

Question no. 1

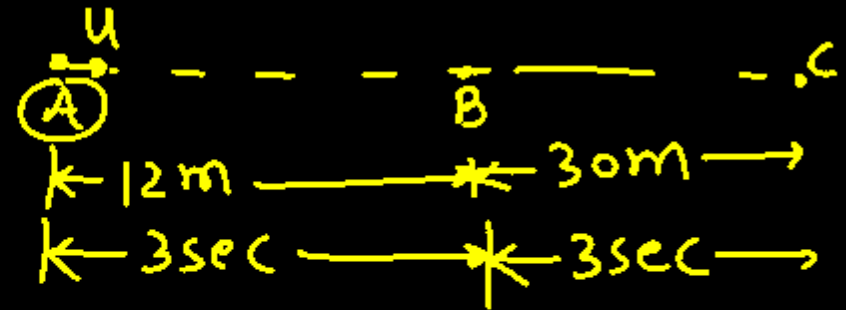
A particle starting with certain initial velocity and uniform acceleration covers a distance of 12 m in first 3 seconds and a distance of 30 m in next 3 seconds. The initial velocity of the particle is

- (1)  $3 \text{ ms}^{-1}$                       (2)  $2.5 \text{ ms}^{-1}$   
 (3)  $2 \text{ ms}^{-1}$                       ✓ (4)  $1 \text{ ms}^{-1}$

$$8-7 = 2u + 3a - u - 3a$$

$$\boxed{1 = u} \quad u = 1 \text{ (m/s)}$$

$a = \text{const}$



AB

$$S = ut + \frac{1}{2}at^2$$

$$12 = u \times 3 + \frac{1}{2} \times a \times (3)^2$$

$$12 = 3u + \frac{9a}{2}$$

$$2 \times 12 = 6u + 9a$$

$$24 = 6u + 9a$$

$$8 = 2u + 3a \text{ --- (1)}$$

AC

$$S = ut + \frac{1}{2}at^2$$

$$42 = u \times 6 + \frac{a}{2} \times 6^2$$

$$42 = 6u + 18a$$

$$7 = u + 3a \text{ --- (2)}$$

Question no. 2

The given electrical network is equivalent to:



- (1) OR gate
- (2)  NOR gate
- (3) NOT gate
- (4) AND gate

Question no. 3

Two wires A and B of the same material, having radii in the ratio 1:2 and carry currents in the ratio 4:1. The ratio of drift speed of electrons in A and B is

(1) ✓ 16:1

(2) 1:16

(3) 1:4

(4) 4:1

$$\frac{r_A}{r_B} = \frac{1}{2} \quad \frac{I_A}{I_B} = \frac{4}{1}$$

$$I = n e A v_d$$

$$I \propto r^2 v_d$$

$$\frac{I_A}{I_B} = \left(\frac{r_A}{r_B}\right)^2 \cdot \frac{v_A}{v_B}$$

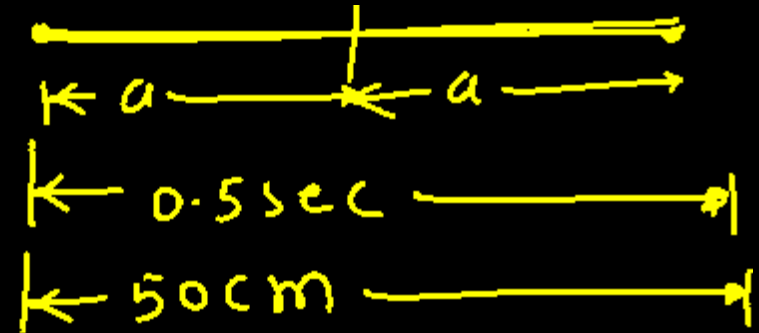
$$\frac{4}{1} = \left(\frac{1}{2}\right)^2 \cdot \frac{v_A}{v_B}$$

$$\frac{16}{1} = \frac{v_A}{v_B}$$

Question no. 4

An object undergoing SHM takes 0.5 s to travel from one point of zero velocity to the next such point. The distance between those points is 50 cm. The period, frequency and amplitude of the motion is

- (1)  1s, 1Hz, 25 cm      (2) 2s, 1Hz, 50 cm  
(3) 1s, 2Hz, 25 cm      (4) 2s, 2Hz, 50 cm



$$2a = 50$$

$$a = \underline{\underline{25 \text{ cm}}}$$

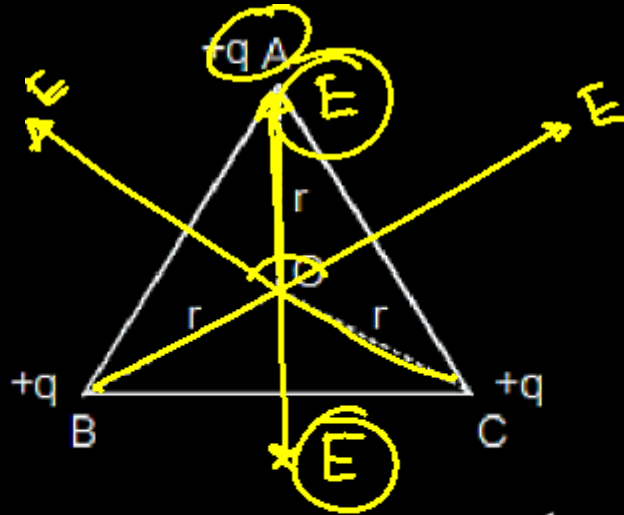
$$\frac{T}{2} = 0.5$$

$$T = 1 \text{ sec}$$

$$f = \frac{1}{T} = \frac{1}{1} = 1 \text{ Hz}$$

Question no. 5

ABC is an equilateral triangle. Charges  $+q$  are placed at each corner as shown in fig. The electric intensity at centre O will be



(1)  $\frac{1}{4\pi\epsilon_0} \frac{q}{r}$

(2)  $\frac{1}{4\pi\epsilon_0} \frac{q}{r^2}$

(3)  $\frac{1}{4\pi\epsilon_0} \frac{3q}{r^2}$

(4) zero

Question no. 6

A uniform rod of mass  $m$ , length  $l$ , area of cross section  $A$  has Young's modulus  $Y$ . If it is hung vertically, elongation under its own weight will be

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

(2)  $\frac{2mgl}{AY}$

(3)  $\frac{mgl}{AY}$

(4)  $\frac{mgY}{Al}$



Stress =  $Y$  strain

$$\frac{F_{avg}}{A} = Y \cdot \frac{\Delta x}{l}$$

$$\frac{mgl}{2AY} = \Delta x$$

$$\Delta x = \frac{mgl}{2AY}$$

Question no. 7

The motion of particle is described by the equation  $x = a + bt^2$ , where  $a = 15$  cm and  $b = 3$  cm/sec<sup>2</sup>. Its instant velocity at time 3 sec will be

- (1) 36 cm/sec                      (2) 9 cm/sec  
(3) 4.5 cm/sec                    (4) 18 cm/sec

$$x = a + bt^2$$

$$\frac{dx}{dt} = 2bt$$

$$V = 2bt$$

$$V = 2 \times 3 \times 3$$

$$V = 18 \text{ (cm/sec)}$$

Question no. 8

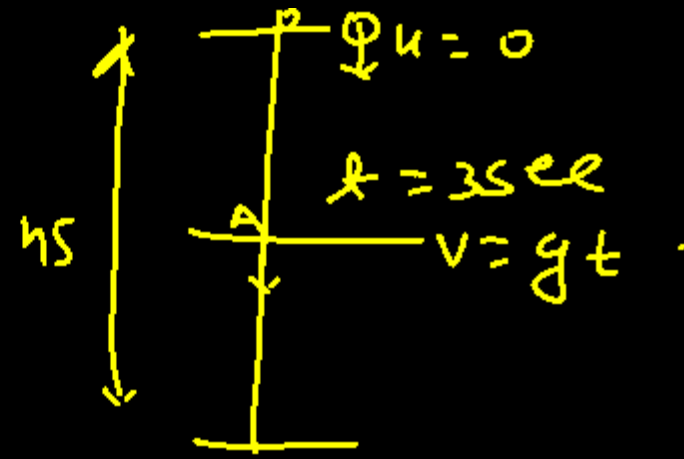
If a body of mass 3 kg is dropped from the top of a tower of height 45 m. Then its kinetic energy after 3 sec is

(1) 557 J

(2) 1350 J

(3) 1050 J

(4) 1296 J



$$K.E = \frac{1}{2} m \cdot v^2$$

$$K.E = \frac{1}{2} m \cdot g^2 \cdot t^2$$

$$= \frac{1}{2} \times 3 \times 100 \times 9$$

$$= \frac{2700}{2}$$

$$= \underline{\underline{1350 \text{ J}}}$$

Question no. 9

In a nuclear fission, 0.1% mass is converted into energy. The energy released by the fission of 1 kg mass will be

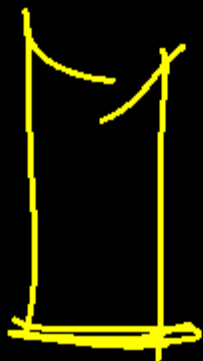
- (1)  $9 \times 10^{19}$  J                      (2)  $9 \times 10^{17}$  J  
(3)  $9 \times 10^{16}$  J                      (4)  $9 \times 10^{13}$  J

$$\begin{aligned} \Delta E &= \Delta m \cdot c^2 \\ &= \frac{0.1}{100} \times 1 \times (3 \times 10^8)^2 \\ &= \frac{1}{1000} \times 9 \times 10^{16} \\ &= 9 \times 10^{13} \text{ J} \end{aligned}$$

Question no. 10

A cylindrical resonance tube, open at both ends, has a fundamental frequency  $f$  in air. If half of the length is dipped vertically in water, the fundamental frequency of the air column will be

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



$v_{\text{open}}$

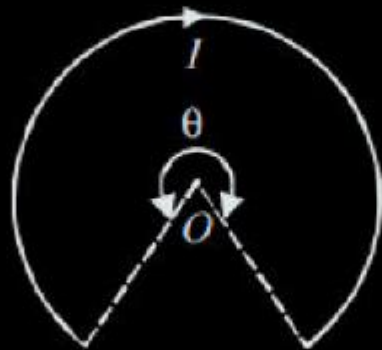
$$f = f_{\text{open}} = \frac{v}{2l}$$

$$f_{\text{closed}} = \frac{v}{4\left(\frac{l}{2}\right)}$$

$$f = \frac{v}{2l}$$

Question no. 11

A current of  $I$  ampere flows in a wire forming a circular arc of radius  $r$  metres subtending an angle  $\theta$  at the centre as shown. The magnetic field at the centre  $O$  in tesla is



(1)  $\frac{\mu_0 I \theta}{4\pi r}$

(2)  $\frac{\mu_0 I \theta}{2\pi r}$

(3)  $\frac{\mu_0 I \theta}{2r}$

(4)  $\frac{\mu_0 I \theta}{4r}$

$$B = \frac{\mu_0}{4\pi} \cdot \frac{I \theta}{r}$$



$$2\pi \times \frac{\mu_0}{4\pi} \cdot \frac{2\pi I}{r}$$



$$B \times 2\pi = \frac{\mu_0}{4\pi} \cdot \frac{2\pi I}{r} \times \theta$$

$$B = \frac{\mu_0 I \theta}{4\pi r}$$

Question no. 12

What is the ratio of the shortest wavelength of the Balmer series to the shortest wavelength of the Lyman series?

(1) 4 : 1

(2) 4 : 3

(3) 4 : 9

(4) 5 : 9

$$\frac{1}{\lambda} = R \left( \frac{1}{n_1^2} - \frac{1}{n_2^2} \right)$$

$$\lambda \propto n_1^2$$

$$\frac{\lambda_B}{\lambda_L} = \left( \frac{2}{1} \right)^2$$

$$= 4$$

|

Question no. 13

Steam is passed into 22 gm of water at  $20^{\circ}\text{C}$ . The mass of water that will be present when the water acquires a temperature of  $90^{\circ}\text{C}$  (Latent heat of steam is 540 cal/g) is

- (1) 24.8 gm                      (2) 24 gm  
 (3) 36.6 gm                      (4) 30 gm

$$\Delta Q_w = 22 \times 1 \times (70)$$

$$\Delta Q_{\text{steam}} = m_s \times 540 + m_s \times 1 \times 10$$

$$22 \times 70 = 550 m_s$$

$$\frac{154}{55} = m_s$$

$$m_s = 2.8 \text{ (gm)}$$

final amount of water

$$= 22 + 2.8$$

$$= 24.8 \text{ gm}$$

Question no. 14

A prism of refractive index  $\sqrt{2}$  has a refracting angle of  $60^\circ$ . At what angle a ray must be incident on it so that it suffers a minimum deviation?

- (1)   $45^\circ$                       (2)   $60^\circ$   
 (3)   $90^\circ$                       (4)   $180^\circ$

$$i + e = A + \delta_m$$

$$2i = 60 + 30$$

$$2i = 90$$

$$i = 45^\circ$$

$$45 = 60 + \frac{\delta_m}{2}$$

$$90 = 60 + \delta_m$$

$$\delta_m = 30$$

$$\mu = \frac{\sin\left(\frac{A + \delta_m}{2}\right)}{\sin\frac{A}{2}}$$

$$\sqrt{2} = \frac{\sin\left(\frac{60 + \delta_m}{2}\right)}{\sin 30}$$

$$\sqrt{2} \sin 30 = \sin\left(\frac{60 + \delta_m}{2}\right)$$

$$\sqrt{2} \times \frac{1}{2} = \sin\left(\frac{60 + \delta_m}{2}\right)$$

$$\frac{1}{\sqrt{2}} = \sin\left(\frac{60 + \delta_m}{2}\right)$$

$$\sin 45 = \sin\left(\frac{60 + \delta_m}{2}\right)$$

Question no. 15

A diametrical tunnel is dug across the earth. A ball is dropped into the tunnel from one side. The velocity of the ball when it reaches the centre of the earth in  
 (Given: gravitational potential at the centre of earth =

$$-\frac{3GM}{2R})$$

(1)  $\sqrt{R}$

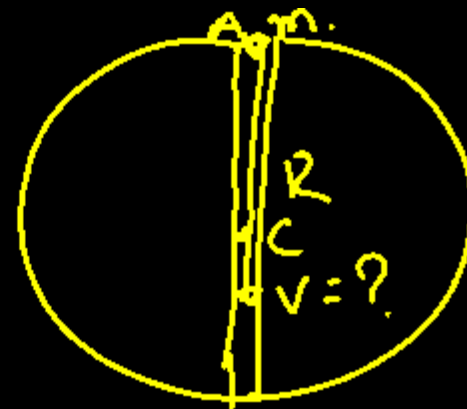
(2)  $\sqrt{gR}$

(3)  $\sqrt{2.5gR}$

(4)  $\sqrt{7.1gR}$

$$V^2 = \frac{GM}{R}$$

$$V = \sqrt{\frac{gR}{2.5}} = \sqrt{\frac{7.1gR}{2.5}}$$



$$E_A = E_C$$

$$mV_A = \frac{1}{2}mv^2 + mV_C$$

$$-m\frac{GM}{R} = \frac{1}{2}mv^2 - \frac{3GM}{2R} \cdot m$$

$$\frac{3GMm}{2R} - \frac{GMm}{R} = \frac{1}{2}mv^2$$

$$\frac{GMm}{R} \left[ \frac{3}{2} - 1 \right] = \frac{1}{2}mv^2$$

$$\frac{GMm}{2R} = \frac{1}{2}mv^2$$

Question no. 16

A coil of circular cross-section having 1000 turns and  $4\text{cm}^2$  face area is placed with its axis parallel to a magnetic field which decreases by  $10^{-2}\text{ Wb m}^{-2}$  in 0.01 s. The e.m.f. induced in the coil is:

- (1) 400 mV                      (2) 200 mV  
 (3) 4 mV                        (4) 0.4 mV

$$N = 1000$$

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

$$\Delta B = 10^{-2}$$

$$\Delta t = 0.01 \text{ sec}$$

$$\mathcal{E} = \frac{NA \cdot \Delta B}{\Delta t}$$

$$\mathcal{E} = \frac{1000 \times 4 \times 10^{-4} \times 10^{-2}}{0.01}$$

$$\mathcal{E} = 10^5 \times 4 \times 10^{-6} = 400 \text{ mV}$$

$$= 400 \text{ mV}$$

Question no. 17

In bringing an electron towards another electron, the electrostatic potential energy of system

- (1) increases                      (2) decreases  
(3) becomes zero                (4) remains unchanged

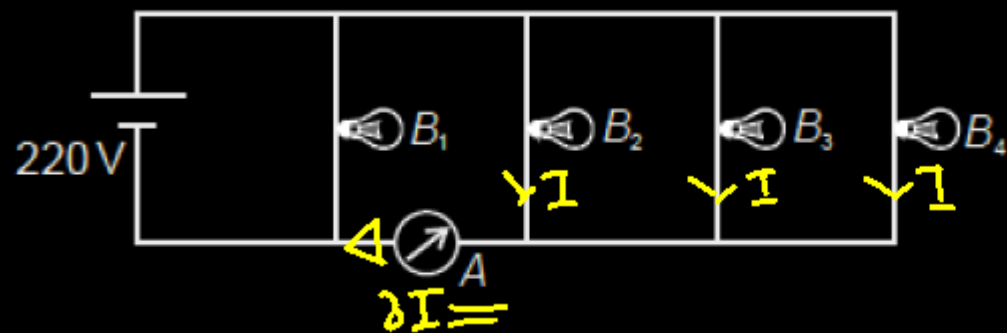


$$U = \frac{1}{4\pi\epsilon_0} \frac{q_1 q_2}{r}$$

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

Question no. 18

Four bulbs  $B_1$ ,  $B_2$ ,  $B_3$  and  $B_4$  of 100 W each are connected to 220 V main as shown in the figure.



The reading in an ideal ammeter will be:

- (1) 0.45 A                      (2) 0.90 A  
 (3) 1.35 A                      (4) 1.80 A

$$P = 100 \text{ W}$$

$$V = 220 \text{ V}$$

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

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

$$V = IR$$

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

$$I = \frac{220}{22 \times 22}$$

$$R = \frac{220 \times 220}{100}$$

$$I = \frac{10}{22}$$

$$R = \frac{22 \times 22}{1}$$

$$I = \frac{10}{22} \text{ A}$$

$$I_{\text{Reading}} = 3I$$

$$= \frac{30}{22}$$

$$= \frac{15}{11} = 1.35 \text{ A}$$

Question no. 19

If  $c$ , the velocity of light,  $g$  the acceleration due to gravity and  $P$  the atmospheric pressure be the fundamental quantities in MKS system, then the dimensions of length will be same as that of

$$P = \frac{F}{A} = \frac{MLT^{-2}}{L^2} = ML^{-1}T^{-2}$$

(1)  $\frac{c}{g}$  (2)  $\frac{c}{P}$  (3)  $\frac{Pcg}{g}$  (4)  $\frac{c^2}{g}$

(1)  $\frac{c}{g} \rightarrow \frac{LT^{-1}}{LT^{-2}} = L$

(2)  $\frac{c}{P} \rightarrow \frac{LT^{-1}}{ML^{-1}T^{-2}} = L^2T$

(3)  $\frac{Pcg}{g} \rightarrow \frac{ML^{-1}T^{-2} \cdot LT^{-1} \cdot LT^{-2}}{LT^{-2}} = ML^{-1}T^{-1} \cdot L = L$

(4)  $\frac{c^2}{g} \rightarrow \frac{(LT^{-1})^2}{LT^{-2}} = L^2T^{-2} \cdot L^2T^2 = L^4$

(L)

Question no. 20

A hollow cylinder has a charge  $q$  coulomb within it. If  $\phi$  is the electric flux in units of volt-meter associated with the curved surface B, the flux linked with the plane surface A in units of volt-meter will be



(1)  $\frac{q}{2\epsilon_0}$

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

(3)  $\frac{q}{\epsilon_0} - \phi$

(4)  $\frac{1}{2} \left( \frac{q}{\epsilon_0} - \phi \right)$

$$\phi + 2\phi_A = \frac{q}{\epsilon_0}$$

$$2\phi_A = \frac{q}{\epsilon_0} - \phi$$

$$\phi_A = \frac{1}{2} \left[ \frac{q}{\epsilon_0} - \phi \right]$$

Question no. 21

The current in a coil of  $L = 40$  mH is to be increased uniformly from 1 A to 11 A in 4 milli sec. The induced e.m.f. will be

(1) 100 V

(2) 0.4 V

(3) 440 V

(4) 40 V

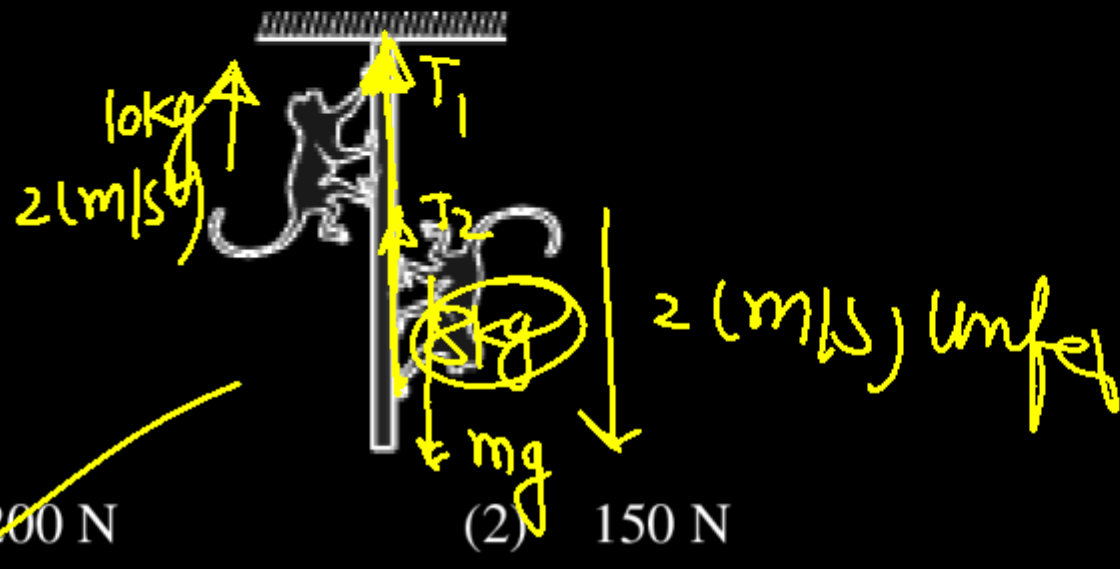
$$\mathcal{E} = L \frac{\Delta I}{\Delta t}$$

$$\mathcal{E} = \frac{40 \times 10^{-3} \times 10}{4 \times 10^{-3}}$$

$$\mathcal{E} = 100 \text{ Volt}$$

Question no. 22

Two monkeys of masses 10 kg and 8 kg are moving along a vertical rope which is light and inextensible, the former climbing up with an acceleration of  $2\text{m/s}^2$  while the latter coming down with a uniform velocity of 2 m/s. Find the tension (in newtons).



