

Question no. 1

The position of a particle as a function of time t , is given by $x(t) = at + bt^2 - ct^3$, where a , b and c are constants. When the particle attains zero acceleration, then its velocity will be

(1) $a + \frac{b^2}{2c}$

(2) $a + \frac{b^2}{4c}$

(3) $a + \frac{b^2}{3c}$

(4) $a + \frac{b^2}{c}$

3

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

$$v = a + 2bt - 3ct^2$$

$$a = \frac{dv}{dt}$$

$$v = a + 2b\left(\frac{b}{3c}\right) - 3c\left(\frac{b}{3c}\right)^2$$

$$a = 2b - 6ct$$

$$a = 0$$

$$t = \frac{2b}{6c} = \frac{b}{3c}$$

$$v = a + \frac{2b^2}{3c} - \frac{3b^2}{9c}$$

$$v = a + \frac{b^2}{3c}$$

3

Question no. 2

A position dependent force $F = 3x^2 - 2x + 7$ acts on a body of mass 7 kg and displaces it from $x = 0$ m to $x = 5$ m. The work done on the body is y joule. If both F and x are measured in SI units, the value of y is

(1) 135

(2) 235

(3) 335

(4) 935



$$W = \int \vec{F} \cdot d\vec{x}$$
$$y \text{ (W)} = \int_0^5 (3x^2 - 2x + 7) dx$$

$$y = (x^3 - x^2 + 7x)_0^5$$

$$y = 5^3 - 5^2 + 7 \times 5 = 125 - 25 + 35$$

$$y = 135 \text{ Joule}$$

Question no. 3

The displacement of a particle moving along x-axis with respect to time t is $x = at + bt^2 - ct^3$. The dimensions of c are

(1) $[T^{-3}]$

(2) $[LT^{-2}]$

(3) $[LT^{-3}]$

(4) $[LT^3]$

$$[x] = [ct^3]$$

$$[x] = [c] [t^3]$$

$$[L] = [c] [T^3]$$

$$[c] = [LT^{-3}]$$

3

3

Question no. 4

A body of mass 50 kg is on verge of motion on inclined plane of angle 30° with the horizontal. The coefficient of friction between the body and the plane is

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

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

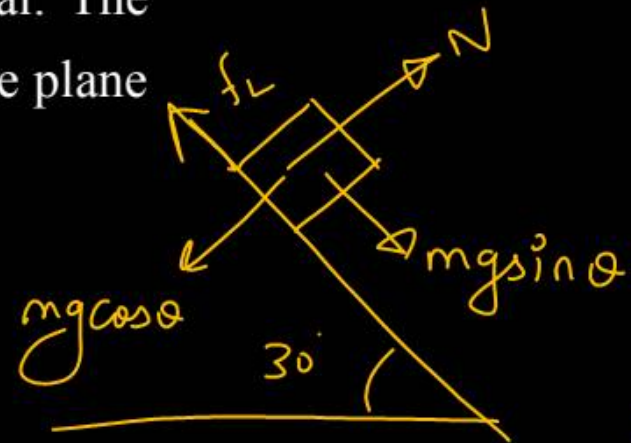
(3) $\frac{1}{\sqrt{2}}$

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

1

$\mu = \frac{1}{\sqrt{3}}$

friction is limiting



$f_L = mg \sin \theta$

$\mu N = mg \sin \theta$

$\mu mg \cos \theta = mg \sin \theta$

$\mu = \tan \theta$

Question no. 5

A body is projected up from the surface of the earth with velocity $\left(\frac{3}{4}\right)^{\text{th}}$ of its escape velocity. If R be the radius of earth, the height it reaches is

(1) $\frac{3R}{10}$

(2) $\frac{9R}{7}$

(3) $\frac{8R}{5}$

(4) $\frac{9R}{5}$

2



$$7h + 7R = 16R$$

$$7h = 9R$$

$$h = \frac{9R}{7}$$

$$v_e = \sqrt{\frac{2GM}{R}}$$

$$K_i + U_i = K_f + U_f$$

$$\frac{1}{2}m \left(\frac{3}{4}\sqrt{\frac{2GM}{R}}\right)^2 - \frac{GMm}{R}$$

$$= 0 - \frac{GMm}{h+R}$$

$$\frac{9}{32} \frac{2GMm}{R} - \frac{GMm}{R} = -\frac{GMm}{h+R}$$

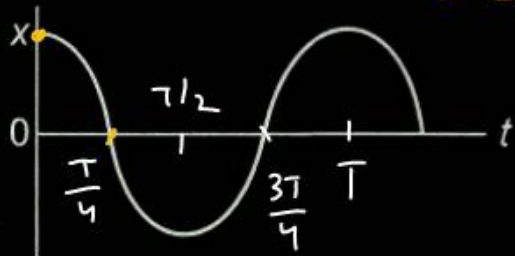
$$\frac{9}{16R} - \frac{1}{R} = -\frac{1}{h+R}$$

$$\frac{-7}{16R} = -\frac{1}{h+R}$$

Question no. 6

The displacement-time graph of a particle executing S.H.M. is shown below

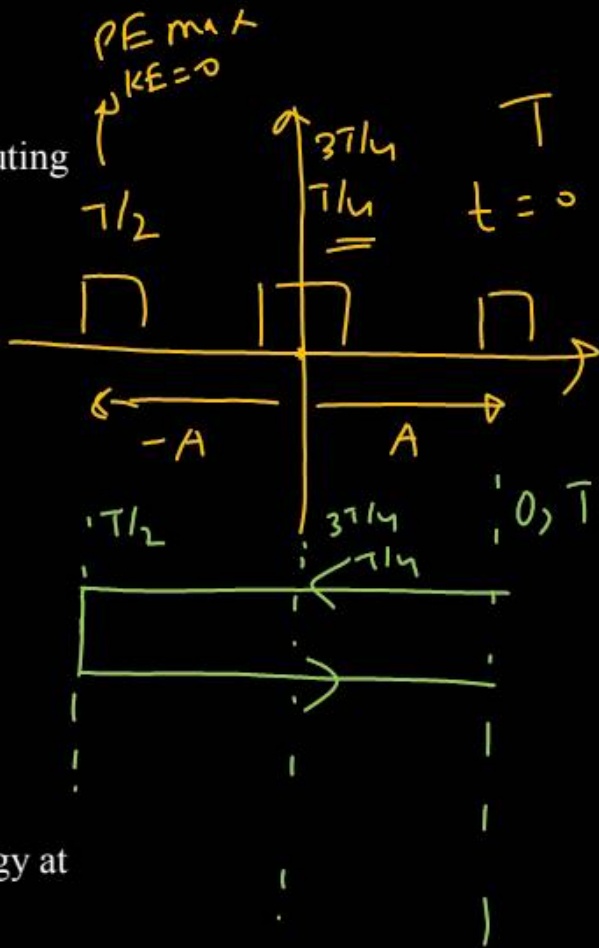
Cos graph



Which of the following statement(s) is (are) true?

- (i) The force is zero at $t = 3T/4$.
- (ii) The acceleration is maximum at $t = T$.
- (iii) The velocity is maximum at $t = T/4$.
- (iv) The potential energy is equal to kinetic energy at $t = T/2$.

