_{rms}}{Z} \times \frac{R}{Z}$

$P_2 = \frac{P \times R \times R^2}{Z^2} = P\left(\frac{R}{Z}\right)^2$

Question no. 2

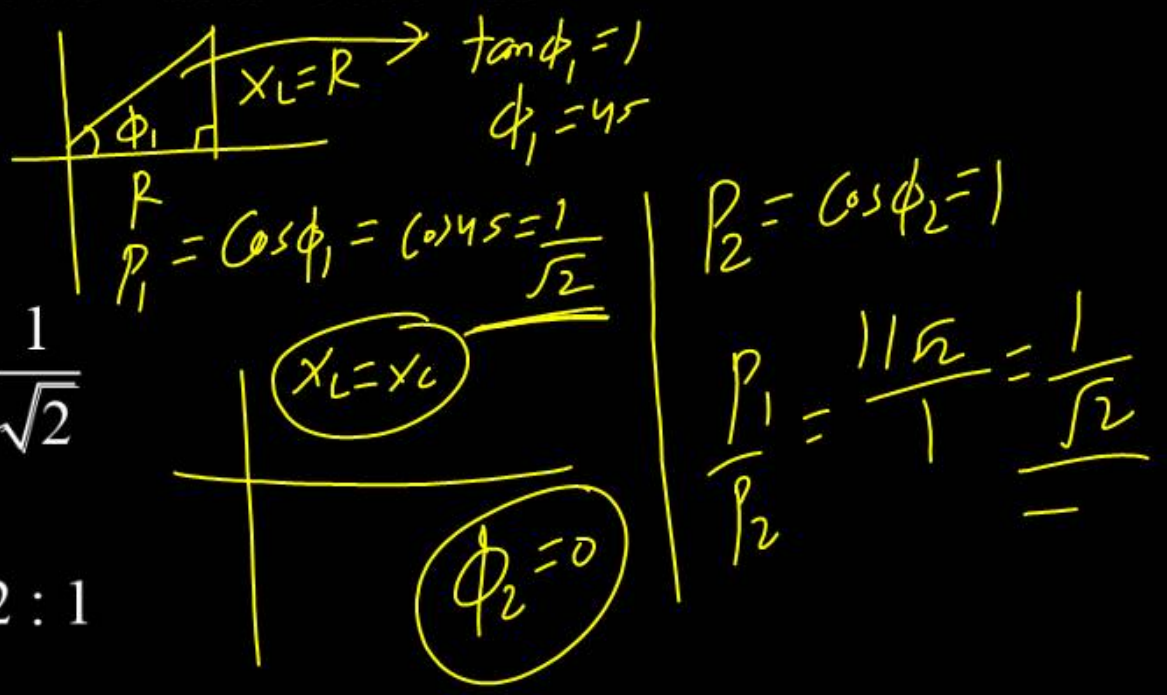
In a series LR circuit $X_L=R$ and power factor of the circuit is P_1. When capacitor with capacitance C such that $X_L=X_C$ is put in series, the power factor becomes P_2. The ratio $\frac{P_1}{P_2}$ is

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

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

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

(4) 2 : 1



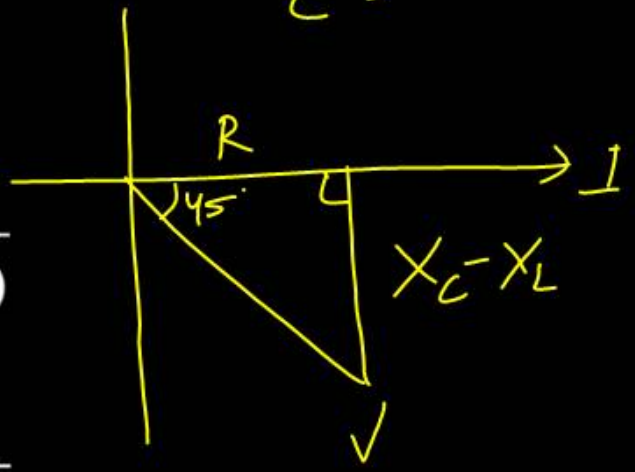
Question no. 3

In a circuit, L, C and R are connected in series with an alternating voltage source of frequency υ. The current leads the voltage by 45°. The value of C is

$R = X_C - X_L$

$R = \frac{1}{2\pi f C} - 2\pi f L$

$C =$



(1) $\frac{1}{\pi\upsilon(2\pi\upsilon L - R)}$

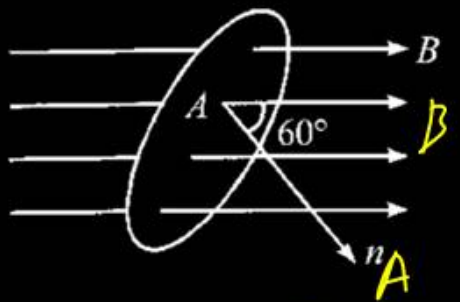
(2) $\frac{1}{2\pi\upsilon(2\pi\upsilon L - R)}$

(3) $\frac{1}{\pi\upsilon(2\pi\upsilon L + R)}$

(4) $\frac{1}{2\pi\upsilon(2\pi\upsilon L + R)}$

Question no. 4

A uniform magnetic field of 4.0 Wb/m^2 is indicated in positive x, direction. Normal to the plane of a coil of area 0.5 m^2 makes angle 60° with magnetic field, as shown in figure. The value of magnetic flux through the coil is



$\phi = BA\cos\theta$

$\phi = 4 \times \frac{1}{2} \times \frac{1}{2} = 1$

(1) 2 Wb

(2) 1 Wb

(3) 3 Wb

(4) $\frac{3}{2}$ Wb

Question no. 5

The network shown an figure is part of a complete circuit. If at a certain instant, the current (I) is 5 A and is decreasing at a rate of 10^3 A/s. Then $V_B - V_A$ is–

(1) 12 V

(2) 18 V

(3) 6 V

(4) 15 V

$V_A - 5 \times 1 + 15 - 5 \times 10^{-3} \left(-10^3\right) = V_B$

$L \, di/dt$

$V_A - 5 + 15 + 5 = V_B$

$V_B - V_A = 15$ Volt

$I = 5A$

$\frac{di}{dt} = -10^3 A/s$

Question no. 6

A transformer is used to light 140 W, 24 V bulb from a 240 V ac mains. If the main current is 0.7 A, the efficiency of the transformer is

(1) 63.8%
(2) 74%
(3) 83.3%
(4) 48%

3

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

$P_{in} = V \times i$

$P_{in} = 240 \times 0.7$

$P_{out} = 140$

$\eta = \frac{140}{240 \times 0.7} \times 100\%$

$\eta = 83.33\%$

Question no. 7

Match List I with List II.

	Column I		Column II
(a)	Diamagnetic	(i)	$\mu_r >> 1$
(b)	Paramagnetic	(ii)	$\mu_r > 1$
(c)	Ferromagnetic	(iii)	$\mu_r = 0$
(d)	Superconductor	(iv)	$0 < \mu_r < 1$

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

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

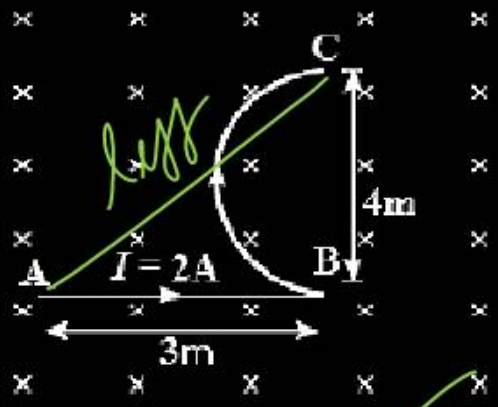
(3) a-iv, b-ii, c-iii, d-i

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

Question no. 8

In the given figure, force on wire ABC will be

(B=2T)



(1) $4(3+2\pi)$N

(2) 20 N

(3) 0 N

(4) 40 N

$l_{eff} = 5m$

$F = BIl_{eff}$

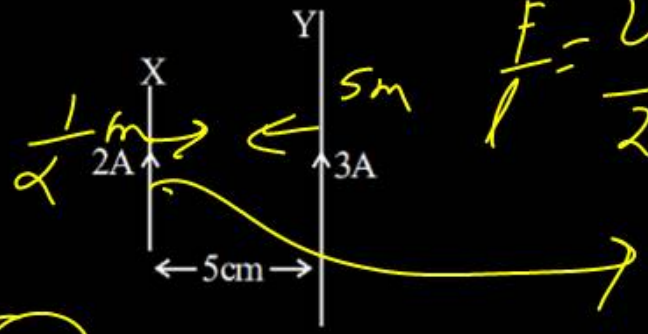
$F = 2T \times 2 \times 5$

$F = 20N$

2

Question no. 9

A wire X of length 50 cm carrying a current of 2A is placed parallel to a long wire Y of length 5 m. 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 X



$\frac{F}{l} = \frac{\mu_0 I_1 I_2}{2\pi d} \times l$

$F = \frac{4\pi \times 10^{-7} \times 2 \times 3}{2\pi \times 5 \times 10^{-2}} \times \frac{1}{2}$

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

(1) 1.2×10^{-5} N directed towards Y

(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.

Question no. 10

A solenoid has length 0.4 cm, radius 1 cm and 400 turns of wire. If a current of 5A is passed through this soleenoid, what is the magnetic field inside the solenoid?

(1) 6.28×10^{-7} T (2) 6.28×10^{-4} T

(3) 6.28×10^{-1} T (4) 6.28×10^{-3} T

$B = \mu_0 n I$

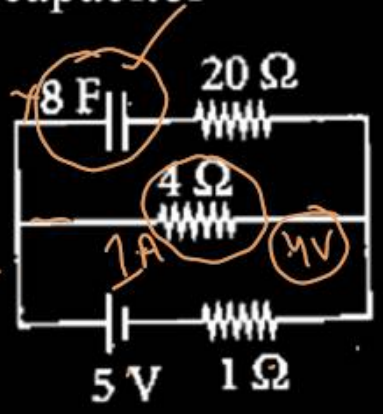
$= 5 \times 10^{-2}$

$B = \frac{4\pi \times 10^{-7} \times 4000}{0.4 \times 10^{-2}} \times 5$

$B = \frac{20\pi \times 10^{-2}}{6.2 \times 10^{-1}} \times 10$

Question no. 11

A capacitor of 8 F is connected as shown. Charge on the plats of the capacitor



$Q = CV$
$= 8 \times 4$
$= 32\ C$

$R = 5\ \Omega$

$I = \frac{15V}{5}$

$V = IR = 1 \times 4 = 4V$

(1) 32 C
(2) 40 C
(3) 0 C
(4) 80 C

Question no. 12

A particle of specific charge (charge /mass) α starts moving from the origin under the action of an electric field $\vec{E} = E_0\hat{i}$ and magnetic field $\vec{B} = B_0\hat{k}$. Its velocity at $(x_0, y_0, 0)$ is $(4\hat{i} - 3\hat{j})$. The value of x_0 is

(1) $\frac{13}{2}\frac{\alpha E_0}{B_0}$

(2) $\frac{16\alpha B_0}{E_0}$

(3) $\frac{25}{2\alpha E_0}$

(4) $\frac{5\alpha}{2B_0}$

$\frac{q}{m} = \alpha$.

$V = 4\hat{i} - 3\hat{j} = \sqrt{4^2 + 3^2} = \sqrt{25} = 5$ m/s

$F = qE$

$qE\,x_0 = \frac{1}{2}mv^2$

$x_0 = \frac{1}{2}\frac{m \times 5^2}{qE} = \frac{25}{2\alpha E}$

Question no. 13

In an ac circuit, V and I are given by $V=100\sin(100t)$ volts and $I=100\sin\left(100t+\frac{\pi}{3}\right)$ mA. The power dissipated in circuit is

(1) 10^4 (2) 10 W

(3) 2.5 W (4) 5 W

V_0

I_0

ϕ

$\langle P\rangle = \frac{V_0 I_0}{2}\cos\phi$

$\langle P\rangle = \frac{100\times 100\times 10^{-3}}{2}\times\frac{1}{2} = \frac{10}{4} = 2.5$

Question no. 14

In a series circuit R = 300Ω, L = 0.9H, C = 2.0μF and ω = 1000 rad/s. The impedance of the circuit is

(1) 1300 Ω (2) 900 Ω

(3) 500 Ω (4) 400 Ω

$Z = \sqrt{R^2 + (X_L - X_C)^2} \rightarrow \sqrt{(300)^2 + (400)^2}$

$Z = 500$

$X_L = 1000 \times 0.9 = 900$

$X_C = \frac{1}{1000 \times 2 \times 10^{-3}}$

$X_C = 500$

Question no. 15

The resonant frequency of a series LCR circuit with L=2.0 H, C=32 μF and R = 10 Ω is

(1) 20 Hz (2) 30 Hz

(3) 40 Hz (4) 50 Hz

$$f_0 = \frac{1}{2\pi\sqrt{LC}}$$

$$f_0 = \frac{1}{2\pi\sqrt{2\times32\times10^{-6}}} = \frac{125}{16\pi}$$

Question no. 16

A connector ab of length ℓ and resistance R slides freely on two horizontally placed rods, the ends of which are connected by resistances R_1 and R_2. The magnetic field B is downwards and the velocity of the connector is v . The current in the connector is

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

$I = \frac{B\ell v}{\frac{R_1 R_2}{R_1 + R_2} + R}$

(1) zero

(2) $\frac{B\ell v}{R}$

(3) $\frac{B\ell v}{R + R_1 + R_2}$

(4) $\frac{B\ell v(R_1 + R_2)}{RR_1 + RR_2 + R_1R_2}$

Question no. 17

Flux ϕ (in weber) in a closed circuit of resistance 10 Ω varies with time t (in sec) according to the equation $\phi = 6t^2 - 5t + 1$. What is the magnitude of the induced current at t=0.25 s?

(1) 1.2 A
(2) 0.8 A
(3) 0.6 A
(4) 0.2 A

$R = 10\Omega$

$\phi = 6t^2 - 5t + 1$

$\mathcal{E} = -\frac{d\phi}{dt} = -(12t - 5)$

$\mathcal{E} = -\left(12 \times \frac{1}{4} - 5\right)$

$\mathcal{E} = -(-2) = +2V$

$i = \mathcal{E}/R = 2/10 = 0.2A$

Question no. 18

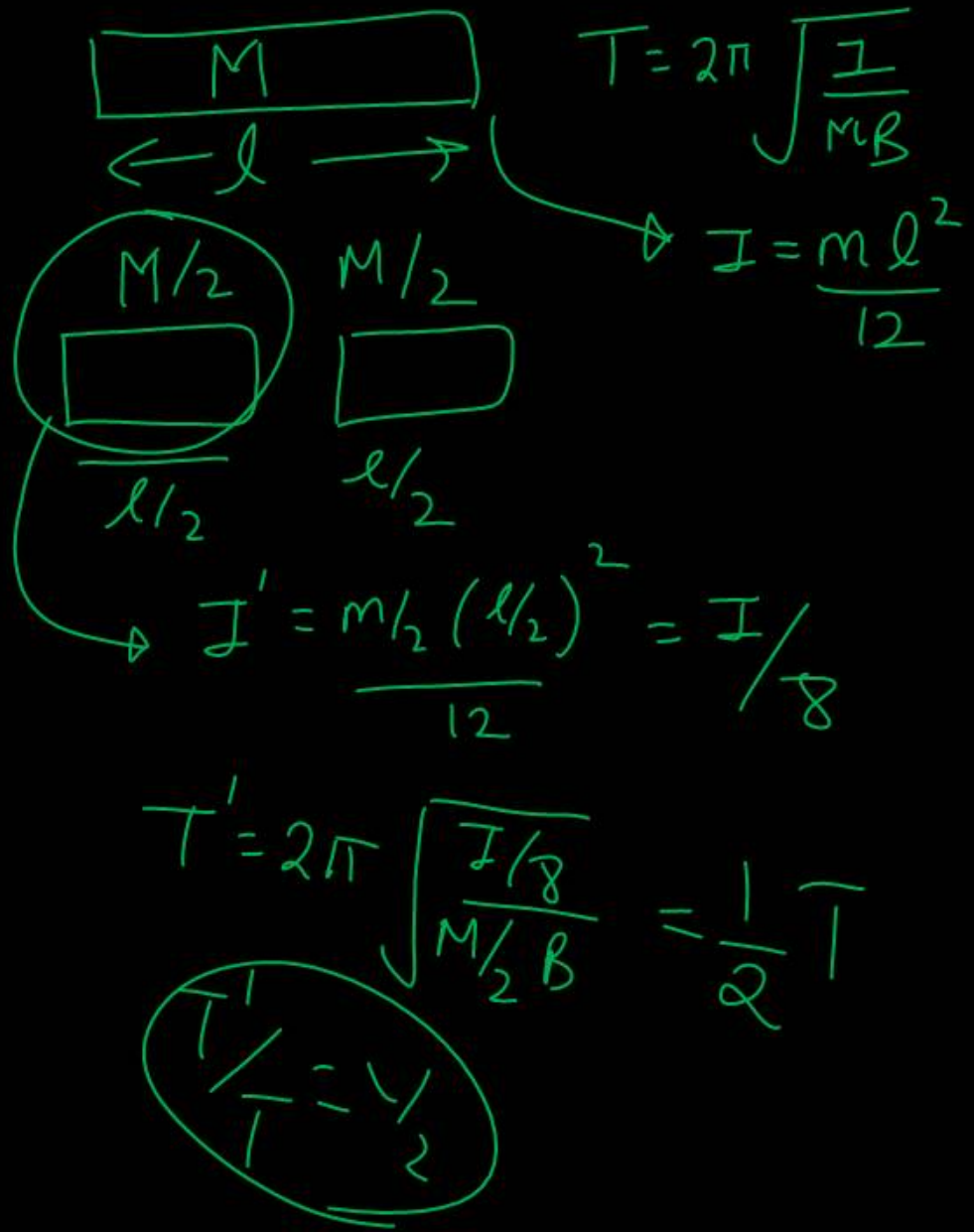
A thin rectangular magnet suspended freely has a period of oscillation equal to T. Now, it is broken into two equal halves (each having half of the original length) and one piece is made to oscillate freely in the same field. If its period of oscillation is T', the ratio $\frac{T'}{T}$ is

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

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

(3) 2

(4) $\frac{1}{4}$



Question no. 19

Needles N_1, N_2 and N_3 are made of a ferromagnetic, a paramagnetic and a diamagnetic substance respectively. A magnet when brought close to them will

(1) attract N_1 and N_2 strongly but repel N_3

(2) attract N_1 strongly, N_2 weakly and repel N_3 weakly

(3) attract N_1 strongly, but repel N_2 and N_3 weakly

(4) attract all three of them

$N_1 \rightarrow$ Ferro (Strong att)

$N_2 \rightarrow$ Para (att)

$N_3 \rightarrow$ Di (Repul)

2

Question no. 20

+e +e +2e

If a proton, deuteron, and α particle on being accelerated by the same potential difference, enters perpendicular to the magnetic field, then the ratio of their kinetic energies is