- (1) 200 N  
(3) 300 N

- (2) 150 N  
(4) 100 N

$$T_1 - 100 = 10 \times 2$$

$$T_1 = 120 \text{ N.}$$

$$T_2 = mg$$

$$T_2 = 80 \text{ N.}$$

$$T_{\text{Net}} = T_1 + T_2$$

$$= 120 + 80$$

$$= \underline{\underline{200 \text{ N}}}$$

Question no. 23

A phase difference between two points separated by 0.8 m in a wave of frequency 120 Hz is  $\pi/2$ . The wave velocity is                     

- (1) 384 m/s                      (2) 768 m/s  
 (3) 250 m/s                      (4) 154 m/s

$$\begin{array}{r} 32 \\ +12 \\ \hline 384 \end{array}$$

$$V = f\lambda$$

$$V = 120 \times 4 \times 0.8$$

$$V = 12 \times 32$$

$$\Delta x = 0.8$$

$$f = 120 \text{ Hz}$$

$$\Delta \phi = \frac{\pi}{2}$$

$$\Delta \phi = \frac{2\pi}{\lambda} \cdot \Delta x$$

$$\frac{\pi}{2} = \frac{2\pi}{\lambda} \cdot 0.8$$

$$\lambda = 4 \times 0.8$$

Question no. 24

In a transformer, number of turns in the primary coil are 140 and that in the secondary coil are 280. If current in primary coil is 4A, then that in the secondary coil is

(1) 4 A

(2) 2 A

(3) 6 A

(4) 10 A

$$N_p = 140 \quad N_s = 280$$

$$I_p = 4 \text{ A} \quad N_s = ?$$

$$I_p N_p = I_s N_s$$

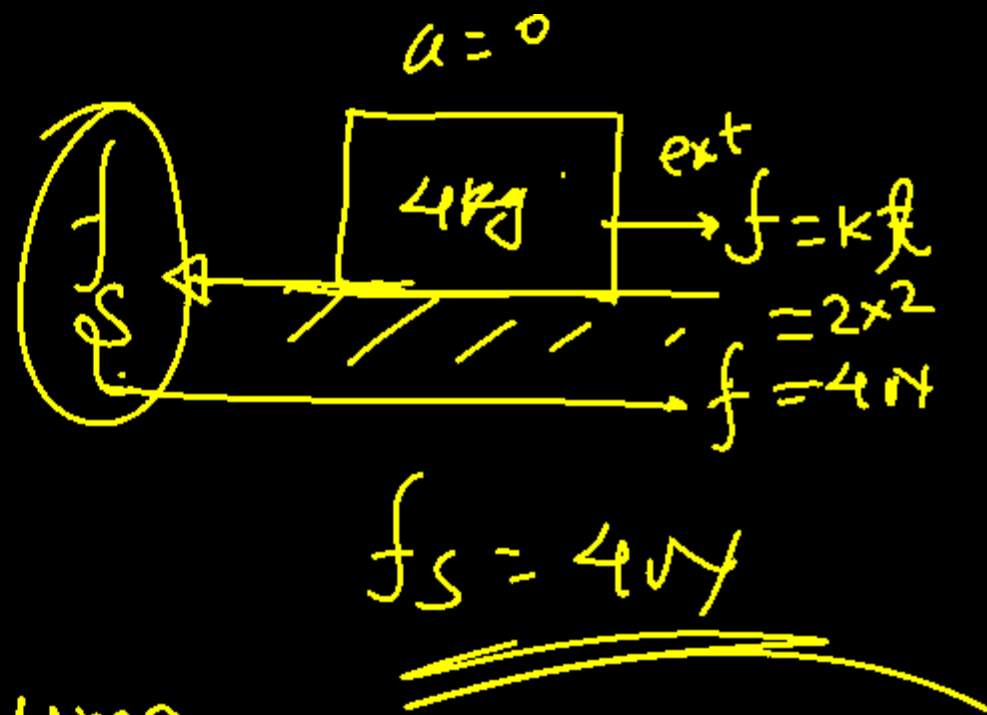
$$4 \times 140 = 280 \times I_s$$

$$I_s = 2 \text{ A}$$

Question no. 25

A block B of mass 4 kg is placed on a rough horizontal plane. A time dependent horizontal force  $f = kt$  acts on the block,  $k = 2 \text{ N/s}^2$ . The frictional force between the block and the plane at  $t = 2 \text{ sec}$  is ( $\mu = 0.2$ )

- (1) 4 N                      (2) 8 N  
 (3) 12 N                    (4) zero



$$\begin{aligned}
 f_{\text{max}} &= \mu mg \\
 &= 0.2 \times 4 \times 10 \\
 &= \underline{\underline{8 \text{ N}}}
 \end{aligned}$$

Question no. 26

A wheel having moment of inertia  $2 \text{ kg-m}^2$  about its vertical axis, rotates at the of 60 rpm about this axis, The torque which can stop the wheel's rotation in one minute would be

(1)  $\frac{\pi}{18} \text{ Nm}$

(2)  $\frac{2\pi}{15} \text{ Nm}$

(3)  $\frac{\pi}{12} \text{ Nm}$

(4)  $\frac{\pi}{15} \text{ Nm}$

$$\omega_f^0 = \omega_i - \frac{\tau}{I} \cdot t$$

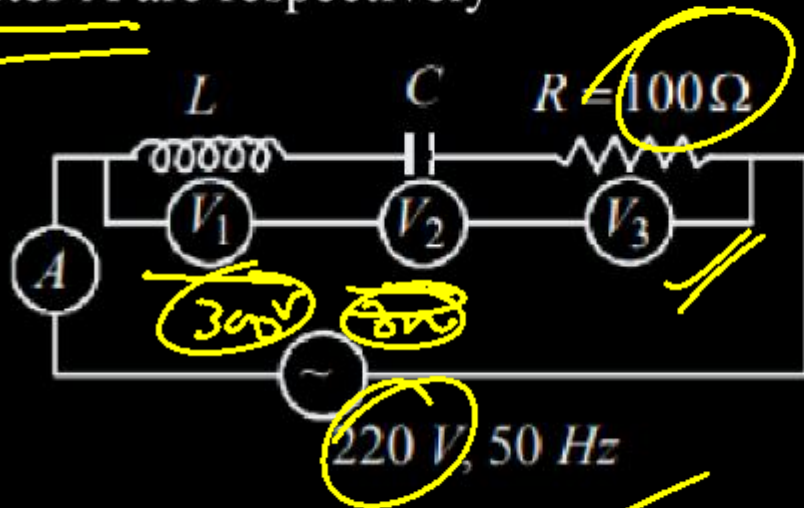
$$\omega_i = \frac{\tau}{I} \cdot t$$

$$\frac{60 \times \pi}{60 \times 30 \times 2} = \frac{\tau \times 60}{15}$$

$$\tau = \frac{\pi}{15} \text{ (Nm)}$$

Question no. 27

In the given circuit the reading of voltmeter  $V_1$  and  $V_2$  are 300 volt each. The reading of the voltmeter  $V_3$  and ammeter A are respectively



- (1) 150 V and 2.2 A      (2) 220 V and 2.2 A  
 (3) 220 V and 2.0 A      (4) 100 V and 2.0 A

$$V = IR$$

$$220 = I \times 100$$

$$I = 2.2 \text{ (AMP)}$$

$$V_{\text{source}} = \sqrt{(V_1 - V_2)^2 + V_3^2}$$

$$V_{\text{source}} = V_3$$

$$220 = V_3$$

Question no. 28

Two waves whose intensities are 9 and 16 are made to interfere. The ratio of maximum and minimum intensities in the interference pattern is

- (1) 49 : 1                      (2) 25 : 7  
 (3) 10 : 9                      (4) 4 : 3

$$\begin{aligned} \frac{I_{\max}}{I_{\min}} &= \left( \frac{\sqrt{I_1} + \sqrt{I_2}}{\sqrt{I_1} - \sqrt{I_2}} \right)^2 \\ &= \left( \frac{\sqrt{\frac{I_1}{I_2}} + 1}{\sqrt{\frac{I_1}{I_2}} - 1} \right)^2 \\ &= \left( \frac{\frac{3}{4} + 1}{\frac{3}{4} - 1} \right)^2 \\ &= \left( \frac{\frac{7}{4}}{-\frac{1}{4}} \right)^2 = \frac{49}{16} \times \frac{16}{1} \\ &= 49:1 \end{aligned}$$

Question no. 29

In Young's experiment., the distance between two slits is  $\frac{d}{3}$  and the distance between the screen and the slit is

$3D$ . The number of fringes in  $\frac{1}{3}m$  on the screen, formed by monochromatic light of wavelength  $3\lambda$ , will be

(1)  $\frac{d}{9D\lambda}$

(2)  $\frac{d}{27D\lambda}$

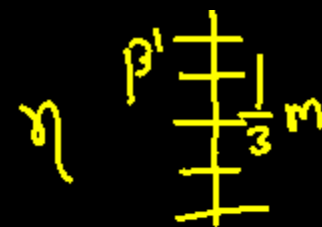
(3)  $\frac{d}{81D\lambda}$

(4)  $\frac{d}{D\lambda}$

$\beta = \frac{\lambda D}{d}$

$\beta' = \frac{3\lambda \times 3D}{\frac{d}{3}}$

$\beta' = \frac{27\lambda D}{d}$



$n\beta' = \frac{1}{3}$

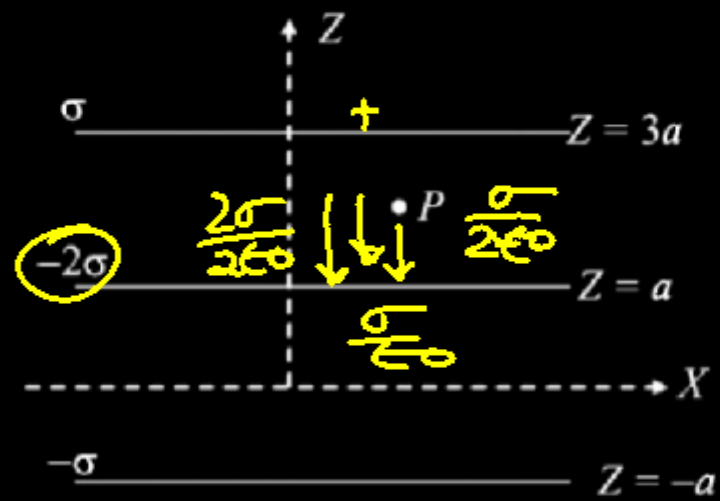
$n \times \frac{27\lambda D}{d} = \frac{1}{3}$

$n = \frac{d}{81\lambda D}$

$n = \frac{d}{81\lambda D}$

Question no. 30

Three infinitely long charge sheets are placed as shown in figure. The electric field at point P is



(1)  $\frac{2\sigma}{\epsilon_0} \mathbf{k}$

(2)  $\frac{4\sigma}{\epsilon_0} \mathbf{k}$

(3)  $-\frac{2\sigma}{\epsilon_0} \mathbf{k}$

(4)  $-\frac{4\sigma}{\epsilon_0} \mathbf{k}$

$$\vec{E}_{\text{net}} = -\left(\frac{\sigma}{2\epsilon_0} + \frac{2\sigma}{2\epsilon_0} + \frac{\sigma}{2\epsilon_0}\right)(-\hat{k})$$

$$= \frac{4\sigma}{2\epsilon_0} (-\hat{k})$$

$$= -\frac{2\sigma}{\epsilon_0} \hat{k}$$

Question no. 31

A capillary tube is immersed vertically in water and the height of the water column is  $x$ . When this arrangement is taken into a mine of depth  $d$ , the height of the water column is  $y$ . If  $R$  is the radius of earth, the ratio  $\frac{x}{y}$  is:

(1)  $\left(1 - \frac{d}{R}\right)$

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

(3)  $\left(\frac{R-d}{R+d}\right)$

(4)  $\left(\frac{R+d}{R-d}\right)$

$\frac{x}{y} = \frac{\frac{1}{g}}{\frac{1}{g} \left(1 - \frac{d}{R}\right)}$

$h = \frac{2T \cos \theta}{r \rho g}$

$Ph \propto \frac{1}{g}$

$\frac{h}{\text{depth}}$

$x \propto \frac{1}{g}$

$x = \frac{2T \cos \theta}{r \rho g}$

$y = \frac{2T \cos \theta}{r \rho g \left(1 - \frac{d}{R}\right)}$

$\frac{x}{y} = \left(1 - \frac{d}{R}\right)$

Question no. 32

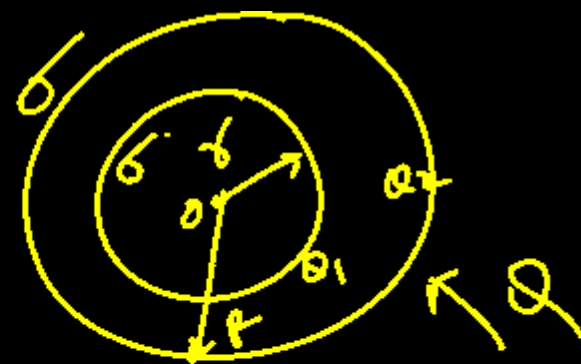
A charge of total amount  $Q$  is distributed over two concentric hollow spheres of radii  $r$  and  $R$  ( $R > r$ ) such that the surface charge densities on the two spheres are equal. The electric potential at the common centre is

- (1)  $\frac{1}{4\pi\epsilon_0} \frac{(R-r)Q}{(R^2+r^2)}$       (2)  $\frac{1}{4\pi\epsilon_0} \frac{(R+r)Q}{2(R^2+r^2)}$   
 (3)  $\frac{1}{4\pi\epsilon_0} \frac{(R+r)Q}{(R^2+r^2)}$       (4)  $\frac{1}{4\pi\epsilon_0} \frac{(R-r)Q}{2(R^2+r^2)}$

Handwritten derivation for potential:

$$V = \frac{1}{4\pi\epsilon_0} \frac{Q}{(R^2+r^2)} \left[ \frac{Q_1}{r} + \frac{Q_2}{R} \right]$$

$$V = \frac{1}{4\pi\epsilon_0} \left[ \frac{Q_1 r^2}{(R^2+r^2) \cdot r} + \frac{Q_2 R^2}{(R^2+r^2) \cdot R} \right]$$



Handwritten derivation for charge distribution:

$$\sigma = \frac{Q_1}{4\pi r^2}, \quad \sigma = \frac{Q_2}{4\pi R^2}$$

$$\frac{Q_1}{4\pi r^2} = \frac{Q_2}{4\pi R^2}$$

$$Q_2 = \frac{Q_1 R^2}{r^2} \Rightarrow Q_2 \neq Q_1 = Q$$

$$\Rightarrow \frac{Q_1 R^2}{r^2} + Q_1 = Q$$

$$Q_2 = \frac{Q R^2}{(R^2+r^2)} \Rightarrow Q_1 = \frac{Q r^2}{(R^2+r^2)} = Q$$

Question no. 33

A particle of mass 2 kg is moving such that at time  $t$ , its position, in meter, is given by  $\vec{r}(t) = 5t\hat{i} - 2t^2\hat{j}$ . The angular momentum of the particle at  $t = 2\text{s}$  about the origin in  $\text{kg m}^{-2} \text{s}^{-1}$  is:

- (1)  $-80\text{k}$                       (2)  $(10\hat{i} - 16\hat{j})$   
 (3)  $-40\text{k}$                         (4)  $40\text{k}$

$$\vec{Y} = 5t\hat{i} - 2t^2\hat{j} \Rightarrow \vec{v} = \underline{10\hat{i} - 8\hat{j}}$$

$$\frac{d\vec{r}}{dt} = 5\hat{i} - 4t\hat{j}$$

$$\boxed{\vec{V} = 5\hat{i} - 8\hat{j}} \quad \vec{P} = (10\hat{i} - 16\hat{j})$$

$$\vec{L} = \vec{r} \times m\vec{V} = \vec{r} \times \vec{P}$$

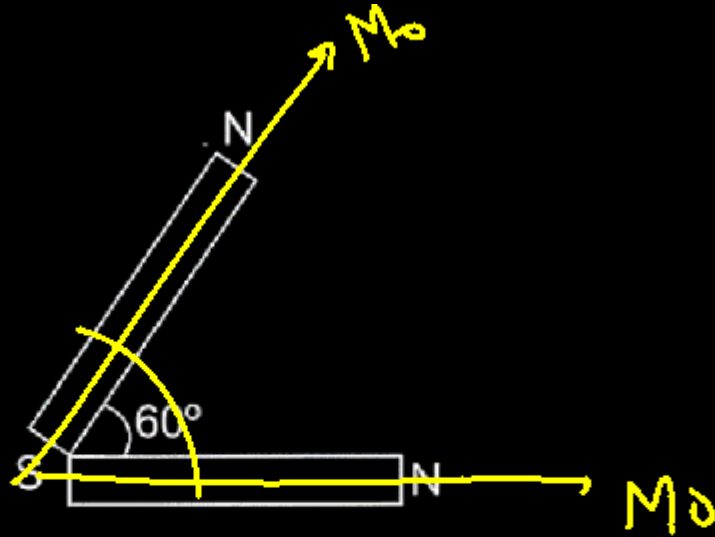
$$\vec{L} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 10 & -8 & 0 \\ 10 & -16 & 0 \end{vmatrix}$$

$$= \hat{i} \begin{vmatrix} -8 & 0 \\ -16 & 0 \end{vmatrix} - \hat{j} \begin{vmatrix} 10 & 0 \\ 10 & 0 \end{vmatrix} + \hat{k} \begin{vmatrix} 10 & -8 \\ 10 & -16 \end{vmatrix}$$

$$= \underline{-80\hat{k}} = \underline{-80\text{k}}$$

Question no. 34

The net magnetic moment of two identical magnets each of magnetic moment  $M_0$ , inclined at  $60^\circ$  with each other is



$$\begin{aligned} M_{\text{Net}} &= \sqrt{M_0^2 + M_0^2 + 2M_0M_0 \cos 60} \\ &= \sqrt{M_0^2 + M_0^2 + M_0^2} \\ &= \underline{\underline{M_0\sqrt{3}}} \end{aligned}$$

(1)  $M_0$

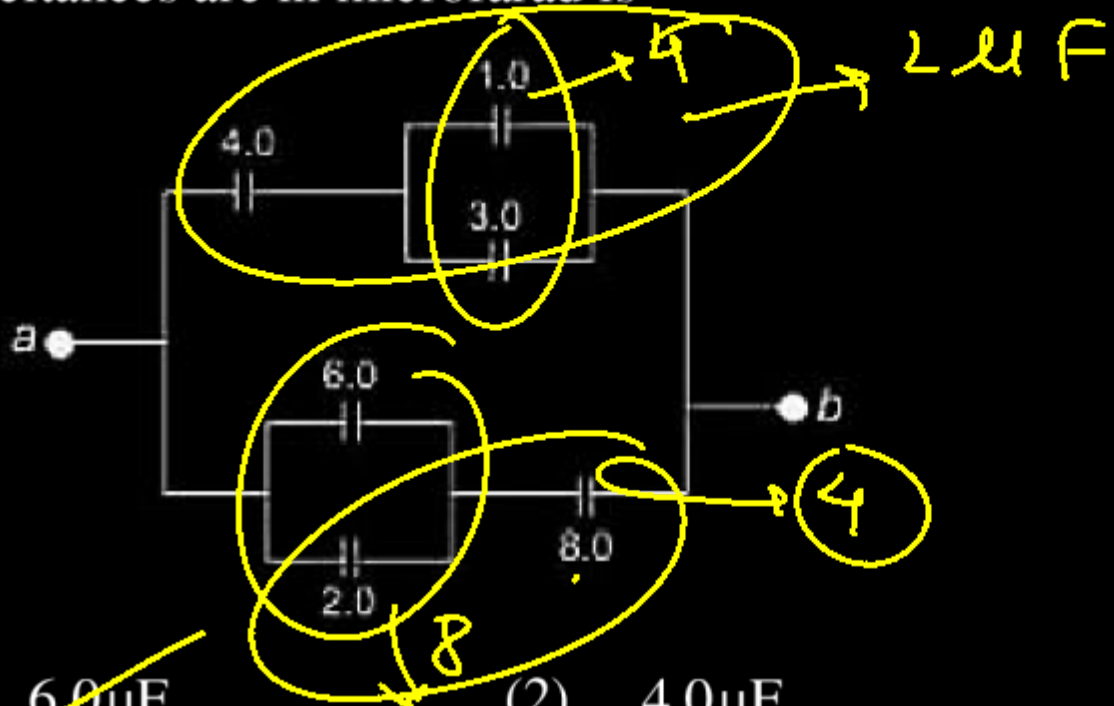
(2)  $\sqrt{2} M_0$

(3)  $\sqrt{3} M_0$

(4)  $2M_0$

Question no. 35

The equivalent capacitance between a and b for the combination of capacitors shown in figure where all capacitances are in microfarad is



- (1) ~~6.0 μF~~
- (2) 4.0 μF
- (3) 2.0 μF
- (4) 3.0 μF

Question no. 36

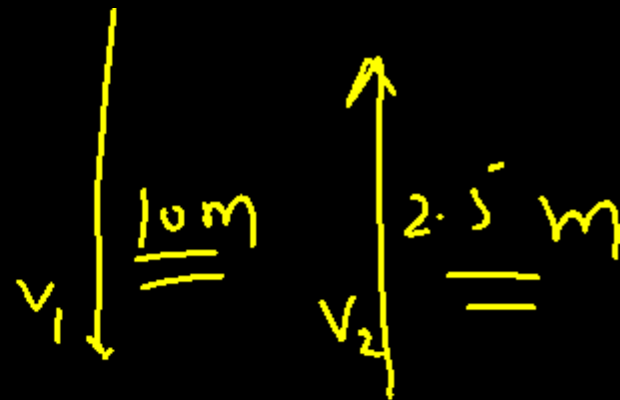
A body falls on the ground from a height of 10 m and rebounds to a height of 2.5 m. Then the ratio of velocities of the body just before and just after the collision will be

(1) 2 : 1

(2) 1 : 2

(3) 4 : 1

(4) 1 : 3



$$\frac{v_1}{v_2} = \sqrt{\frac{2gh_1}{2gh_2}}$$

$$= \sqrt{\frac{h_1}{h_2}}$$

$$= \sqrt{\frac{10}{2.5}}$$

$$= 2$$

Question no. 37


A point particle is held on the axis of a ring of mass  $m$  and radius  $r$  at a distance  $r$  from centre  $C$ . When released, it reaches  $C$  under the gravitational attraction of the ring. Its speed at  $C$  will be

(1)  $\sqrt{\frac{2Gm}{r}(\sqrt{2}-1)}$

(2)  $\sqrt{\frac{Gm}{r}}$

(3)  $\sqrt{\frac{2Gm}{r}\left(1-\frac{1}{\sqrt{2}}\right)}$

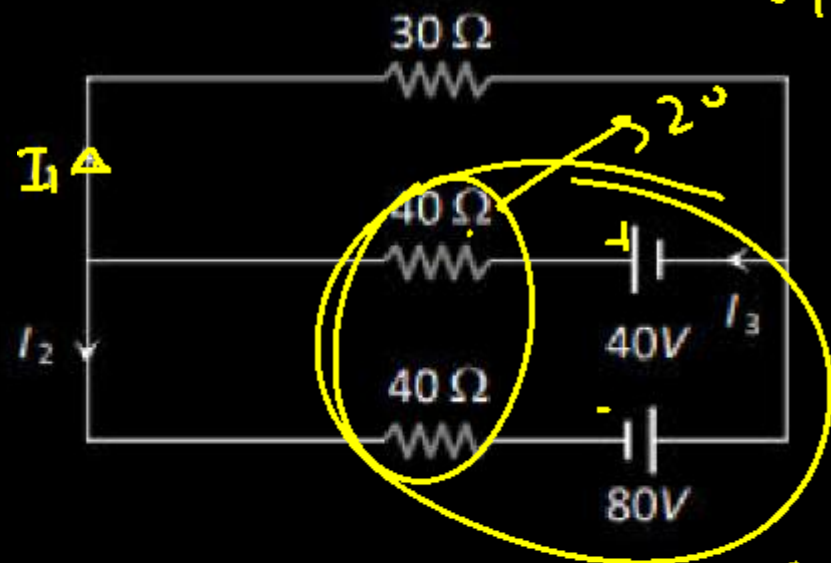
(4)  $\sqrt{\frac{2Gm}{r}}$



$v = 0$   
 $K_i = 0$   
 $U_i = -\frac{GMm}{r\sqrt{2}}$   
 $K \cdot E_f = \frac{1}{2}mv^2$   
 $U_f = -\frac{GMm}{r}$   
 $-\frac{GMm}{r\sqrt{2}} = \frac{1}{2}mv^2 - \frac{GMm}{r}$   
 $\frac{GM}{r} - \frac{GM}{r\sqrt{2}} = \frac{v^2}{2}$   
 $\sqrt{\frac{2GM}{r}\left(1-\frac{1}{\sqrt{2}}\right)} = v$

Question no. 38

Current  $I_1$  in the following circuit is



(1) 0.4 A

(2) -0.4 A

(3) 0.8 A

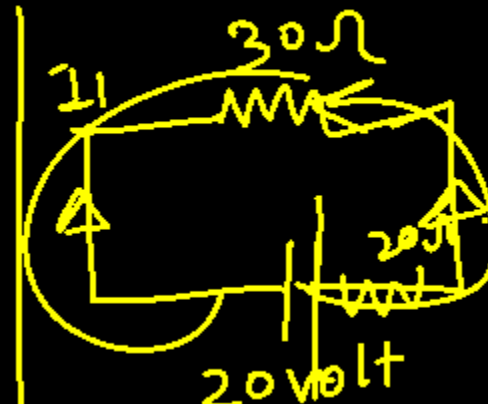
(4) -0.8 A

$$R_{eq} = \frac{r_1 r_2}{r_1 + r_2} = 20$$

$$E_{eq} = \frac{E_1 + E_2}{\frac{1}{r_1} + \frac{1}{r_2}} = \frac{40 + 80}{\frac{1}{40} + \frac{1}{40}} = \frac{120}{\frac{2}{40}} = 2400$$

$$E_{eq} = 1 - 2 = \frac{1}{\frac{1}{40} + \frac{1}{40}} = \frac{1}{\frac{2}{40}} = 20$$

$$E_{eq} = -20 \text{ volt}$$



$$V = IR$$

$$-20 = I \times 50$$

$$I = -\frac{20}{5 \times 10}$$

$$I = -4 \text{ A}$$

Question no. 39

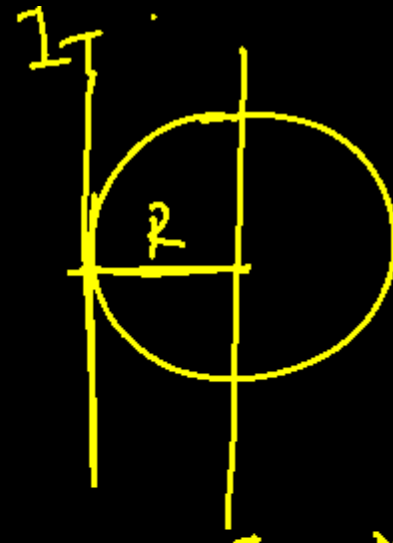
The moment of inertia of disc about a tangent axis in its plane is