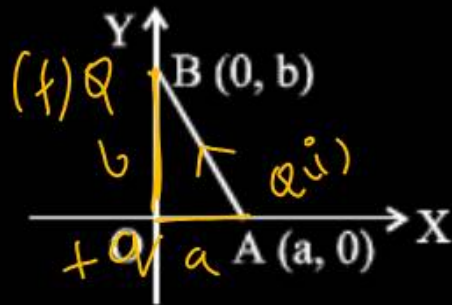
- (1) i and ii
- (2) i, ii and iii
- (3) i and iv
- (4) all of these



2

Question no. 7

A charge $+q$ is placed at the origin O of X - Y axes as shown in the figure. The work done in taking a charge Q from A to B along the straight line AB is



(1) $\frac{qQ}{4\pi\epsilon_0} \left(\frac{a-b}{ab} \right)$

(2) $\frac{qQ}{4\pi\epsilon_0} \left(\frac{b-a}{ab} \right)$

(3) $\frac{qQ}{4\pi\epsilon_0} \left(\frac{b}{a^2} - \frac{1}{b} \right)$

(4) $\frac{qQ}{4\pi\epsilon_0} \left(\frac{a}{b^2} - \frac{1}{b} \right)$

$$W_{ext} = U_f - U_i$$

$$= U_B - U_A$$

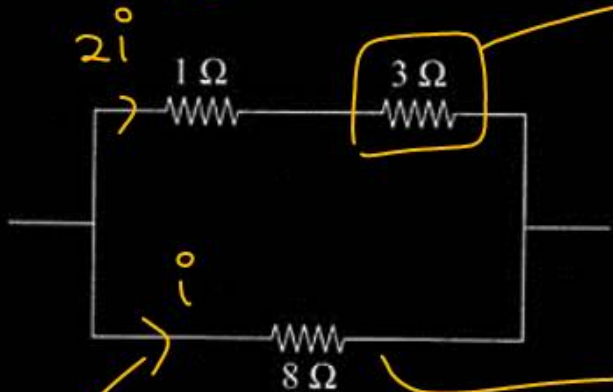
$$= \frac{k\phi q}{b} - \frac{k\phi q}{a}$$

$$= \frac{\phi q}{4\pi\epsilon_0} \left(\frac{1}{b} - \frac{1}{a} \right)$$

$$= \frac{\phi q}{4\pi\epsilon_0} \left(\frac{a-b}{ab} \right)$$

Question no. 8

Power dissipated across the 8 Ω resistor in the circuit shown here is 2 watt. The power dissipated in watt units across the 3 Ω resistor is



- (1) 3.0
- (2) 2.0
- (3) 1.0
- (4) 0.5

1

$$i^2 \times 8 = 2$$
$$i^2 = \frac{1}{4}$$

$$P = i^2 \times 3$$

(current is 2i)

$$P = (2i)^2 \times 3$$

$$P = 4i^2 \times 3$$

$$P = 12i^2$$

$$P = 12 \times \frac{1}{4} = 3W$$

$$P = 3W$$

Question no. 9

If frequency of R-L circuit is f then impedance will be

(1) $\sqrt{R^2 + (2\pi fL)^2}$

(2) $R^2 + (2\pi f^2)^2$

(3) $\sqrt{(R^2 + L\pi f^2)}$

(4) $R^2 + (2\pi fL)^2$

$$Z = \sqrt{R^2 + X_L^2}$$

$$Z = \sqrt{R^2 + (2\pi fL)^2}$$

1

1

Question no. 10

Hydrogen atom is excited from ground state to another state with principal quantum number equal to 4. Then the number of spectral lines in the emission spectra will be

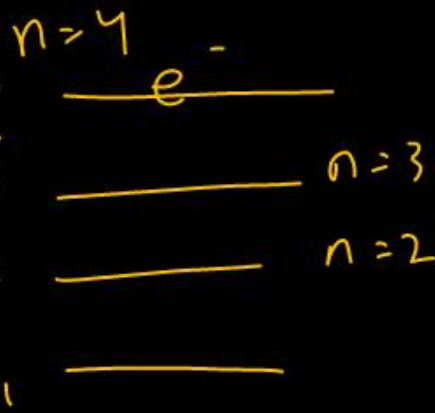
(1) 3

(2) 5

(3) 6

(4) 2

3

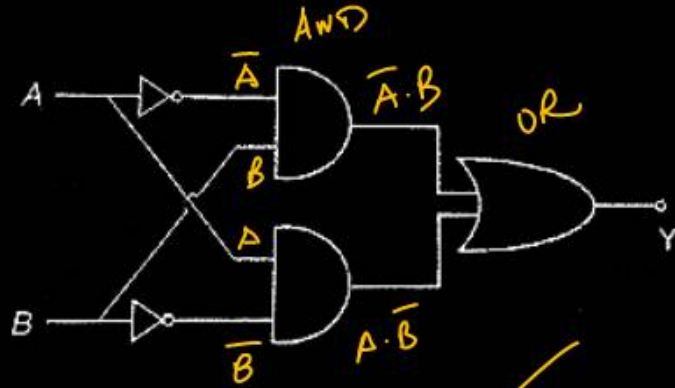


$$\frac{n(n-1)}{2}$$

$$\frac{4 \times (4-1)}{2} = \frac{12}{2} = 6 \checkmark$$

Question no. 11

The following circuit represents



$$Y = \bar{A}B + A\bar{B}$$

XOR

(1) OR gate

(2) XOR gate

(3) AND gate

(4) NAND gate

2

Question no. 12

Young's double slit experiment is first performed in air then in a medium other than air. It is found that 8th bright fringe in the medium lies where 5th dark fringe lies in air. The refractive index; of the medium is nearly

- (1) 1.59 (2) 1.69
 (3) 1.78 (4) 1.25

3

$$8^{\text{th}} \text{BF med} \equiv 5^{\text{th}} \text{DF air}$$

↳ position

$$8 \beta_{\text{med}} = \frac{9}{2} \beta_{\text{air}}$$

$$\frac{8 \cancel{\beta_{\text{air}}}}{n} = \frac{9 \cancel{\beta_{\text{air}}}}{2}$$

$$n = 16/9 = 1.777 \dots$$

Question no. 13

A girl riding a bicycle with a speed of 5 ms^{-1} towards east direction sees raindrops falling vertically downwards. On increasing the speed to 15 ms^{-1} , rain appears to fall making an angle of 45° of the vertical.

Find the magnitude of velocity of rain.