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

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

$K_p = eV$

$K_d = eV$

$K_\alpha = 2eV$

$K_p : K_d : K_\alpha = 1 : 1 : 2$

4

Question no. 21

An iron rod of susceptibility 599 is subjected to a magnetising field of 1200 Am^{-1}. The permeability of the material of the rod is

(Take, $\mu_0 = 4\pi \times 10^{-7} TmA^{-1}$)

(1) $8.0 \times 10^{-5} TmA^{-1}$ (2) $2.4\pi \times 10^{-5} TmA^{-1}$

(3) $2.4\pi \times 10^{-7} TmA^{-1}$ (4) $2.4\pi \times 10^{-4} TmA^{-1}$

$\chi = 599$

$H = 1200\ A/m$

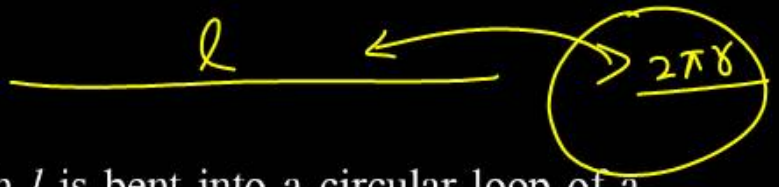
$\mu = \mu_0 \mu_r$

$= 4\pi \times 10^{-7}(1 + \chi)$

$= 4 \times 3.14 \times 10^{-7}(600)$

$= 2.4 \cdot \pi \times 10^{-5} = 2.4\pi \times 10^{-4}$

Question no. 22



The wire of length l is bent into a circular loop of a single turn and is suspended in a magnetic field of induction B. When a current I is passed through the loop, the maximum torque experienced by it is

(1) $\left(\frac{1}{4\pi}\right)BIl^2$

(2) $\frac{1}{4\pi}BI^2l$

(3) $\left(\frac{1}{4\pi}\right)BIl$

(4) $\left(\frac{1}{4\pi}\right)B^2Il$

$l = 2\pi r \quad \therefore r = \frac{l}{2\pi}$

$\tau = nIAB$

$= 1 I B (\pi r^2)$

$= 1 I B \left(\pi \left(\frac{l}{2\pi}\right)^2\right)$

$= IB \cdot \pi \frac{l^2}{4\pi^2}$

$= \frac{1}{4\pi}(BIl^2)$

Question no. 23

Two parallel plate air capacitors of same capacity C are connected in series to a battery of emf 'E'. Then one of the capacitors is completely filled with dielectric material of constant 'K'. The change in the effective capacity of the series combination is

(1) $\frac{C}{2}\left[\frac{K-1}{K+1}\right]$ (2) $\frac{2}{C}\left[\frac{K-1}{K+1}\right]$

(3) $\frac{C}{2}\left[\frac{K+1}{K-1}\right]$ (4) $\frac{C}{2}\left[\frac{K-1}{K+1}\right]^2$

$C_{net} = \frac{C}{n} = \frac{C}{2}$

$C_1 = \frac{C}{2}$

$C_2 = \frac{kC \times C}{kC + C} = \frac{kC^2}{C(k+1)} = \frac{kC}{k+1}$

$\Delta C = \frac{kC}{k+1} - \frac{C}{2}$

$\Delta C = \frac{2kC - kC - C}{2(k+1)} = \frac{kC - C}{k+1} = \frac{C}{2}\left(\frac{k-1}{k+1}\right)$

Question no. 24

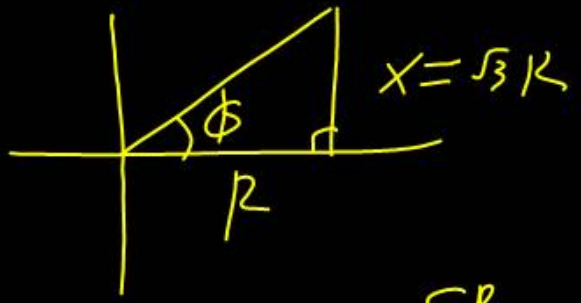
In an ac circuit, the reactance of a coil is $\sqrt{3}$ times its resistance. The phase difference between the voltage and current through the coil is

(1) $\frac{\pi}{3}$

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

(3) $\frac{\pi}{4}$

(4) $\frac{\pi}{6}$



$X = \sqrt{3} \times R$

$\tan\phi = \frac{\sqrt{3}R}{R} = \sqrt{3}$

$\phi = 60^\circ$

Question no. 25

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

Then what will be the rms values of current.

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

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

$I = \sqrt{\frac{a^2 + b^2}{2}}$

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

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

Question no. 26

Which of the following combination should be selected for better tuning of an LCR circuit used for communication?

(1) R=20 Ω , L= 1.5 H, C= 35 μ F

(2) R=25 Ω , L= 2.5 H, C= 45 μ F

(3) R=15 Ω , L= 3.5 H, C= 30 μ F

(4) R=25 Ω , L= 1.5 H, C= 45 μ F

$$Q = \frac{X_L}{R} = \frac{X_C}{R} = \frac{1}{R}\sqrt{\frac{L}{C}}$$

Question no. 27

Current in a circuit falls from 5.0 A to 0 A in 0.1 s. If an average emf of 200 V is induced, estimate the coefficient self-inductance of the circuit.

(1) 3 H
(2) 2 H
(3) 4 H
(4) 5 H

$$V = L\frac{\Delta I}{\Delta t}$$

$$200 = L \times \frac{5}{0.1}$$

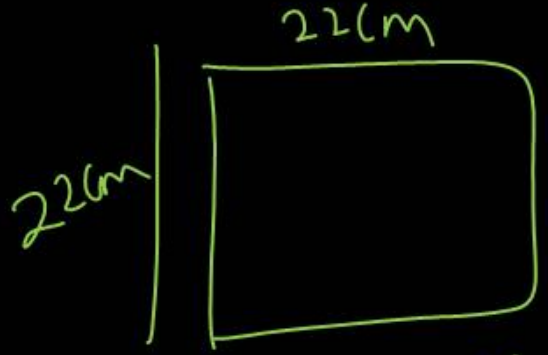
$$L = \frac{20}{5} = 4\,H$$

Question no. 28

A square loop of side 22 cm is changed to a circle in time 0.4 s. With its plane normal to a magnetic field of 0.2 T, the emf induced is

(1) −6.6 mV (2) −13.2 mV

(3) +6.6 mV (4) +13.2 mV



$A = 22 \times 22 \times 10^{-4}\ m^2$

$\phi_i = 0.2 \times 22 \times 22 \times 10^{-4}$

$22cm \times 4 = 2\pi r$

$r = \frac{88cm}{2\pi} = \frac{44}{\pi} = \frac{44}{\frac{22}{7}} \times 10^{-2}$

$r = 14cm$

$\phi_2 = 0.2 \times \frac{22}{7} \times (14 \times 10^{-2})^2$

$\mathcal{E} = \frac{\Delta\phi}{t} = -\frac{(\phi_f - \phi_i)}{t}$

$\mathcal{E} = -\left(0.2 \times \frac{22}{7} \times (14 \times 10^{-2})^2 - 0.2 \times 22 \times 22 \times 10^{-4}\right) \Big/ 0.2$

$\mathcal{E} = -6.6\ mV$

Question no. 29

At a certain place, the horizontal component of earth's magnetic field is $\sqrt{3}$ times the vertical component. The angle of dip at that place is

(1) 60°
(2) 45°
(3) 90°
(4) 30°

$\tan\delta = \frac{B_V}{B_H}$

4

$B_H = \sqrt{3}\, B_V$

$\frac{1}{\sqrt{3}} = \frac{B_V}{B_H}$

$\tan\delta = \frac{1}{\sqrt{3}}$

$\delta = 30$

Question no. 30

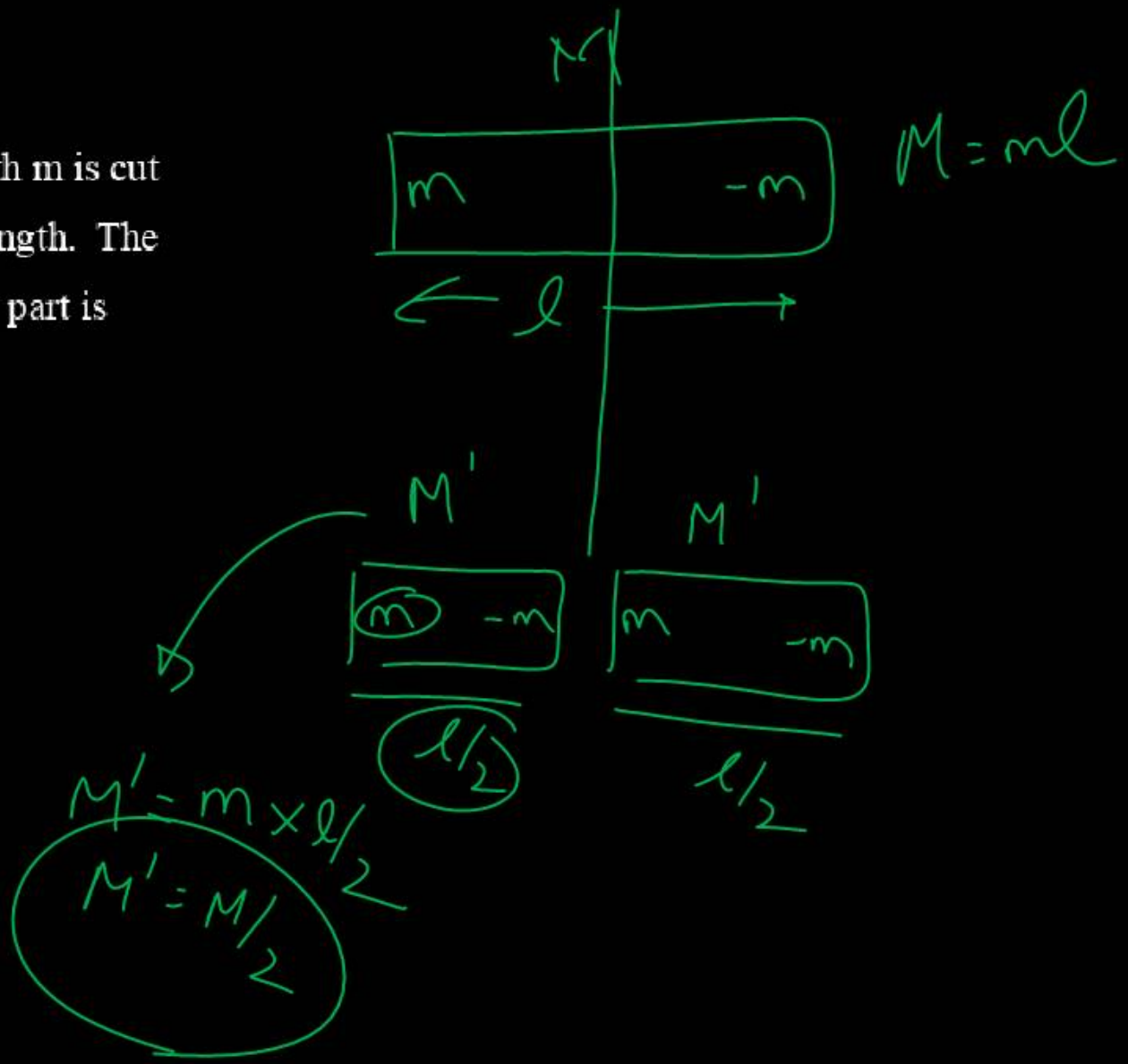
A bar magnet of moment M and pole strength m is cut in two equal parts perpendicular to its length. The magnetic moment and pole strength of either part is

(1) $\frac{M}{2}, \frac{m}{2}$

(2) $M, \frac{m}{2}$

(3) $\frac{M}{2}, m$

(4) M, m



Question no. 31

B_X and B_Y are the magnetic fields at the centre of two coils X and Y respectively each carrying equal current. If coil X has 200 turns and 20 cm radius and coil Y has 400 turns and 20 cm radius, the ratio of B_X and B_Y

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

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

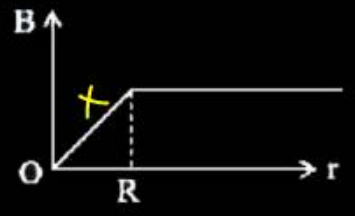
$$B_x = \frac{\mu_0 n_1 I}{2r}$$

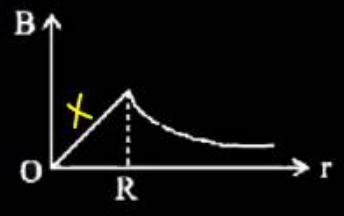
$$B_y = \frac{\mu_0 n_2 I}{2r}$$

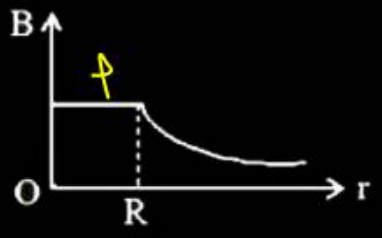
$$\frac{B_x}{B_y} = \frac{200}{400} = \frac{1}{2}$$

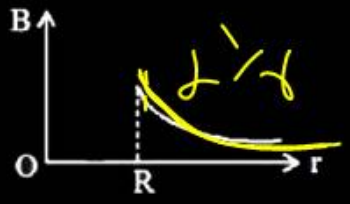
Question no. 32

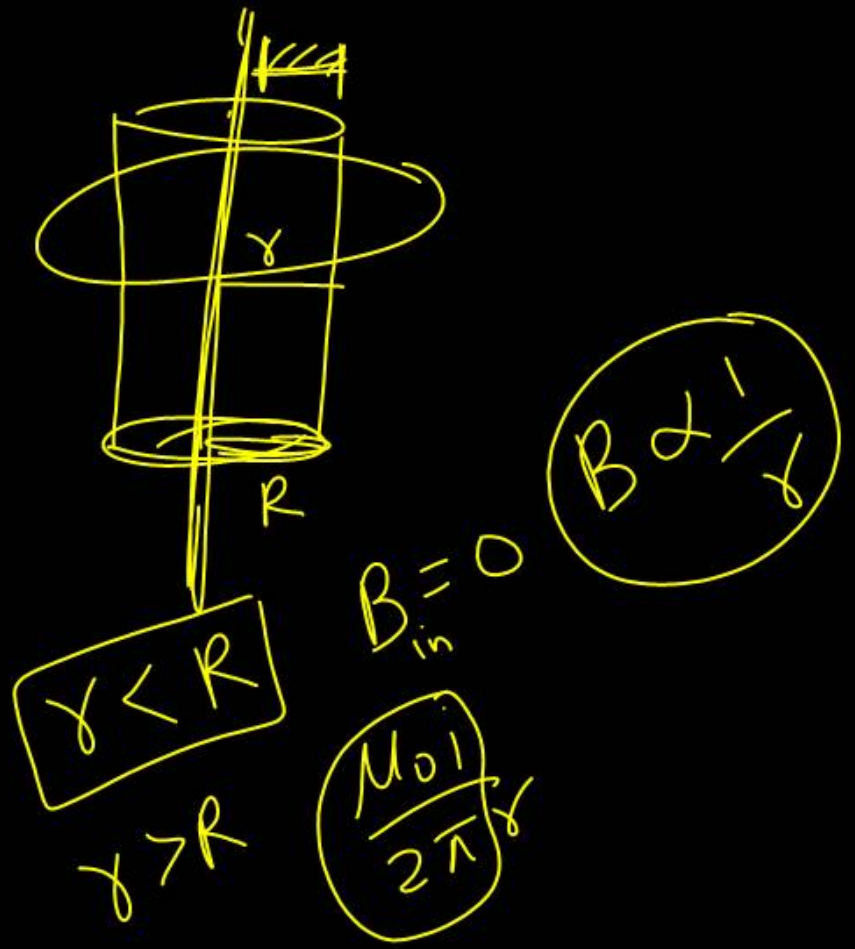
An infinitely long hollow conducting cylinder with radius R carries a uniform current along its surface. Choose the correct representation of magnetic field (B) as a function of radial distance (r) from the axis of cylinder.

(1) 

(2) 

(3) 

(4) 



Question no. 33

The resistance of a bulb filament is 100Ω at a temperature of 100°C. If its temperature coefficient of resistance be 0.005 per °C, its resistance will become 200Ω at a temperature of

(1) 1000°C (2) 400°C

(3) 500°C (4) 200°C

$R_t = R_0(1+\alpha t)$

$100 = R_0\left(1 + \frac{0.005 \times 100}{1000}\right)$

$100 = R_0 \cdot 1.5$

$R_0 = \frac{200}{3}$

$200 = R_0(1+0.005t)$

$200 = \frac{200}{3}(1+0.005t)$

$3 - 1 = 0.005t$

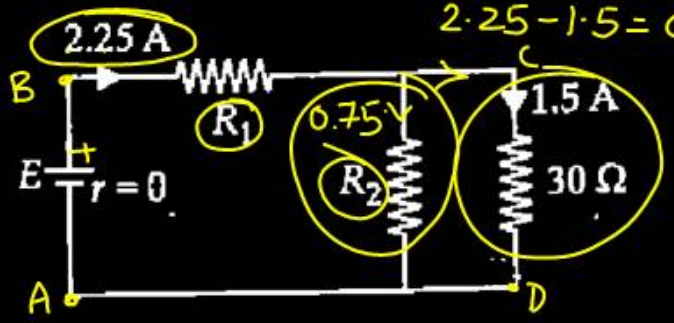
$2 = \frac{5}{1000}t$

$\frac{2000}{5} = t$

$400 = t$

Question no. 34

In the circuit, $R_1 = R_2$. The value of E and R_1 are _____(E – EMF, R_1 – resistance)



2.25 − 1.5 = 0.75 A

(1) 180 V, 60 Ω (2) 120 V, 60 Ω

(3) 180 V, 10 Ω (4) 120 V, 10 Ω

key $V_1 = V_2$

I R

$1.5 \times 30 = 0.75 \times R_2$

$R_2 = \frac{1.5 \times 30}{0.75} = 60\ \Omega$

$R_2 = 60 = R_1$

E $R_1 = R_2$

180 60

ABCD =

$\Sigma IR = \Sigma E$

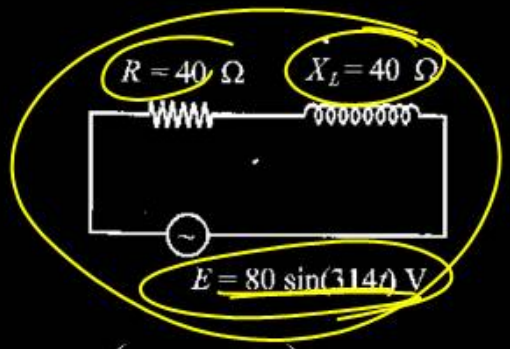
$2.25 \times 60 + 1.5 \times 30 = +E$

$135 + 45 = E$

$180 = E$

Question no. 35

Expression for current in the ac circuit shown in the figure is



(1) $I = 1 \sin\left(314t + \frac{\pi}{4}\right)$

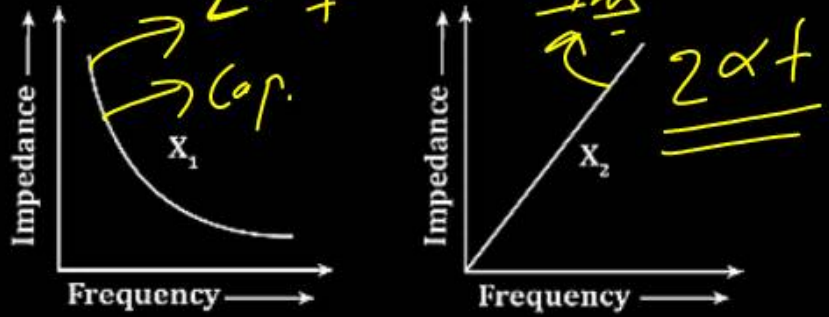
(2) $I = \sqrt{2} \sin\left(314t + \frac{\pi}{4}\right)$