(1)  $\frac{MR^2}{4}$

(2)  $\frac{3MR^2}{2}$

(3)  $\frac{5}{4}MR^2$

(4)  $\frac{7MR^2}{4}$



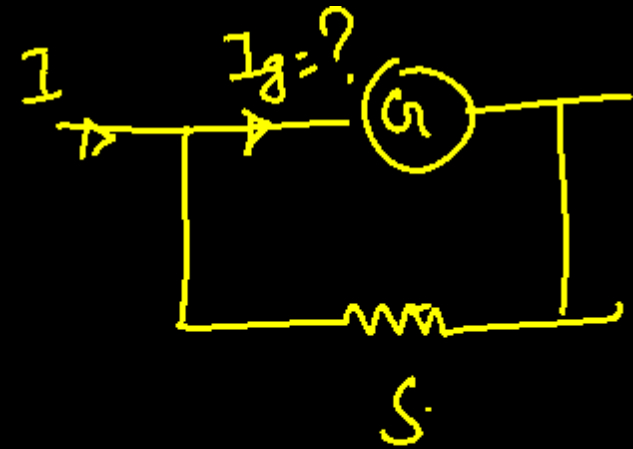
$I_D = \frac{MR^2}{4}$

$$I_T = \frac{MR^2}{4} + MR^2$$
$$= \frac{5}{4}MR^2$$

Question no. 40

A shunt of resistance  $1\ \Omega$  is connected across a galvanometer of  $120\ \Omega$  resistance. A current of  $5.5$  ampere gives full scale deflection in the galvanometer. The current that will give full scale deflection in the absence of the shunt is nearly:

- (1)  $5.5$  ampere                      (2)  $0.5$  ampere  
(3)  $0.004$  ampere                      (4)  $0.045$  ampere



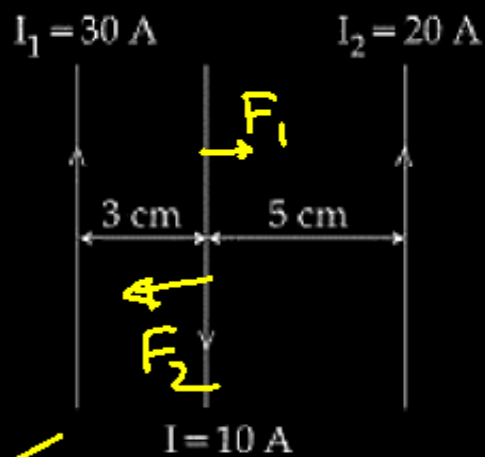
$$I_g = \frac{I \cdot S}{I + I_g}$$

$$I_g = \frac{5.5 \times 1}{120 + 1}$$

$$I_g = \frac{5.5}{121} \text{ (Am)}$$
$$= \underline{\underline{0.045 \text{ (A)}}}$$

Question no. 41

Three straight parallel current carrying conductors are shown in the figure. The force experienced by the middle conductor of length 25 cm is:



- (1)  $3 \times 10^{-4}$  N toward right
- (2)  $6 \times 10^{-4}$  N toward right
- (3)  $9 \times 10^{-4}$  N toward right
- (4) Zero

$$\begin{aligned}
 F_1 &= \frac{\mu_0}{4\pi r} \times 2 I_1 I_2 l \\
 &= 10^{-7} \times \frac{2 \times 30 \times 20 \times 100}{3} \\
 &= 10^{-7} \times 50 \times 100 \\
 &= 5 \times 10^{-7} \\
 &= \underline{\underline{5 \times 10^{-4} \text{ N}}}
 \end{aligned}$$

$$F_2 = \frac{10^{-7} \times 2 \times 20 \times 25}{5}$$

$$F_2 = 10^{-7} \times 10 \times 200$$

$$F_2 = 2 \times 10^3 \times 10^{-7}$$

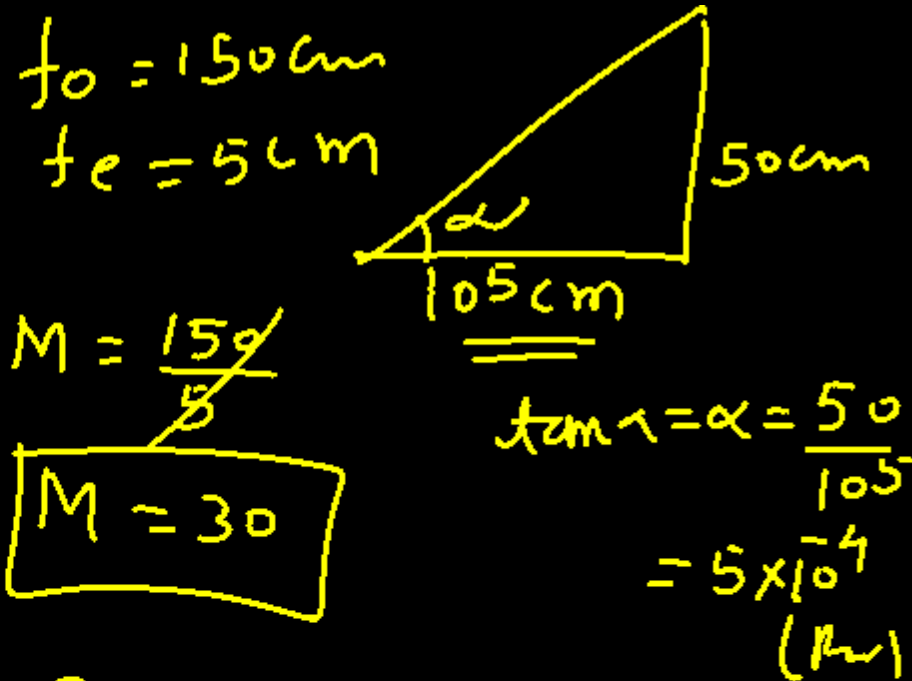
$$F_2 = \underline{\underline{2 \times 10^{-4}}}$$

$$F_{\text{net}} = \underline{\underline{3 \times 10^{-4} \text{ (N)}}}$$

Question no. 42

A telescope has an objective lens of focal length 150 cm and an eyepiece of focal length 5 cm. If a 50 cm tall tower at a distance of 1 km is observed through this telescope in normal setting, the angle formed by the image of the tower is  $\theta$ , then  $\theta$  is close to:

- (1)  $30^\circ$                       (2)  $15^\circ$   
 (3)  $84^\circ$                       (4)  $1^\circ$



~~$M = \frac{150}{5}$~~

$M = 30$

$\theta = M \cdot \alpha$

$= \frac{30 \times 5 \times 10^{-4} \times 180}{\text{r}}$

$= 0.86$

$= 1^\circ$  (Ans)

Question no. 43

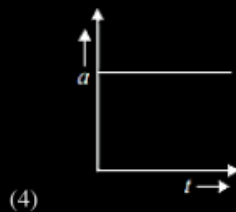
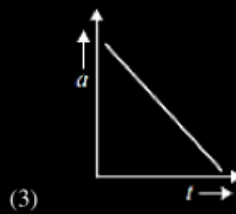
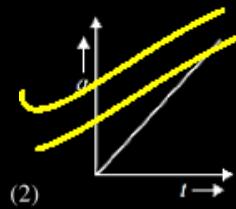
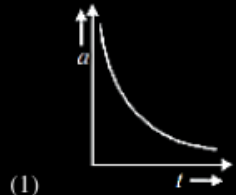
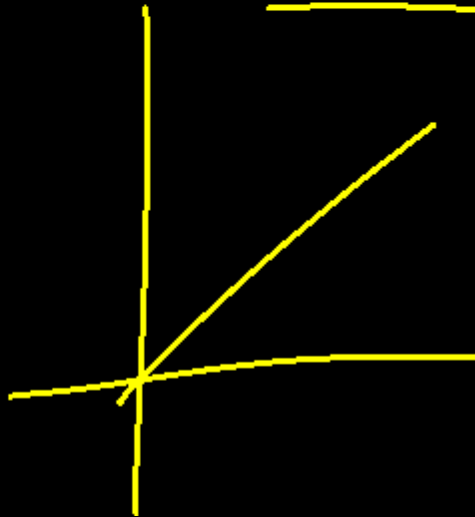
The distance travelled by a body moving along a line in time  $t$  is proportional to  $t^3$ .

The acceleration-time ( $a, t$ ) graph for the motion of the body will be

$$S \propto t^3$$

$$v \propto t^2$$

$$\underline{\underline{a \propto t}}$$



Question no. 44

A motor car is travelling at 30 m/s on a circular road of radius 500 m. It is increasing in speed at the rate of 2 m/s<sup>2</sup>. Then the acceleration of the car will be

(1) 4 m/s<sup>2</sup>

(2) 3 ms/s<sup>2</sup>

(3) 2.7 m/s<sup>2</sup>

(4) 8 m/s<sup>2</sup>

$$a_t = 2 \text{ (m/s}^2\text{)}$$

$$a_r = \frac{v^2}{r} = \frac{900}{500}$$

$$= \frac{9}{5}$$

$$a = \sqrt{a_r^2 + a_t^2}$$

$$= \sqrt{\left(\frac{9}{5}\right)^2 + (2)^2}$$

$$= \sqrt{\frac{81}{25} + 4}$$

$$= \sqrt{18.1}$$

$$= \underline{\underline{2.7}} \text{ (m/s}^2\text{)}$$

Question no. 45

An artificial satellite moving in a circular orbit around the earth has a total (kinetic + potential) energy  $E_0$ . Its potential energy is

(1)  $-E_0$

(2)  $1.5 E_0$

(3)  $2E_0$

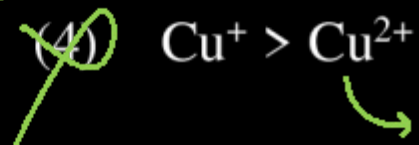
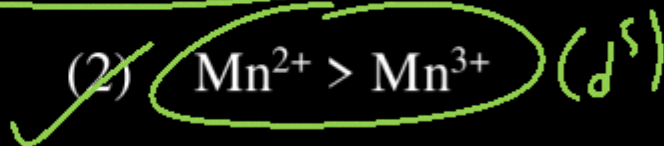
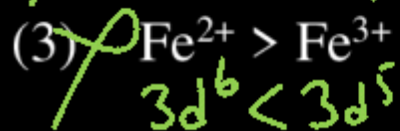
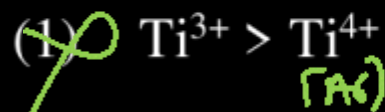
(4)  $E_0$

$$E_0 = -\frac{1}{2} \frac{GMm}{r}$$

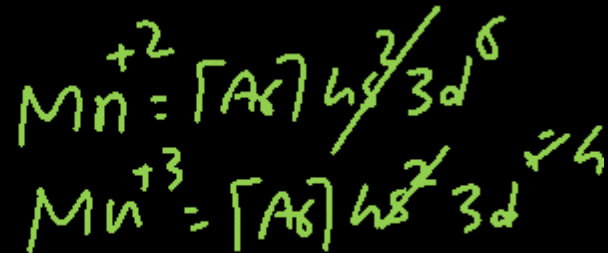
$$2E_0 = -\frac{GMm}{r}$$

$$\underline{\underline{2E_0 = U}}$$

In which of the following cases, the stability of two oxidation states is correctly represented



Hydration Energy



2

Question no. 47

The rate constant of a zero order reaction is  $2.0 \times 10^{-2}$  mol L<sup>-1</sup> s<sup>-1</sup>. If the concentration of the reactant after 25 seconds is 0.5 M. What is the initial concentration?

- (1) 0.5 M                      (2) 1.25 M  
(3) 12.5 M                    ~~(4) 1.0 M~~

$$k = \frac{a_0 - a}{t}$$

$$2 \times 10^{-2} = \frac{a_0 - 0.5}{25}$$

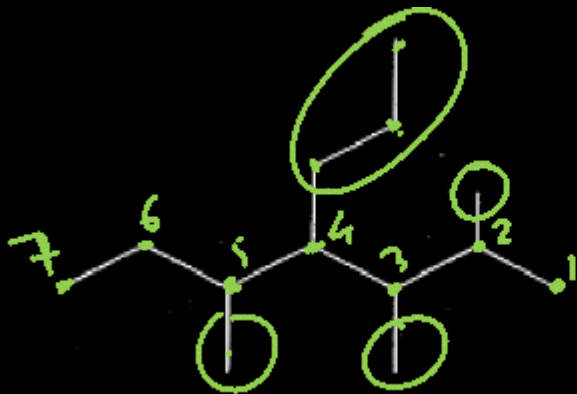
$$50 \times 10^{-2} = a_0 - 0.5$$

$$0.5 + 0.5 = a_0$$

$$a_0 = 1$$

Question no. 48

The correct IUPAC name for following compound is –



n/iso/neo  
di/tri/tetra  
∞

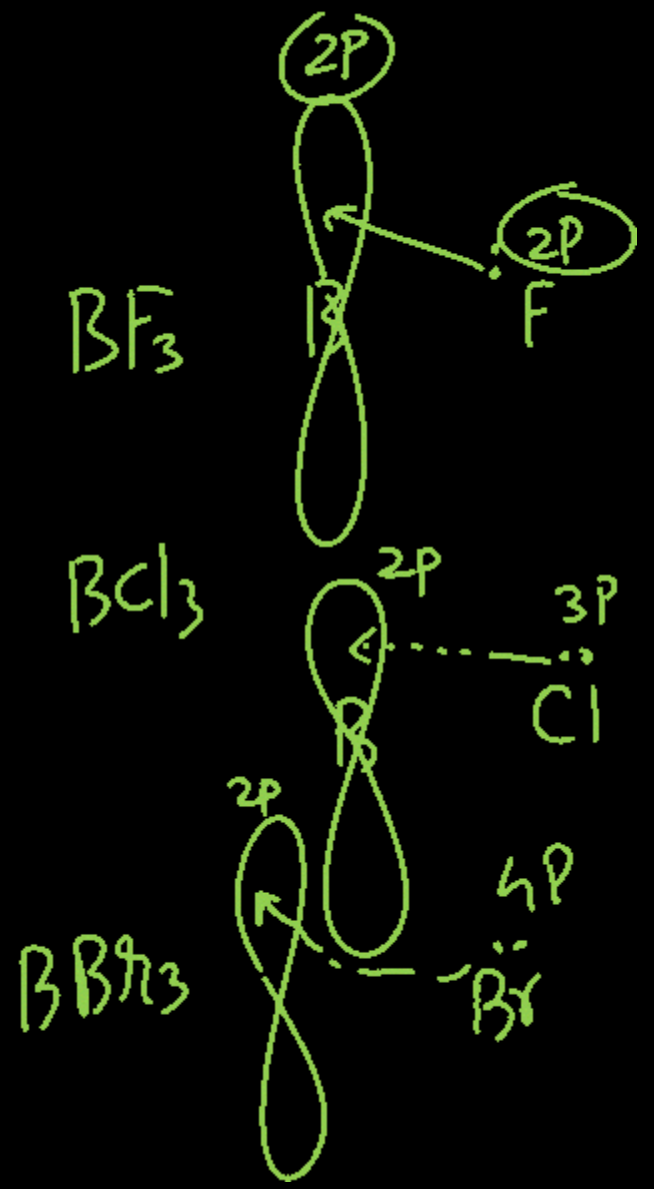
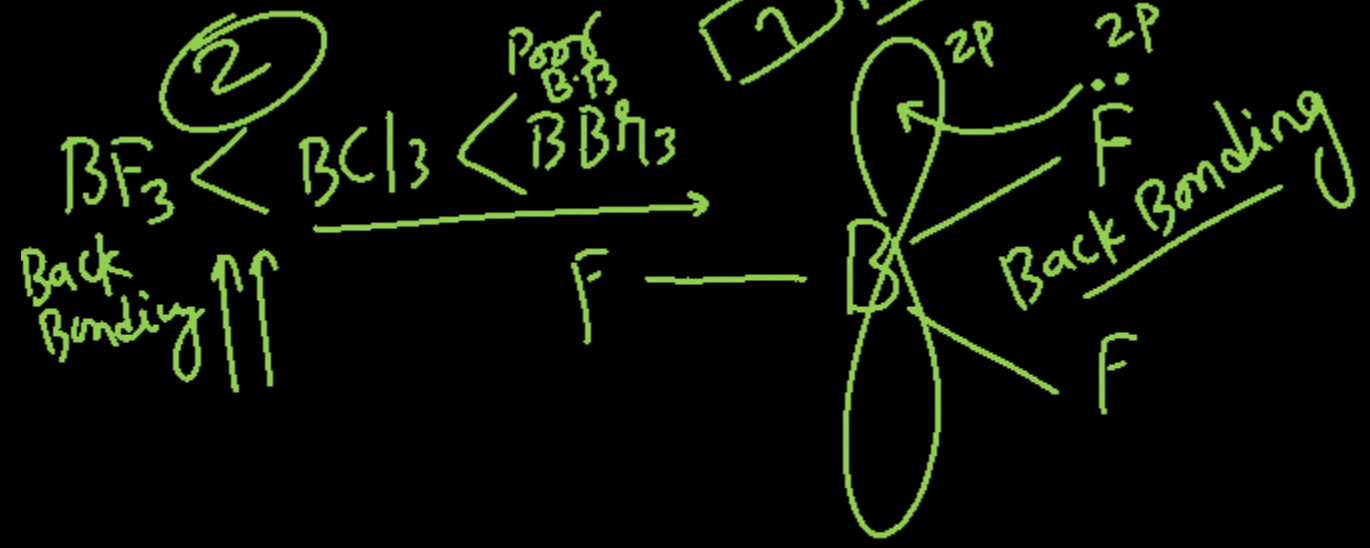
- (1) 5-Methyl – 4-(1'-2'-dimethylpropyl) heptane
- (2) 3-Methyl-4-(1', 2'-dimethylpropyl) heptane
- (3) 2, 3, 5-Trimethyl-4-propylheptane
- (4) 4-Propyl-2,3,5-trimethylpeptane

3

Question no. 49

The tendency of  $\text{BF}_3$ ,  $\text{BCl}_3$  and  $\text{BBr}_3$  to behave as Lewis acid decreases in the sequence:

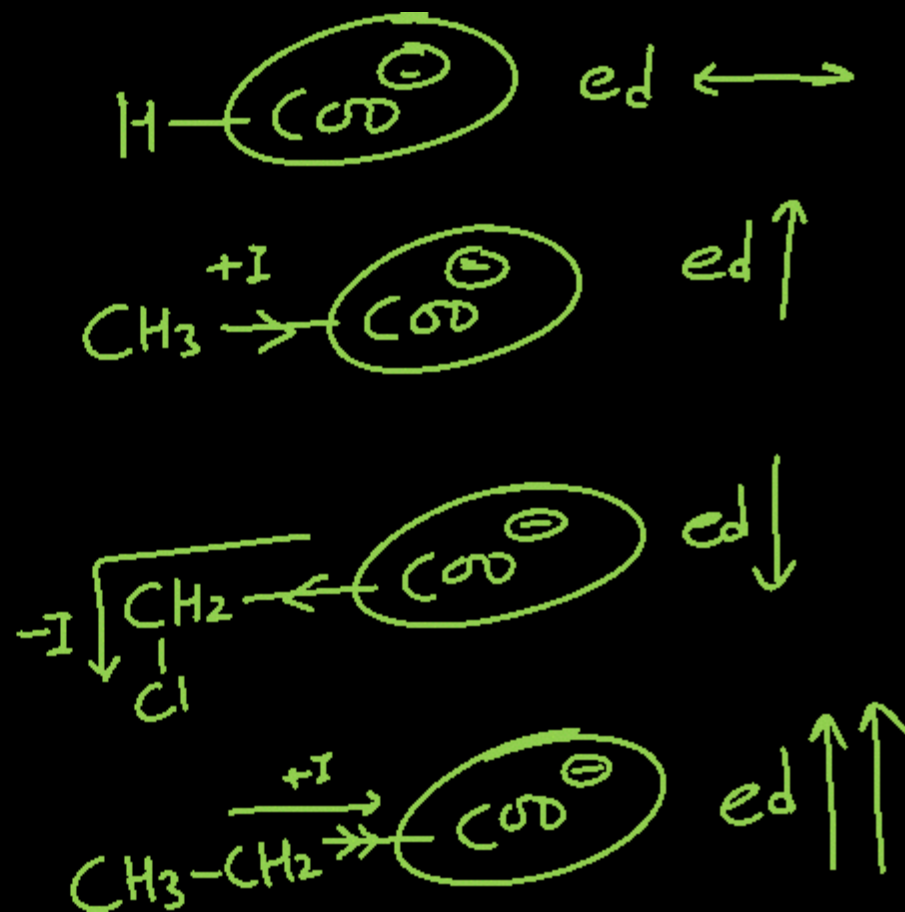
- (1)  $\text{BCl}_3 > \text{BF}_3 > \text{BBr}_3$
- (2)  $\text{BBr}_3 > \text{BCl}_3 > \text{BF}_3$
- (3)  $\text{BBr}_3 > \text{BF}_3 > \text{BCl}_3$
- (4)  $\text{BF}_3 > \text{BCl}_3 > \text{BBr}_3$



Question no. 50

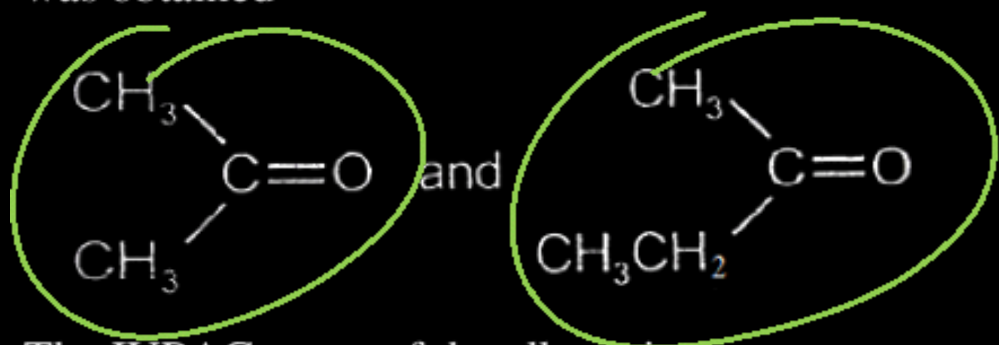
Which of the following is correct order of acidity?