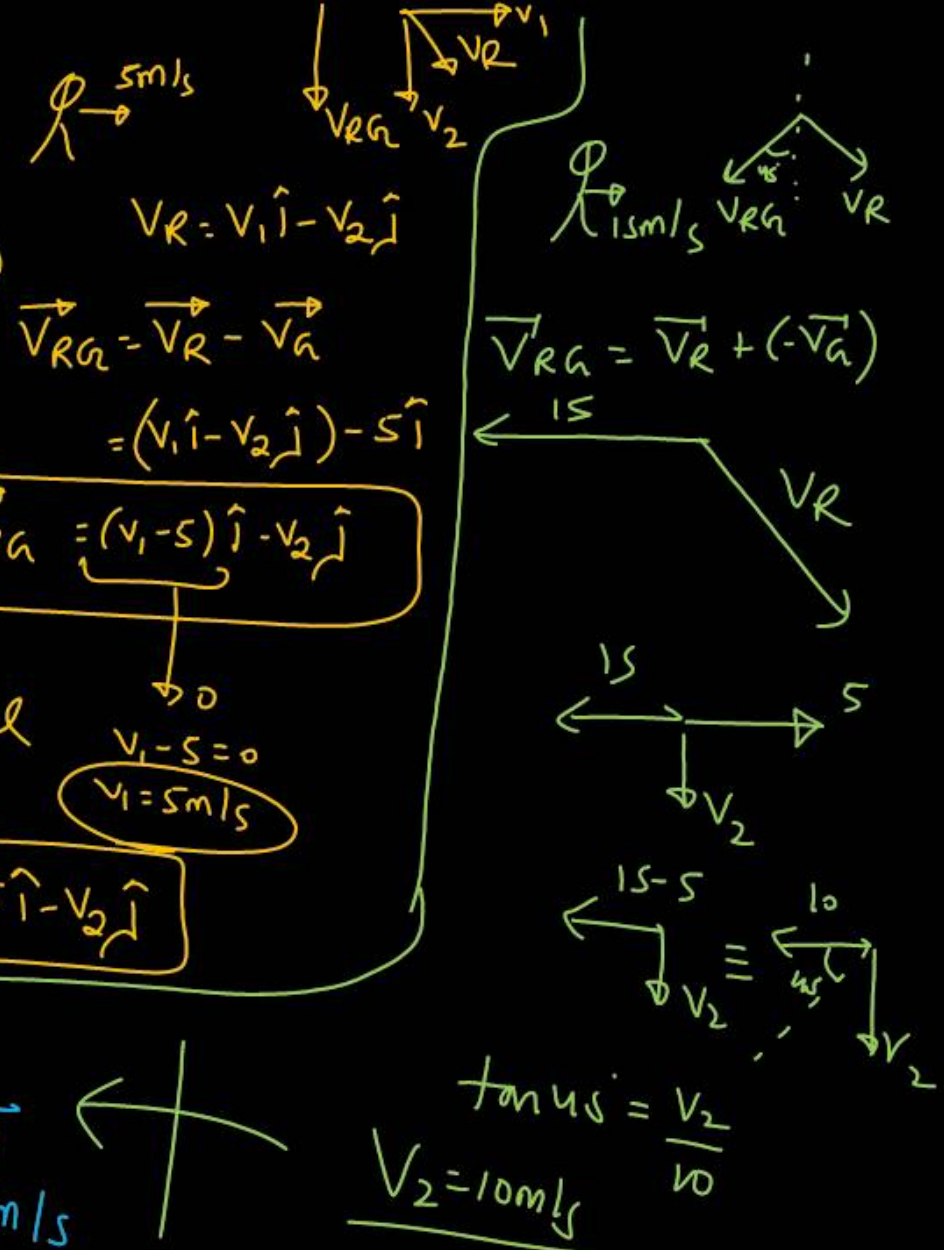
(1) 5 ms^{-1}

(2) $5\sqrt{5} \text{ ms}^{-1}$

(3) 25 ms^{-1}

(4) 10 ms^{-1}

2

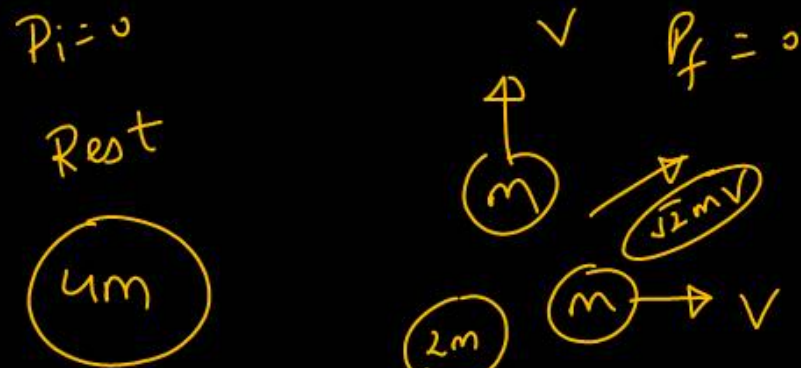


Question no. 14

A body of mass $4m$ is lying in xy -plane at rest. It suddenly explodes into three pieces. Two pieces each of mass m move perpendicular to each other with equal speeds v . The total kinetic energy generated due to explosion is

- (1) mv^2 (2) $(3/2)mv^2$
 (3) $2mv^2$ (4) $4mv^2$

2



$$2m v' = \sqrt{2} m v$$

$$v' = \frac{v}{\sqrt{2}}$$

$$\begin{aligned}
 KE &= \frac{1}{2} (2m) v'^2 + 2 \times \frac{1}{2} m v^2 \\
 &= m (v'^2 + v^2) \\
 &= m \left(\frac{v^2}{2} + v^2 \right) = \frac{3}{2} m v^2
 \end{aligned}$$

Question no. 15

A person throws balls into air vertically upward in regular intervals of time of one second. The next ball is thrown when the velocity of the ball thrown earlier becomes zero. The height to which the balls rise is

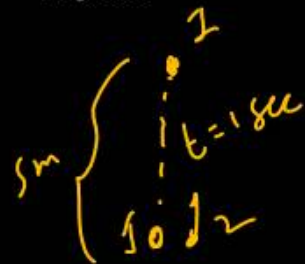
(Assume, $g = 10 \text{ m s}^{-2}$)

(1) 5 m ✓

(2) 10 m

(3) 7.5 m

(4) 20 m



$$\frac{u}{g} = 1$$

$$u = 10 \text{ m/s} \quad \checkmark$$

$$h = \frac{u^2}{2g} = \frac{100}{20} = 5 \text{ m} \quad \checkmark$$

Question no. 16

A rod of mass m and length l is made to stand at an angle of 60° with the vertical. Potential energy of the rod in this position is

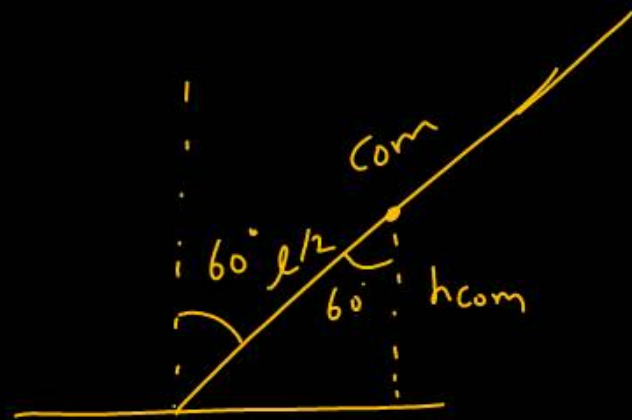
(1) $mg l$

(2) $\frac{mg l}{2}$

(3) $\frac{mg l}{3}$

(4) $\frac{mg l}{4}$

4



$$\cos 60^\circ = \frac{h_{com}}{l/2}$$

$$h_{com} = \frac{l}{2} \times \frac{1}{2} = \frac{l}{4}$$

$$U = mg h_{com}$$

$$U = mg \frac{l}{4}$$

$$U = \frac{mg l}{4}$$

Question no. 17

A wire of natural length l , Young's modulus Y and area of cross-section A is extended by x . Then the energy stored in the wire is given by