(3) $I = 1 \sin\left(314t - \frac{\pi}{4}\right)$

(4) $I = \sqrt{2} \sin\left(314t - \frac{\pi}{4}\right)$

Question no. 36

The given graphs below depict the dependence of two impedances X_1 and X_2 on the frequency of the alternating emf applied individually to them. We can then say that



(1) X_1 is an inductor and X_2 is a capacitor

(2) X_1 is a resistor and X_2 is a capacitor

(3) X_1 is a capacitor and X_2 is an inductor

(4) X_1 is an inductor and X_2 is a resistor

Question no. 37

In small time interval Δt, flux through a circuit of resistance R changes by $\Delta\phi$. The charge Q passes through any point in the circuit in given interval is

(1) $Q = \frac{\Delta\phi}{R\Delta t}$

(2) $Q = \frac{\Delta\phi}{R}$

(3) $Q = \frac{\Delta\phi}{\Delta t}$

(4) $Q = R\frac{\Delta\phi}{\Delta t}$

$\mathcal{E} = \frac{\Delta\phi}{\Delta t}$

$I = \frac{\Delta\phi}{\Delta t \times R} = \frac{q}{\Delta t}$

$q = \frac{\Delta\phi}{R}$

Question no. 38

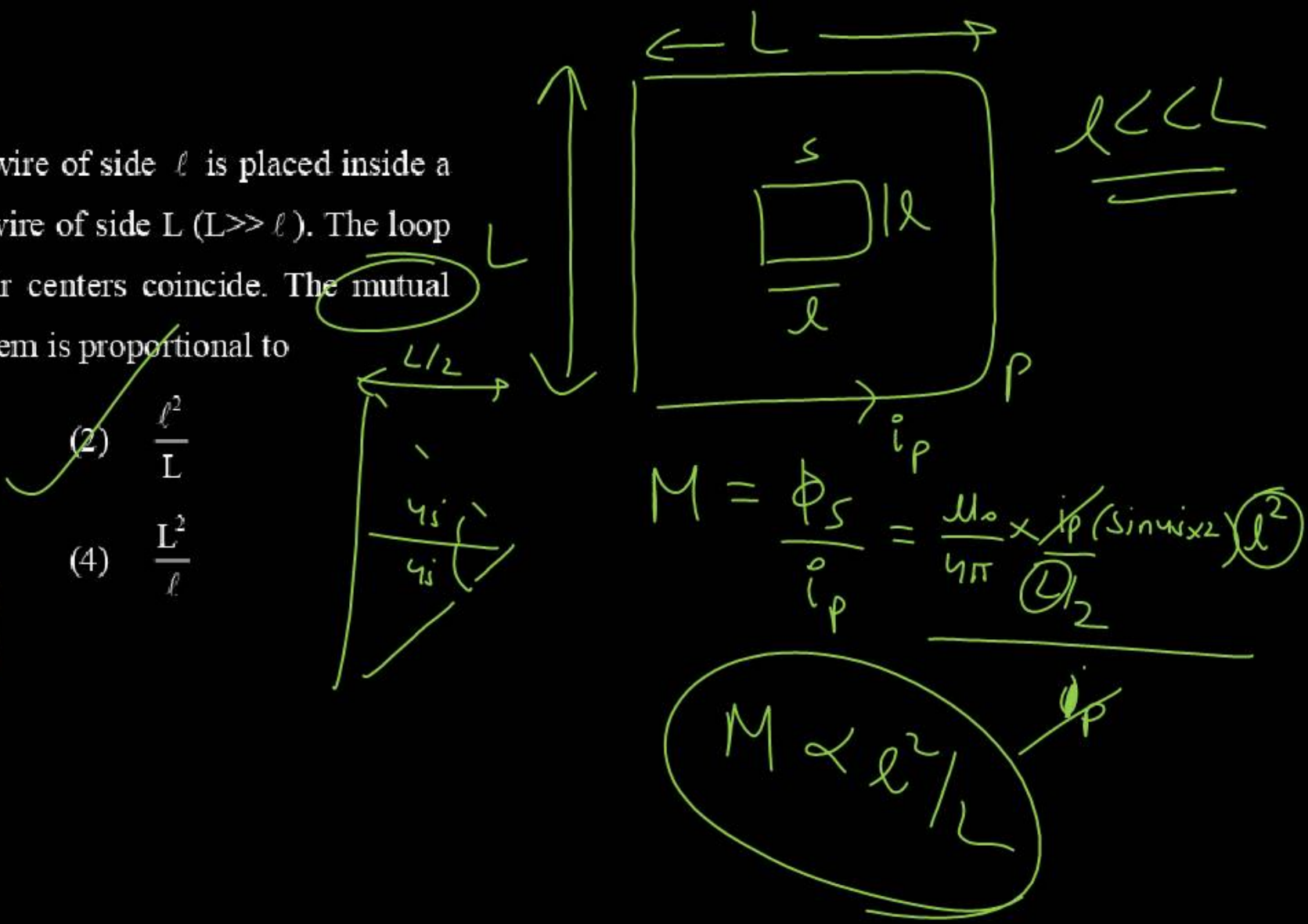
A small square loop wire of side ℓ is placed inside a large square loop of wire of side L ($L >> \ell$). The loop are coplanar and their centers coincide. The mutual inductance of the system is proportional to

(1) $\frac{\ell}{L}$

(2) $\frac{\ell^2}{L}$

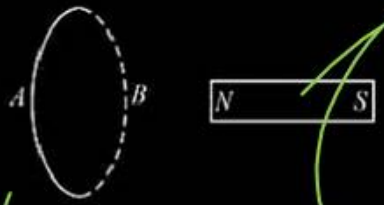
(3) $\frac{L}{\ell}$

(4) $\frac{L^2}{\ell}$



Question no. 39

In the given figure, the magnet is pushed towards the fixed ring along the axis of the ring and it passes through the ring. Choose the correct option.



(1) When magnet goes towards the ring, the face B becomes south pole and the face A becomes north pole

(2) When magnet goes away from the ring, the face B becomes north pole and the face A becomes southpole

(3) When magnet goes away from the ring, the face A becomes north pole and the face B becomes southpole

(4) Face A will always be a north pole

Question no. 40

Curie temperature is the temperature above which

(1) a ferromagnetic material becomes paramagnetic

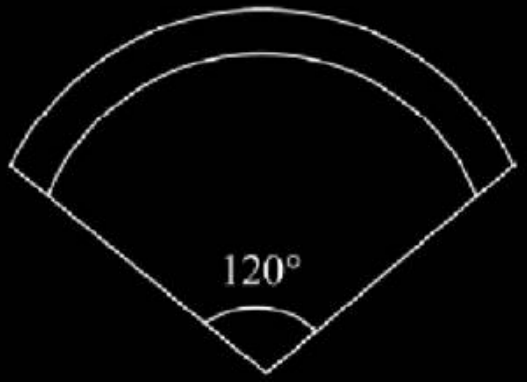
(2) a paramagnetic material becomes diamagnetic

(3) a ferromagnetic material becomes diamagnetic

(4) a paramagnetic material becomes ferromagnetic

Question no. 41

A bar magnet of length l and magnetic dipole moment M is bent in the form of an arc as shown in figure.



The new magnetic dipole moment will be

(1) $\frac{3}{\pi}M$

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

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

(4) $\frac{\sqrt{3}}{\pi}M$

2

M

M'

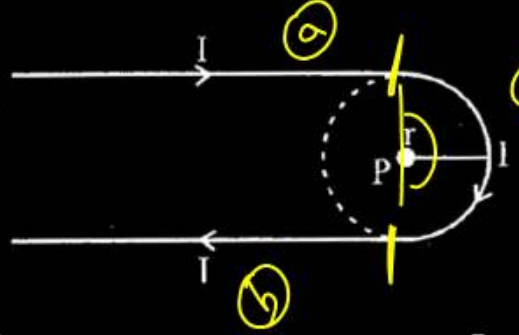
θ

$M' = \frac{M \sin(\theta/2)}{(\theta/2)}$

$M' = \frac{M \times \sqrt{3}/2}{\pi/3} = \frac{3\sqrt{3}M}{2\pi}$

Question no. 42

A hairpin like shape as shown in figure is made by bending a long current carrying wire. What is the magnitude of a magnetic field at point P which lies on the centre of the semicircle?



(1) $\frac{\mu_0 I}{4\pi r}(2+\pi)$ (2) $\frac{\mu_0 I}{4\pi r}(2-\pi)$

(3) $\frac{\mu_0 I}{2\pi r}(2-\pi)$ (4) $\frac{\mu_0 I}{2\pi r}(2+\pi)$

$B = (2 \times B_{st}) + B_{semicircle}$

$= 2\frac{\mu_0 i}{4\pi r} + \frac{\mu_0 i}{2r}\left(\frac{\theta}{2\pi}\right)$

$= \frac{2\mu_0 i}{4\pi r} + \frac{\mu_0 i \pi}{2r2\pi}$

$= \frac{\mu_0 i}{4\pi r}(2+\pi) = \frac{2\mu_0 i}{4\pi r} + \frac{\mu_0 i \pi}{4r\pi}$

Question no. 43

In a certain region static electric and magnetic fields exist. The magnetic field is given by $\vec{B} = B_0(\hat{i} + 2\hat{j} - 4\hat{k})$. If a test charge moving with a velocity $\vec{v} = v_0(3\hat{i} - \hat{j} + 2\hat{k})$ experiences no force in that region, then the electric field in the region, in SI units, is

(1) $\vec{E} = -v_0B_0(14\hat{j} + 7\hat{k})$

(2) $\vec{E} = v_0B_0(14\hat{j} + 7\hat{k})$

(3) $\vec{E} = -v_0B_0(\hat{i} + \hat{j} + 7\hat{k})$

(4) $\vec{E} = -v_0B_0(3\hat{i} - 2\hat{j} - 4\hat{k})$

$\vec{F} = 0 = q(\vec{E} + \vec{v} \times \vec{B})$

$0 = \vec{E} + \vec{v} \times \vec{B}$

$\vec{F}_m \rightarrow \vec{v} \times \vec{B}$

$\vec{E} = -(\vec{v} \times \vec{B})$

$\vec{F}_m \leftarrow \vec{v} \times \vec{B}$

+ve

$\vec{F}_m = q(\vec{v} \times \vec{B})$

$\vec{E} = -\frac{(\vec{F}_m)}{q}$

$\vec{E} \propto -\vec{F}_m$

Question no. 44

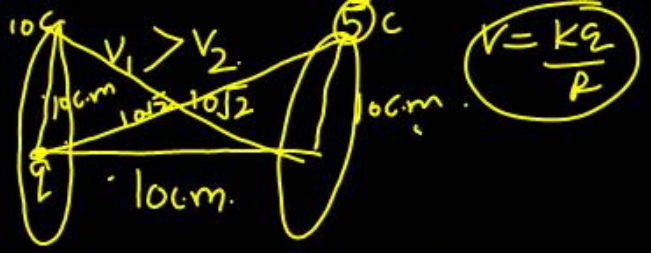
Two identical thin rings, each of radius 10 cm carrying charges 10 C and 5 C are coaxcially placed at a distance 10 cm apart. The work done in moving a charge q from the centre of the first ring to that of the second is

(1) $\frac{q}{8\pi\varepsilon_0}\left(\frac{\sqrt{2}+1}{\sqrt{2}}\right)$

(2) ~~$\frac{q}{8\pi\varepsilon_0}\left(\frac{\sqrt{2}-1}{\sqrt{2}}\right)$~~

(3) $\frac{q}{4\pi\varepsilon_0}\left(\frac{\sqrt{2}+1}{\sqrt{2}}\right)$

(4) $\frac{q}{4\pi\varepsilon_0}\left(\frac{\sqrt{2}-1}{\sqrt{2}}\right)$



$W = q(V_1 - V_2)$

$V_1 = \frac{k\times 10}{10} + \frac{k\times 5}{10\sqrt{2}}$

$V_1 = k_1\left(1 + \frac{1}{2\sqrt{2}}\right)$

$V_2 = \frac{k\times 5}{10_2} + \frac{k\times 10}{10\sqrt{2}}$

$V_2 = k\left(\frac{1}{2} + \frac{1}{\sqrt{2}}\right)$

$W = q\left(k_1\left(1+\frac{1}{2\sqrt{2}}\right) - \left(\frac{1}{2}+\frac{1}{\sqrt{2}}\right)\right)$

$W = qk\left(1 + \frac{1}{2\sqrt{2}} - \frac{1}{2} - \frac{1}{\sqrt{2}}\right)$

$W = qk\left(\frac{1}{2} + \left(\frac{1}{2\sqrt{2}} - \frac{1}{\sqrt{2}}\right)\right)$

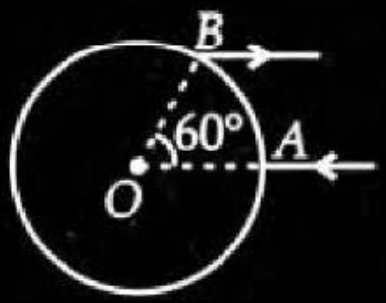
$W = qk\left(\frac{1}{2} + \frac{1-2}{2\sqrt{2}}\right)$

$W = \frac{kq}{2}\left(\frac{\sqrt{2}-1}{\sqrt{2}}\right)$

$k = \frac{1}{4\pi\epsilon_0}$ $\quad W = \frac{q}{8\pi\epsilon_0}\left(\frac{\sqrt{2}-1}{\sqrt{2}}\right)$

Question no. 45

A uniform wire of resistance 36 ohm is bent in the form of a circle. The effective resistance across the points A and B is



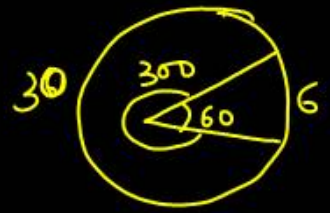
(1) 5 Ω

(2) 15 Ω

(3) 7.2 Ω

(4) 30 Ω

360 − 60



Ratio

$36 \times \frac{300}{360} : \frac{60 \times 36}{360}$

$R_1 = 30\Omega \qquad R_2 = 6$

$R = \frac{30 \times 6}{30+6} = \frac{5}{\cancel{36}} \frac{\cancel{30} \times 6}{\cancel{36}}$

Question no. 46

$[Co(NH_3)_4(NO_2)_2]Cl$ exhibits :

(1) linkage isomerism, geometrical isomerism and optical isomerism

(2) linkage isomerism, ionization isomerism and optical isomerism

(3) linkage isomerism, ionization isomerism and geometrical isomerism

(4) ionization isomerism, geometrical isomerism and optical isomerism

$-NO_2$ $-ONO$

Linkage

ion

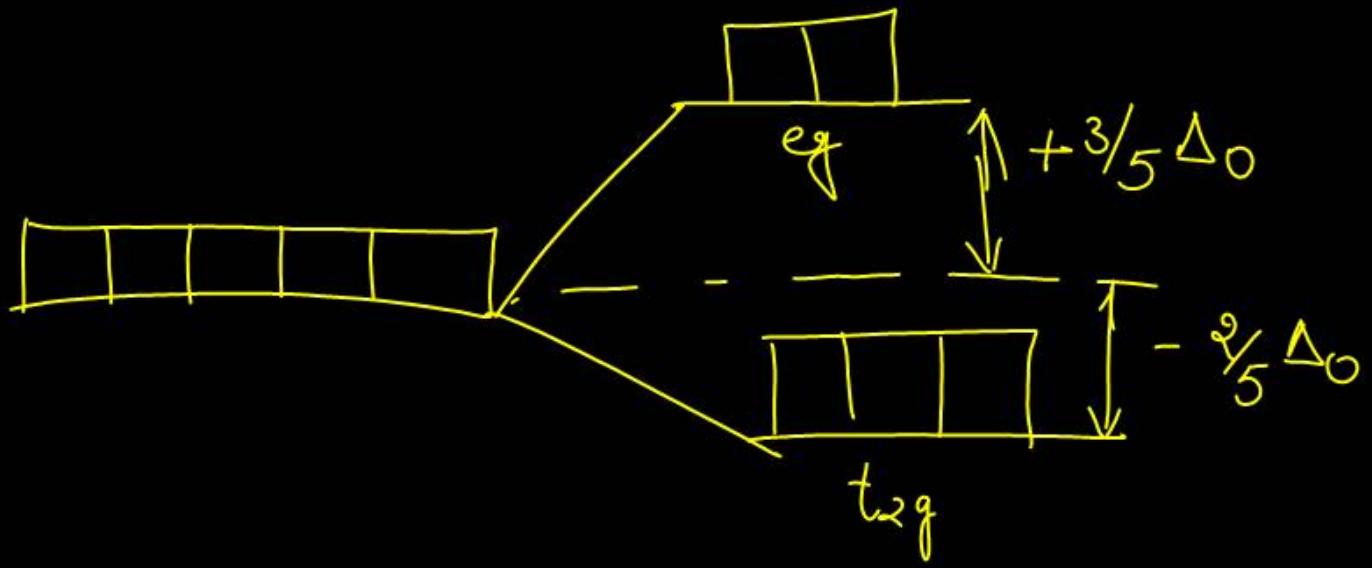
Ma_4b_2 Geometrical

Question no. 47

After the splitting of d-orbitals in octahedral crystal field, the energy of two e_g orbitals will :

(1) increase by $\left(\frac{3}{5}\right)\Delta_0$ (2) increase by $\left(\frac{2}{5}\right)\Delta_0$

(3) decrease by $\left(\frac{3}{5}\right)\Delta_0$ (4) decrease by $\left(\frac{2}{5}\right)\Delta_0$



Question no. 48

The octahedral complex of a metal ion M^{3+} with four monodentate ligands L_1, L_2, L_3 and L_4 absorb wavelengths in the region of red, green, yellow and blue, respectively. The increasing order of ligand strength of the four ligands is

(1) $L_4 < L_3 < L_2 < L_1$ (2) $L_1 < L_3 < L_2 < L_4$

(3) $L_3 < L_2 < L_4 < L_1$ (4) $L_1 < L_2 < L_4 < L_3$

$E = \frac{hc}{\lambda}$

V
I
L_4 B
L_2 G
L_3 Y
O
L_1 R

$L_1 > L_3 > L_2 > L_4$

Question no. 49

The increasing order of the crystal field splitting power of some common ligands is

(1) $H_2O < OH^- < Cl^- < F^- < CN^-$

(2) $H_2O < Cl^- < OH^- < CN^- < F^-$

(3) $CN^- < H_2O < OH^- < F^- < Cl^-$

(4) $Cl^- < F^- < OH^- < H_2O < CN^-$

$CN^- > H_2O > OH^- > F^- > Cl^-$

Question no. 50

The most stable complex among the following is

(1) $K_3[Al(C_2O_4)_3]$

(2) $[Pt(en)_2]\,Cl_2$

(3) $[Ag(NH_3)_2]\,Cl$

(4) $K_2[Ni(EDTA)]$

Chelate

Question no. 51

Arrange the following in the correct order of their second ionization enthalpies Cr, Mn, Ni, Cu, Zn

(1) Cr > Mn < Ni < Cu > Zn

(2) Cr > Mn > Ni < Cu > Zn

(3) Cr > Mn < Ni > Cu < Zn

(4) Cr < Mn < Ni < Cu > Zn

Cr $3d^5$ ~~$4s^1$~~

Mn $3d^5 4s^2$

Ni $3d^8 4s^2$

Cu $3d^{10} 4s^1$

Zn $3d^{10} 4s^2$

Cr > Mn < Ni < Cu

Question no. 52

For M^{3+}/M^{2+} systems, E° values for some metals are -

$Cr^{3+}/Cr^{2+} = -0.4V$; $Mn^{3+}/Mn^{2+} = +1.5V$;

$Fe^{3+}/Fe^{2+} = +0.77V$.