- (1)  $\text{HCOOH} > \text{CH}_3\text{COOH} > \text{ClCH}_2\text{COOH} > \text{C}_2\text{H}_5\text{COOH}$
- (2)  $\text{ClCH}_2\text{COOH} > \text{HCOOH} > \text{CH}_3\text{COOH} > \text{C}_2\text{H}_5\text{COOH}$  **(2)**
- (3)  $\text{CH}_3\text{COOH} > \text{HCOOH} > \text{ClCH}_2\text{COOH} > \text{C}_2\text{H}_5\text{COOH}$
- (4)  $\text{C}_2\text{H}_5\text{COOH} > \text{CH}_3\text{COOH} > \text{HCOOH} > \text{ClCH}_2\text{COOH}$



Question no. 51

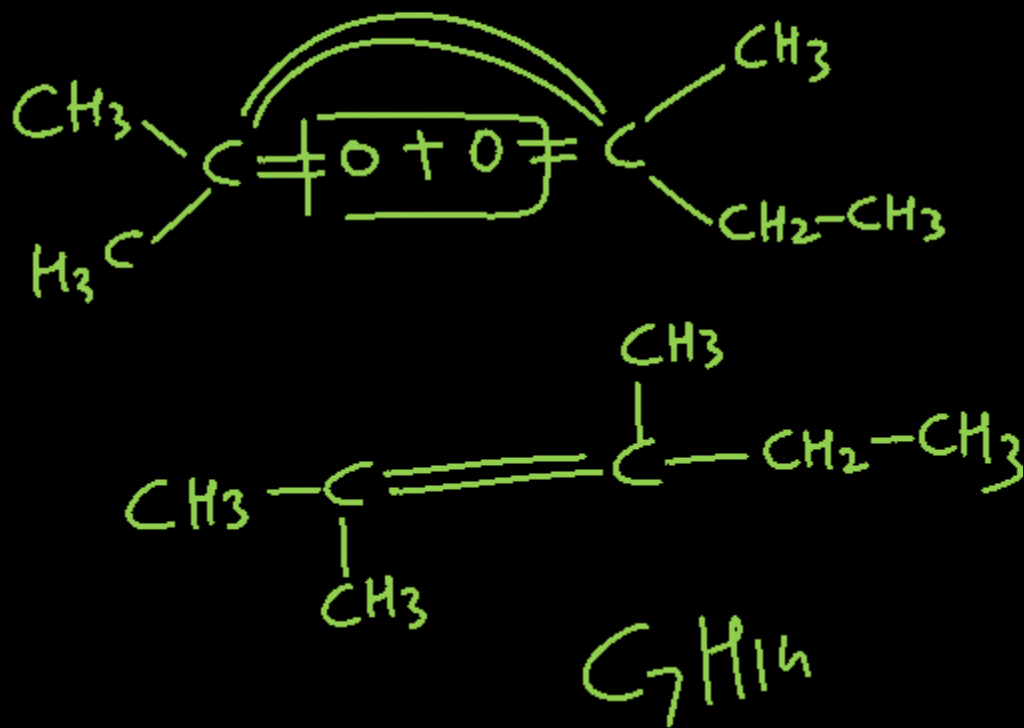
An alkene having molecular formula  $C_7H_{14}$  was subjected to ozonolysis in the presence of zinc dust. An equimolar amount of the following two compounds was obtained



The IUPAC name of the alkene is

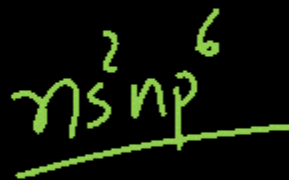
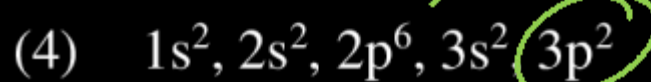
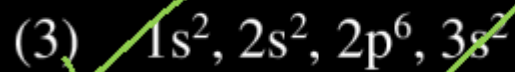
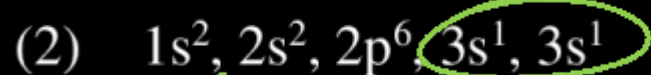
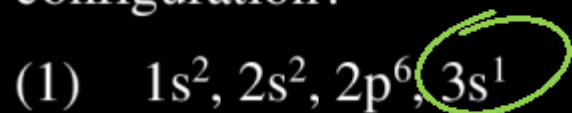
- (1) 3,4-dimethyl-3-pentene
- (2) 3,4-dimethyl-2-pentene
- (3) 2,3-dimethyl-3-pentene
- (4) 2,3-dimethyl-2-pentene

4



Question no. 52

A sudden large jumps between the value of second and third ionization energies of an element, would be associated with which of the following electronic configuration?

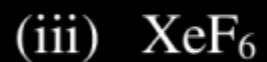


3

3

Question no. 53

Among the following molecules those having same number of lone pairs on Xe are



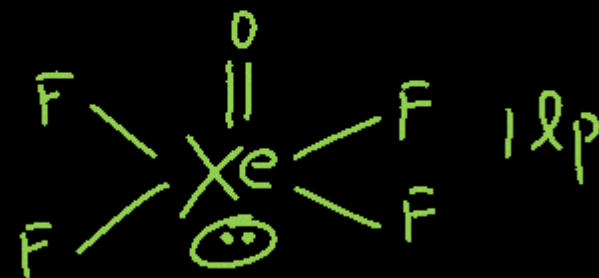
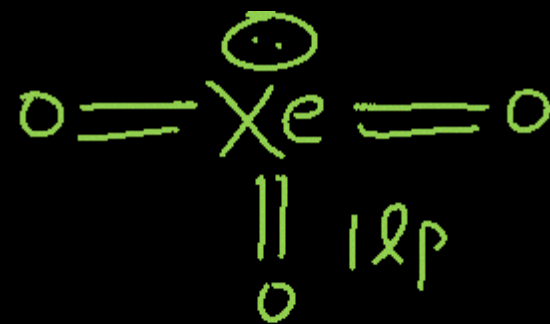
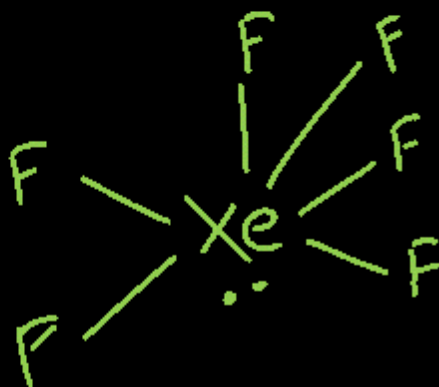
(1) (i) and (ii) only

(2) (i) and (iii) only

(3) (ii) and (iii) only

(4) (i), (ii) and (iii) only

4



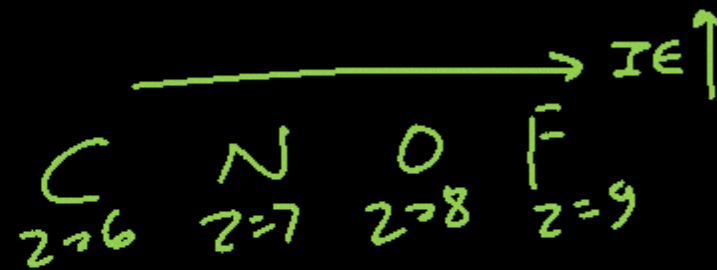
Question no. 54

Consider the following statements

- I. The radius of an anion is larger than that of the parent atom. ✓
- II. The ionization energy generally increases with increasing atomic number in a period. ✓
- III. The electronegativity of an element is the tendency of an isolated atom to attract an electron. ✓

Which of the above statements is/are correct?

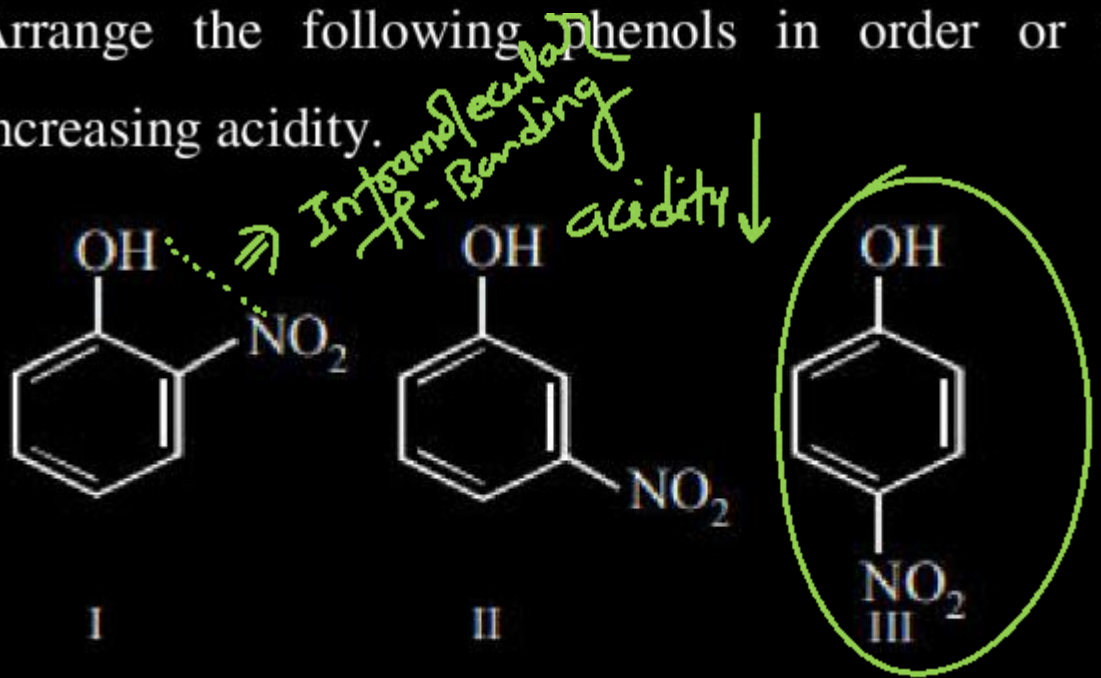
- (1) I alone
- (2) II alone
- (3) I and II
- (4) II and III



3

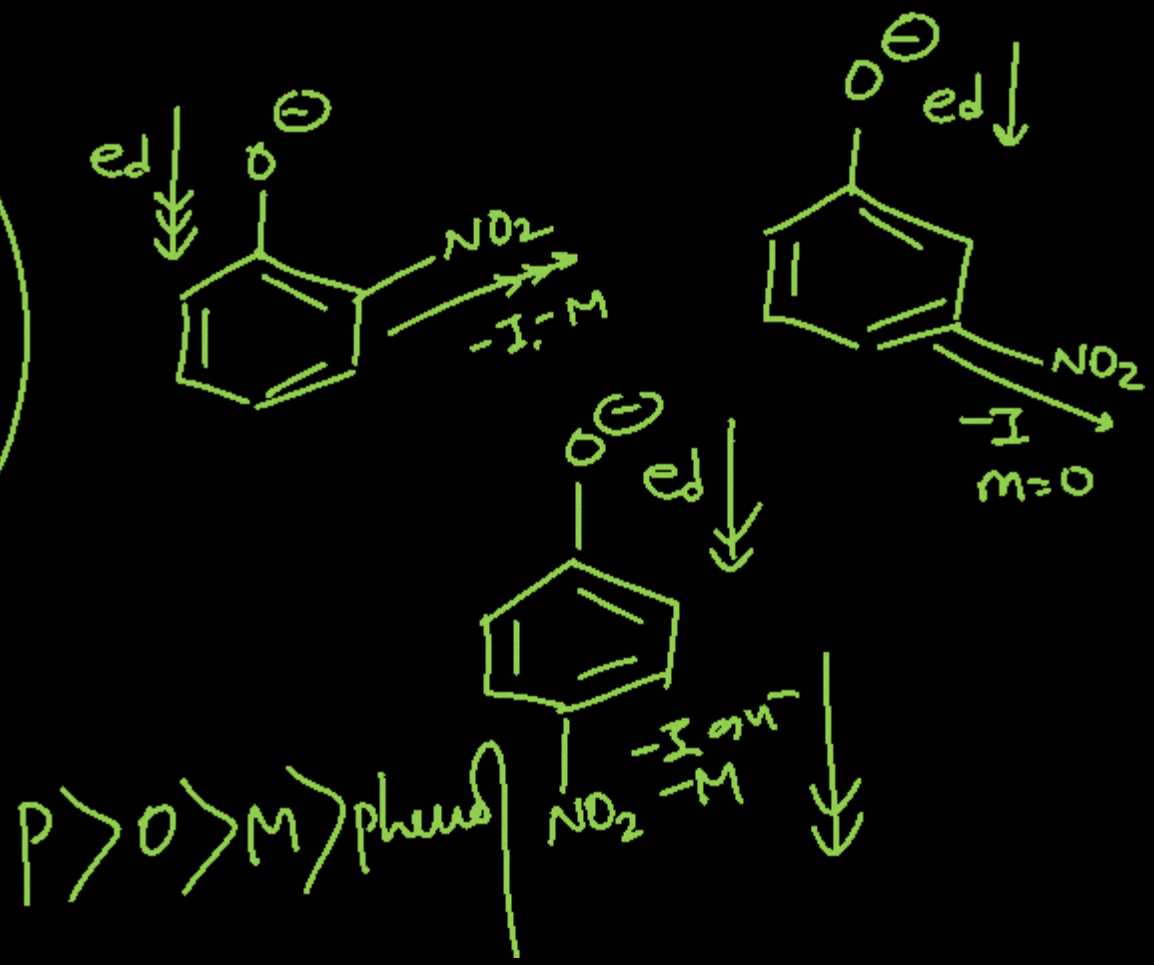
Question no. 55

Arrange the following phenols in order of their increasing acidity.



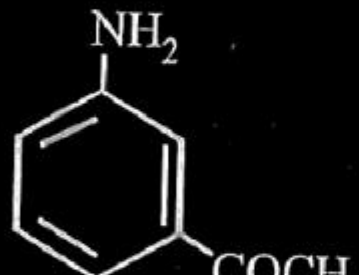
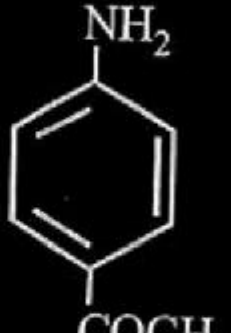

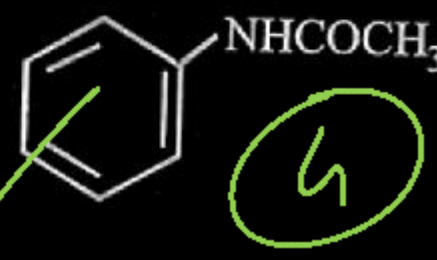
- (1) I > III > II
- (2) I > II > III
- (3) III > I > II
- (4) III > II > I

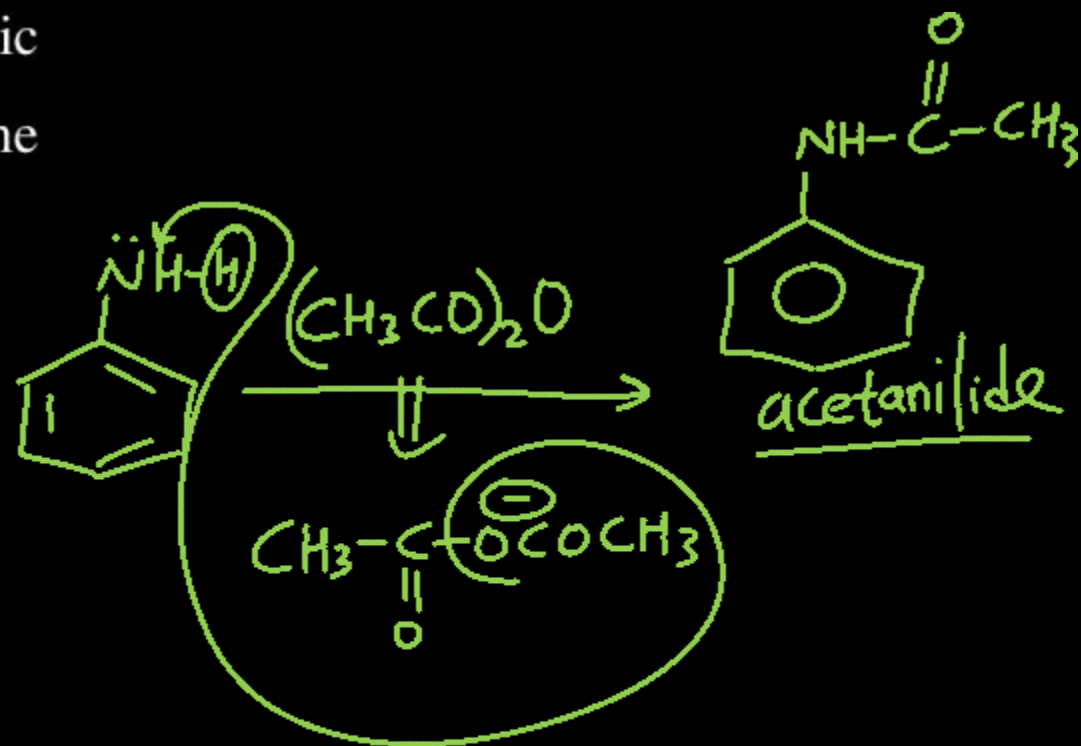
3



Question no. 56

Aniline is an activated system for electrophilic substitution. The compound formed on heating aniline with acetic anhydride is

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



## Question no. 57

A molecule M associates in a given solvent according to the equation  $M \rightleftharpoons M)_n$ . For a certain concentration of M, the van't Hoff factor was found to be 0.9 and the fraction of associated molecules was 0.2. The value of n is:

(1) 3

(2) 5

(3) 2

(4) 4

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

$$0.9 = (1 - 0.2) + 0.2/n$$

$$0.9 = 0.8 + 0.2/n$$

$$0.1 = \frac{0.2}{n}$$

$$n = \frac{0.2}{0.1} = 2$$

$$n = 2$$

Question no. 58

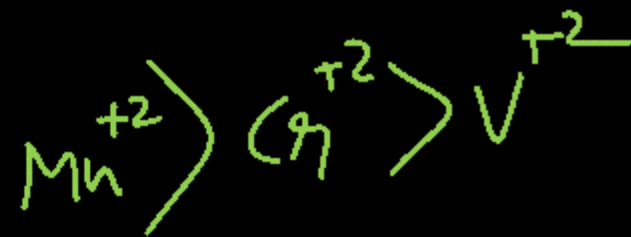
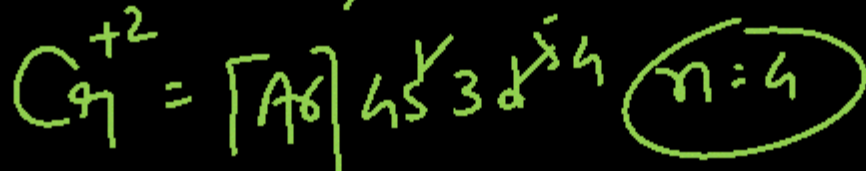
What is the correct order of spin only magnetic moment (in BM) of  $\text{Mn}^{2+}$ ,  $\text{Cr}^{2+}$  and  $\text{V}^{2+}$ ?

- (1)  $\text{Mn}^{2+} > \text{V}^{2+} > \text{Cr}^{2+}$
- (2)  $\text{V}^{2+} > \text{Cr}^{2+} > \text{Mn}^{2+}$
- (3)  $\text{Mn}^{2+} > \text{Cr}^{2+} > \text{V}^{2+}$
- (4)  $\text{Cr}^{2+} > \text{V}^{2+} > \text{Mn}^{2+}$

3

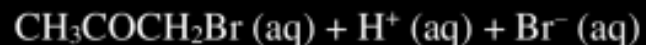
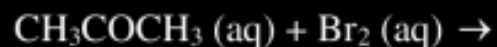
magnetic moment  $\propto$  no. of unpaired  $e^-$

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



## Question no. 59

The bromination of acetone that occurs in acid solution is represented by this equation.



These kinetic data were obtained for given reaction concentrations.

Initial Concentrations	M		rate of reaction, $\text{Ms}^{-1}$
$[\text{CH}_3\text{COCH}_3]$	$[\text{Br}_2]$	$[\text{H}^+]$	
0.30	0.05	0.05	$5.7 \times 10^{-5}$
0.30	0.10	0.05	$5.7 \times 10^{-5}$
0.30	0.10	0.10	$1.2 \times 10^{-4}$
0.40	0.05	0.20	$3.1 \times 10^{-4}$

1

Based on given data, the rate equations is:

(1) ~~Rate =  $k[\text{CH}_3\text{COCH}_3][\text{H}^+]$~~

(2) Rate =  $k[\text{CH}_3\text{COCH}_3][\text{Br}_2]$

(3) Rate =  $k[\text{CH}_3\text{COCH}_3][\text{Br}_2][\text{H}^+]^2$

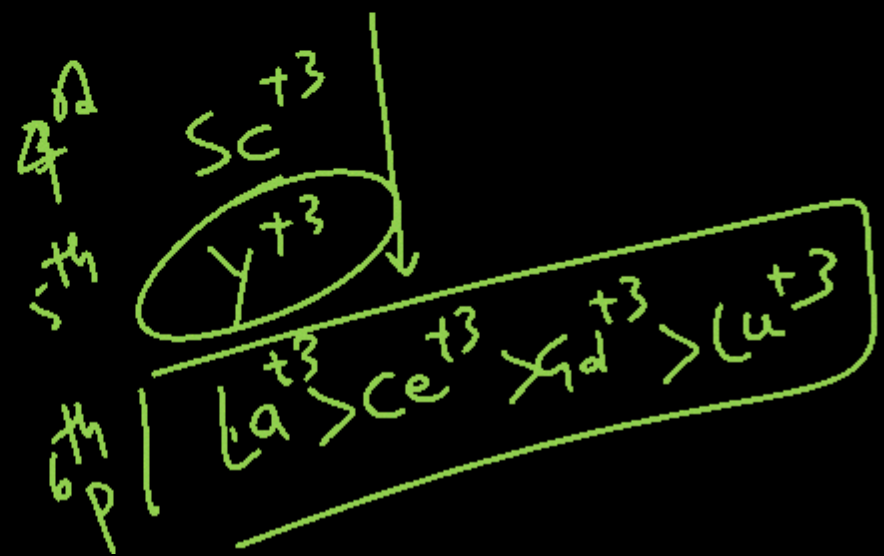
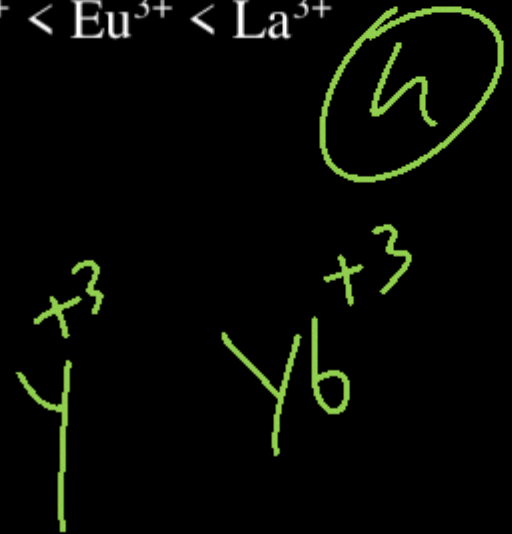
(4) Rate =  $k[\text{CH}_3\text{COCH}_3][\text{Br}_2][\text{H}^+]$



Question no. 61

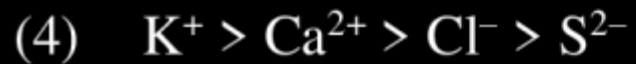
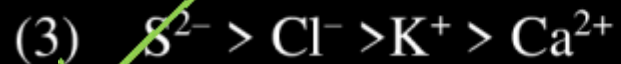
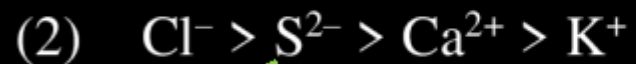
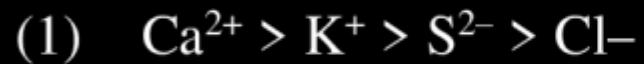
The correct order of ionic radii of  $Y^{3+}$ ,  $La^{3+}$ ,  $Eu^{3+}$  and  $Lu^{3+}$  is

- (1)  ~~$Y^{3+} < La^{3+} < Eu^{3+} < Lu^{3+}$~~
- (2)  ~~$Lu^{3+} < Eu^{3+} < La^{3+} < Y^{3+}$~~
- (3)  ~~$La^{3+} < Eu^{3+} < Lu^{3+} < Y^{3+}$~~
- (4)  $Y^{3+} < Lu^{3+} < Eu^{3+} < La^{3+}$



Question no. 62

The correct order of the decreasing ionic radii among the following isoelectronic species are:



Size  $\propto \frac{-ve}{+ve}$

3

Question no. 63

0.45 g of acid of molecular weight 90 was neutralized by 20 ml. of a 0.5 N caustic potash. The basicity of an acid is

(1) 1

~~(2) 2~~

(3) 3

(4) 4

$$\frac{W}{E} = N \times V_{\text{alk}}$$

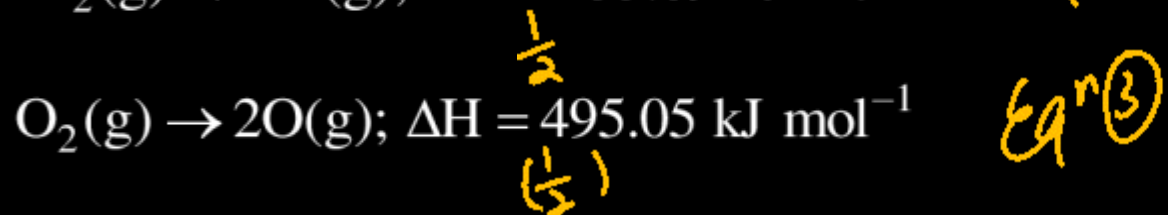
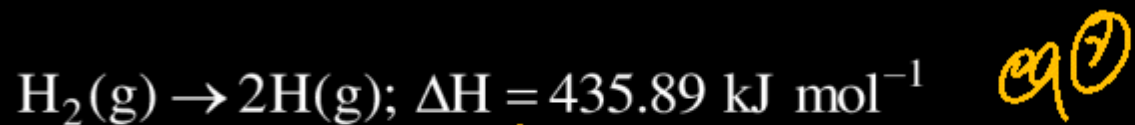
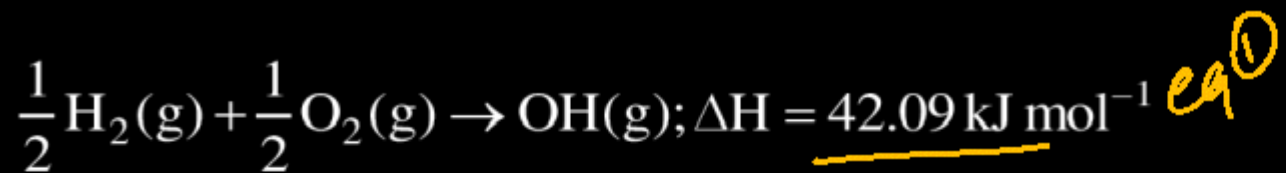
$$\frac{0.45}{90/v.f.} = \frac{0.5 \times 20}{1000}$$

$$v.f. = \frac{1 \times 9}{4.5} = 2$$

$$v.f. = 2$$

Question no. 64

The enthalpies of the following reactions are shown below.