(1) $\frac{1}{2} \frac{YA}{l} x^2$

(2) $\frac{1}{3} \frac{YA}{l} x^2$

(3) $\frac{1}{2} \frac{Yl}{A} x^2$

(4) $\frac{1}{2} \frac{YA}{l^2} x^2$

1

Strain

$$\epsilon = \frac{x}{l}$$

Stress = σ

$$\frac{\sigma}{\epsilon} = Y$$

$$\frac{U}{V} = \frac{1}{2} \times \sigma \times \epsilon$$

$$U = \frac{1}{2} (\epsilon Y) (\epsilon) V$$

$$U = \frac{\epsilon^2 Y V}{2} = \frac{(x/l)^2 Y A l}{2} = \frac{x^2 A Y}{2 l}$$

Question no. 18

If a closed organ pipe of length L_1 in its fundamental mode resonates with an open organ pipe of length L_2 , then $L_1 : L_2$ is

(1) $1 : 2$

(2) $2 : 1$

(3) $1 : 4$

(4) $4 : 1$

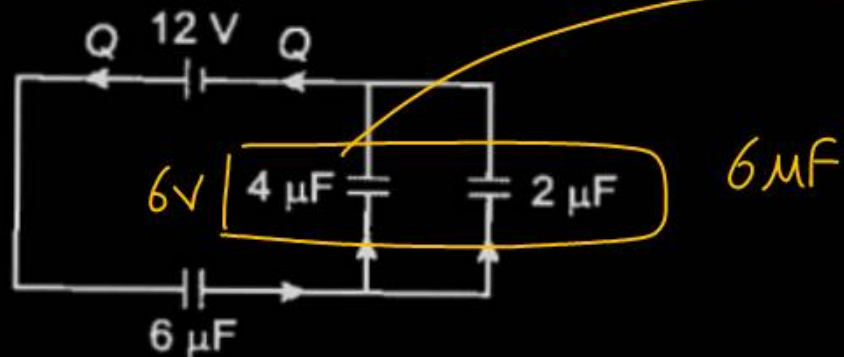
$$\frac{\cancel{v}}{4L_1} = \frac{\cancel{v}}{2L_2}$$

$$\frac{1}{2} = \frac{2}{4} = \frac{L_1}{L_2}$$



Question no. 19

The charge deposited on $4 \mu\text{F}$ capacitor in the circuit is



$$Q = 6 \times 4 = 24 \mu\text{C} \\ = 24 \times 10^{-6} \text{C}$$

- (1) $6 \times 10^{-6} \text{C}$ (2) $12 \times 10^{-6} \text{C}$
 (3) $24 \times 10^{-6} \text{C}$ (4) $36 \times 10^{-6} \text{C}$

3

Question no. 20

 G

A galvanometer of resistance 20Ω is to be converted into an ammeter of range 1 A . If a current of 1 mA produces full scale deflection, the shunt required for the purpose is

- (1) 0.01Ω (2) 0.05Ω
 (3) 0.02Ω (4) 0.04Ω

3

 I_g

$$S = \frac{I_g G}{I_A - I_g}$$

$$S = \frac{10^{-3} \times 20}{1 - 10^{-3}}$$

$$S = 10^{-3} \times 20 = 2 \times 10^{-2}$$

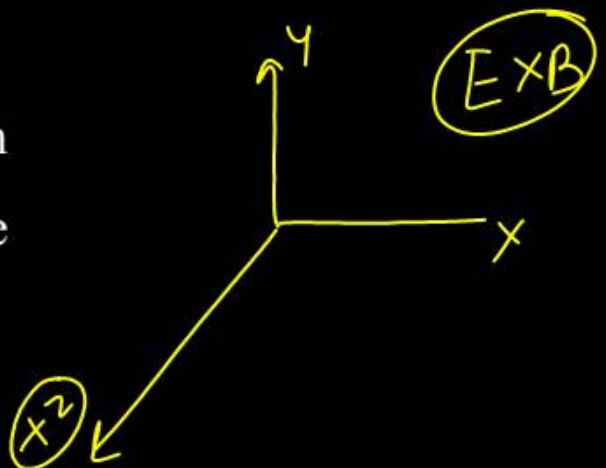
$$= 0.02 \Omega$$

Question no. 21

The electric and the magnetic fields, associated with an e.m. wave, propagating along the +z-axis, can be represented by

(1) $[\vec{E} = E_0 \hat{i}, \vec{B} = B_0 \hat{j}]$ (2) $[\vec{E} = E_0 \hat{k}, \vec{B} = B_0 \hat{i}]$

(3) $[\vec{E} = E_0 \hat{j}, \vec{B} = B_0 \hat{i}]$ (4) $[\vec{E} = E_0 \hat{j}, \vec{B} = B_0 \hat{k}]$



$(-z) \times \times \times$

Question no. 22

The mass of ${}^7_3\text{Li}$ nucleus is 0.042 u less than the sum of the masses of all its nucleons. The binding energy per nucleon of ${}^7_3\text{Li}$ nucleus is nearly

(1) 46 MeV

(2) 5.6 MeV

(3) 3.9 MeV

(4) 23 MeV

$$\Delta m = 0.042 \times \frac{931.5 \text{ MeV}}{c^2}$$

$$= 37 \frac{\text{MeV}}{c^2}$$

$$\Delta m = 0.042 \text{ u}$$

$$1 \text{ u} = \frac{931.5 \text{ MeV}}{c^2}$$

$$BE = \Delta m c^2$$

$$= 37 \text{ MeV}$$

$$E_{bn} = \frac{37 \text{ MeV}}{7} = 5.3 \text{ MeV}$$

Question no. 23

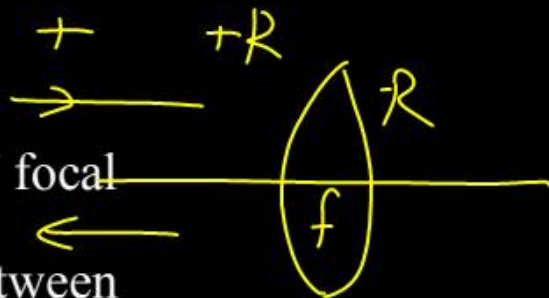
Two identical equi-convex lenses ($\mu = 3/2$) of focal length f each are kept in contact. The space between the two lenses is filled with water ($\mu_w = 4/3$). The focal length of the combination is