On the basis of this data, the correct stability order of species Cr^{3+}, Mn^{3+} and Fe^{3+} will be

(1) $Cr^{3+} > Fe^{3+} > Mn^{3+}$ (2) $Fe^{3+} > Cr^{3+} > Mn^{3+}$

(3) $Mn^{3+} > Cr^{3+} > Fe^{3+}$ (4) $Mn^{3+} > Fe^{3+} > Cr^{3+}$

Cr^{+3} $-0.40V$

Fe^{+3} $+0.77V$

Mn^{+3} $+1.50V$

$Cr < Fe < Mn$

Question no. 53

Most common oxidation states shown by cerium are

(1) +2, +4 (2) +3, +4

(3) +3, +5 (4) +2, +3

$Ce_{58} = 6s^2 5d^1 4f^1$

+3 +4

Question no. 54

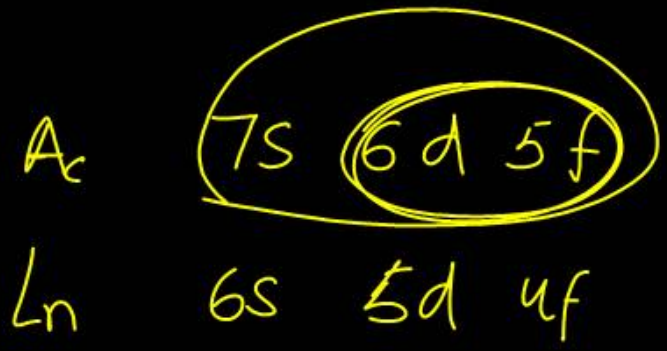
The main reason for larger number of oxidation states exhibited by the actinoids than the corresponding lanthanoids is

(1) lesser energy difference between 5f and 6d-orbitals than between 4 f and 5 d- orbitals

(2) larger atomic size of actinoids than the lanthanoids

(3) more energy difference between 5f and 6d–orbitals than between 4f and 5d – orbitals

(4) greater reactive nature of the actinoids than the lanthanoids



Question no. 55

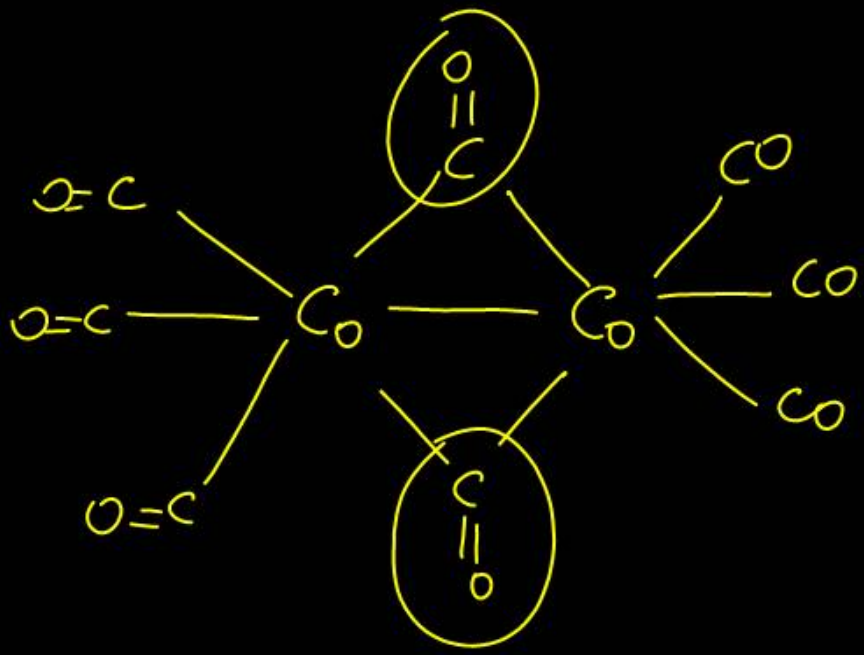
$[Co_2(CO)_8]$ displays

(1) one Co – Co bond, four terminal CO and four bridging CO

(2) one Co – CO bond, six terminal CO and two bridging CO

(3) no Co – Co bond, four terminal CO and four bridging CO

(4) no Co – Co bond, six terminal CO and two bridging CO.



Question no. 56

The element expected to form smallest ion to achieve the nearest noble gas configuration is

(1) N

(2) Na

(3) O

(4) F

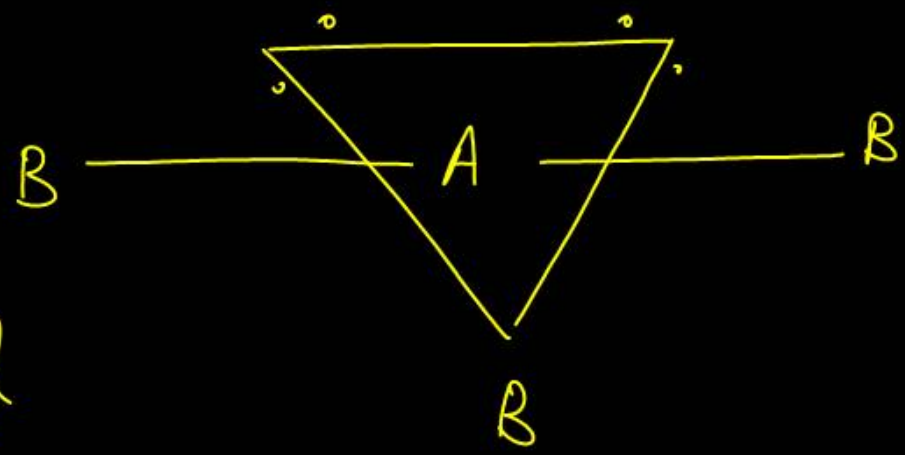
Question no. 57

A central atom in a molecule has two lone pairs of electrons and forms three single bonds. The shape of this molecule is

(1) planar triangular (2) trigonal pyramidal

(3) see–saw (4) T–shaped

(5)



Trigonal bi pyramid

Question no. 58

Which species have maximum magnetic moment?

$\mu = \sqrt{n(n+2)}$ B.M.

(1) $[Cr(H_2O)_6]^{2+}$ (2) $[Cr(H_2O)_6]^{3+}$

(3) $[Mn(H_2O)_6]^{2+}$ (4) $[CoCl_4]^{2-}$

$Cr^{+2} = 3d^4 4s^0$ $n = 4$

$Cr^{+3} = 3d^3 4s^0$ $n = 3$

$Mn^{+2} = 3d^5 4s^0$ $n = 5$

$Co^{+2} = 3d^7 4s^0$

Question no. 59

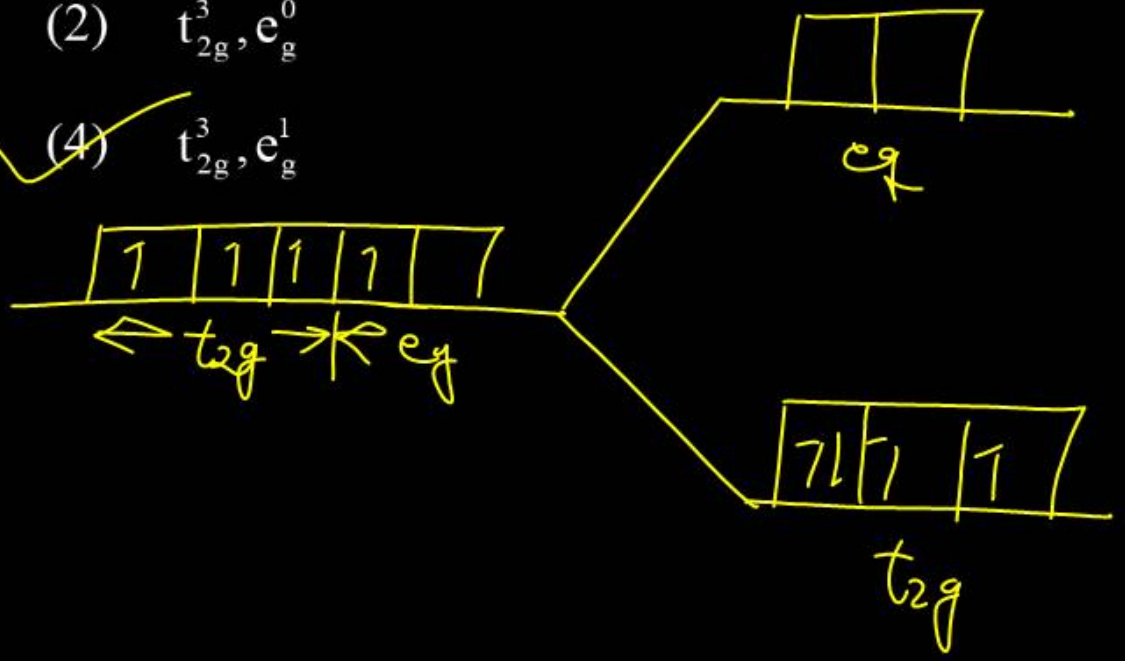
Which electronic distribution have maximum number of unpaired electrons?

(1) t_{2g}^2, e_g^0

(2) t_{2g}^3, e_g^0

(3) t_{2g}^4, e_g^0

(4) t_{2g}^3, e_g^1



Question no. 60

Facial and meridianal isomerism will be exhibited by

(1) $[Co(NH_3)_3Cl_3]$ (2) $[Co(NH_3)_4Cl_2]\,Cl$

(3) $[Co(en)_3]Cl_3$ (4) $[Co(NH_3)_5Cl]Cl_2$

Ma_3b_3

fac - mer

Question no. 61

As per IUPAC nomenclature, the name of the complex $[Co(H_2O)_4(NH_3)_2]Cl_3$ is

(1) tetraaquadiaminecobalt (III) chloride

(2) tetraaquadiamminecobalt (III) chloride

(3) diaminetetraaquacobalt (III) chloride

(4) diamminetetraaquacobalt (III) chloride

diammine tetraaqua cobalt (III) chloride

Question no. 62

Which of the following is an example of homoleptic complex?

(1) $[Co(NH_3)_6]Cl_3$ (2) $[Pt(NH_3)_2Cl_2]$

(3) $[Co(NH_3)_4Cl_2]$ (4) $[Co(NH_3)_5Cl]Cl_2$

Question no. 63

Cu^{+} ion is not stable in aqueous solution. Which of the following options does not show correct reason for this-

(1) Copper (I) compounds undergo disproportionation in aqueous solution to give Cu^{2+} (aq) and Cu (s)

(2) the E° value is not favourable for this transformation

(3) the disproportionation reaction shows that Cu^{2+} (aq) is much more stable than Cu^{+} (aq)

(4) the hydration enthalpy of Cu^{2+} (aq) is much

$Cu^{+2} > Cu^{+}$

$Cu^{+} \longrightarrow Cu^{+2} + Cu$

Question no. 64

Which one of the following has a magnetic moment of 1.73 BM?

(1) V^{3+} (2) Cr^{3+}

(3) Fe^{3+} (4) Ti^{3+}

$V^{+3} = 3d^2 4s^0$

$Cr^{+3} = 3d^3 4s^0$

$\mu = \sqrt{n(n+2)}$ B.M. $Fe^{+3} = 3d^5 4s^0$

1.73 $n = 1$ $Ti^{+3} = 3d^1 4s^0$

Question no. 65

Lanthanoid contraction is caused due to

(1) the same effective nuclear charge from Ce to Lu

(2) the imperfect shielding on outer electrons by 4f electrons from the nucelar charge

(3) the appreciable shielding on outer electrons by 4f electrons from the neuclear charge

(4) the appreciable shielding on outer electrons by 5d electrons from the nuclear charge.

Question no. 66

Which of the following compounds show colour due to d–d transition?

(1) $K_2Cr_2O_7$ (2) $CuSO_4.5H_2O$

(3) $KMnO_4$ (4) K_2CrO_4

$Cr^{+6} = 3d^0 4s^0$ $Cu^{+2} = 3d^9$

$Mn^{+7} = 3d^0 4s^0$

Question no. 67

Among H_2, He_2^+, Li_2, B_2, C_2, N_2, O_2^- and F_2, the number of diamagnetic species is :

(1) 4 (2) 5

(3) 6 (4) 7

$H_2 = \sigma_{1s}^2$

$He_2^+ = \sigma_{1s}^2, \sigma_{1s}^{*1}$

$Li_2 = \sigma_{1s}^2, \sigma_{1s}^{*2}, \sigma_{2s}^2$

$B_2 = \sigma_{1s}^2, \sigma_{1s}^{*2}, \sigma_{2s}^2, \sigma_{2s}^{*2}, \pi_{2p_x}^1 = \pi_{2p_y}^1$

$C_2 = \pi_{2p_x}^2 = \pi_{2p_y}^2$

$N_2 = \pi_{2p_x}^2 = \pi_{2p_y}^2, \sigma_{2p_z}^2$

$O_2^- = \pi_{2p_x}^{*2} = \pi_{2p_y}^{*1}$

$F_2 = \pi_{2p_x}^{*2} = \pi_{2p_y}^{*2}$

Question no. 68

The correct decreasing order for metallic character is

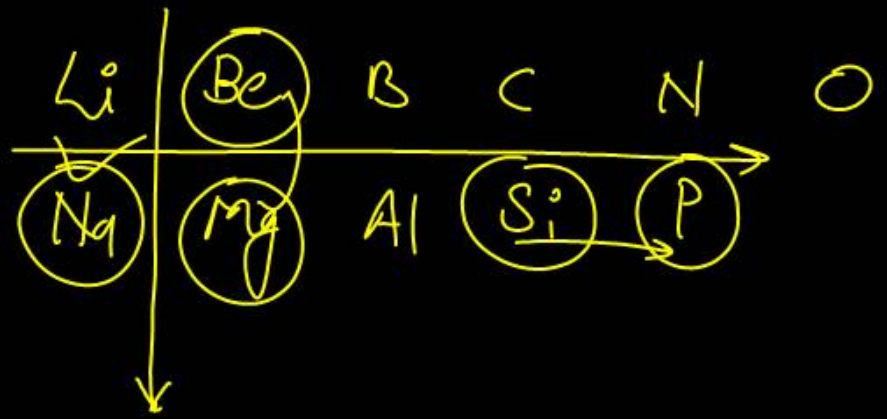
(1) P > Si > Be > Mg > Na

(2) Si > P > Be > Na > Mg

(3) Na > Mg > Be > Si > P

(4) Be > Na > Mg > Si > P

Na > Mg > Be >



Question no. 69

In the compound $CoCl_3.5NH_3$:

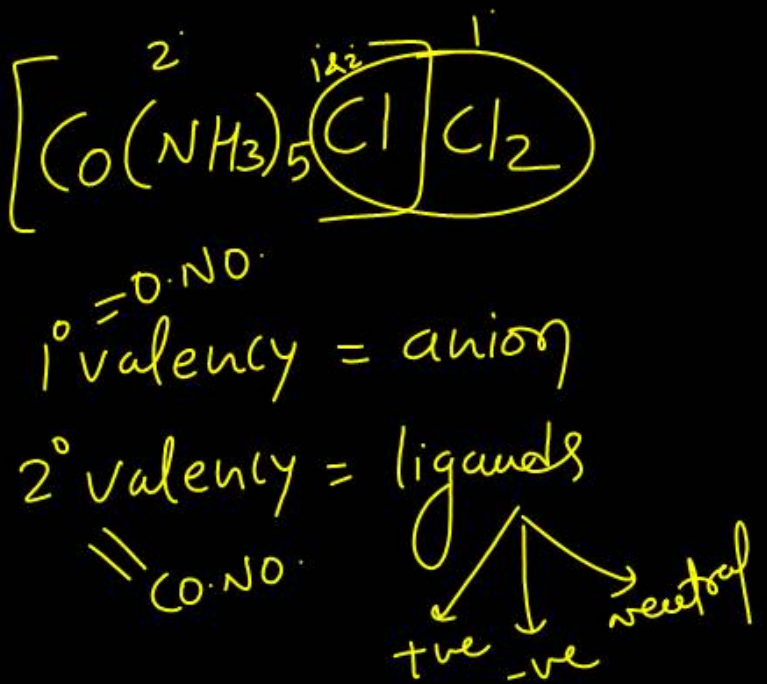
(1) all the Cl atoms show primary valency only

(2) two Cl atoms show primary valency and one Cl atom shows secondary valency

(3) two Cl atoms show primary valency and one Cl atom shows primary valency as well as secondary valency

(4) All the Cl atoms show secondary valency

3



Question no. 70

For an octahedral complex, which of the following d-electron configuration will give maximum CFSE?