Calculate the O – H bond energy for the hydroxyl radical.

(1) 223.18 kJ mol<sup>-1</sup>      ~~(2) 423.38 kJ mol<sup>-1</sup>~~

(3) 513.28 kJ mol<sup>-1</sup>      (4) 113.38 kJ mol<sup>-1</sup>

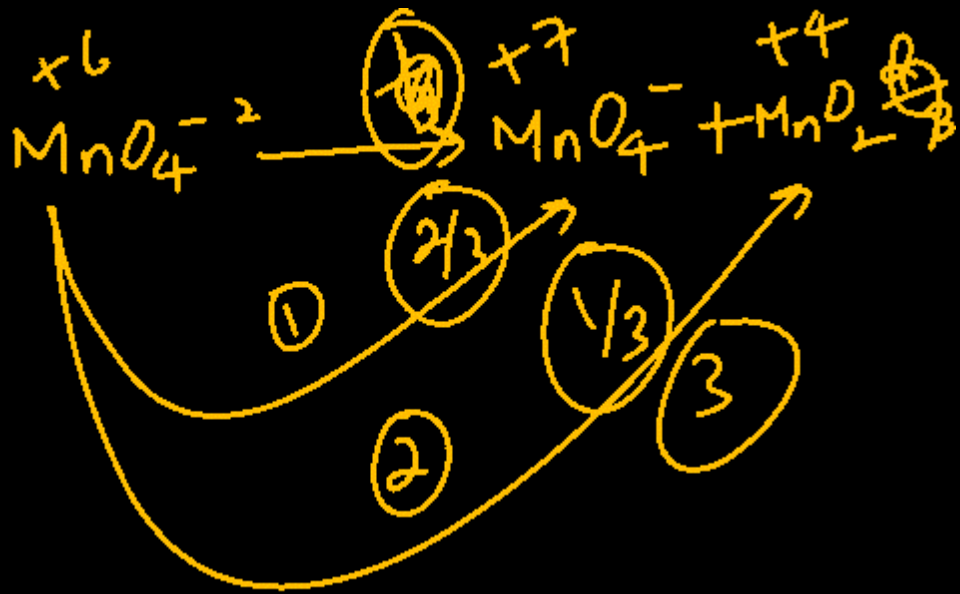
$$\begin{aligned} & \frac{1}{2} \text{eq}^{\textcircled{2}} + \frac{1}{2} \text{eq}^{\textcircled{3}} - \text{eq}^{\textcircled{1}} \\ &= \frac{1}{2} \times 435.89 + \frac{1}{2} \times 495 - 42.09 \\ &= \underline{423.85 \text{ kJ}} \end{aligned}$$

Question no. 65

$\text{MnO}_4^{2-}$  (1 mole) in neutral aqueous medium disproportionates to

- (1) ~~2/3~~ mole of  $\text{MnO}_4^-$  and 1/3 mole of  $\text{MnO}_2$
- (2) 1/3 mole of  $\text{MnO}_4^-$  and 2/3 mole of  $\text{MnO}_2$
- (3) 1/3 mole of  $\text{Mn}_2\text{O}_7$  and 1/3 mole of  $\text{MnO}_2$
- (4) 2/3 mole of  $\text{Mn}_2\text{O}_7$  and 1/3 mole of  $\text{MnO}_2$

A



Question no. 66

→ 1 mol

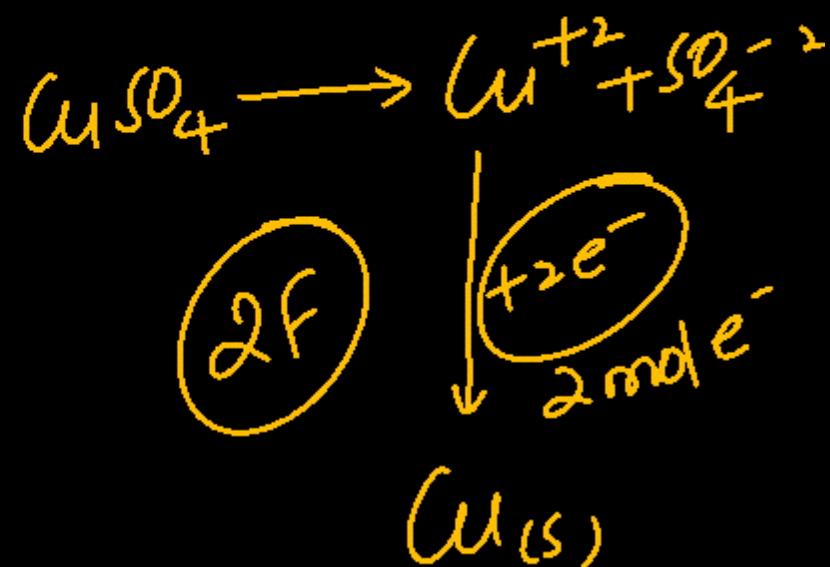
One litre of 1 M  $\text{CuSO}_4$  solution is electrolysed. After passing 2 F of electricity, molarity of  $\text{CuSO}_4$  solution will be

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

(2)  $\frac{M}{4}$

(3) M

~~(4) 0~~



IONS के लिए  
→ = 0

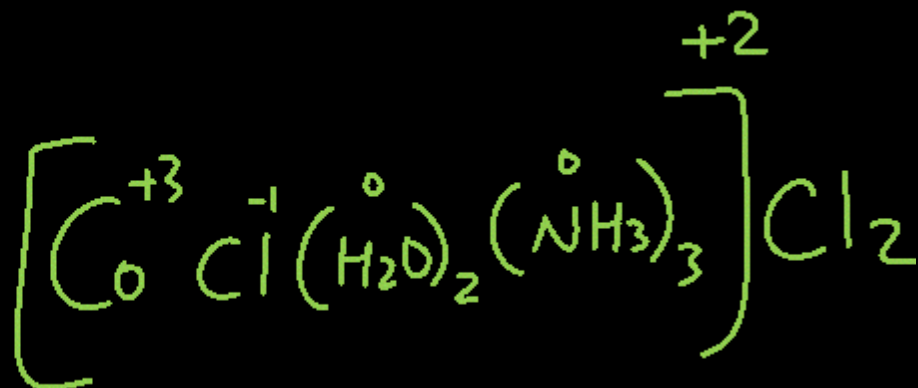
Molarity = 0

Question no. 67

The hypothetical complex chlorodiaquatriammine cobalt (III) chloride can be represented as



①



## Question no. 68

One mole of an ideal gas is allowed to expand reversibly and adiabatically from a temperature of  $27^{\circ}\text{C}$ . If the work done during the process is 3 kJ, then final temperature of the gas is ( $C_v = 20 \text{ J/K}$ )

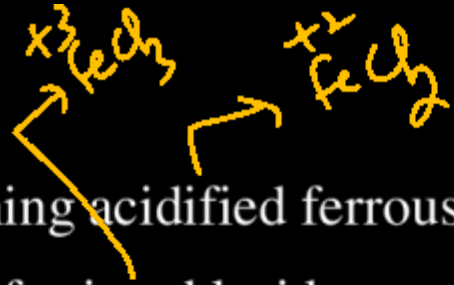
- (1) 100 K                      ~~(2)~~ 150 K  
(3) 195 K                      (4) 255 K

$$W = n C_v dT$$
$$= 1 \times 20 (T_1 - T_2)$$
$$\frac{150}{3000} = \frac{1}{20} (300 - T_2)$$
$$150 = 300 - T_2$$

$$T_2 = 150 \text{ K}$$

Question no. 69

Two electrolytic cells, one containing acidified ferrous chloride and another acidified ferric chloride, are connected in series. The ratio of iron deposited at cathodes in the two cells will be:



(1) 3 : 1

(2) 2 : 1

(3) 1 : 1

~~(4) 3 : 2~~

$$\frac{w_1}{w_2} = \frac{E_1}{E_2}$$

$$\frac{w_1}{w_2} = \frac{\cancel{6}/2}{\cancel{6}/3}$$

$$\frac{w_1}{w_2} = 3/2$$

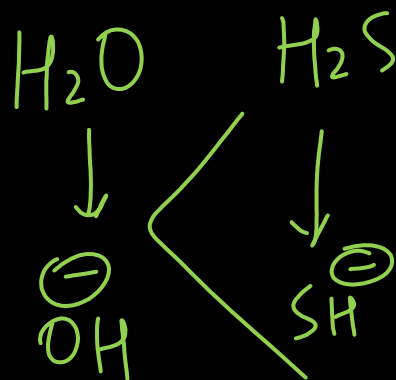
$$3:2$$

Question no. 70

Predict the relative acidic strength among the following

- (1)  $\text{H}_2\text{S} < \text{H}_2\text{Se} < \text{H}_2\text{O} < \text{H}_2\text{Te}$
- (2)  $\text{H}_2\text{O} < \text{H}_2\text{S} < \text{H}_2\text{Se} < \text{H}_2\text{Te}$
- (3)  $\text{H}_2\text{Te} < \text{H}_2\text{Se} < \text{H}_2\text{S} < \text{H}_2\text{O}$
- (4)  $\text{H}_2\text{O} < \text{H}_2\text{Se} < \text{H}_2\text{S} < \text{H}_2\text{Te}$

P-Block  
Hydride  
Acidity  $\propto$  Size



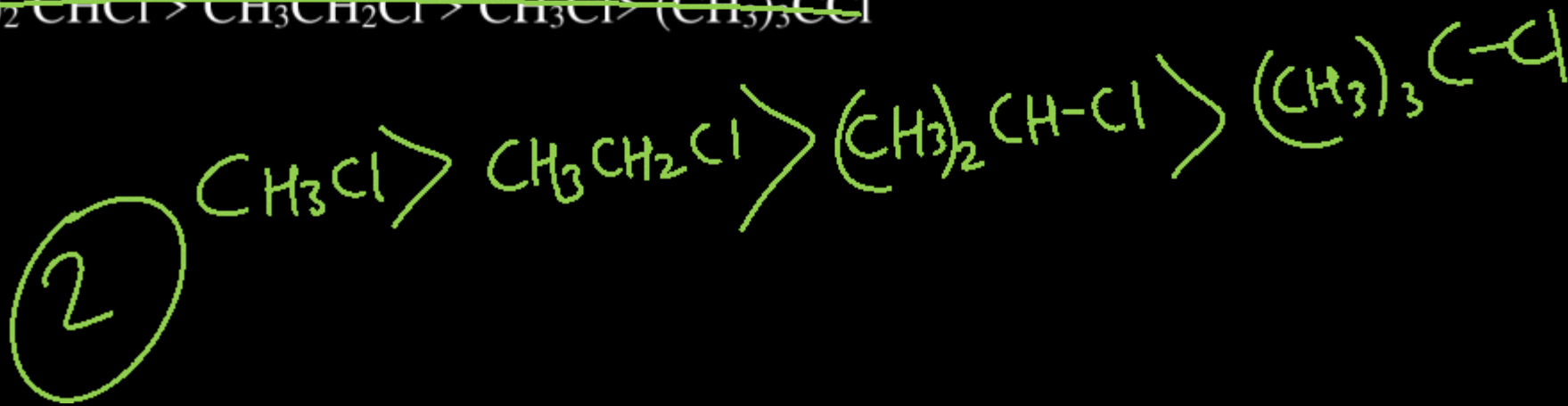
Question no. 71

In  $S_N2$  reactions, the correct order of reactivity for the following compounds is :  $\rightarrow$   $CH_3CH_2Cl$

$CH_3Cl$ ,  $CH_3Cl$ ,  $(CH_3)_2CHCl$  and  $(CH_3)_3CCl$

- (1)  $CH_3Cl > (CH_3)_2CHCl > CH_3CH_2Cl > (CH_3)_3CCl$   
(2)  $CH_3Cl > CH_3CH_2Cl > (CH_3)_2CHCl > (CH_3)_3CCl$   
(3)  ~~$CH_3CH_2Cl > CH_3Cl > (CH_3)_2CHCl > (CH_3)_3CCl$~~   
(4)  ~~$(CH_3)_2CHCl > CH_3CH_2Cl > CH_3Cl > (CH_3)_3CCl$~~

$S_N2$  Reactivity  $\propto \frac{1}{\text{steric hindrance}}$



Question no. 72

Calculate the pH of a solution obtained by mixing 2 ml of HCl of pH 2 and 3 ml of solution of KOH of

pH = 12  $\rightarrow [H^+] = 10^{-2}$   $pOH = 2$   $[OH^-] = 10^{-2}$

- (1) 10.30 (2) 3.70  
 (3) 11.30 (4) None of these

$$pH = 14 - 2.7 = \underline{11.3}$$

$$M_A (N_1 V_1) = 2 \times 10^{-2} = 2 \times 10^{-2}$$

$$KOH (N_2 V_2) = 10^{-2} \times 3 = 3 \times 10^{-2}$$

Bare > Acid sol<sup>n</sup> Basic

$$[OH^-] = \frac{(N_1 V_1)_{Base} - (N_2 V_2)_{Acid}}{V_1 + V_2}$$

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

$$[OH^-] = \frac{1 \times 10^{-2}}{5} = 0.2 \times 10^{-2} = 2 \times 10^{-3}$$

$$pOH = 3 - \log 2 = \underline{2.7}$$

Question no. 73

Mole fraction of methanol in its aqueous solution is 0.5. The concentration of solution in terms of percent by mass of methanol is

(1) 36

(2) 50

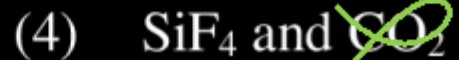
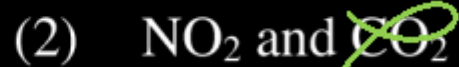
(3) 64

(4) 72

$$\begin{aligned} X_{\text{CH}_3\text{OH}} &= 0.5 & X_{\text{H}_2\text{O}} &= 0.5 \\ \text{1 mol} & & \text{1 mol} & \\ \text{Wt} &= 32 \text{ gm} & \text{Wt} &= 18 \text{ gm} \\ \text{W}_{\text{sol}^n} &= 32 + 18 = 50 \text{ gm} \\ \% \text{ W/W} &= \frac{32}{50} \times 100 \\ &= \underline{64\%} \end{aligned}$$

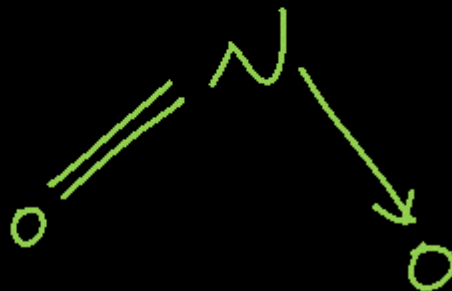
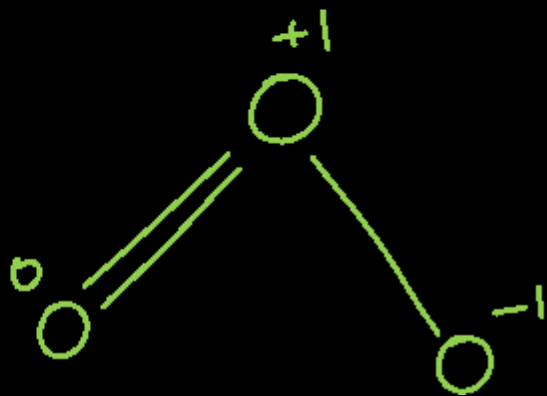
Question no. 74

Which one of the following pairs of molecules will have permanent dipole moments for both members?



$\mu \neq 0$   
Polar molecules

3



Question no. 75

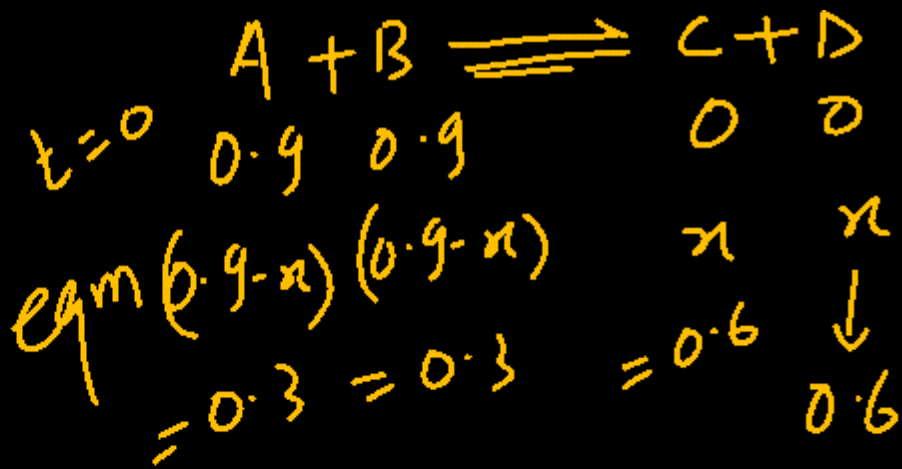
In a reaction  $A + B \rightleftharpoons C + D$ , the initial concentrations, of A and B were  $0.9 \text{ mole dm}^{-3}$  each. At equilibrium the concentration of D was found to be  $0.6 \text{ mol dm}^{-3}$ . What is the value of equilibrium constant for the reaction

(1) 8

~~(2) 4~~

(3) 9

(4) 3



$$K_{eq} = \frac{0.6 \times 0.6}{0.3 \times 0.3} = 2 \times 2 = 4$$

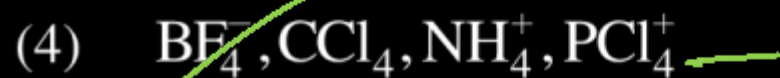
$K_{eq} = 4$

Question no. 76

Higher order ( $>3$ ) reactions are rare due to:

- (1) Shifting of equilibrium towards reactants due to elastic collision.
- (2) Loss of active species on collision.
- (3) ~~Low~~ Low probability of simultaneous collision of all the reacting species.
- (4) Increase in entropy and activation energy as more molecules are involved.

In which of the following sets, all the given species are isostructural?



4

Question no. 78

The boiling point of a solution of 0.11 g of a substance in 15 g of ether was found to be  $0.1^{\circ}\text{C}$  higher than that of pure ether. The molecular weight of the substance will be

( $K_b = 2.16 \text{ K kg mol}^{-1}$ )

- (1)  $148 \text{ g mol}^{-1}$       ~~(2)  $158 \text{ g mol}^{-1}$~~   
(3)  $168 \text{ g mol}^{-1}$       (4)  $178 \text{ g mol}^{-1}$

$$\Delta T_b = K_b \times m$$
$$0.1 = 2.16 \times \frac{0.11 \times 1000}{M_w \times 15}$$
$$M_w = \frac{2.16 \times 0.11 \times 1000}{0.1 \times 15}$$

$M_w = 158.4$

Question no. 79

Both geometrical and optical isomerism are shown by

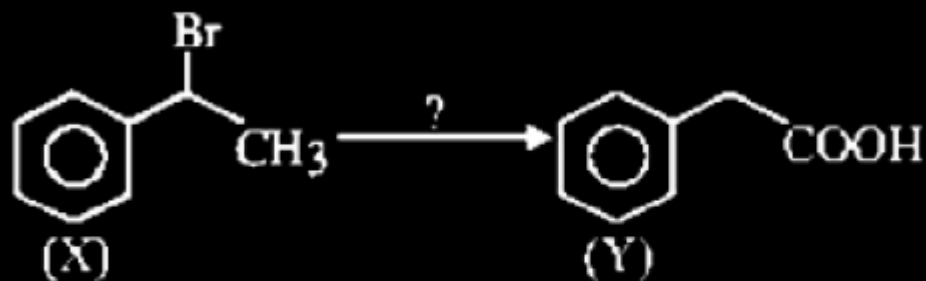


①  
 $\text{M}(\text{AA})_2\text{a}_2$

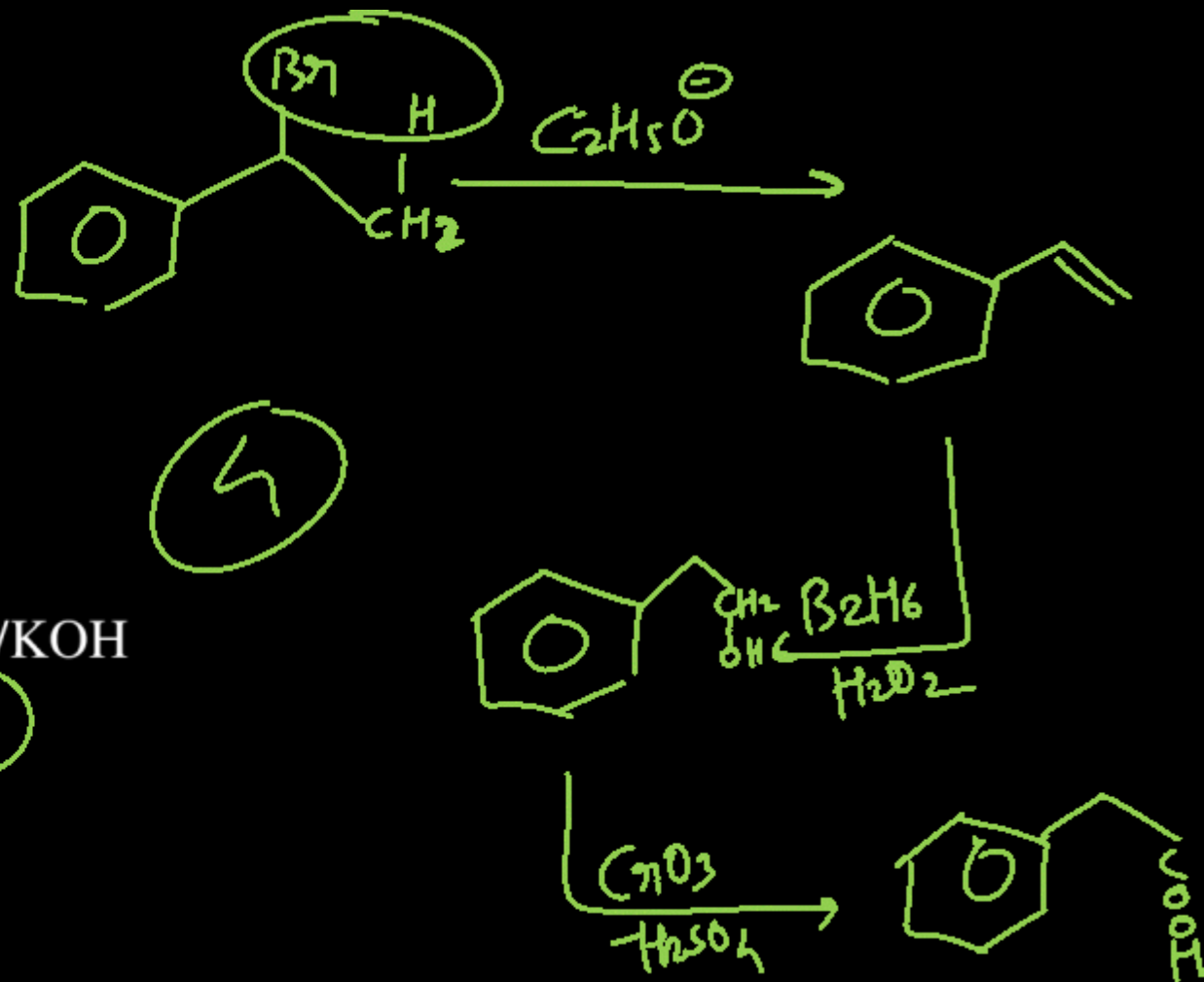
$\text{M}(\text{AA})_3 \rightarrow \begin{matrix} \text{GI} \times \\ \text{OI} \checkmark \end{matrix}$   
 $\text{M}(\text{AB})_3 \rightarrow \begin{matrix} \text{GI} \checkmark \\ \text{OI} \checkmark \end{matrix}$   
 $\text{M}(\text{AA})_2\text{a}_2 \rightarrow \begin{matrix} \text{GI} \checkmark \\ \text{OI} \checkmark \end{matrix}$   
 $\text{M}(\text{AA})_2\text{ab}$

Question no. 80

The correct sequence of reagents for the above conversion of X to Y is :

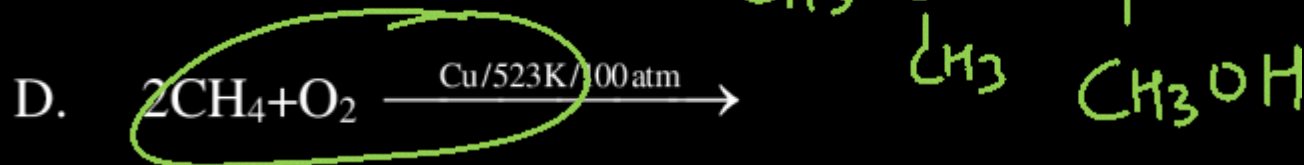
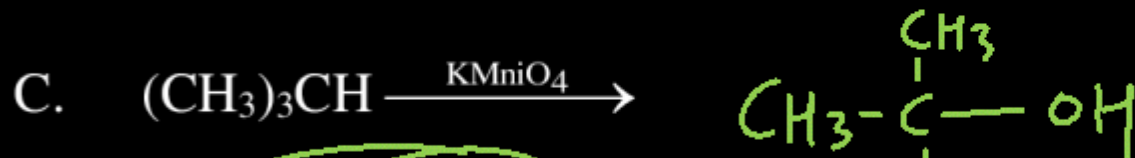


- (1) (i) NaOH (aq) (ii) Jones reagent (iii)  $H_3O^+$
- (2) (i)  $B_2H_6 / H_2O_2$  (ii) NaOEt (iii) Jones
- (3) (i) Jones reagent (ii) NaOEt (iii) Hot  $KMnO_4 / KOH$
- (4) (i) NaOEt (ii)  $B_2H_6 / H_2O_2$  (iii) Jones reagent



Question no. 81

The reactions which produce alcohol as the product are:



Choose the correct answer from the options given below.