(1) $3f/4$

(3) $3f$

(2) $f/3$

(4) $4f/3$



$$\frac{1}{f} = \left(\frac{3}{2} - 1\right) \left(\frac{1}{R} + \frac{1}{R}\right)$$

$$P_T = P_1 + P_2 + P_3$$

$$\frac{1}{f_T} = \frac{1}{f} + \frac{1}{f_1} + \frac{1}{f}$$

$$\frac{1}{f_T} = \frac{1}{f} - \frac{2}{3f} + \frac{1}{f}$$

$$\frac{1}{f} = \frac{1}{2} \times \frac{2}{R}$$

$$f = R$$

$$\frac{1}{f_1} = \left(\frac{4}{3} - 1\right) \left(-\frac{1}{R} - \frac{1}{R}\right)$$

$$\frac{1}{f_1} = \frac{1}{3} \times \left(-\frac{2}{R}\right)$$

$$f_1 = -\frac{3f}{2}$$

Question no. 24

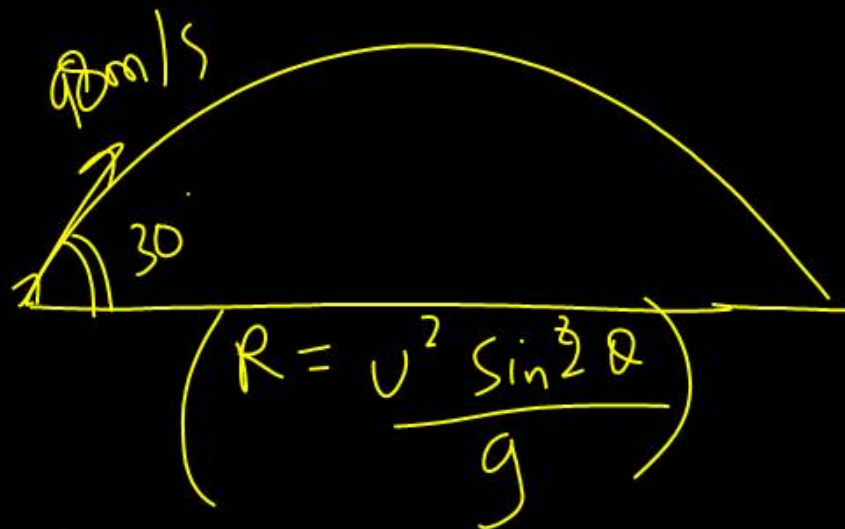
What is the range of a projectile thrown with velocity 98 ms^{-1} with angle 30° from horizontal?

(1) $490\sqrt{3} \text{ m}$

(2) $245\sqrt{3} \text{ m}$

(3) $980\sqrt{3} \text{ m}$

(4) 100 m



$$R = \frac{98 \times 98 \times \sin(60)}{10}$$

$$= \frac{98 \times 98 \times \frac{\sqrt{3}}{2}}{10}$$

$$= \underline{\underline{490\sqrt{3}}}$$

Question no. 25

The Dimensional formula of Planck's constant h is

(1) $[ML^2 T^{-1}]$

(2) $[ML^2 T^{-3}]$

(3) $[MLT^{-1}]$

(4) $[ML^3 T^{-2}]$

$$E = h\nu$$

$$h = \frac{E}{\nu}$$

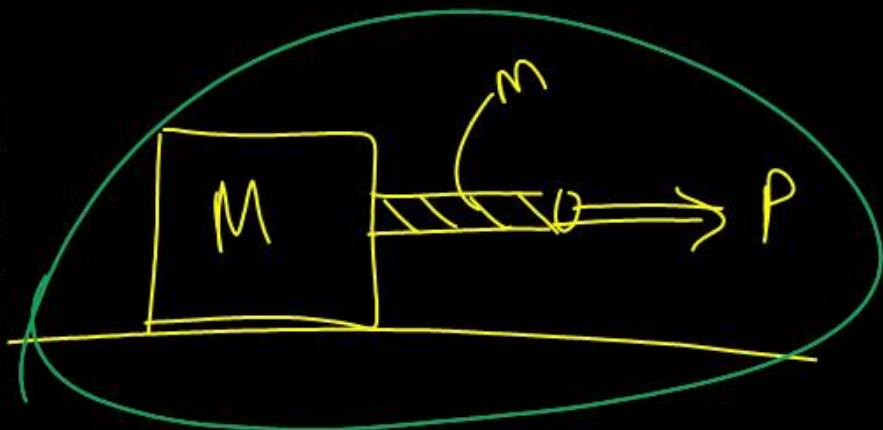
$$= \frac{f \cdot s}{\nu}$$

$$= \frac{MLT^{-2} \times L}{T}$$

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

Question no. 26

A block of mass M is pulled along a horizontal frictionless surface by a rope of mass m . If a force P is applied at the free end of the rope, the force exerted by the rope on the block is



(1) $\frac{Pm}{(M+m)}$

(2) $\frac{Pm}{(M-m)}$

(3) P

(4) $\frac{PM}{(M+m)}$

$a = \frac{F_{net}}{\text{total mass}}$

$T = \frac{P}{M+m}$

$\Sigma f_x = ma$
 $= MP$
 $\frac{MP}{(M+m)} = \frac{P \cdot M}{(m+M)}$

Question no. 27

A force $(4\hat{i} + \hat{j} - 2\hat{k})$ N acting on a body maintains its velocity at $(2\hat{i} + 2\hat{j} + 3\hat{k})$ m s⁻¹. The power exerted is

(1) 4 W

(3) 2 W

(2) 5 W

(4) 8 W

$$8 + 2 - 6 = 4$$

$$P = f \cdot v$$

Question no. 28

The work done in increasing the volume of a soap bubble of radius r to 27 times will be, if the surface tension of soap solution is T .

- (1) $32\pi r^2 T$ (2) $64\pi r^2 T$
 (3) $27\pi r^2 T$ (4) $54\pi r^2 T$

$S.A_1 = 4\pi r^2 \Rightarrow 8\pi r^2$
 $S.A_2 = 4\pi r_2^2 \Rightarrow 72\pi r^2$

$\Delta A = 72 - 8 = 64\pi r^2$

$V_1 = \frac{4}{3}\pi r^3$
 $V_2 = 27 \cdot \frac{4}{3}\pi r^3 = 36\pi r^3$

~~radius r in r_2~~

~~$V_2 = V_1 = 36\pi r^3$
 $3 \times \frac{36}{4} r^3 = 27 r^3 = r_2^3$
 $r_2 = 3r$~~