(1) high spin, d^6 $t_{2g}^4 e_g^2$ (2) Low spin, d^5 $t_{2g}^5 e_g^0$

(3) Low spin, d^4 $t_{2g}^4 e_g^0$ (4) High spin, d^7

$\Delta O_{CFSE} = (-0.4 n_{t_{2g}} + 0.6 n_{e_g}) \times \Delta p$

$-0.4 \times x + 0.6 \times y + x\Delta p = \Delta O_{CFSE}$

$-0.4 \times 4 + 0.6 \times 2 = -0.4$

$-2 + 0 = -2$

$-0.4 \times 4 + 0 = -1.6$

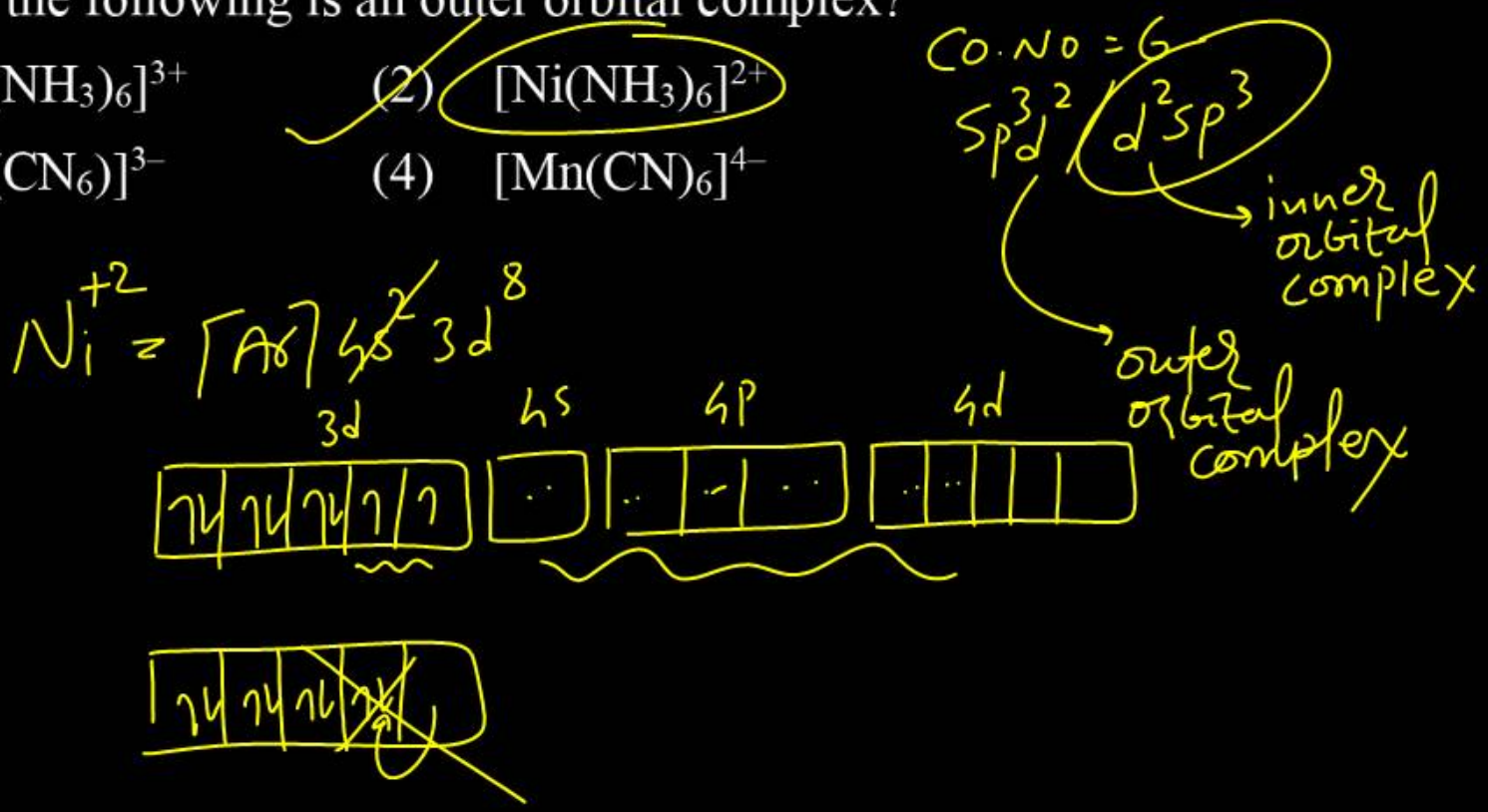
$-0.4 \times 5 + 1.2 = -0.8$

Question no. 71

Which of the following is an outer orbital complex?

(1) $[Cr(NH_3)_6]^{3+}$ (2) $[Ni(NH_3)_6]^{2+}$

(3) $[Fe(CN_6)]^{3-}$ (4) $[Mn(CN)_6]^{4-}$



Question no. 72

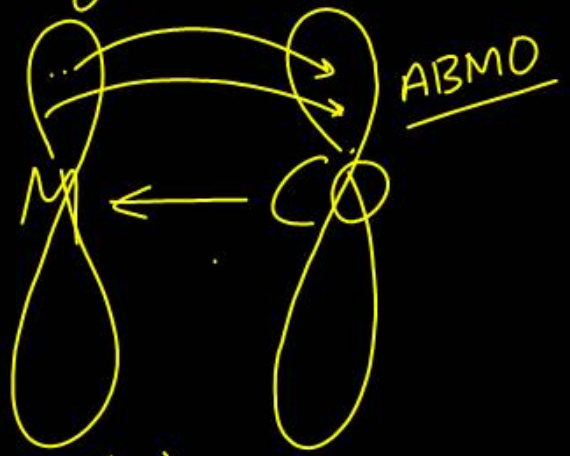
Among the following metal carbonyls, the C – O bond order is lowest in

(1) $[Mn(CO)_6]^+$ (2) $[Fe(CO)_5]$

(3) $[Cr(CO)_6]$ (4) $[V(CO)_6]^-$

Mn $^{+1}$ Fe ^{0} Cr ^{0} V $^{-1}$

Synergistic Bonding



as. -ve charge on Metal ↑es

Back bonding ↑

more no. of e⁻ transferred in ABMO of CO (L)

$N_a \uparrow \Rightarrow BO \downarrow$

$BO = \frac{N_b - N_a}{2}$ ↑

Question no. 73

Which among the following will be named as dibromidobis (ethylene diamine) chromium (III) bromide?

(1) $[Cr(en)_2Br_2]Br$

(2) $[Cr(en)Br_4]^-$

(3) $[Cr(en)Br_2]Br$

(4) $[Cr(en)_3]Br_3$

Question no. 74

Which of the following statements is correct?

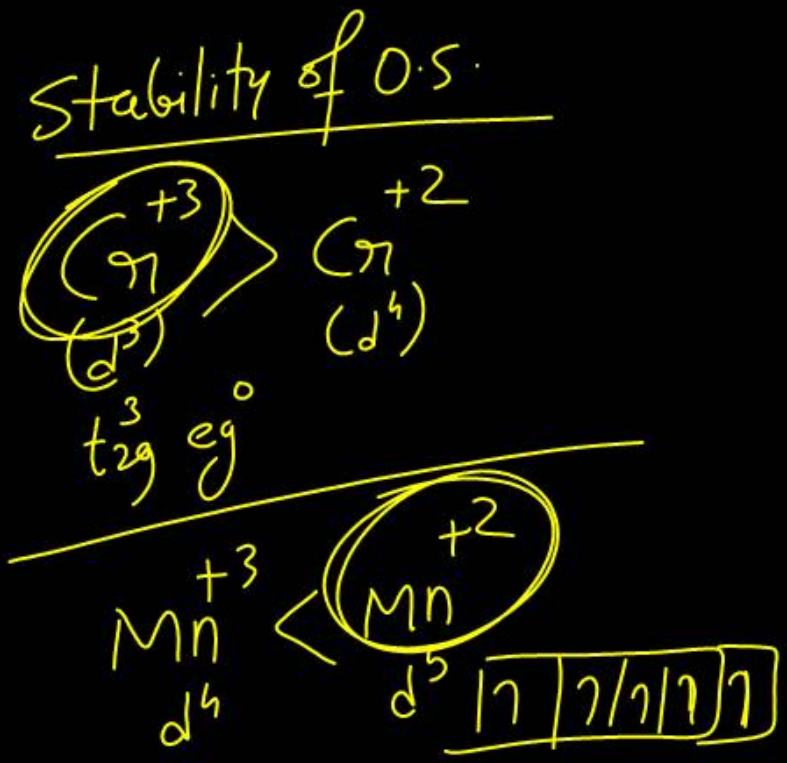
Both Cr^{2+} and Mn^{3+} have d^4 configuration but

(1) Cr^{2+} is oxidizing and Mn^{3+} is reducing in character

(2) both Cr^{2+} and Mn^{3+} are oxidizing in character

(3) Cr^{2+} is reducing and Mn^{3+} is oxidizing in character

(4) both Cr^{2+} and Mn^{3+} are reducing in character



Question no. 75

Which of the following pairs has both the ions coloured in aqueous solution?

(1) Sc^{3+}, Co^{2+}

(2) Ni^{2+}, Cu^{+}

(3) Ni^{2+}, Ti^{3+}

(4) Sc^{3+}, Ti^{3+}

$3d^8$, $3d^1$, $n=2$, $n=2$

$Sc^{+3} = 3d^0$

$[Ar]\,4s^2\,3d^0$

colourless

$Cu^{+1} = [Ar]\,4s^0\,3d^{10}$

$3d^{10}$ colourless

d^0, d^{10}

→ No d-d transition

→ colourless

Question no. 76

Which of the following lanthanoid ion is paramagnetic?

(1) Ce^{4+}

(2) Yb^{2+}

(3) Lu^{3+}

(4) Eu^{2+}

Eu^{+2} = $[Xe]_{54}\, 6s^2\, 4f^7$, $Z = 63$

4

Ce^{+4} = $[Xe]_{54}\, 6s^2\, 4f^1\, 5d^1$ Dia, $Z = 58$

Yb^{+2} = $[Xe]_{54}\, 6s^2\, 4f^{14}$ Dia, $Z = 70$

Lu^{+3} = $[Xe]_{54}\, 6s^2\, 4f^{14}\, 5d^1$ Dia, $Z = 71$

Question no. 77

Identify correct statements from below:

A. The chromate ion is square planar

B. Dichromates are generally prepared from chromates.

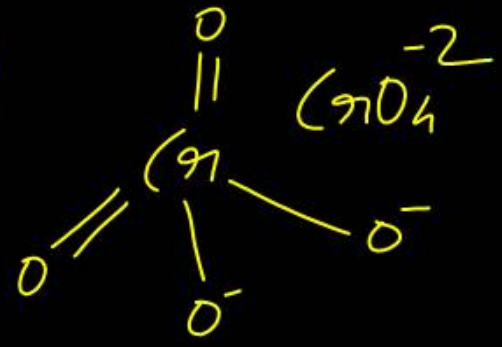
C. The green mangnate is diamagnetic.

D. Dark green coloured K_2MnO_4 disproportionates in a neutral or acidic medium to give permangnate.

E. With increasing oxidation number of transition metal, ionic character of the oxides decreases.

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

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



Chromite ore → Sod Chromate → Sod dichromate → $K_2Cr_2O_7$

MnO_4^{-2} (+6)

$3d^1$

$K_2MnO_4 \longrightarrow MnO_4^- + MnO_2$ (+6 → +7, +4)

Question no. 78

In the formation of N_2^+, the electron is lost from :

(1) σ-orbital (2) π-orbital

(3) σ*-orbital (4) π*-orbital

$N_2 = \sigma 1s^2 . \sigma^* 1s^2 . \sigma 2s^2 . \sigma^* 2s^2 . \pi 2p_x^2 = \pi 2p_y^2 \sigma 2p_z^2$

(1) (3)

$\sigma 2p_z$ BMO

Question no. 79

Match List–I with List–II.

	List–I (Electronic configuration of elements)		List–I (Δ_iH in kJ mol^{-1})
(A)	$1s^2 2s^2$	(i)	801
(B)	$1s^2 2s^2 2p^4$	(ii)	899
(C)	$1s^2 2s^2 2p^3$	(iii)	1314
(D)	$1s^2 2s^2 2p^1$	(iv)	1402

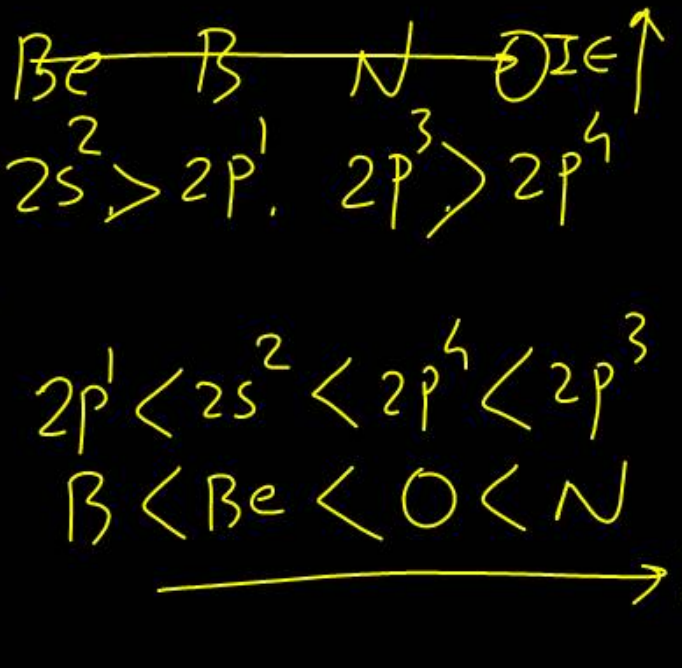
Choose the most appropriate answer from the options givven below.

(1) (A)→(ii), (B)→(iii), (C)→(iv), (D)→(i)

(2) (A)→(i), (B)→(iv), (C)→(iii), (D)→(ii)

(3) (A)→(i), (B)→(iii), (C)→(iv), (D)→(ii)

(4) (A)→(iv), (B)→(i), (C)→(ii), (D)→(iii)

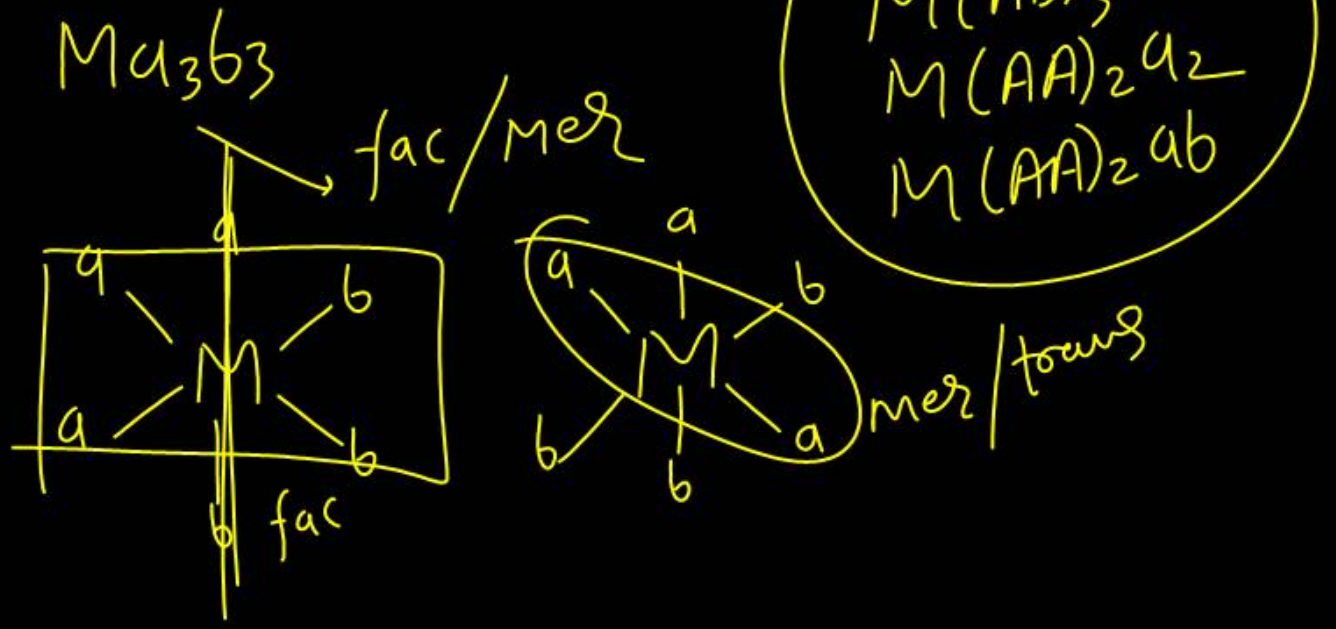


Question no. 80

Which of the following complex species is not expected to exhibit optical isomerism?

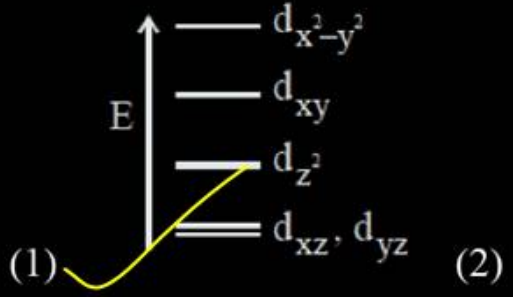
(1) $[Co(NH_3)_3Cl_3]$ (2) $[Co(en)(NH_3)_2Cl_2]^+$

(3) $[Co(en)_3]^{3+}$ (4) $[Co(en)_2Cl_2]^+$

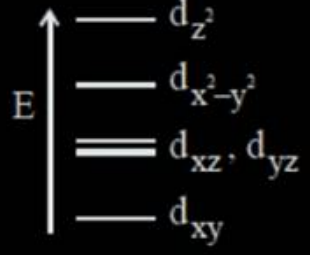


Question no. 81

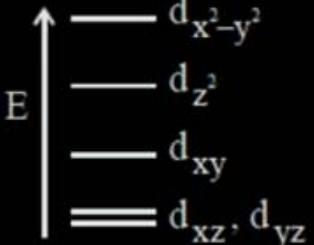
Complete removal of both the axial ligands (along the z-axis) from an octahedral complex leads to which of the following splitting patterns? (relative orbital energies not on scale).