3

(1) A and D only

(2) A, C and E only

(3) C and D only

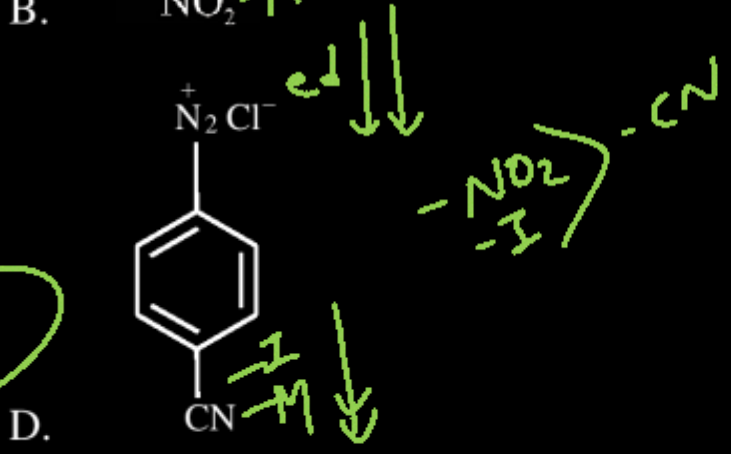
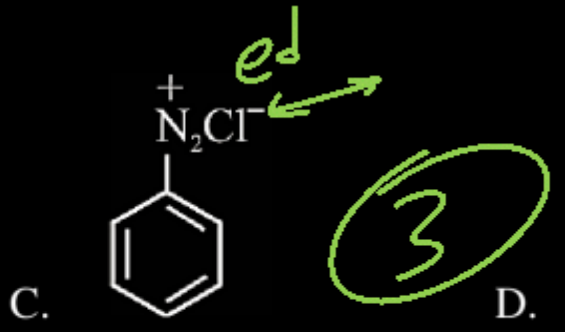
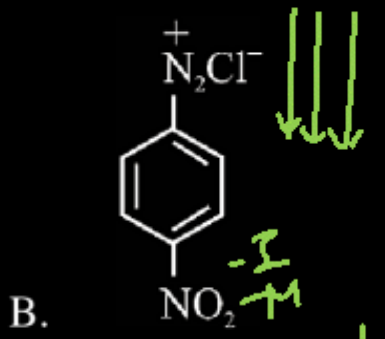
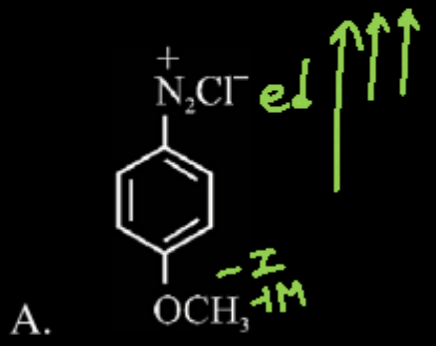
(4) B, D and E

Question no. 82

The correct stability order of the following diazonium salts is

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Stability of Diazonium salt  $\propto$  ed on Ring



(1) A > B > C > D

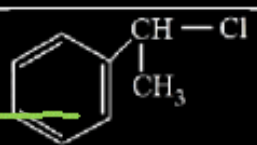
(2) C > D > B > A

(3) A > C > D > B

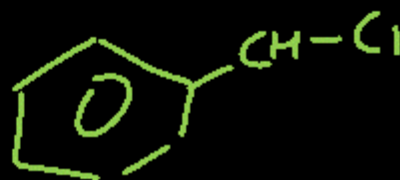
(4) C > A > D > B

Question no. 83

Match the list I and list II.

	List - I		List - II
A.	Vinyl Chloride	I.	$\text{CH}_2=\text{CH}-\text{CH}_2\text{Cl}$ <i>sp<sup>2</sup> sp<sup>3</sup>-C</i>
B.	Benzyl Chloride	II.	$(\text{CH}_3)_2\text{CHCl}$
C.	Alkyl chloride	III.	$\text{CH}_2=\text{CHCl}$
D.	Allyl Chloride	IV.	

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Choose the correct answer from the options given below:

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

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

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

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

3

Question no. 84

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Match the list I and list II.

	List - I (Reagents)		List - II (Name of Reaction involving carbonyl compounds)
A.	$\text{NH}_2 - \text{NH}_2, \text{KOH}$	I.	Tollen' s Test
B.	$\text{Ag} (\text{NH}_3)_2 \text{OH}$	II.	Clemmensen Reduction
C.	Aq. $\text{CuSO}_4$ , Sodium Potassium tartarate, $\text{KOH}$	III.	Wolff-Kishner Reduction
D.	$\text{Zn} - \text{Hg}, \text{HCl}$	IV.	Fehling' s Test

1

Choose the correct answer from the options given below

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

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

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

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

Question no. 85

Match List-I with List-II.

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	List - I (Reagents)		List - II Reaction Name (Involving aldehydes)
A.	$H_2, Pd-BaSO_4$	I.	Etard Reaction
B.	$SnCl_2, HCl$	II.	Rosenmund Reduction
C.	$CrO_2Cl_2, CS_2$	III.	Gatterman - Koch Reaction
D.	$CO, HCl,$ anhyd. $AlCl_3$	IV.	Stephen Reaction

Choose the correct answer from the options given below:

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

4

Question no. 86

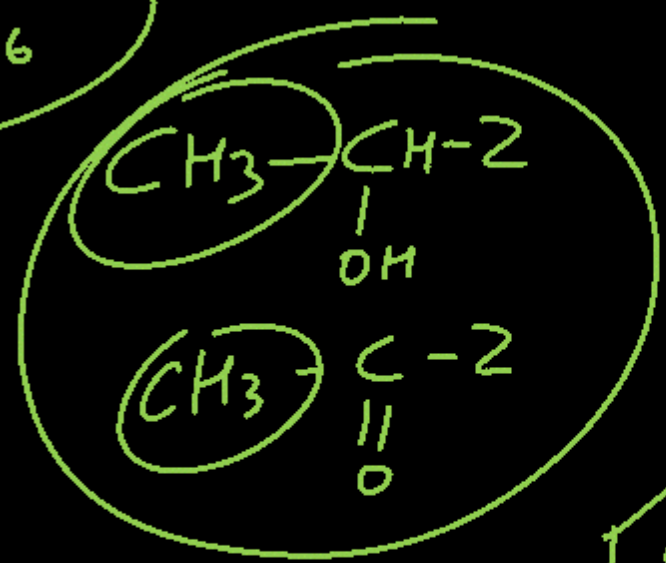
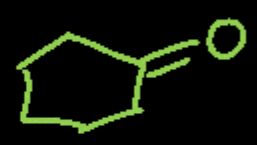
Iodoform test can differentiate between

- A. Methanol and Ethanol
- B. ~~CH<sub>3</sub>COOH and CH<sub>3</sub>CH<sub>2</sub>COOH~~
- C. ~~Cyclohexene and cyclohexanone~~
- D. ~~Diethyl ether and Pentan-3-one~~
- E. Anisole and acetone

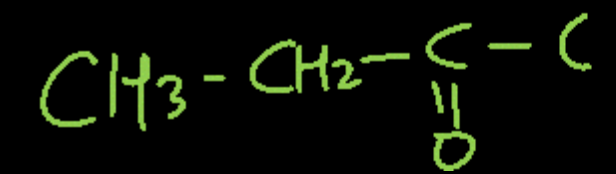
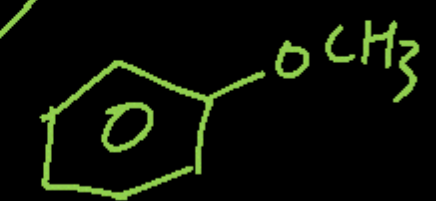
Choose the Correct answer from the options given below:

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

JEE  
Main  
2026



alcohol  
aldehyde  
ketone

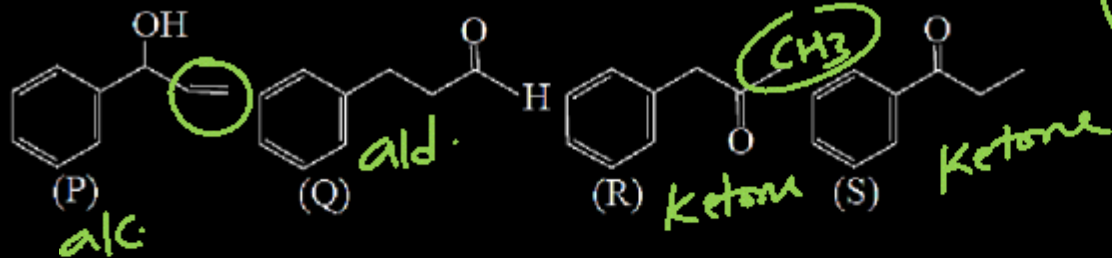


1

Question no. 87

Given below are the four isomeric compounds (P,Q,R,S)

JEE  
Main  
2026



Identify correct statements from below.

A. Q, R and S will give precipitate with 2, 4 - DNP.

Ald/ketone

B. ~~P and Q will give positive Baeyer's test.~~

alkaline  $KMnO_4$

C. ~~R and S will give yellow precipitate with  $I_2/NaOH$ .~~

iodoform Rxn ( $\alpha$ -methyl ketone)

D. Q alone will deposit silver with Tollens reagent

Ald.

Choose the correct option.

(1) A and D only

(2) A only

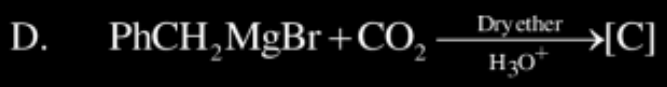
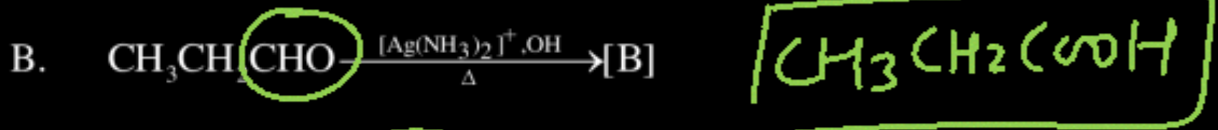
(3) C only

(4) A, B and D only

1

**Question no. 88**

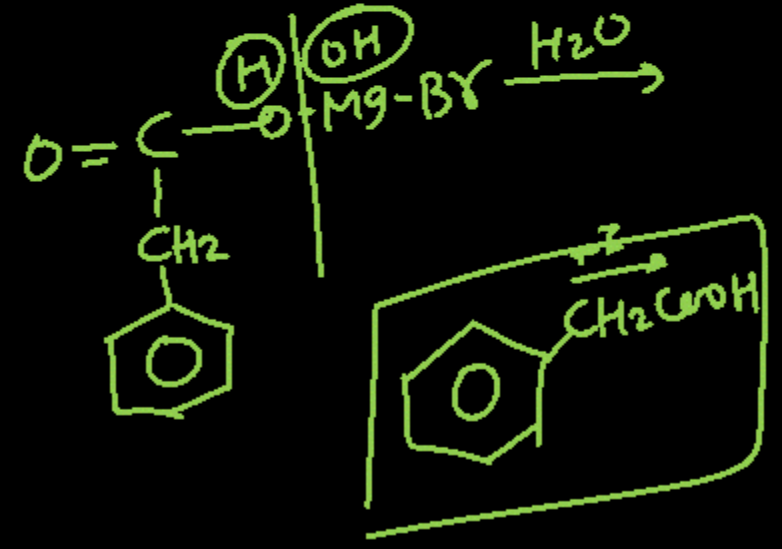
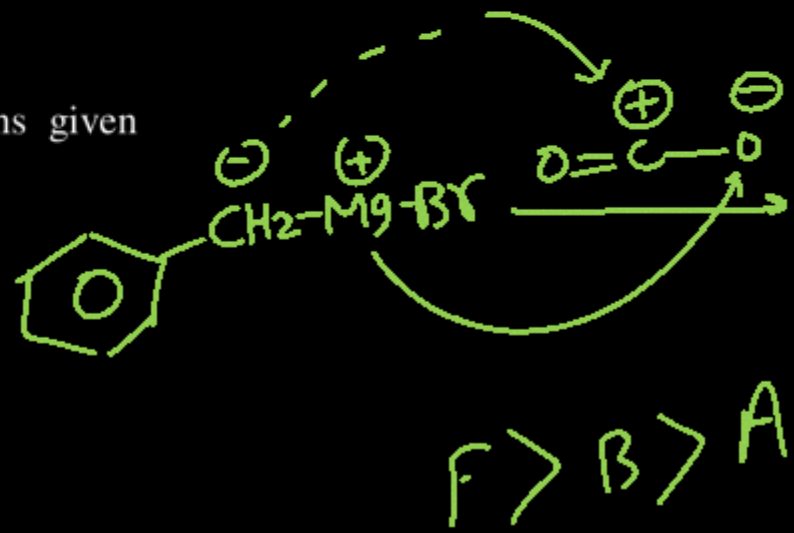
The correct order of acidic strength of the major products formed in the given reactions, is :



Choose the correct answer from the options given below :

- (1)  $\text{C} > \text{B} > \text{A} > \text{D}$
- (2)  ~~$\text{A} > \text{D} > \text{C} > \text{B}$~~
- (3)  ~~$\text{A} > \text{D} > \text{B} > \text{C}$~~
- (4)  $\text{C} > \text{A} > \text{D} > \text{B}$

$\text{C} > \text{A}$   
 $\text{C} > \text{B}$   
 4



$\text{F} > \text{B} > \text{A}$

Question no. 89

In period 4 of the periodic table, the elements with highest and lowest atomic radii are respectively.

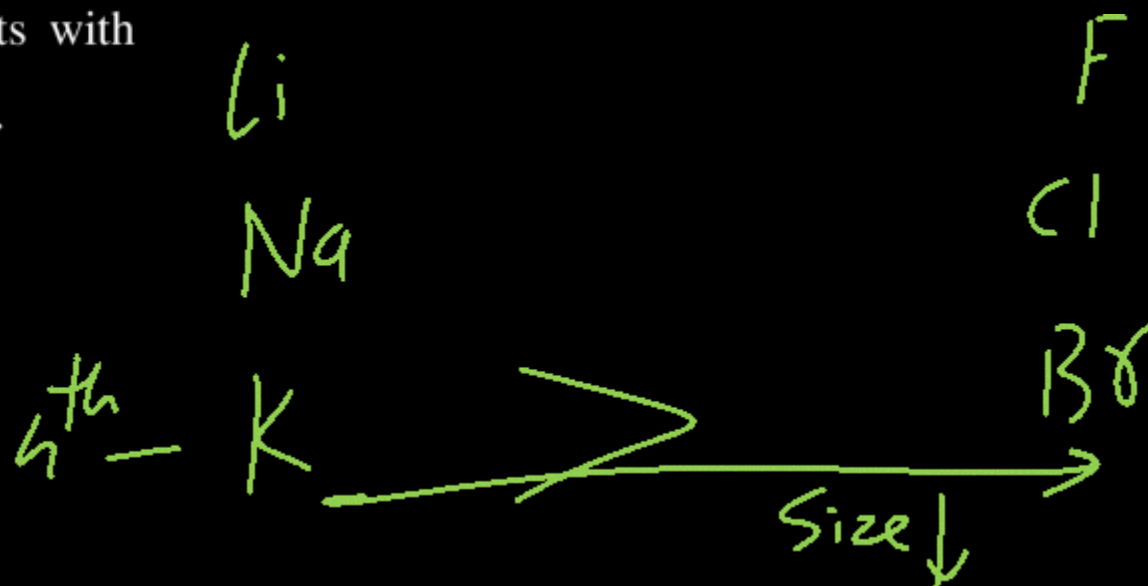
(1) Na & Cl

(2) K & Se

(3) ~~K & Br~~

(4) Rb & Br

3



Question no. 90

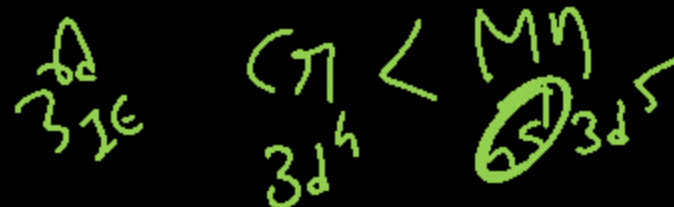
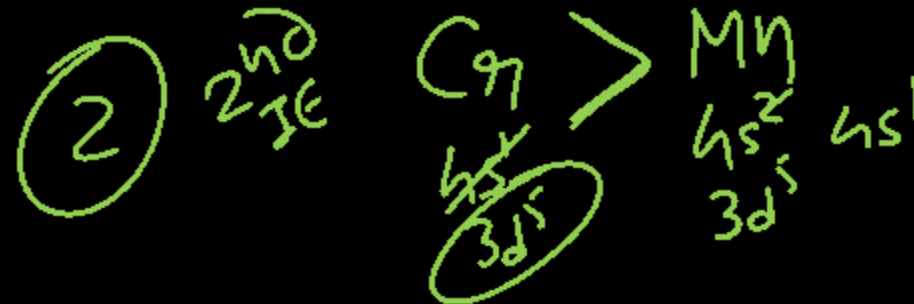
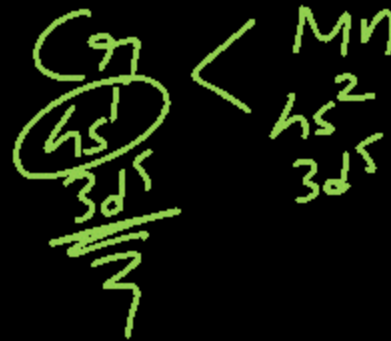
Given below are two statements:

**Statement-I :** The first ionization enthalpy of Cr is lower than that of Mn. ✓

**Statement-II:** The second and third ionization enthalpies of Cr are higher than those of Mn.

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

- (1) Both statement-I and Statement-II are false.
- (2) ✓ Statement I is true but Statement-II is false
- (3) Both statement-I and Statement-II are true
- (4) Statement I is false but Statement-II is true



## Question no. 91

Given below are two statements :

**Statement I** : BOD represents the amount of dissolved oxygen that would be consumed if all the organic matter in one litre of water were oxidised by micro-organisms. ✓

**Statement II** : High value of BOD indicates that water is highly polluted by organic matter. ✓

In the light of the above statements, choose the correct 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 statement II is incorrect.
- (4) Statement I is incorrect but statement II is correct.

BOD ↑ = Polluted ↑  
water

1

Question no. 92

During double fertilisation in plants, one male gamete  
fuses with the egg cell and the other male gamete  
fuses with

(1) synergids cell

~~(2) polar nuclei~~

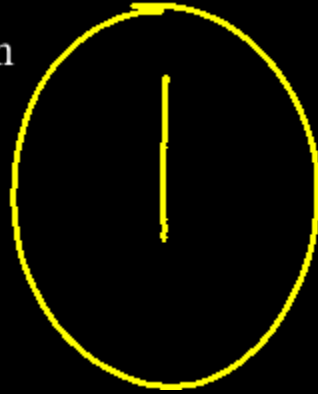
(3) antipodal cell

(4) nucellar cell

Question no. 93

Eukaryotes differ from prokaryotes in mechanism of DNA replication due to

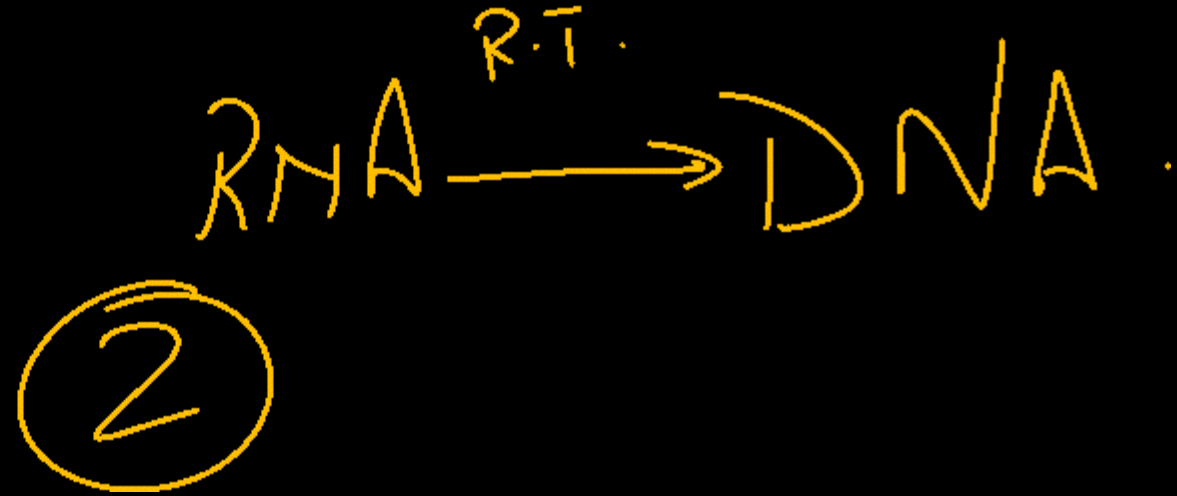
- (1) Number of origin of replication (ori)
- (2) Requirement of DNA ligase
- (3) Direction of replication fork movement
- (4) Semi-conservative mode of replication



Question no. 94

A patient contracts HIV through sharing needles. Later, the virus enters macrophages and helper T-lymphocytes, replicates using reverse transcriptase, and progressively reduces T-helper cells. What is the role of reverse transcriptase in HIV infection?

- (1) Converts viral DNA into RNA
- (2)  Converts viral RNA into DNA
- (3) Degrades T-helper cells
- (4) Produces antibodies



Question no. 95

Protonema and leafy stage are the predominant stage  
of the life cycle of

(1) moss

(2) ~~diatoms~~

(3) ~~liverwort~~

(4) ~~gymnosperm~~

Question no. 96

During translation, proteins are synthesised by

- (1) ~~ribosomes~~ using the information on ~~DNA~~. *m-RNA*
- (2) ~~lysosome~~ using the information on DNA.
- (3) ribosomes using the information on mRNA.
- (4) lysosome using the information of mRNA.