$\frac{4}{3}\pi r_2^3$

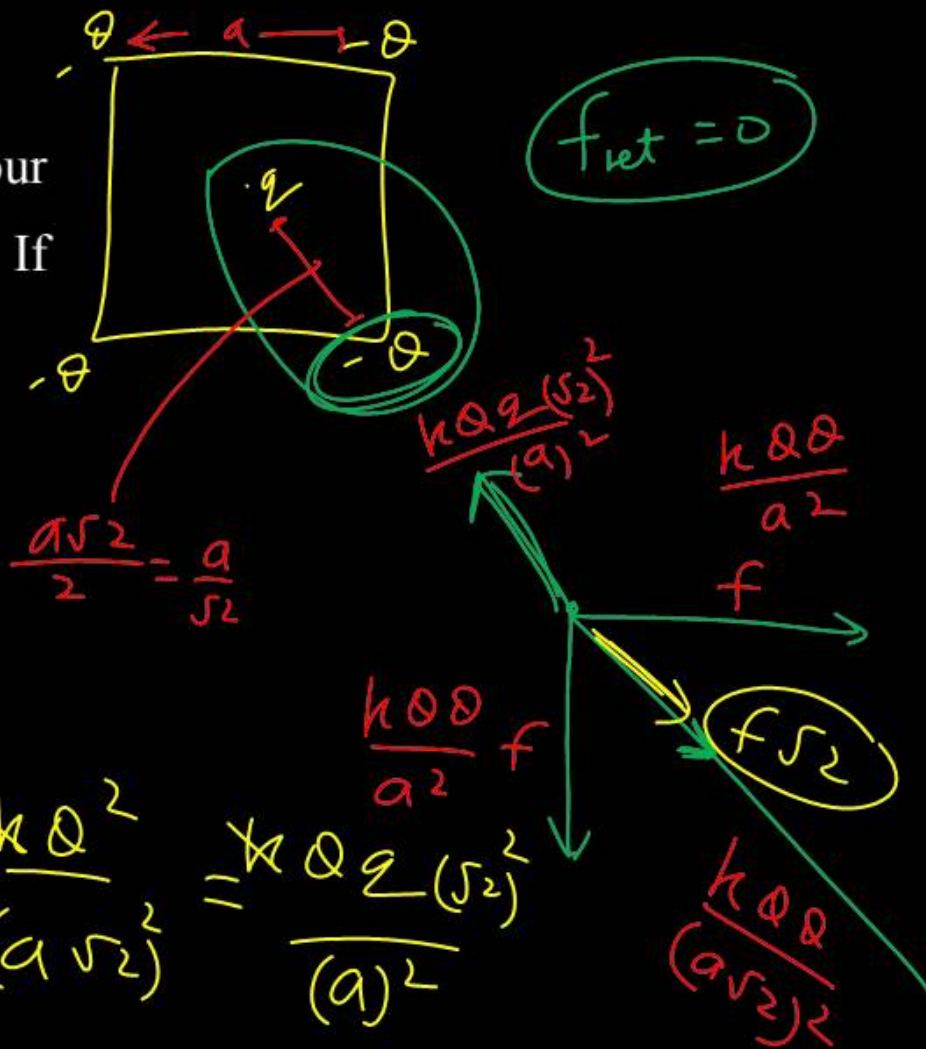
$r_2 = 3r$

$WD = T(\Delta A) = 64\pi r^2 \cdot T$

Question no. 29

Four charges equal to $-Q$ are placed at the four corners of a square and a charge q is at its centre. If the system is in equilibrium, the value of q is

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



$$Q\sqrt{2} + \frac{Q}{2} = 2q$$

$$\frac{Q\sqrt{2}}{2} + \frac{Q}{4} = q$$

$$\frac{Q}{4}(2\sqrt{2} + 1) = q$$

$$\frac{kQ^2}{a^2}\sqrt{2} + \frac{kQ^2}{(a\sqrt{2})^2} = \frac{kQq}{(a)^2}(\sqrt{2})^2$$

$$\frac{kQq}{a^2} f = \frac{kQq}{(a\sqrt{2})^2} f\sqrt{2}$$

Question no. 30

A gold wire of resistance 24Ω is stretched uniformly to a length equal to 4 times its original length. Its new resistance will be

- (1) 94Ω (2) 144Ω
(3) 288Ω ~~(4) 384Ω~~

$\times 16$

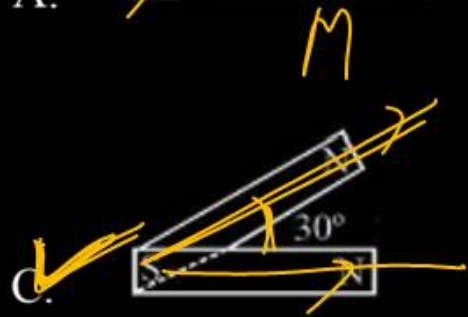
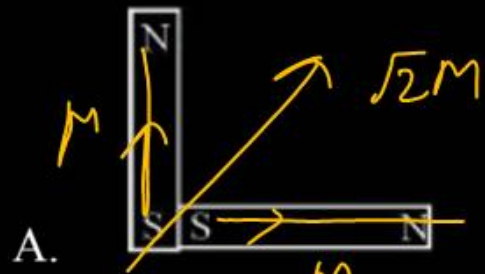
$\frac{24}{\times 16}$

$$R = \frac{\rho L}{A \times L}$$

$R \propto L^2$

Question no. 31

Following figures show the arrangement of bar magnets in different configurations. Each magnet has magnetic dipole moment \vec{m} . Which configuration has highest net magnetic dipole moment?



- (1) A
- (3) C

- (2) B
- (4) D

Question no. 32

An electromagnetic wave of wavelength ' λ ' is incident on a photosensitive surface of negligible work function. If ' m ' mass is of photoelectron from the surface has de-Broglie wavelength λ_d , then

(1) $\lambda = \left(\frac{2m}{ch}\right) \lambda_d^2$

(2) $\lambda_d = \left(\frac{2mc}{h}\right) \lambda^2$

(3) $\lambda = \left(\frac{2mc}{h}\right) \lambda_d^2$

(4) $\lambda = \left(\frac{2h}{mc}\right) \lambda_d^2$

$$K = \frac{hc}{\lambda} = \frac{p^2}{2m}$$

$$\lambda_d = \frac{h}{p}$$

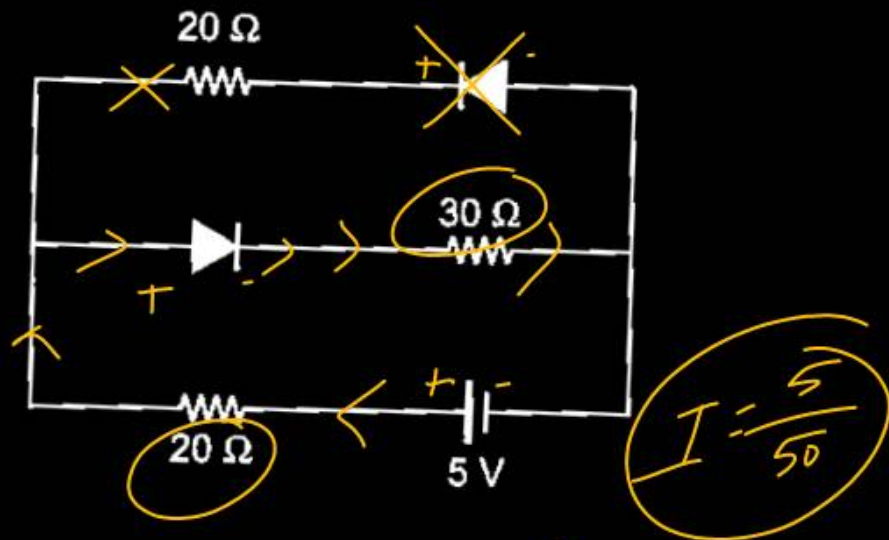
$$\lambda_d^2 = \frac{h^2}{2mhc} \times \lambda$$

$$\lambda = \frac{2cm}{h} \times \lambda_d^2$$

$$p^2 = \frac{hc \times 2m}{\lambda}$$

$$\lambda_d = \frac{h}{\sqrt{hc \times 2m}} \times \sqrt{\lambda}$$

Current in the circuit will be



(1) $\frac{5}{40}$ A

(2) $\frac{5}{50}$ A

(3) $\frac{5}{10}$ A

(4) $\frac{5}{20}$ A

Question no. 34

A light ray falls on a glass surface of refractive index

$\sqrt{3}$ at an angle 60° . The angle between the refracted and reflected rays would be