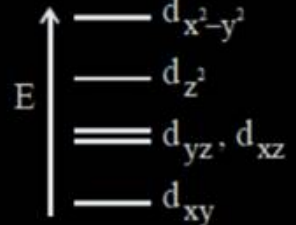
(1)



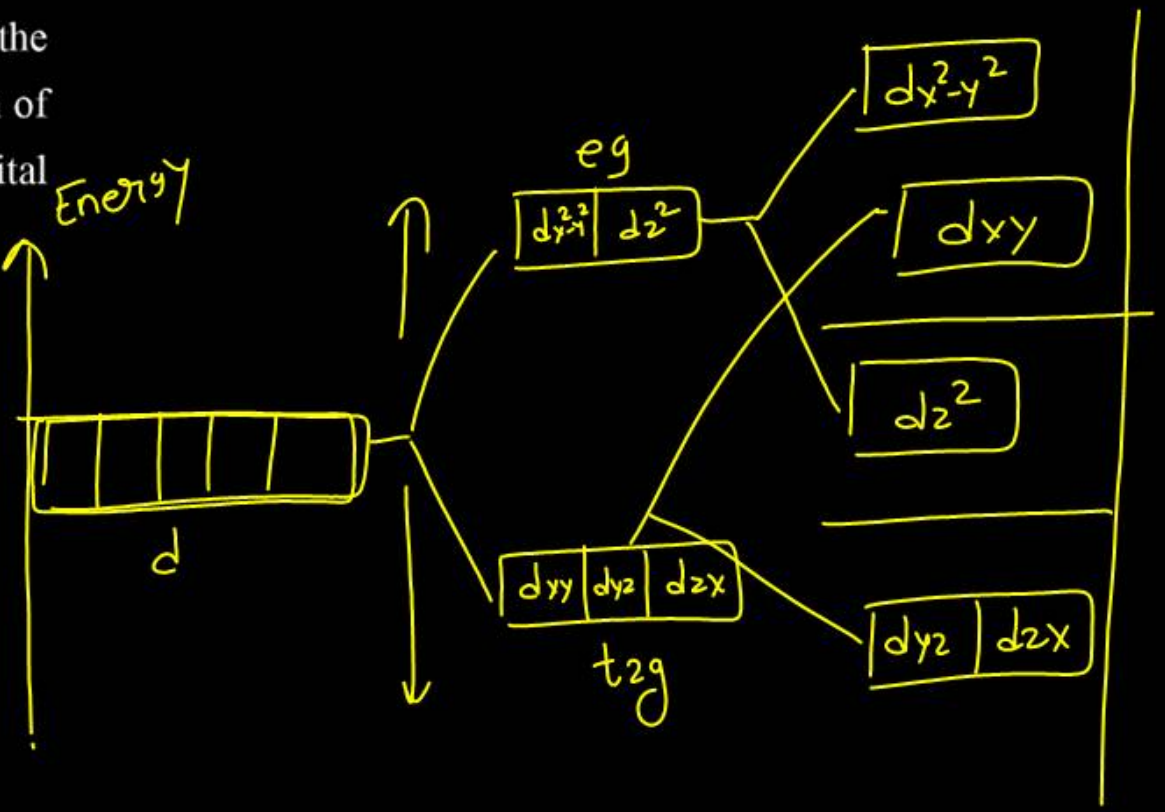
(2)



(3)



(4)



Question no. 82

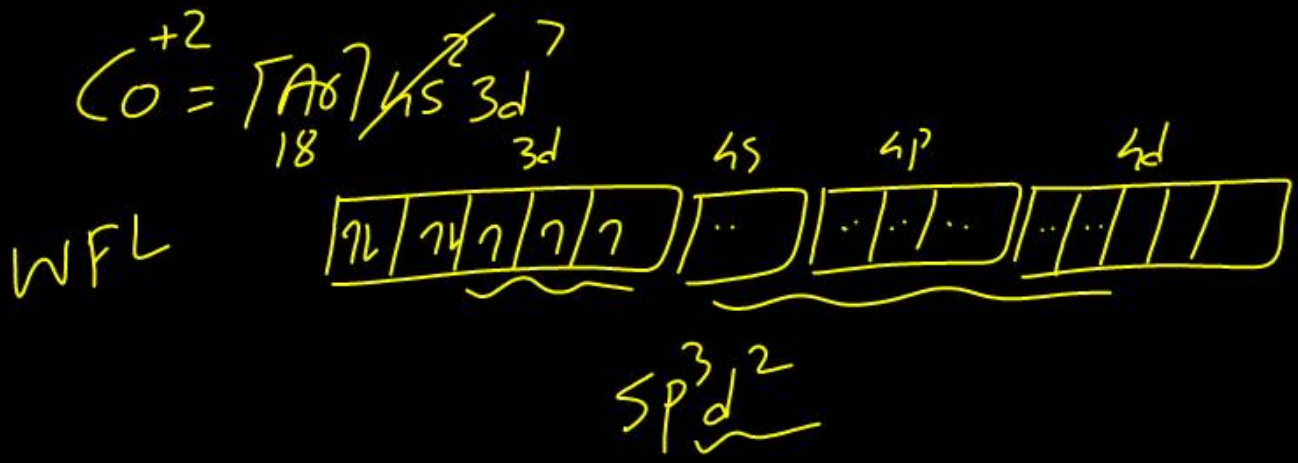
The complex $[CoF_6]^{4-}$ is

(1) outer orbital and diamagnetic

(2) inner orbital and paramagnetic

(3) outer orbital and paramagnetic

(4) inner orbital and diamagnetic



Question no. 83

In which of the following coordination entities, the magnitude of Δ_0 (CFSE in octahedral field) will be maximum? (Atomic number of Co = 27)

(1) $[Co(H_2O)_6]^{3+}$ WFL

(2) $[Co(NH_3)_6]^{3+}$

(3) $[Co(CN)_6]^{3-}$

(4) $[Co(C_2O_4)_3]^{3-}$ chelate SFL

CFSE ∝ charge on metal ×

∝ 3d < 4d < 5d ×

∝ strength of ligand.

∝ chelate

Question no. 84

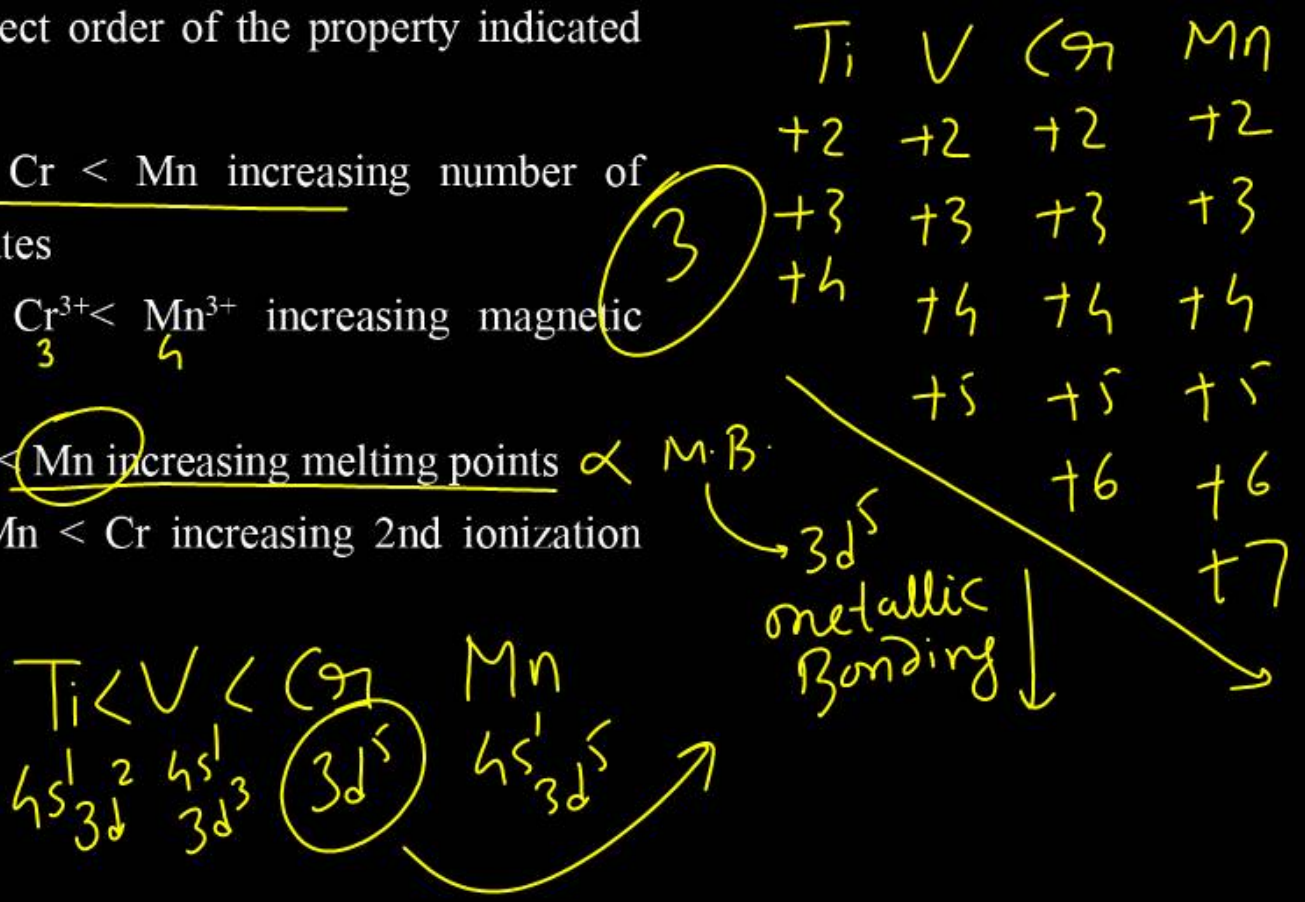
Which one of the following does not correctly represent the correct order of the property indicated against it

(1) Ti < V < Cr < Mn increasing number of oxidation states

(2) $Ti^{3+} < V^{3+} < Cr^{3+} < Mn^{3+}$ increasing magnetic moment

(3) Ti < V < Cr < Mn increasing melting points

(4) Ti < V < Mn < Cr increasing 2nd ionization enthalpy



Question no. 85

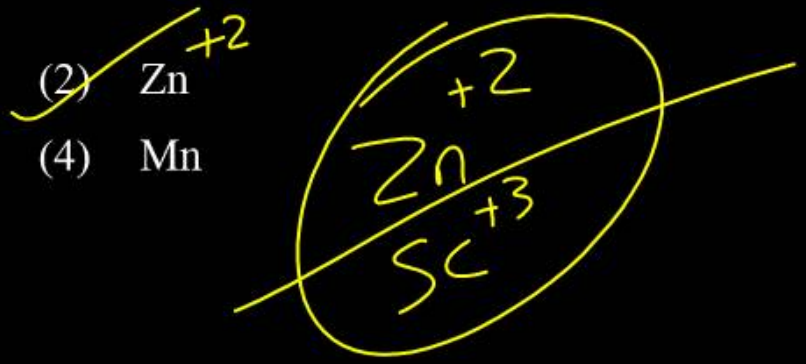
Which of the following element does not show variable valency?

(1) Ni

(2) Zn

(3) Cu

(4) Mn



Question no. 86

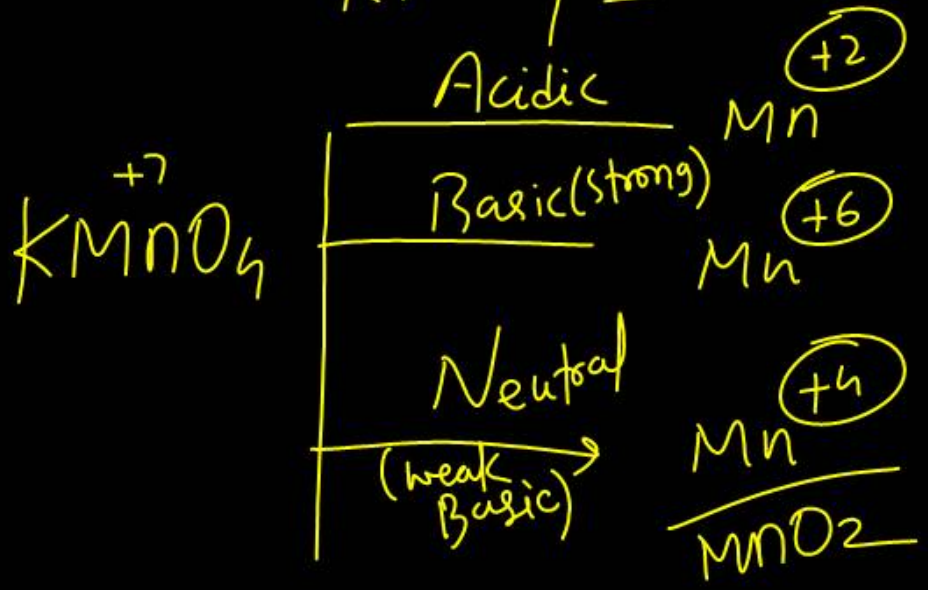
Potassium permanganate acts as an oxidant in neutral, strong alkaline as well as acidic media. The final products obtained from it in the three conditions are, respectively

(1) MnO_2, MnO_4^{2-}, Mn^{2+}

(2) ~~MnO_4^{2-}, Mn^{3+}, Mn^{2+}~~

(3) ~~MnO_2, MnO_4^{2-}, Mn^{3+}~~

(4) ~~MnO, MnO_4^{-}, Mn^{2+}~~



Question no. 87

Most basic hydroxide among the following is

(1) $Lu(OH)_3$ (2) $Eu(OH)_3$

(3) $Yb(OH)_3$ (4) $Ce(OH)_3$

La ⟶ Lu

at. size ↓

Ionic size ↓

Basicity of Hydroxides ↓

La ⟶ Lu

cation size ↓

Polarization ↑

Covalent ch2 ↑

Bond strength ↑

M—OH

Tendency to Donate OH^- ↓

Basicity ↓

Question no. 88

Wilkinson catalyst is

(1) $[(Ph_3P)_3IrCl]$

(2) $[(Ph_3P)_3RhCl]$

(3) $[(Et_3P)_3RhCl]$ $(Et = C_2H_5)$

(4) $[(Et_3P)_3IrCl]$

Question no. 89

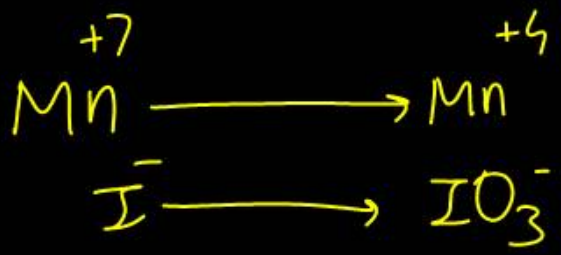
$KMnO_4$ oxidises I^- in acidic and neutral/faintly alkaline solution, respectively, to

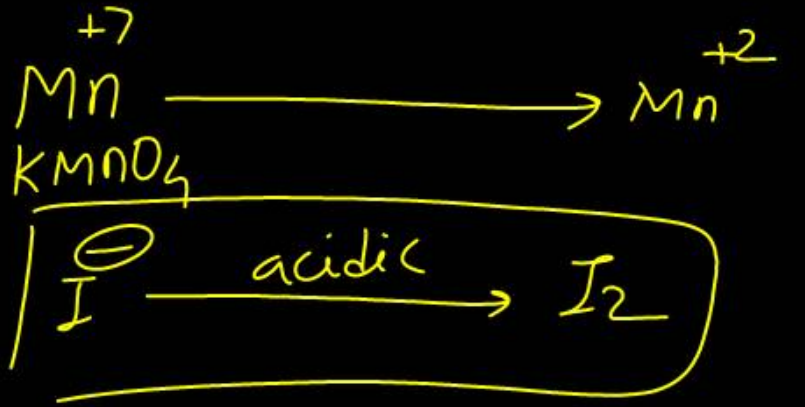
(1) IO_3^- and IO_3^-

(2) I_2 and IO_3^-

(3) I_2 and I_2

(4) IO_3^- and I_2





Question no. 90

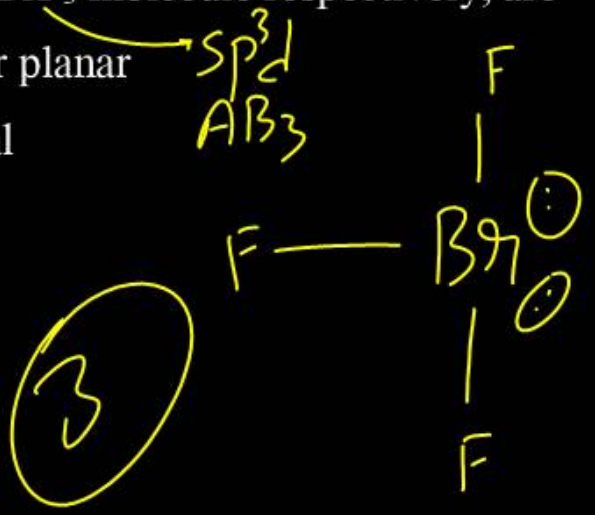
Number of lone pair (s) of electrons on central atom and the shape of BrF_3 molecule respectively, are

(1) 0, triangular planar

(2) 1, pyramidal

(3) 2, T– shape

(4) 1, T–shape



Question no. 91

A fish Nile Perch introduced into Lake Victoria in East Africa led to the extinction of Cichlid fishes in the lake. This is an example for

(1) Coextinction

(2) Habitat loss and fragmentation

(3) Over exploitation

(4) Alien species invasion

Question no. 92

Match the following columns and choose the correct option.

	Column I		Column II
(a)	Term biodiversity popularised by	(i)	Robert Costanza
(b)	Long-term ecosystem experiments	(ii)	David
(c)	Rivet popper hypothesis	(iii)	Edward Wilson
(d)	Cost of ecosystemservices	(iv)	Paul Ehrlich

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

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

a - 3
b - 2
c - 4
d - 1

2

Question no. 93

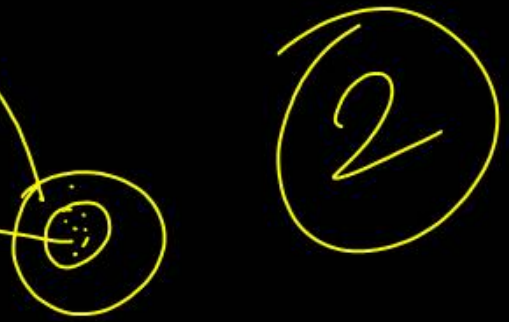
In which part of biosphere reserve human settlement is permissible?

(1) Buffer Zone

(2) Transition Zone

(3) Core Zone

(4) All of the above



Question no. 94

Western Ghats have a large number of plant and animal species that are not found anywhere else. Which of the following terms will you use to notify such species?

(1) Keystone

(2) Endemic

(3) Vulnerable

(4) Threatened

Question no. 95

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

(1) Species diversity (2) Ecological diversity

(3) Genetic diversity (4) Hybridization

3

Question no. 96

Match the colum List–I and List–II

	List–I		List–II
A.	No. of Hotspots in world	i.	448
B.	No. of Biosphere reserves in india	ii.	90
C.	No. of Wild life sanctuary in india	iii.	14
D.	National park in india	iv	34

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

Question no. 97

Out of the four basic processes given below, which contribute to an increase in population density of an area?

A. Immigration
B. Emigration
C. Natality
D. Mortality

Choose the correct option.

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

Question no. 98

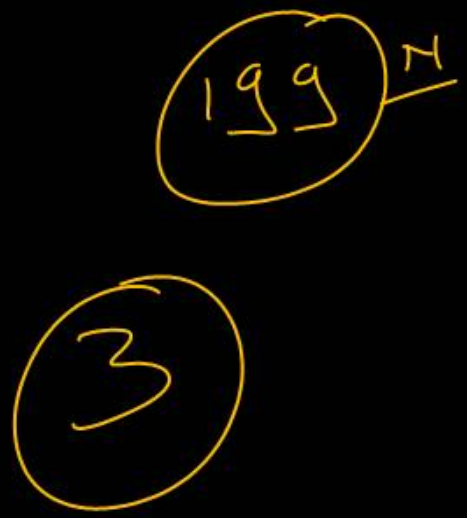
According to Gause, if two species are occupying same ecological niche and competing for common resources, then

(1) Both species will eliminate each other

(2) Inferior type will eliminate the superior type of species

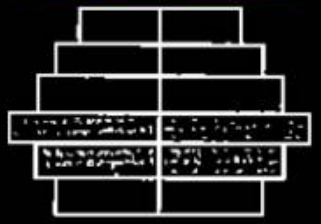
(3) Superior species will exclude the inferior type of species

(4) Both species will be unaffected



Question no. 99

Which of the given age pyramid reflects a stable human population?