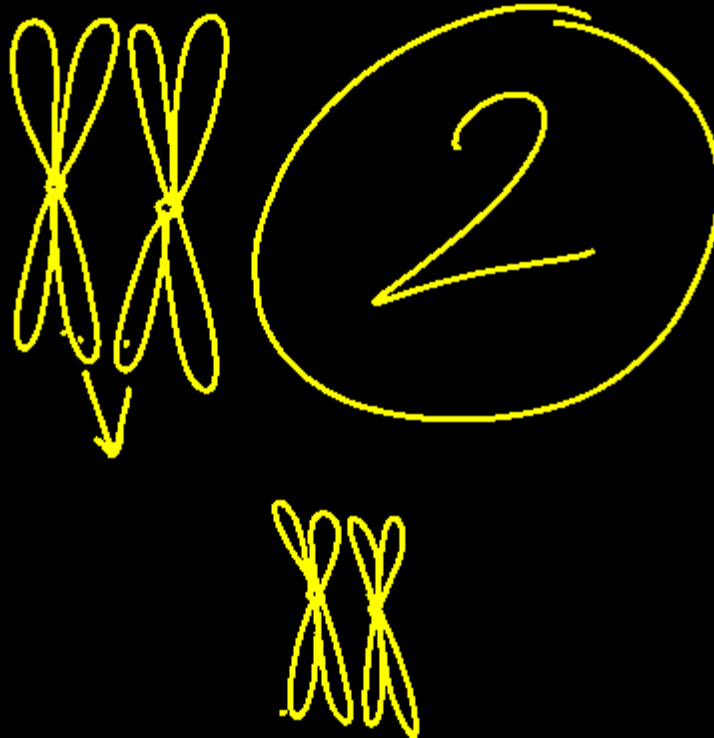
3

Meiosis

Crossing over takes place between which chromatids and in which stage of the cell cycle?

- (1) Non-sister chromatids of ~~non-homologous~~ chromosomes at Zygotene stage of prophase I.
- (2) Non-sister chromatids of homologous chromosomes at Pachytene stage of prophase I.
- (3) Non-sister chromatids of homologous chromosomes at Zygotene stage of prophase I.
- (4) Non-sister chromatids of non-homologous chromosomes at Pachytene stage of prophase I.

Pachytene



Question no. 98

In non-cyclic reactions of photosynthesis, electrons from chlorophyll molecules in photosystem-I are used in the formation of NADPH. What is the source of such electrons?

- (1) Light ✗
- (2) NADPH ✗
- (3) Photosystem-I ✗
- (4) Photosystem-II, which splits water molecule.

4



Question no. 99

Match List-I with List-II.

	List-I		List-II
A.	Autosomal recessive trait	i.	Down's syndrome
B.	Sex-linked recessive trait	ii.	Phenylketonuria
C.	Metabolic error linked to autosomal recessive	iii.	Haemophilia
D.	Additional 21 <sup>st</sup> chromosome	iv.	Sickle cell anaemia

A - iv  
B - iii  
C - ii  
D - i

Choose the correct answer from options given below:

- (1) ~~A - ii, B - i, C - iv, D - iii~~  
 (2) ~~A - iv, B - i, C - ii, D - iii~~  
 (3) A - iv, B - iii, C - ii, D - i ✓  
 (4) ~~A - iii, B - iv, C - i, D - ii~~

3

Question no. 100

Chemiosmotic theory of ATP synthesis in the chloroplasts and mitochondria is based on the :

- (1) membrane potential ✗
- (2) accumulation of  $\text{Na}^+$  ions ✗
- (3) accumulation of  $\text{K}^+$  ions ✗
- (4) proton gradient

4

**Question no. 101**

Match List-I with List-II.

	List-I		List-II
A.	Barbiturates	i.	CNS depressant
B.	Morphine	ii.	Depression
C.	Cocaine	iii.	Effects cardiovascular
D.	Cannabinoid	iv.	Interferes with dopamine transport

Choose the correct answer from options given below:

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

1

Question no. 102

Which among the following belong to same phyla?

(1) Physalia, Obelia, Pleurobranchia - Coelenterata

(2) Bombyx, Culex, Limulus - Arthropoda

(3) Starfish, Jelly fish, Sea urchin - Echinodermata

(4) Cuttle fish, Devil fish, Locusta - Mollusca

2

Question no. 103

Match List-I with List-II.

	List-I		List-II
A.	Delivers blood to <u>kidney</u>	i.	Proximal convoluted tubules
B.	Extends from cortex of kidney to the inner parts of the medulla	ii.	Renal artery
C.	70 – 80 percent of electrolytes are reabsorbed by this segment	iii.	Collecting duct
D.	Loop of Henle	iv.	Ascending and descending limb

3

Choose the correct answer from options given below:

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

Which of the following is a chordate feature and not shared by the non-chordates?

- (1) Metamerism            (2) Axial organisation  
(3) Bilateral symmetry   (4) Notochord

4

Question no. 105

Given below are two statements :

**Statement I :** Dengue is transmitted through the bite of infected female mosquito.

→ Aedes

**Statement II :** Dengue is a viral disease.

In the light of the above statements, choose the correct 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 statement II is incorrect.
- (4) Statement I is incorrect but statement II is correct.

1

Question no. 106

Which one of the following groups of animals is correctly matched with its characteristic feature without even a single exception?

- (1) Reptilia possess 3 - chambered heart with one incompletely divided ventricle.
- (2) Chordata : Possess a mouth provided with an upper and lower jaw.
- (3) chondrichthyes : Possess cartilaginous endoskeleton.
- (4) Mammalia : Give birth to young ones.

3

Question no. 107

From the statements given below choose the correct option: *True/ correct*

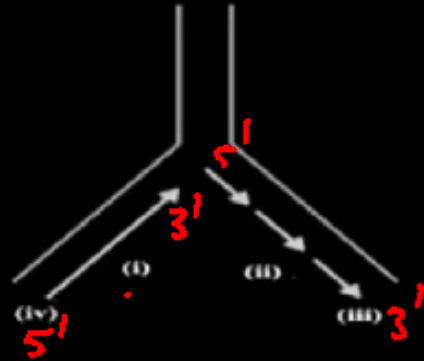
- A.  Interstitial fluid (tissue fluid) and plasma have almost same mineral distribution.
- B.  Lymph has no large proteins and RBC.
- C.  Exchange of the nutrients and gases, etc between blood and cells always occurs through tissue fluid.
- D.  Lymph is an important carrier for nutrients, hormones etc.
- E.  Lymph can be defined as the blood minus RBC but has specialised lymphocytes.

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

4

## Question no. 108

Origin of replication of DNA in *E. coli* is shown below. Identify the labelled parts (i), (ii), (iii) and (iv).



4

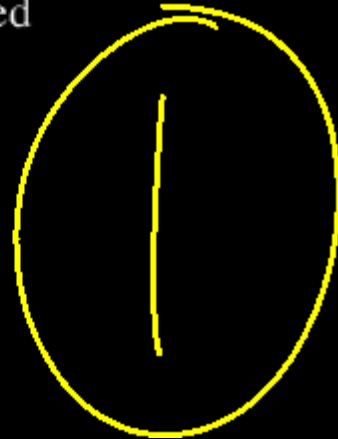
- (1) ~~(i) – discontinuous synthesis, (ii) – continuous synthesis, (iii) 3' end, (iv) 5' end.~~
- (2) (i) – ~~continuous synthesis, (ii) – discontinuous synthesis, (iii) 5' end, (iv) 3' end.~~
- (3) ~~(i) – discontinuous synthesis, (ii) – continuous synthesis, (iii) 5' end, (iv) 3' end.~~
- (4) (i) – continuous synthesis, (ii) – discontinuous synthesis, (iii) 3' end, (iv) 5' end.

Question no. 109

From the statements given below choose the correct option :

- A. ~~Nucleosome~~ contains ~~basic~~ <sup>histone</sup> proteins.
- B. ~~Tightly packed~~ DNA of chromatin is called ~~heterochromatin~~.
- C. ~~Loosely packed~~ DNA of chromatin is called ~~euchromatin~~.
- D. ~~H<sub>2</sub>A, H<sub>2</sub>B are linker proteins.~~ <sup>octamer</sup>
- E. ~~DNA is basic in nature.~~

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



Question no. 110

Which of the following is a hormone releasing Intra Uterine Device (IUD)?

- (1) Multiload 375
- (2) ✓ LNG-20
- (3) Cervical cap
- (4) Vault ✓

2

Question no. 111

We can produce a concentrated/dilute urine. This is special mechanism. Identify the mechanism.

- (1) Reabsorption from PCT.
- (2) Reabsorption from collecting duct.
- (3) Reabsorption/Secretion in DCT.
- (4) Counter current mechanism in Henle's loop/vasa recta.

4

Question no. 112

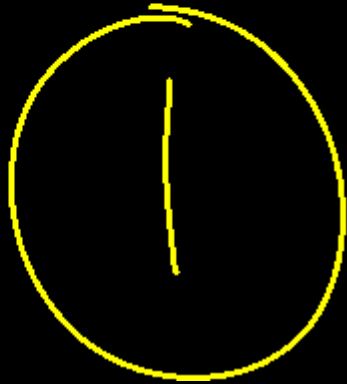
Artificial insemination means

- (1) Transfer of sperms of husband to a test tube containing ova.
- (2) ✓ Artificial introduction of sperms of a healthy donor into the vagina.
- (3) Introduction of sperms of a healthy donor directly into the ovary.
- (4) Transfer of sperms of a healthy donor to a test tube containing ova.

2

cry gene is obtained from

- (1) Bacillus thuringiensis
- (2) Bacillus subtilis
- (3) Clostridium welchi
- (4) E. coli



**Question no. 114**

Match List-I with List-II.

	<b>List-I</b> <b>(Excretory organs)</b>		<b>List-II</b> <b>(Animals)</b>
A.	Nephridia	i.	Cockroach
B.	Malpighian tubules	ii.	Earthworm
C.	Protonephridia	iii.	Human
D.	Kidneys	iv.	Flat worms

1

Choose the correct answer from options given below:

- (1) ✓ A – ii, B – i, C – iv, D – iii
- (2) A – iv, B – ii, C – i, D – iii
- (3) A – i, B – ii, C – iv, D – iii
- (4) A – ii, B – iv, C – iii, D – i

Question no. 115

Gel electrophoresis is used for

- (1) Construction of recombinant DNA by joining with cloning vectors.
- (2) Isolation of DNA molecules.
- (3) Cutting DNA into fragments.
- (4) Separation of DNA fragments according to their size.

4

Question no. 116

Progestogens in the contraceptive pill

- (1) prevents ovulation
- (2) inhibits estrogen
- (3) checks attachment of zygote endometrium
- (4) provide protection against STIs.



Question no. 117

Match List-I with List-II.

	List-I		List-II
A.	<u>Darwin</u>	i.	Abiogenesis
B.	<u>Oparin</u>	ii.	Use and disuse of organs
C.	<u>Lamarck</u>	iii.	Continental drift theory
D.	<u>Wagner</u>	iv.	Evolution by natural selection

A - iv  
B - i  
C - ii  
D - iii

Choose the correct answer from options given below:

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

2

**Question no. 118**

Match List-I with List-II.

	List-I		List-II
A.	FSH	i.	Normal growth
B.	GH	ii.	Ovulation
C.	Prolactin	iii.	Parturition
D.	Oxytocin	iv.	Milk secretion

Choose the correct answer from options given below:

- (1) ✓ A – ii, B – i, C – iv, D – iii
- (2) A – ii, B – i, C – iii, D – iv
- (3) A – i, B – iv, C – iii, D – ii
- (4) A – i, B – ii, C – iv, D – iii

1

Question no. 119

A tissue is a group of cells which are

- (1) similar in origin, but dissimilar in structure and function.
- (2) dissimilar in origin, structure and function.
- (3) dissimilar in origin, but similar in structure and function.
- (4) similar in origin and function, may be similar or dissimilar in structure

Question no. 120

The symbiotic association between fungi and algae is called.

- (1) lichen
- (2) mycorrhiza
- (3) rhizoid
- (4) endomycorrhiza

## Question no. 121

Given below are two statements :

**Statement I :** Bacteria can be classified into two groups (gram-positive and gram-negative) on the basis of differences in cell envelope only.

**Statement II :** The plasma membrane is selectively permeable in nature.

In the light of the above statements, choose the correct 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 statement II is incorrect.
- (4) Statement I is incorrect but statement II is correct.

A student is given specimens of Bufo, Rana, Hyla, Salamandra and Ichthyophis. She is asked to identify which one is limbless. Which amphibian is limbless?

- (1) Bufo
- (3) Hyla

- (2) Rana
- (4) Ichthyophis

(limbless amphibian)

4

Question no. 123

Given below are two statements :

**Statement I :** Bryophytes are known as amphibians of the plant kingdom.

**Statement II :** The dominant phase in all Bryophytes is gametophyte.

In the light of the above statements, choose the correct 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 statement II is incorrect.
- (4) Statement I is incorrect but statement II is correct.

Question no. 124

Which of the following statements is not correct for stomatal apparatus?

- (1) Inner walls of guard cells are thick and inelastic.
- (2) Guard cells invariably possess chloroplasts and mitochondria.
- (3) Guard cells do not possess subsidiary cells.
- (4) Stomata are involved in gaseous exchange.

Question no. 125

Tendons and ligaments are the examples of

- (1) areolar connective tissue
- (2) adipose tissue
- (3)  dense regular connective tissue
- (4) loose connective tissue



Question no. 126

Read the following statements and choose the correct statement.

A. Glycine does not contain any sulphur group. ✓

B. Lipids are not polymeric. ✓

C. Concanavalin A is a lectin. ✓

D. Lysine is a basic amino acid. W.A.L.

E. Adenine pairs with thymine through three H-bonds.

(1) A, B and E only

(2) B, C and D only

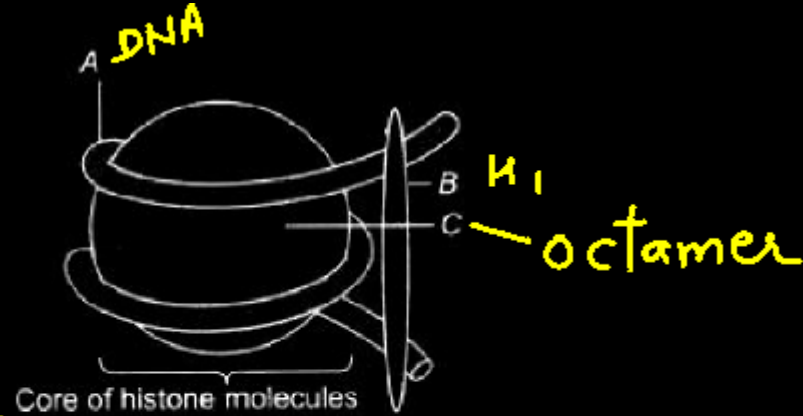
(3) C, D and E only

(4) A, B, C and D only ✓

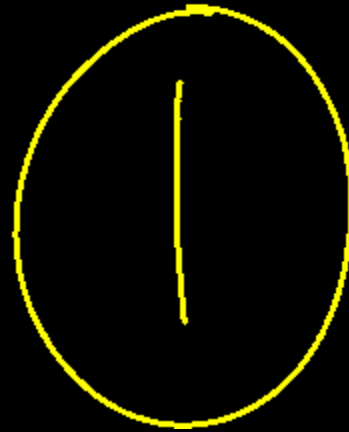
9

Question no. 127

Identify A, B and C of a nucleosome.



- (1) A – DNA; B – H1 histone; C – Histone octamer
- (2) A – H1 histone; B – DNA; C – Histone octamer
- (3) A – Histone octamer; B – RNA; C – H1 histone
- (4) A – RNA; B – H1 histone; C – Histone octamer



Question no. 128

The use of bioresources by multinational companies and other organisations without proper authorisation from the countries and people concerned without compensatory payment is called.

- (1) bioethics
- (2) biopiracy
- (3) bioterror
- (4) bioweapon

2

Question no. 129

Oxidative phosphorylation refers to

- (1) ~~anaerobic production of ATP.~~
- (2) ~~production of ATP by citric acid cycle.~~
- (3) production of ATP by chemiosmosis.
- (4) ~~alcoholic fermentation.~~

~~2~~

3

Question no. 130

Match the following families with their economic products :

Malvaceae → Cotton, Jute

Brassicaceae → Mustard oil, Radish

Asteraceae → Sunflower oil, Lettuce

Poaceae → Rice, Sugarcane

Choose the correct matching set:

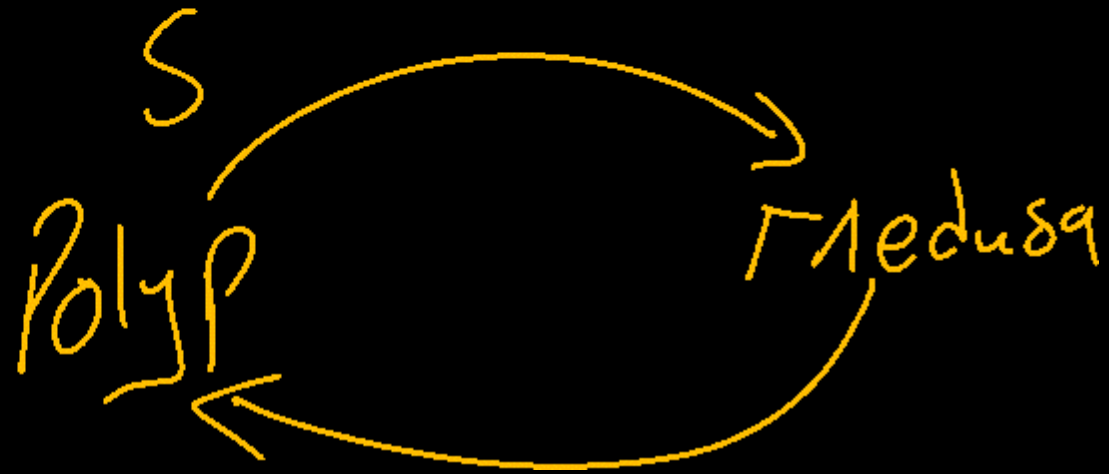
- (1) All four correct.
- (2) Malvaceae and Brassicaceae only
- (3) Brassicaceae and Asteraceae only
- (4) Asteraceae and Poaceae only

## Question no. 131

Metagenesis refers to :

- (1) Alteration of generation between asexual and sexual phases of an organism.
- (2) Occurrence of a drastic change in form during post embryonic development.
- (3) Presence of a segmented body and parthenogenetic mode of reproduction.
- (4) Presence of different morphic forms.

Obelia. (1)



Question no. 132

Which one of the following group of codons is called as degenerate codons?

- (1) UAA, UAG and UGA ✓
- (2) GUA, GUG, GCA, GCG and GAA
- (3) UUC, UUG, CCU, CAA and CUG
- (4) UUA, UUG, CUU, CUC, CUA and CUG

leucine

4

### Question no. 133

Some vascular bundles are described as open because these

- (1) are surrounded by pericycle but not endodermis
- (2) are capable of producing secondary xylem and phloem.
- (3) possess conjunctive tissue between xylem and phloem.
- (4) are not surrounded by pericycle.

**Question no. 134**

Match List-I with List-II.

	<b>List-I</b> <b>(Type of neuron)</b>		<b>List-II</b> <b>(location)</b>
A.	Unipolar neuron	I.	In cerebral cortex
B.	Bipolar neuron	II.	In embryonic stage
C.	Multipolar neuron	III.	In retina of eye
D.	Nodes or Ranvier	IV.	Gaps between two adjacent myelin sheaths

4

Choose the correct answer from options given below:

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

Question no. 135

To make 100 molecules of glucose, how many molecules of ATP and NADPH are required?

- (1) 1800 and 1200 respectively
- (2) 1200 and 1800 respectively
- (3) 1800 and 600 respectively
- (4) 200 and 600 respectively

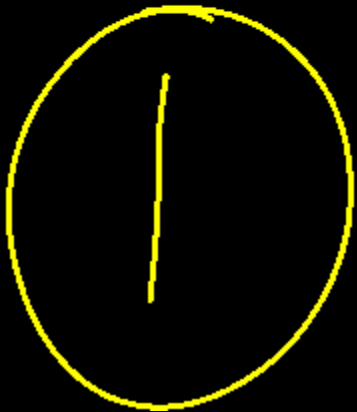
C<sub>3</sub> cycle

1 Glucose

18 ATP  
12 NADPH<sub>2</sub>

1800 ATP  
1200 NADPH<sub>2</sub>

100 Gly



Question no. 136

The enzyme that is not found in a  $C_3$  plant is:

- (1) ~~RuBP carboxylase~~ (2) PEP carboxylase  
(3) ~~NADP reductase~~ (4) ~~ATP synthase~~

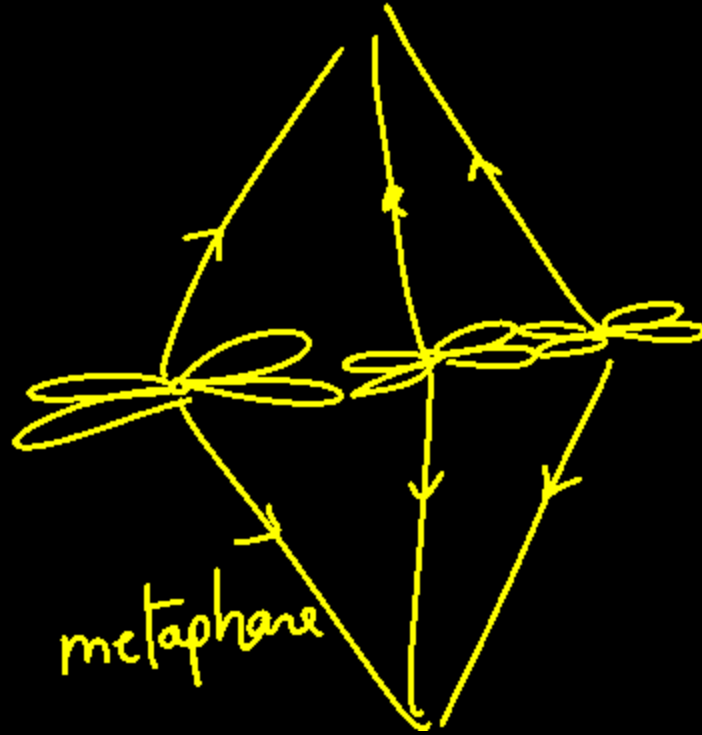
2

Question no. 137

The major event that occurs during the anaphase of mitosis, which brings about the equal distribution of chromosomes is

- (1) replication of the genetic material
- (2) splitting of the chromatids
- (3) splitting of the centromeres
- (4) condensation of the chromatin

3



Match List-I with List-II.

	List-I (Respiratory capacities)		List-II (Respiratory volumes)
A.	Residual volume	I.	Additional volume of air, a person can inspire by a forcible inspiration
B.	Vital capacity	II.	Total volume of air a person can inspire after a normal expiration <b>IC</b>
C.	Inspiratory reserve volume	III.	Volume of air remaining in the lungs even after a forcible expiration <b>RV</b>
D.	Inspiratory capacity	IV.	The maximum volume of air a person can breathe in after a forced expiration

A - iii  
 B - iv  
 C - i  
 D - ii

Choose the correct answer from options given below:

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

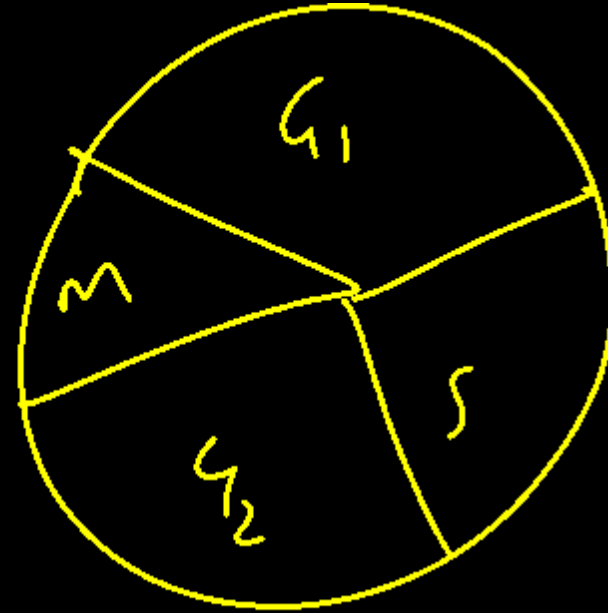
4

Question no. 139

Which of the following statement(s) is/are correct about S-phase (synthetic phase)?

- A.  It occurs between  $G_1$  and  $G_2$  phase.
- B.  It marks the period during which DNA replicates.
- C.  At the end of this phase, DNA is doubled but the number of chromosomes remains unchanged.
- D.  As the DNA is doubled in this phase, number of chromosomes is also doubled.
- E.  Amount of DNA changes from  $2C$  to  $4C$ .