(1) 60°

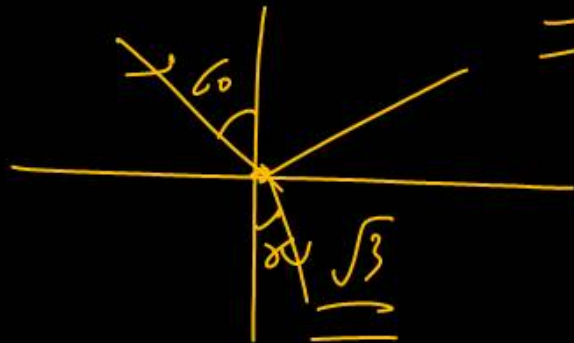
(2) ~~90°~~

$$u = \tan \theta_p$$

(3) 120°

(4) 30°

$$\sqrt{3} = \tan 30 = \underline{\underline{\sqrt{3}}}$$



A running man has half kinetic energy to that of a boy of half of his mass. The man speeds up by 1 ms^{-1} , so as to have same kinetic energy as that of the boy. The original speed of the man is

(1) $\sqrt{2} \text{ ms}$

(2) $\sqrt{2} - 1 \text{ ms}^{-1}$

(3) $\frac{1}{\sqrt{2}-1} \text{ ms}^{-1}$

(4) $\frac{1}{\sqrt{2}} \text{ ms}^{-1}$

$$\frac{1}{2} M V_1^2 = \frac{1}{2} \times \frac{1}{2} \left(\frac{M}{2}\right) \times V_2^2$$

$$V_2^2 = 4V_1^2$$

$$\frac{1}{2} M (V_1 + 1)^2 = \frac{1}{2} \times \frac{M}{2} \times V_2^2$$

$$(V_1 + 1)^2 = \frac{V_2^2}{2} = \frac{4V_1^2}{2}$$

Question no. 36

A physical quantity Q is found to depend on observables x , y and z , obeying relation $Q = \frac{x^3 y^2}{z}$

The percentage error in the measurements of x , y and z are 1%, 2% and 4% respectively. What is percentage error in the quantity Q ?

(1) ✓ 11%

(2) 4%

(3) 1%

(4) 3%

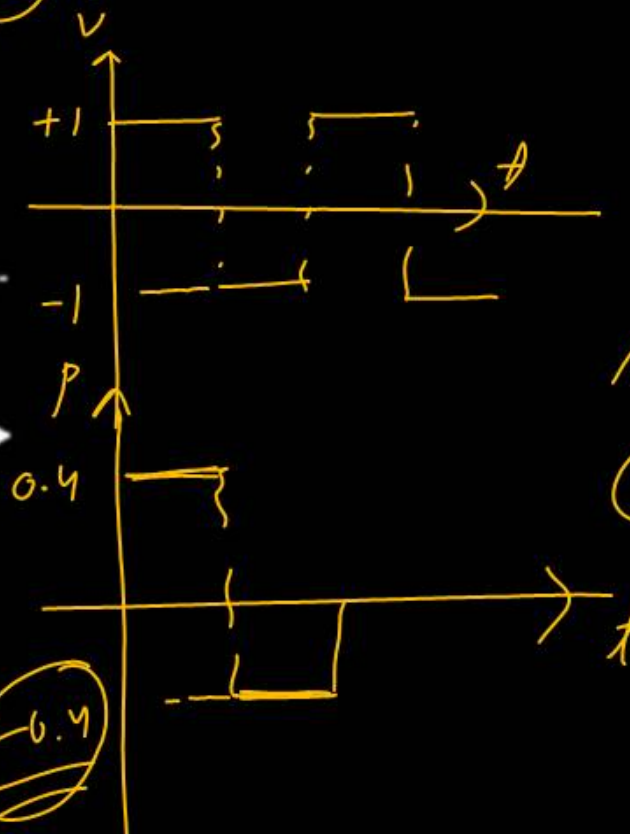
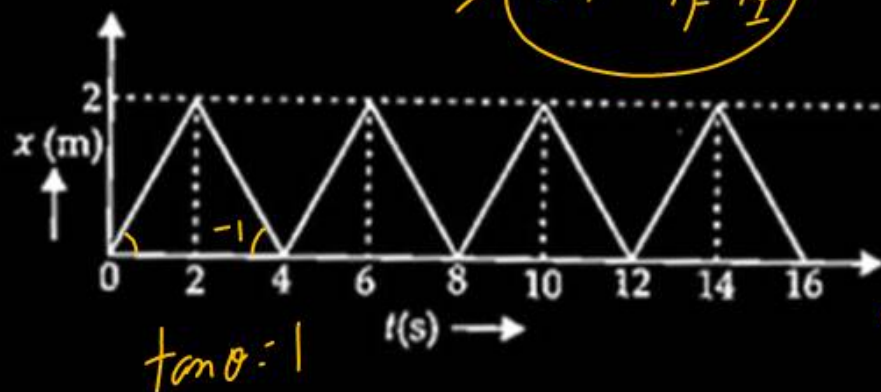
$$\frac{\Delta Q}{Q} = \frac{3\Delta x}{x} + \frac{2\Delta y}{y} + \frac{\Delta z}{z}$$

$$\rightarrow = \underline{3 \times 1} + \underline{2 \times 2} + \underline{4}$$

$$\Rightarrow \underline{\underline{11\%}}$$

Question no. 37

The figure shows the position time ($x-t$) graph of one dimensional motion of a body of mass 0.4 kg. The magnitude of each impulse is



$\Delta p = -0.4 - 0.4$
 $\Delta p = -0.8$
 $\Delta p = 0.8 \text{ N s}$

- (1) 0.2 N s (2) 0.4 N s
 (3) 0.8 N s (4) 1.6 N s

Question no. 38

A body rolls down an inclined plane. If its kinetic energy of rotation is 40% of its kinetic energy of translation motion, then the body is

(1) hollow cylinder

(2) ring

(3) solid disc

(4) solid sphere

$$K_L = \frac{1}{2} M V^2$$

100

$$K_R = \frac{1}{2} \times I \times \frac{V^2}{R^2}$$

$$K_R = \frac{1}{2} \times \frac{2}{5} M R^2 \times \frac{V}{R^2}$$

$$K_R = \frac{1}{2} M V^2 \times \frac{2}{5}$$

$$K_R = \frac{20}{100} \times \frac{2}{5} \times \frac{100}{1}$$

Question no. 39

Two spheres of the same material have radii 1 m and 4 m and temperatures 4000 K and 2000 K respectively. The ratio of energy radiated per second by the first sphere to the second is