(1) 

(2) 

(3) 

(4) 

3

192

Expanding

Question no. 100

Which of the following experssion correctly represents 'Verhulst – Pearl' logistic growth curve

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

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

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

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

Question no. 101

Identify the food chain.

Dead animal → Blow fly → Maggots → Common frog → Snake

(1) Grazing food chain

(2) Detritus food chain

(3) Decomposer food chain

(4) Predator food chain

2

Question no. 102

The biomass available for cosumption to heterotrophs and the rate of formation of new organic matter by consumers are defined as

(1) gross primary productivity and net primary productivity respectively.

(2) net primary productivity and gross primary productivity respectively.

(3) gross primary productivity and secondary productivity respectively.

(4) net primary productivity and secondary productivity respectively.

4

Question no. 103

A commercial blood cholesterol lowering agent is obtained from

(1) Trichoderma polysporum

(2) Monascus purpureus

(3) Rhizopus stolonifer

(4) Streptococcus

2

Question no. 104

Which of the following pair of alcoholic drinks is produced by distillation of the fermented broth?

(1) Wine and rum
(2) Beer and wine
(3) Wine and Brandy
(4) Brandy and Whisky

4

Question no. 105

Cyclosporin A, used as immunosuppressive agent, is produced from

(1) Trichoderma polysporum

(2) Monascus purpureus

(3) Saccharomyces cerevisiae

(4) Penicillium notatum

Question no. 106

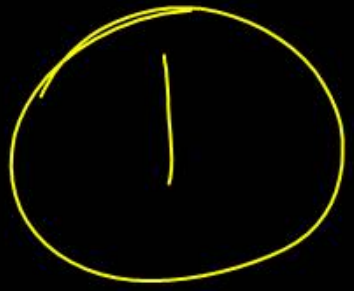
From the following identify the pair of species that show co–evolution.

(1) Fig tress and pollinator species of wasp

(2) Fungus and cyanobacteria

(3) Sea anemone and clown fish

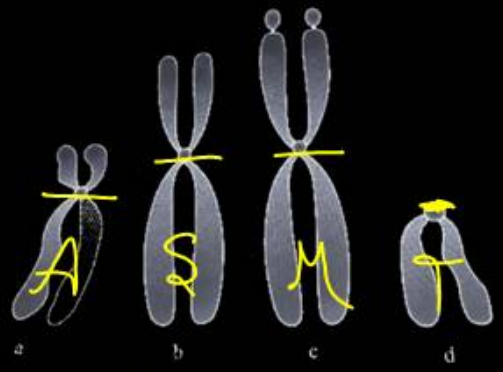
(4) All of them



Ans – (A)

Question no. 107

Recognise the figure and out the correct matching.



(1) b – acrocentric, a – telocentric, d – metacentric, c – submetacentric

(2) a – acrocentric, d – telocentric, c – metacentric, b – submetacentric

(3) a – acrocentric, d – telocentric, b – metacentric, c – submetacentric

(4) d – acrocentric, c – telocentric, a – metacentric, b – submetacentric

Question no. 108

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. 109

Physical removal of large and small particle form the sewage through filtration and sedimentation is called

(1) Primary treatment

(2) Secondary treatment

(3) Biological treatment

(4) Both B and C

Question no. 110

Which one of the following is an example of carrying out biological control of pests/ diseases using microbes?

(1) Bt-cotton to increase cotton yield

(2) Lady bird beetle against aphids in mustard

(3) Trichoderma sp. against certain plant pathogens

(4) Nucleopolyhedrovirus against white rust in Brassica

Question no. 111

. Match the entities in Column I with their characters in Column Ii regarding proteins and their functions :

	Column I (Proteins)		Column II (Functions)
a.	Ligases	i.	Catalysing hydrolysis of ester, ether, peptide, glycosidic, C-C, C-halide or P – N bonds
b.	Isomerases	ii.	Catalysing a transfer of a group
c.	Lyases	iii.	Enzymes which catalyse oxido-reduction between two substrates
d.	Hydrolases	iv.	Optical, geometric or positional isomers.
e.	Transferases	v.	Catalyse joining of C-O, C-S, C-N, P-O, etc, bonds
f.	Oxidoreductases/ dehydrogenases	vi.	Catalyse removal of groups from substrates

(1) a-iv, b-v, c-vi, d-i, e-iii, f-ii

(2) a-iv, b-v, c-vi, d-i, e-ii, f-iii

(3) a-v, b-iv, c-vi, d-i, e-ii, f-iii

(4) a-iv, b-v, c-iii, d-iii, e-i, f-vi

Question no. 112

Pick the correct statements regarding cell cycle.

A. Interphase is called the resting phase

B. Interphase is the time during which the cell is preparing for division

C. DNA synthesis occurs only during one specific stage in the cell cycle

D. The replicated chromosomes (DNA) are distributed to daughter nuclei during cell division

(1) A and C

(2) A and B

(3) C and D

(4) A, B, C and D

Question no. 113

In which of the following, both the pairs have correct combinations?

	In situ conservation	Ex situ cnservation
(1)	National Park	Botanical Garden
(2)	Gene Bank	Tissue Culture
(3)	Botanical Garden	Zoological Park
(4)	Zoological Park	Biosphere Reserve

Question no. 114

Match the following columns and choose the correct option.

	Column I		Column II
(a)	Genetic diversity	(i)	Presence of desert, rain forest, mangroves in India
(b)	Species diversity	(ii)	More than 1000 mango strains found in India
(c)	Ecological diversity	(iii)	Variety of amphibian species found in India

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

a - 2
b - 3
c - 1

1

Question no. 115

Which of the following is considered a hot–spot of biodiversity in India?

(1) Indo–Gangetic Plain

(2) Eastern Ghats

(3) Aravalli Hills

(4) Western Ghats

Question no. 116

In species – area relationship among frugivorous birds and mammal in the tropical forests of different continents, the regression coefficient is

(1) 0.1 to 0.2

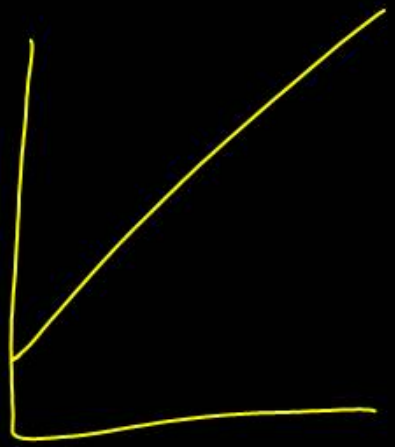
(2) 0.6 to 1

(3) 1.15

(4) 2.15 to 3

$\log S = \log C + z \log A$

3



Question no. 117

Overexploitation has resulted in the extinction of

(1) Steller's cow

(2) Lantana

(3) Passenger pigeon

(4) Both (1) and (3)

4

Question no. 118

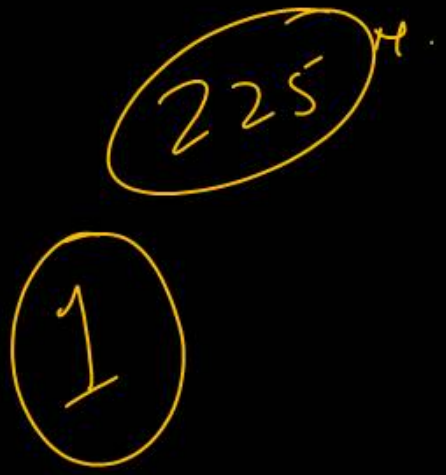
The earth summit held in Rio de Janeiro in 1992 was called

(1) For conservation of biodiversity and sustainabled 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. 119

$dN/dt = rN[(K - N)/K]$. Here $(K - N/K)$ represents

(1) Carrying capacity

(2) Rate of change in population density

(3) Intrinsic growth rate

(4) Environmental resistance

Question no. 120

'Competitive release' refers to

(1) Inability of two species to co–exist idenfinitely and eventual elimination of the competitively inferior species

(2) Avoidance of competition between species competing for same resource by figuring a compromise

(3) Expansion of distribution of a species restricted to a small area due to a competitively superior species being experimentally eliminated.

(4) Evolutionary success in devising a mechanism to counter and neutralize competition

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Competition

3

Question no. 121

Epiphytes growing on trees is an example of

(1) Mutualism (2) Commensalism

(3) Amensalism (4) Parasitism

(+, 0)

2

Question no. 122

Asymptote in a logistic growth curve is obtained when

(1) K = N

(2) K > N

(3) K < n

(4) The value of 'r' approaches zero

1

195

Carrying Capacity = K = equal N

Question no. 123

Grazing food chain.

A. It starts with green plants called producers as the first trophic level.

B. Energy food grazing food chain comes from organic remains or detritus.

C. A much less fraction of energy flows through this type of food chain in terrestrial ecosystem.

Which of the statements give above are correct?

(1) A and B

(2) A and C

(3) B and C

(4) A, B and C

Question no. 124

Thr primary productivity in an ecosystem is expressed as :

(1) $gm^{-3}\ yr^{-1}$

(2) gm^{-2}/yr^{-1}

(3) $K\ cal\ m^{-2}\ yr^{-1}$

(4) $K\ cal\ m^{-2}$

Question no. 125

Fruit juices are made clear by the activity of

(1) Lipases and cellulases

(2) Pectinases and proteases

(3) Cellulases and nucleases

(4) Lipases and amylases

2

Question no. 126

Enzymes used in detergent formulations to remove oil stains from laundry are

(1) Protease
(2) Pectinase
(3) Lipase
(4) Streptokinase

3

Question no. 127

Which of the following microbe is used for commercial production of ethanol?

(1) Aspergillus fumigatus

(2) Saccharomyces cerevsiae

(3) candida sp.

(4) Streptococcus

2

Question no. 128

Brood parasitism is found in

(1) Plasmodium and human

(2) Ticks and dogs

(3) Cuckoo and crow

(4) None of the above

3

Question no. 129

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

(1) Producers

(2) Primary consumers

(3) Secondary consumers

(4) Decomposers

(microbes, fungus)

4

Question no. 130

Which one of the following processes during decomposition is correctly described?

(1) Humification-Leads to the accumulation of a dark coloured substance humus which undergoes microbial action at every fast rate.

(2) Catabolism-Last step decomposition under fully anaerobic condition.

(3) Leaching-water soluble inorganic nutrients rise to the top layers of soil

(4) Fragmentation-Carried out by organisms such as earthworm

4

Question no. 131

Which is incorrect about the Nucleopolyhedrovirus (NPV)?

(1) These are species-specific

(2) These are broad-spectrum

(3) They have no negatative impact on plants, mammals, bird, fish and non-target insects.

(4) They aid in an overall IPM programmer or when an ecologically sensitive area is bing treated.

2

Question no. 132

During sewage treatment, biogases are produced which include;

(1) Methane, hydrogen sulphide, carbon dioxide

(2) Methane, oxygen, hydrogen sulphide

(3) Hydrogen sulphide, methane, sulphur dioxide

(4) Hydrogen sulphide, nitrogen, methane

Question no. 133

Acid insoluble classes of compounds generally are polymeric substances but their exception is

(1) Protein
(2) Polysaccharides
(3) Nucleic acids
(4) Lipids

4

Question no. 134

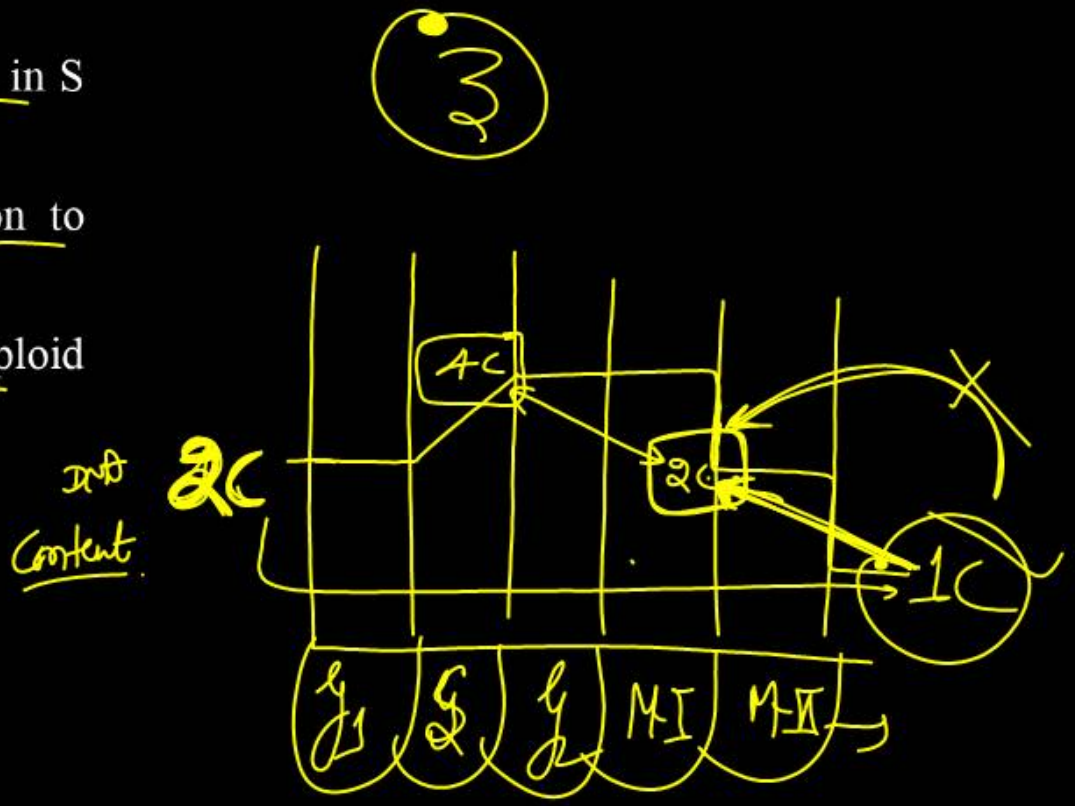
After meiosis 1 the resultant daughter cells have

(1) four times the amount of DNA in comparison to haploid gamete

(2) same amount of DNA as in the parent cell in S phase

(3) twice the amount of DNA in comparison to haploid gamete

(4) same amount of DNA in comparison to haploid gamete



Question no. 135

Which of the following is a unique feature of biodiversity hotspot?

(1) Very low level of species richness

(2) High degree of endemism

(3) Have many alien species

(4) Do not need conservation

endenism

2

Question no. 136

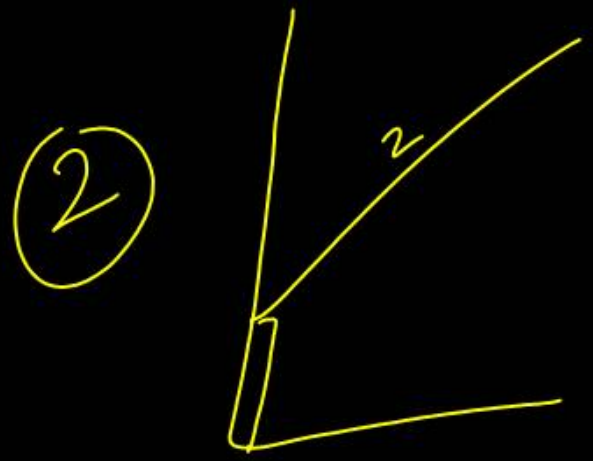
Which of the given equation is correct with respect to species-area relationship

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

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

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

(4) log A=log Z+ S log A



Question no. 137

Amongst vertebrates, the species diversity is the maximum in

(1) Birds

(2) Fishes

(3) Reptiles

(4) Mammals

2

Question no. 138

As we move from the poles to equator, the biological diversity

(1) Increases

(2) Decreases

(3) First increases then decreases

(4) remains constant

Question no. 139

Which of the following is/are invasive alien species in the indian context?

(1) Lantana

(2) Parthenium

(3) Eichhornia

(4) All of these

4

Question no. 140

The World Summit on sustainable development held in 2002 in Johannesburg, South Africa pledged for:

(1) A signification reduction in the current rate of biodiversity loss.

(2) Declaration of more biodiversity hotspots.

(3) Increases in agricaultuarl production

(4) Collection and preservation of seeds of different genetic strains of commerically important plants.

Question no. 141

Which one is incorrely matched w.r.t. population?

	Species A	Species B	Name of interaction
(1)	+	+	Mutualism
(2)	–	–	Competition
(3)	0	–	Commensalism
(4)	+	–	Parasitism

193

3

Question no. 142

Match the following and choose the correct combination from the options given below.

	Column I (Population interaction)		Column II (Example)
A.	Mutualism	1.	Ticks on dogs
B.	Commensalism	2.	Balanus and Chathamalus
C.	Parasitism	3.	Sparrow and any seed
D.	Competition	4.	Epiphyte on a mango branch
E.	Predation	5.	Orchids and bee

	A	B	C	D	E
(1)	1	5	4	3	2
(2)	2	1	5	4	3
(3)	3	2	1	5	4
(4)	5	4	1	2	3

Question no. 143

A community is defined as

(1) A group of birds

(2) A collection of species

(3) Interacting populations

(4) An interactive ecosystem

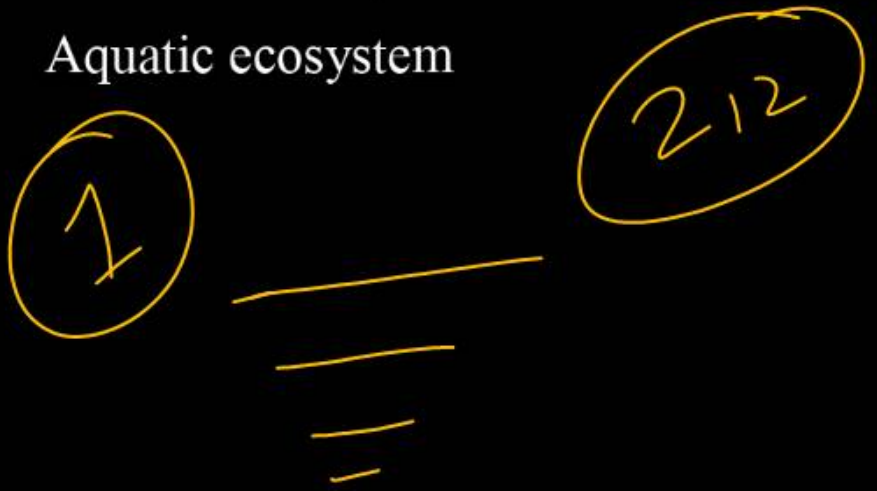
3

Question no. 144

The pyramid of number may be inverted in

(1) Tree ecosystem (2) Grassland ecosystem

(3) Pond ecosystem (4) Aquatic ecosystem



Question no. 145

Increase in toxic concentration from one trophic level to another trophic level is called

(1) ecological toxification

(2) bio–magnification

(3) bioconcentration

(4) cytological effect

2

Question no. 146

Vertical distribution of different species occupying different levels in a biotic community is known as

(1) Divergence
(2) Stratification
(3) Zonation
(4) Mineralization

2

Question no. 147

KVIC stands for

(1) Khadi Village and Industries Committee

(2) Khadya and Vikas Industrial Commission

(3) Khadi and Village Industries Commission

(4) Khadi and Vikas Industrial commission

3

Question no. 148

The greater BOD of waste water indicates

(1) It has less pollution level

(2) More amount of dissolved organic matter present

(3) high level of dissolved oxygen

(4) High level of dissolved inorganic nutrients

Question no. 149

NEET

Threatened animals and plants are taken out from their natural habitat and palced in special settings, protected and given special care is

(1) In situ conservation

(2) Ex situ conservation

(3) Conservation in national park

(4) Conservation in biosphere

2

Question no. 150

Depending on the ease of extraction, membrane proteins can be classified as

(1) Saturated and unsaturated

(2) Hydrophilic and hydrophobic

(3) Integral and peripheral

(4) Acidic, basic and neutral

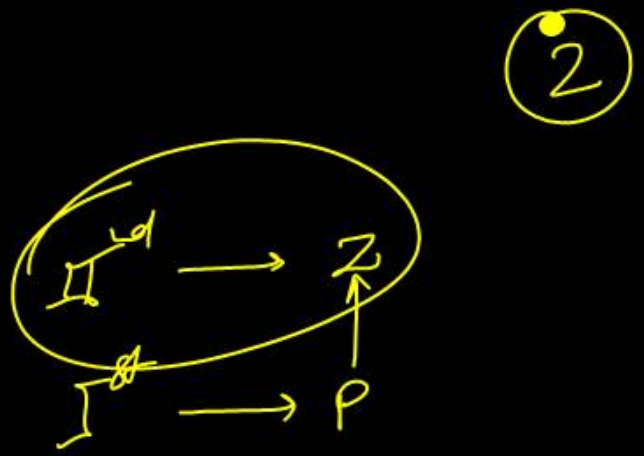
3

Question no. 151

The second trophic level in a lake is

(1) Phytoplankton (2) Zooplankton

(3) Benthos (4) Fishes



Question no. 152

In the equation GPP- R =NPPGPP is gross Primary Productivity NPP is Net Primary Productivity R here is ____.