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



2

Question no. 140

Variation shown by the medicinal plant *Rauwolfia* growing in different Himalayan ranges comes under

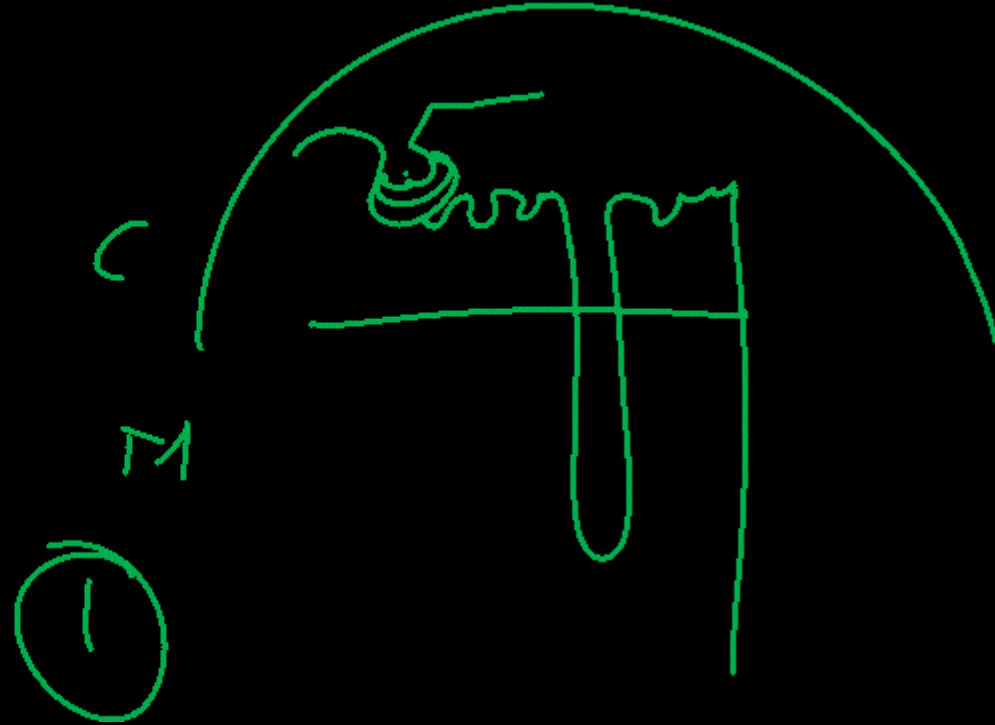
- (1) Species diversity
- (2) Ecological diversity
- (3) Genetic diversity
- (4) Population diversity

Question no. 141

Which of the following structures are situated in the cortical region of the kidney are.

- A. Malpighian corpuscle ✓
- B. PCT (Proximal Convoluted Tubules) ✓
- C. DCT (Distal Convoluted Tubules) ✓
- D. Collecting duct
- E. Loop of Henle

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



Question no. 142

Which of the following contraceptive method correctly matches with its mode of action?

	Contraceptive method	Mode of action
(1)	Tubectomy	Makes the <u>uterus</u> unsuitable for <u>implantation</u> $\phi$
(2)	Oral pills	Inhibit ovulation and implantation
(3)	Diaphragms	Spermicidal and increases phagocytosis or sperm within the uterus
(4)	IUDs	Blocks gamete transport

2

Question no. 143

Incidence of emphysema a respiratory disorder is high in cigarette smokers. In such cases.

- (1) the bronchioles are found ~~damaged~~
- (2) the alveolar ~~walls~~ are found damaged
- (3) the plasma membrane is found damaged
- (4) the respiratory muscles are found damaged

2

Question no. 144

Tidal volume and expiratory reserve volume of an athlete is 500 mL and 1000 mL, respectively. What will be his expiratory capacity if the residual volume is 1200 mL?

- (1) 1700 mL                      (2) 2200 mL  
(3) 2700 mL                      (4) 1500 mL

$TV = 500 \text{ mL}$   
 $ERV = 1000 \text{ mL}$   
 $RV = 1200 \text{ mL}$

$EC = TV + ERV$

4

Question no. 145

Name the chronic respiratory disorder caused mainly by cigarette smoking.

- (1) Asthma                      (2) Respiratory acidosis  
(3) Respiratory alkalosis (4)  Emphysema

4

Question no. 146

What causes the lub sound in the heart?

- (1) Opening of semilunar valves
- (2) Closure of semilunar valves
- (3) Closure of atrioventricular valves
- (4) Contraction of ventricles

3

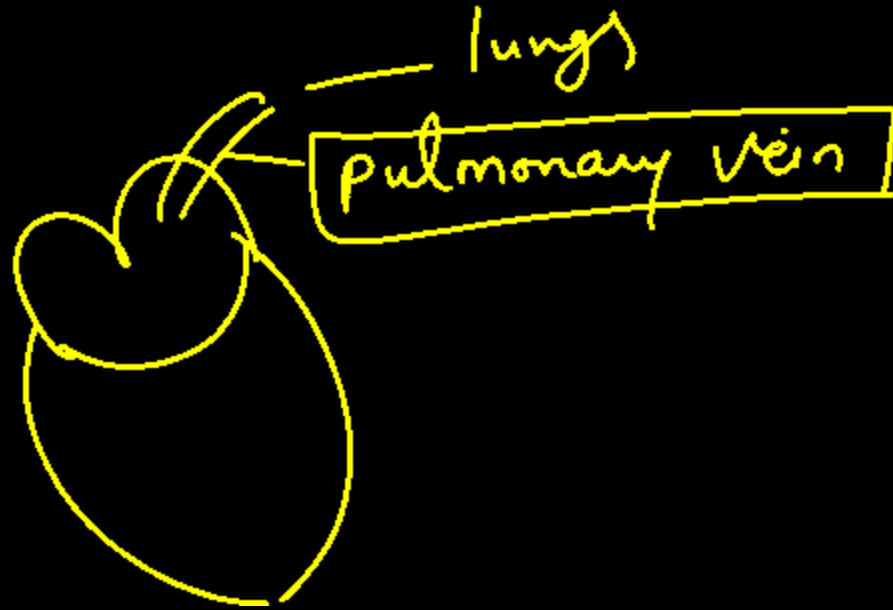


Question no. 147

Which blood vessel carries oxygenated blood from the lungs to the heart?

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

2



Question no. 148

A certain road accident patient with unknown blood group needs immediate blood transfusion. His one doctor friend at once offers his blood. What was the blood group of the donor?

- (1) Blood group B      (2) Blood group AB  
(3) Blood group O      (4) Blood group A

3

Question no. 149

What would be the stroke volume of a person having cardiac output of 6000 mL per minute with 75 heartbeats per minute?

(1) 78 mL

(2) 82 mL

(3) 90 mL

(4) 80 mL

4

$$C.O = S.V. \times H.R$$

$$804 \begin{array}{r} 6000 = S.V \times 75 \\ \times 75 \\ \hline 6000 \\ \hline S.V \end{array}$$

Question no. 150

The diagram given here is the standard ECG of a normal person. The T-wave represents the

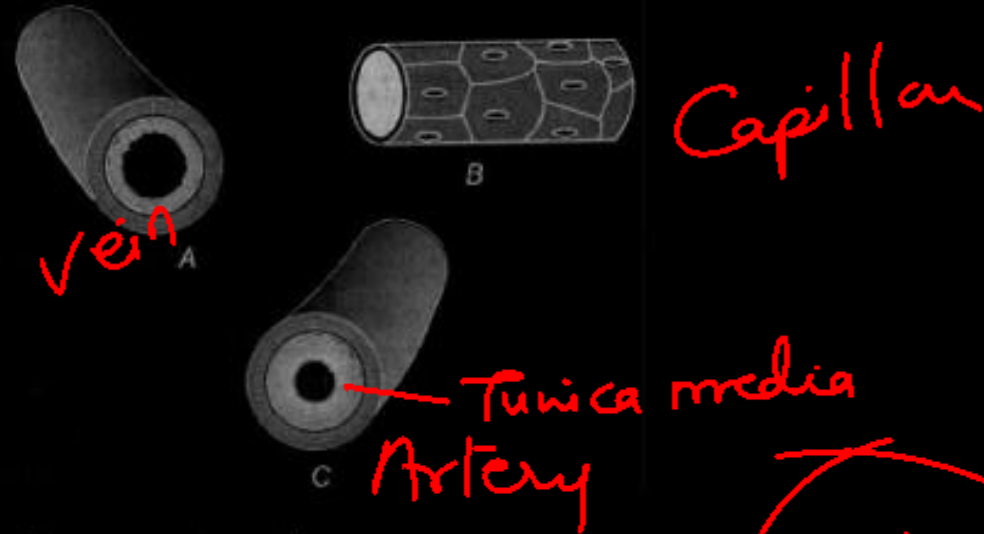


- (1) contraction of both atria
- (2) beginning of systole
- (3) repolarization of ventricles
- (4) end of systole

3

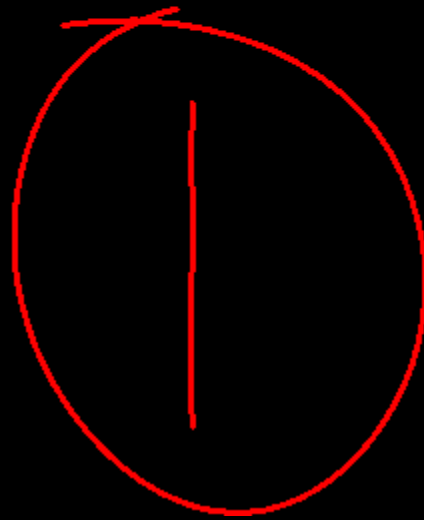
Question no. 151

Identify A, B and C in the given diagram



Choose the correct option.

- (1) A-Vein, B-Capillary, C-Artery
- (2) A-Artery, B- Vein, C- Capillary
- (3) A- Vein, B- Artery, C- Capillary
- (4) A- Capillary , B- Artery, C- Vein



Question no. 152

Order of toxicity among ammonia, urea and uric acid  
(from least to maximum) is

- (1) uric acid < urea < ammonia
- (2) uric acid < ammonia < urea
- (3) urea < ammonia < uric acid
- (4) ammonia < urea < uric acid

1

Question no. 153

Which hormone increases permeability of the distal tubules and collecting duct to water

- (1) Renin
- (2) Aldosterone
- (3) ANF
- (4) ADH

4

Question no. 154

For how long, contraction of the muscles continues in sliding filament theory?

- (1) Till ATP binds to myosin head
- (2) Till ADP binds to myosin head
- (3)  Till  $\text{Ca}^{2+}$  is present in sarcoplasm
- (4) Till polymerization of myosin head is going on

3

Sarcoplasmic Reticulum  
↓  $\text{Ca}^{2+}$  release

↓ Sarcoplasm.

↓  
M/A

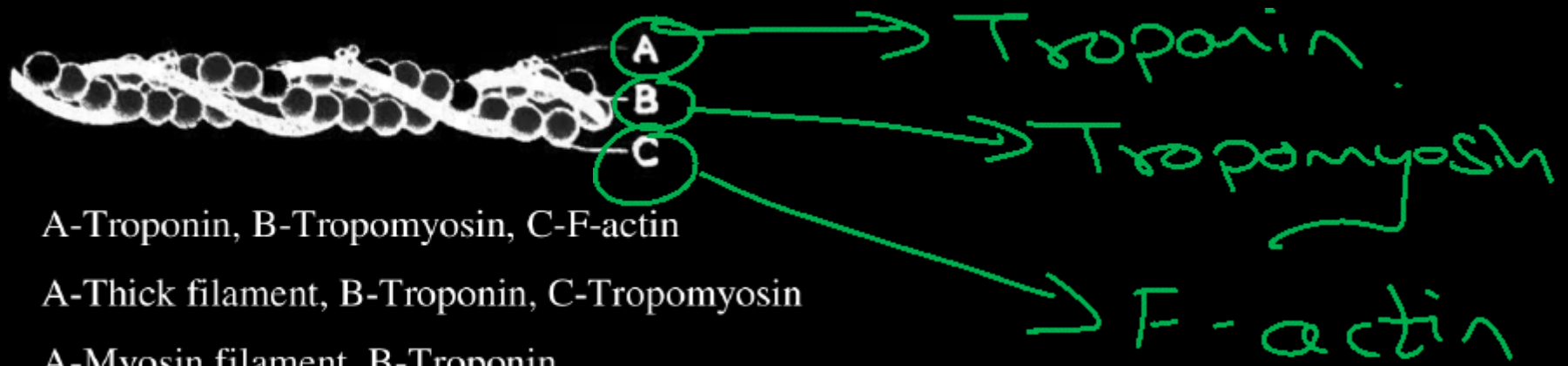
Question no. 155

The joint present between the parietal bone and temporal bone of the skull is

- (1)  fibrous joint
- (2)  cartilaginous joint
- (3)  ball and socket joint
- (4)  pivot joint

Question no. 156

Identify A, B and C in the given diagram.



- (1) A-Troponin, B-Tropomyosin, C-F-actin
- (2) A-Thick filament, B-Troponin, C-Tropomyosin
- (3) A-Myosin filament, B-Troponin, C-Tropomyosin
- (4) A-Meromyosin, B-Troponin, C-Tropomyosin

①

Question no. 157

Select the pairs that matches correctly to the parts given.

- (1) Hindbrain – Medulla, thalamus, pons
- (2) Mid-Brain – Medulla, thalamus, spinal cord
- (3) Brain stem – Midbrain, pons, medulla
- (4) Brain stem – Brain, spinal cord, pons

3

## Question no. 158

Which of the following structures or regions is incorrectly paired with its functions?

(1)	Medulla oblongata	Controls respiration and cardiovascular reflexes.
(2)	Limbic system <i>A Emo.</i>	Consists of fibre tracts that <u>interconnect different regions of brain</u>
(3)	Hypothalamus	Production of releasing hormones and regulation of temperature hunger and thirst.
(4)	Corpus callosum	<u>Band of fibres connecting left and right cerebral hemispheres.</u>

2

Question no. 159

**Assertion (A) :** Diabetes insipidus is marked by excessive urination and much thirst of water.

**Reason (R) :** ADH is secreted by posterior lobe of pituitary.

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

2

Question no. 160

**Assertion (A)** : In old persons, there is gradually weakening of immune system.

**Reason (R)** : it is because of degeneration of thymus gland.

T-cell ↓

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

1

Question no. 161

More than one ovule in an ovary is found in

(1) watermelon, paddy, wheat

(2) maize, mango, wheat

(3) wheat, paddy, mango

~~(4) watermelon, papaya, orchids~~

*single ovule*

Question no. 162

The outermost and innermost wall layers of microsporangium in an anther are respectively

- (1) Endothecium and tapetum
- (2) Epidermis and endodermis
- (3) Epidermis and middle layer
- (4) Epidermis and tapetum



Question no. 163

Select the correct option of haploid cells from the following groups?

- (1) Primary oocyte, secondary oocyte, spermatid
- (2) Secondary spermatocyte, first polar body, ovum
- (3) Spermatogonia, primary, spermatocyte, spermatid
- (4) Primary spermatocyte, secondary spermatocyte, second polar body

2

Question no. 164

Among the given problems, which one is not related  
to reproductively healthy society ?

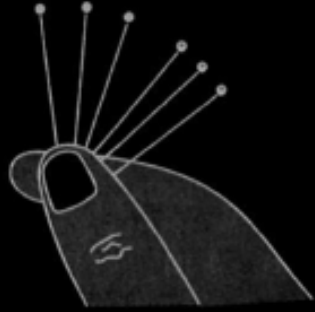
- (1) Over population
- (2) Low infant mortality rate
- (3) Increased livelihood facilities
- (4) High maternal mortality rate

MMR

4

## Question no. 165

Refer to the given figure. Which of the following correctly explains their mechanism of action ?

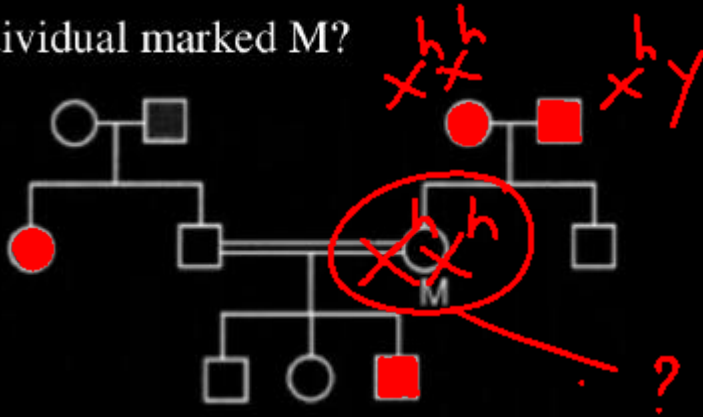


- (1) They inhibit spermatogenesis in males by reducing FSH secretion
- (2) They release progestogens / oestrogen-progestogen combinations, which inhibit ovulation and implantation and alter cervical mucus.
- (3) They are inserted into the uterine cavity to prevent implantation by creating a foreign body reaction
- (4) They act as emergency contraceptives only, effective only if used within 72 hours of coitus.

2

Question no. 166

The diagram given below shows the inheritance of haemophilia in a family. What will be the genotype of the individual marked M?



- (1) M - XY                      (2) M - XX  
(3) M - X<sup>h</sup>X<sup>h</sup>                  (4) M = X<sup>h</sup>X

3

*Gene related*

Which of the following is/are Mendelian disorder ?

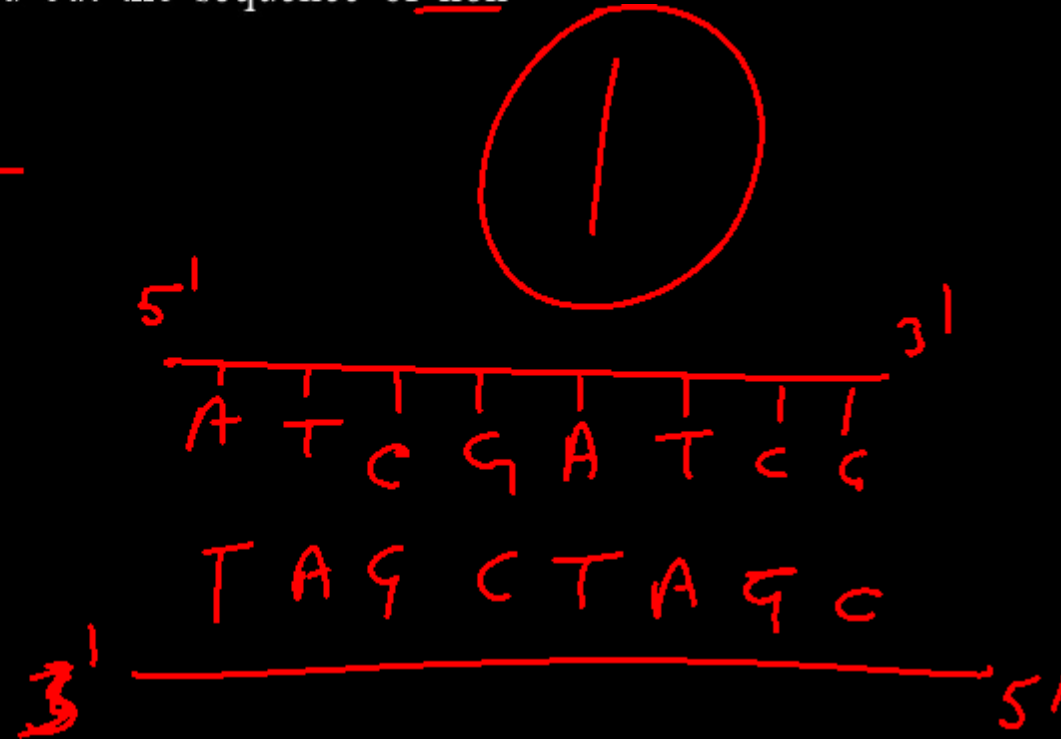
- (1) Thalassemia
- (2) Cystic fibrosis
- (3) Phenylketonuria
- (4) All of the above

4

Question no. 168

If the coding strand has the sequence 5'-ATCGATCG-3' then find out the sequence of non-coding strand

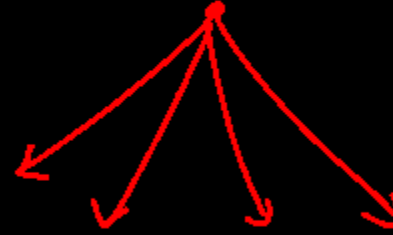
- (1) 3'-TAGCTAGC-5'
- (2) ~~5'-TAGGTACG-3'~~
- (3) ~~3'-UAGGUACG-5'~~
- (4) ~~5'-UACFUACG-3'~~



Homologous

Tendrils of Cucurbita and thorns of Bougainvillea are

- (1) ~~homologous~~ organs that have evolved due to ~~convergent~~ evolution.
- (2) homologous organs that have evolved due to divergent evolution.
- (3) ~~analogous~~ organs that have evolved due to ~~convergent~~ evolution.
- (4) ~~analogous~~ organs that have evolved due to ~~divergent~~ evolution.



2

Question no. 170

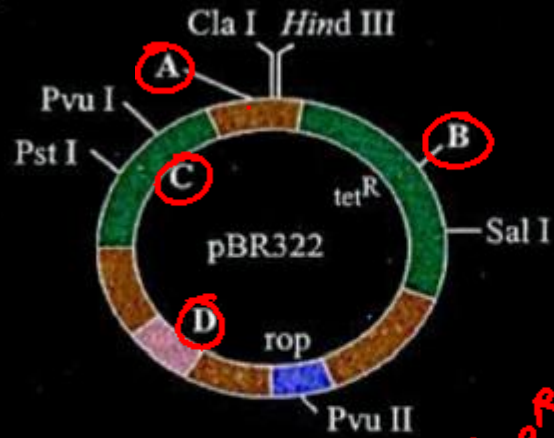
The word NACO stands for

- (1) National AIDS control Organisation
- (2) Non – governmental AIDS control Organisation
- (3) National Agrochemical Organisation
- (4) National Anti AIDS Co-operative Organisation

1

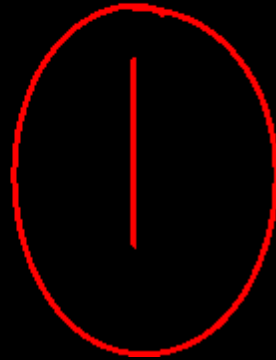
## Question no. 171

Identify A, B, C and D in the given diagram of E. coli cloning vector pBR322



A - Eco RI  
 B - Bam HI  
 C - Amp<sup>R</sup>  
 D - Ori

- (1) A-Eco RI, B - Bam HI, C - Ori, D - ~~amp<sup>R</sup>~~ ori
- (2) A-amp<sup>R</sup>, B-ori, C - Bam HI, D -Eco RI
- (3) A-ori, B-Bam HI, C-Eco RI, D - amp<sup>R</sup>
- (4) A-Bam HI, B - Eco RI, C-amp<sup>R</sup>, D - Ori



Question no. 172

Which of the following enzymes catalyses the removal of nucleotides from the ends of DNA ?

- (1) Endonuclease      (2) Exonuclease  
(3) DNA ligase        (4) Hind II

2

## Question no. 173

'Restriction' in restriction enzyme refers to

- (1) cleaving of phosphodiester bond in DNA by the enzyme.
- (2) cutting of DNA at specific position only.
- (3) prevention of the multiplication of bacteriophage by the host bacteria.
- (4) All of the above.

3

Question no. 174

Animals whose DNA is manipulated to express desired characters are known as

- (1) transgenic animals ✓
- (2) hybrid animals ✗
- (3) transversion animals ✗
- (4) genetically manipulated animals ✗

1

Question no. 175

Which factor shows a negative effect on the population growth rate ?

- (1) Immigration      जनक वृद्धि  $\rightarrow$  +ve
- (2) Natality        जनक  $\rightarrow$  +ve
- (3) Emigration       $\rightarrow$  +ve
- (4) Population interaction      जनक वृद्धि  $\rightarrow$  -ve

## Question no. 176

Logistic growth is represented by which of the following equation ?

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

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

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

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

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

Question no. 177

A bear that eats a fish that earlier eat bugs that eat algae is an example of a.

- (1) primary producer
- (2) primary consumer
- (3) secondary consumer
- (4) tertiary consumer



## Question no. 178

Select the strategies for ex situ conservation from the list given below :

- i. Zoological parks
- ii. Sacred groves
- iii. Gene banks
- iv. Botanical gardens

- (1) ii, iii and iv
- (2) i, ii and iii
- (3) i, iii and iv
- (4) i, ii, iii and iv

Question no. 179

If  $\log A = 4$ ,  $Z = 0.3$ , and  $\text{Log } C = 0.8$ , find the value of  $\log 'S'$  ?

- (1) 3.76
- (2) 100
- (3) 4.24
- (4) 2

$$\begin{aligned}\log S &= \log C + Z \log A \\ &= 0.8 + (0.3 \times 4) \\ &= 0.8 + 1.2 = \underline{2}\end{aligned}$$

Question no. 180

Which one of the following group of organisms are exotic species introduced in India?

- (1) Lantana, Eichhornia, Vallisneria
- (2) Nelumbia, Parthenium, Eichhornia
- (3) Lantana, Eichhornia, Parthenium
- (4) Nelumbia, Nymphaea, Eichhornia