(1) Photosynthertically active radiation

(2) Respiratory quotient

(3) Respiratory loss

(4) Reproductive allocation

3

Question no. 153

Which one of the following is not a biofertiliser?

(1) Mycorrhiza

(2) Agrobacterium

(3) Rhizobium

(4) Nostoc

2

Question no. 154

Select the correct group of biocontrol agents:

(1) Trichoderma, Baculovirus, Bacillus thuringiensis

(2) Oscillatoria, Rhizobium, Trichoderma

(3) Nostoc, Azospirillum, Nucleopolhedrovirus

(4) Bacillus thuringiensis, Tobacco mosaic virus, Aphids

Question no. 155

Which of the following is the most abundant protein in whole of the biosphere

(1) RuBisCo
(2) Collagen
(3) Keratin
(4) Ribozyme

Question no. 156

When the last member of a particular species die, the species is said to be

(1) Critically endangered

(2) Endangered

(3) Diversified

(4) Extinct

4

Question no. 157

A table of species diversity in different areas is given here.

	A	B	C	D	E
I	5	5	-	-	15
II	12	6	3	2	-
III	5	4	4	5	6
IV	12	7	3	2	4
No of individuals					

Which area is seemingly more diverse?

(1) III (2) IV

(3) II (4) I

Question no. 158

Global species diversity and land area covered by India with respect to world is–

(1) 12%, 7%

(2) 2.4%, 9%

(3) 8.1%, 2.4%

(4) 4%, 3%

3

Question no. 159

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. 160

'Bioprospecting' is

(1) Increasing production of useful products by using bioresources.

(2) Monitoring the loss of biodiversity in different geographical areas.

(3) Exploring molecular genetics and species leverl diversity for products of economic importance.

(4) Selecting useful species for commerical utilization of them or their products.

Question no. 161

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

(1) Mango — 1,000 species

(2) Groundnut

(3) Rice — 50,000 species

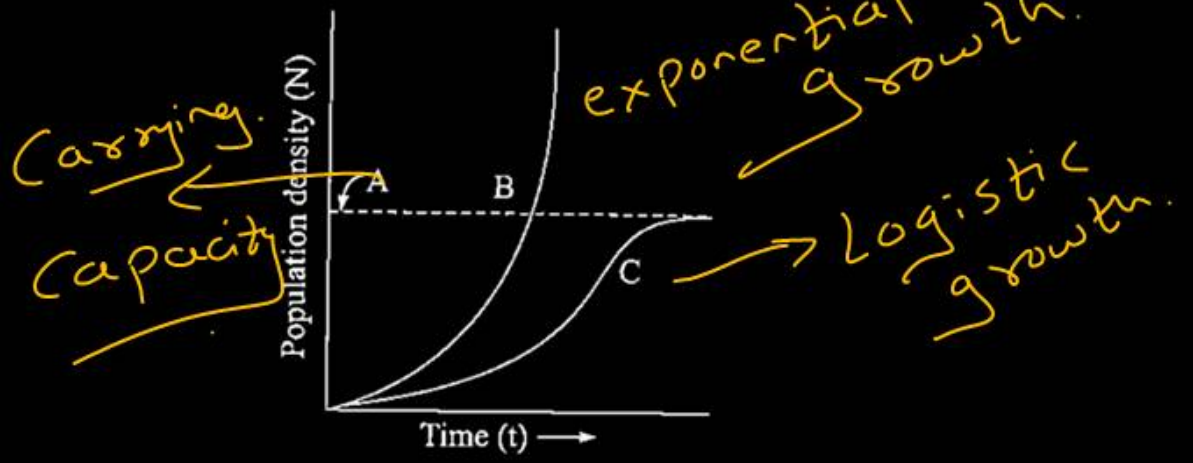
(4) Maize

3

217

Question no. 162

Which is correctly labelled with respect to the given diagram?



(1) B : Logistic curve

(2) C : Intrinsic rate of natural growth

(3) C : Exponential curve

(4) A : Carrying capacity

Question no. 163

Limit of the environment to support a population is called its

(1) Biotic Capacity

(2) Purifying Capacity

(3) Carrying Capacity

(4) Environmental Resistance

Question no. 164

If 4 individuals in a laboratory population of 40 fruits flies died during a specified time interval (i.e., a week), the death rate in the population during that period is

(1) 1
(2) 0.1
(3) 0.01
(4) 0.4

Death Rath = No of Death / Total Population

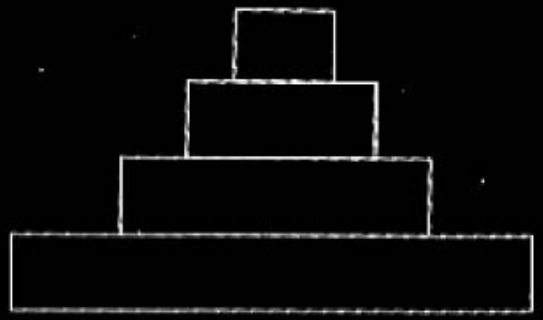
= 4 / 40

= 0.1

2

Question no. 165

The pyramid given below does not illustrate



3

(1) Pyramid of number in grassland

(2) Pyramid of energy in aquatic sea ecosystem

(3) Pyramid of biomass in ecosystem

(4) Pyramid of biomass in grassland

Question no. 166

The rate of formation of new organic matter by rabbit in a grassland, is called

(1) net productivity

(2) secondary productivity

(3) net primary productivity

(4) gross primary productivity

2

Question no. 167

NEET

Find the incorrect match :

(1) Aspergillus niger-Citric acid

(2) Acetobacter aceti – Acetic acid

(3) Clostridium butylicum – Butyric acid

(4) Lactobacillus – Gluconic acid

4

Question no. 168

Large-holed cheese is ripened by

(1) Penicillium species

(2) Yeast species

(3) Propionibacterium

(4) Leuconostoc species

3

Question no. 169

Which of the following biocontrol agent is used in treatment of plant diseases?

(1) Chlorella

(2) Anabaena

(3) Lactobacillus

(4) Trichoderma

4

Question no. 170

Which is the incorrect statement for the species-Area relationship?

(1) Larger areas have higher Z values

(2) Extinction rates are greater on small island

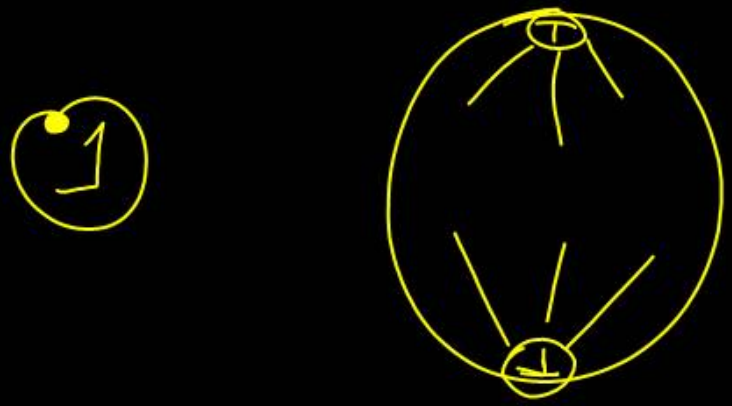
(3) Larger core areas show more species

(4) Larger areas contain more habitats

Question no. 171

Organelle important in spindle formation during nuclear division is

(1) Centriole
(2) Golgi body
(3) Chloroplast
(4) Mitochondrion

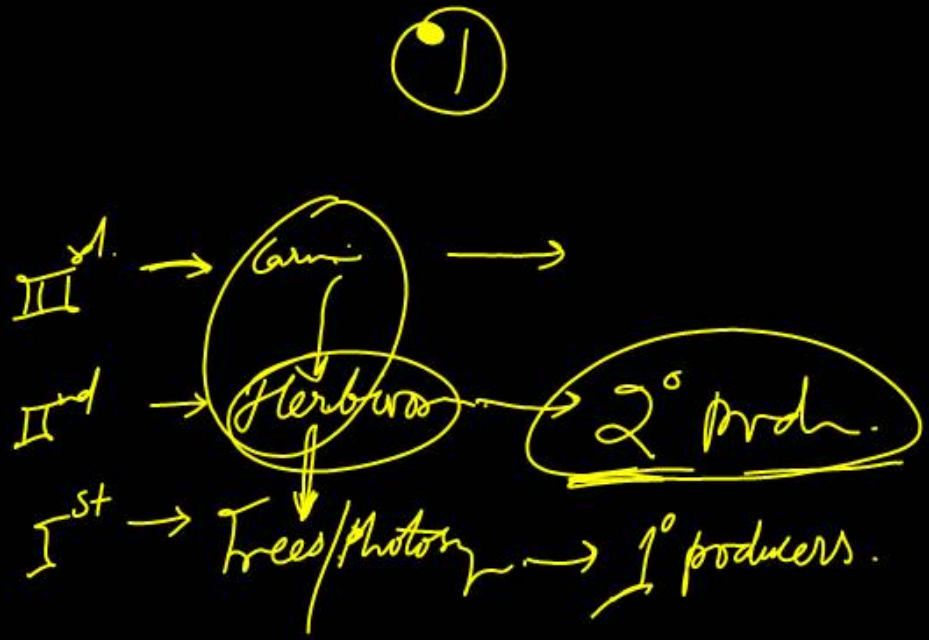


Question no. 172

Secondary producers are

(1) Herbivores (2) Producers

(3) Carnivores (4) None of the above



Question no. 173

Full form of BOD is

(1) Biological Oxygen Demand

(2) Biological Organic Demand

(3) Biochemical Oxygen Deficit

(4) Biochemical Oxygen Demand

Question no. 174

Which one of the following microbes forms symbiotic association with plants and helps them in their nutrition?

(1) Glomus
(2) Trichoderma
(3) Azotobacter
(4) Aspergillus

Question no. 175

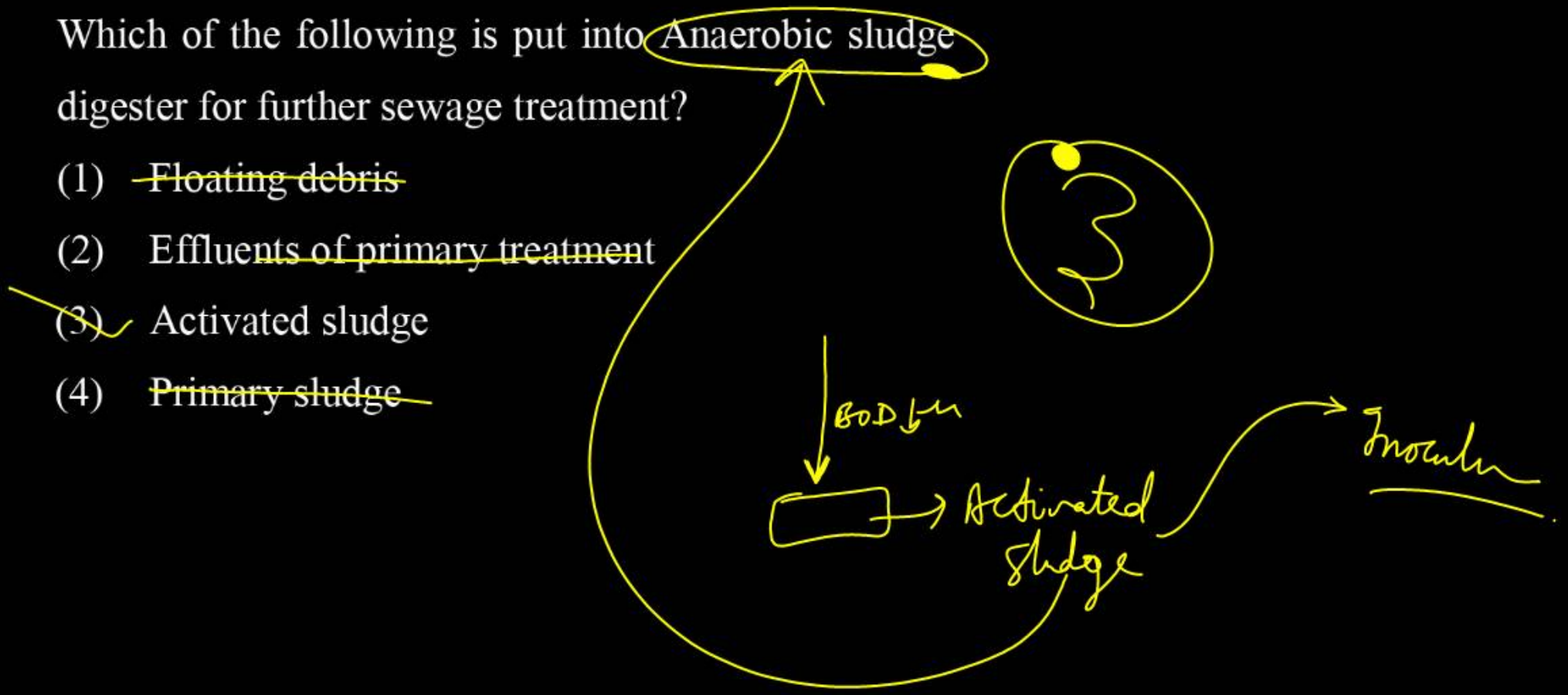
Which of the following is put into Anaerobic sludge digester for further sewage treatment?

(1) ~~Floating debris~~

(2) ~~Effluents of primary treatment~~

(3) Activated sludge

(4) ~~Primary sludge~~



Question no. 176

Cellulose dose not form 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. 177

Which of the following options gives the correct sequence of events during mitosis?

(1) Condensation → nuclear membrane disassembly → arrangement at equator → centromere division → segregation → telophase

(2) Condensation → crossing over → nuclear membrane disassembly → segregation → telophase

(3) Condensation → arrangement at equator → centromere division → segregation → telophase

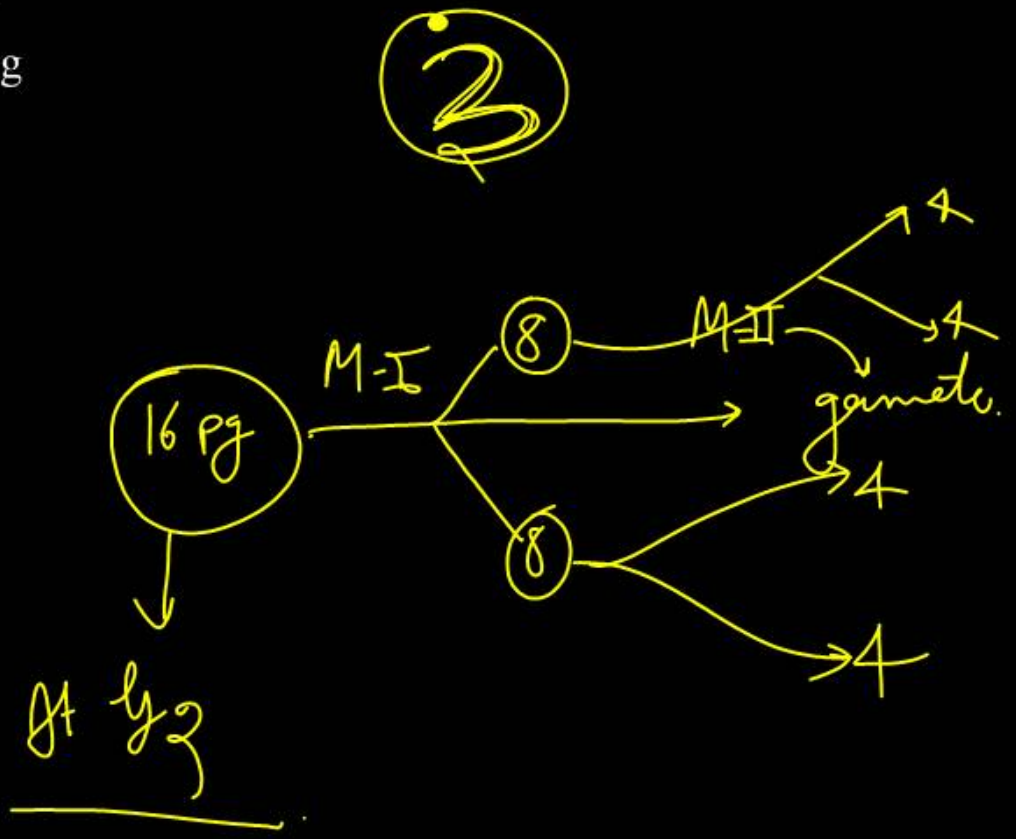
(4) Condensation → nuclear membrane disassembly → crossing over → segregation → telophase

Question no. 178

In the beginning of meiosis, a meiocyte has 16 pg of DNA. The amount in a gamete will be

(1) 16 pg (2) 8 pg

(3) 4 pg (4) 32 pg



Question no. 179

Which of the following groups contains all polysaccharides?

(1) Glycogen, Sucrose and maltose

(2) Sucrose e, glucose and fructose

(3) Maltose, lactose and fructose

(4) Glycogen, cellulose and starch

Question no. 180

Cilium and flagellum emerge from centriole like structure called

(1) Centrosome (2) Kinetochore

(3) Basal body (4) Centromere