(1) ~~1 : 1~~

(2) 16 : 1

(3) 4 : 1

(4) 1 : 9

$$P \propto e A \sigma T^4$$

$$P \propto e \times 4\pi r^2 \times \sigma T^4$$

$$\frac{P_1}{P_2} = \frac{r_1^2}{r_2^2} \times \frac{T_1^4}{T_2^4} \Rightarrow \frac{1}{16} \times \frac{4000^4}{2000^4} \Rightarrow \frac{1}{1}$$

Question no. 40

An electron of mass m , charge e falls through a distance h meter in a uniform electric field E . Then time of fall

(1) $t = \sqrt{\frac{2hm}{eE}}$

(2) $t = \frac{2hm}{eE}$

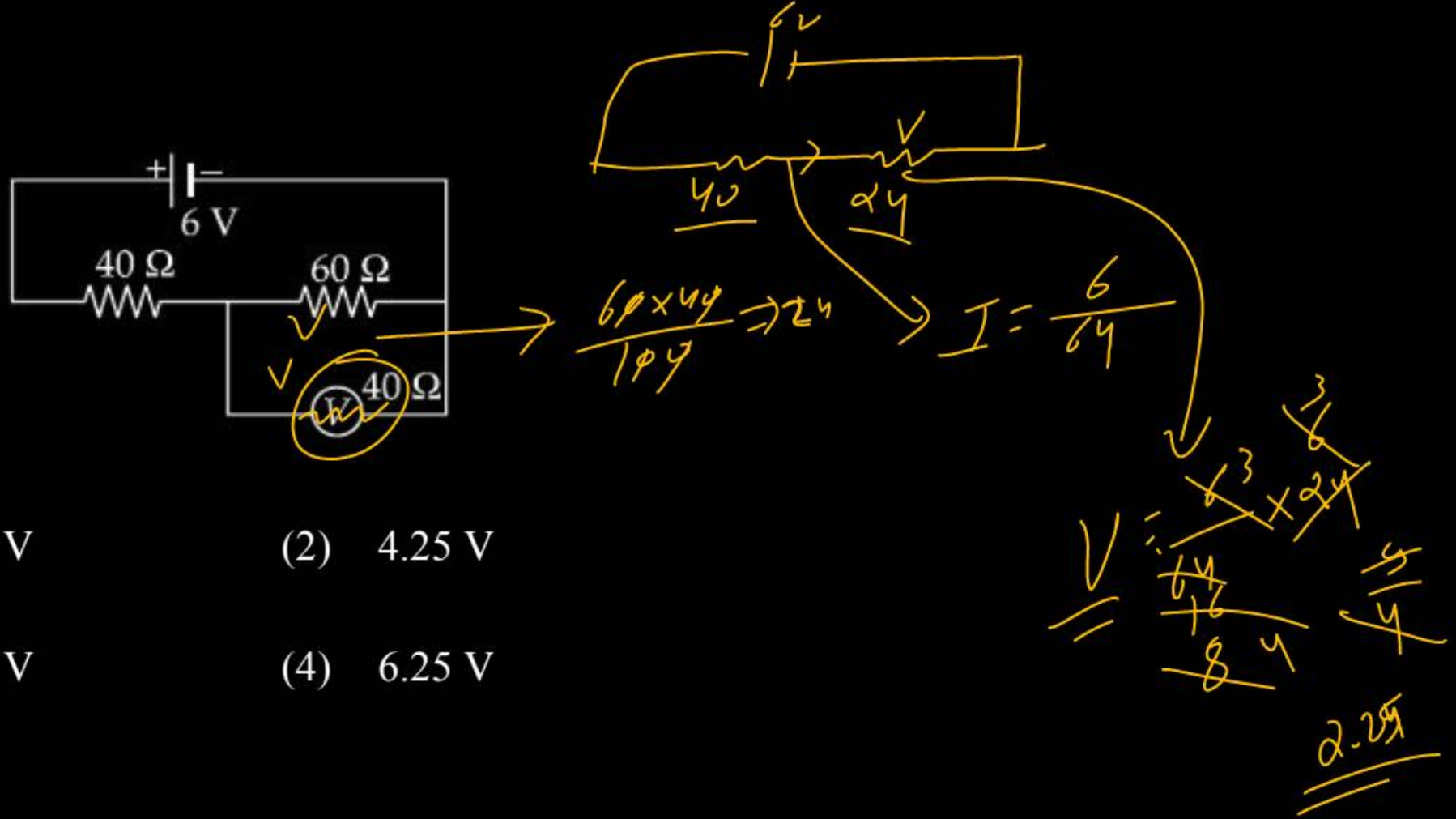
(3) $t = \sqrt{\frac{2eE}{hm}}$

(4) $t = \frac{2eE}{hm}$

$u=0$
 $qE = mg$
 $a = \frac{eE}{m}$
 $h \rightarrow t = ?$
 $h = 0 + \frac{1}{2} a t^2$
 $t = \sqrt{\frac{2h}{a}} = \sqrt{\frac{2hm}{eE}}$

Question no. 41

The measurement of voltmeter in the following circuit is



(1) ~~2.25 V~~

(2) 4.25 V

(3) 3.25 V

(4) 6.25 V

Question no. 42

A long solenoid has 1000 turns. When a current of 4 A flows through it, the magnetic flux linked with each turn of the solenoid is $4 \times 10^{-3} \text{ Wb}$. The self-inductance of the solenoid is

(1) 2 H

(2) 1 H

(3) 4 H

(4) 3 H

$$\Phi_1$$

$$\Phi_T = 4 \times 10^{-3} \times 1000$$

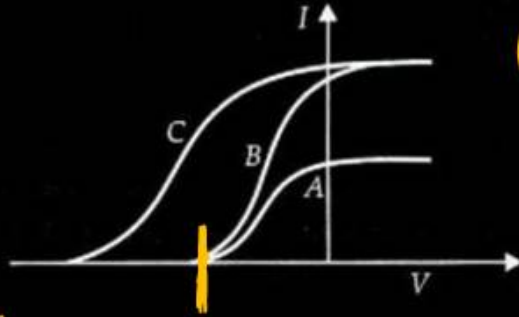
$$\Phi_T = 4$$

$$L = \frac{\Phi_T}{I}$$

$$L = \frac{4}{4} = \underline{\underline{1 \text{ H}}}$$

Question no. 43

In a photoelectric experiment anode potential is plotted against plate current.



$$I_C = I_B$$

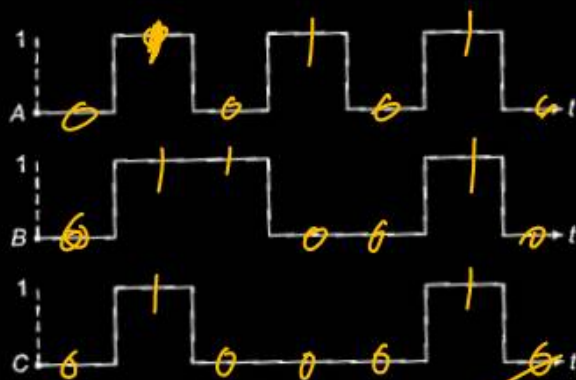
$$I_{\text{sat}}(C) = I_{\text{sat}}(B)$$

$$f_B = f_A$$

- (1) A and B will have same intensities while B and C will have different frequencies
- (2) B and C will have different intensities while A and B will have different frequencies
- (3) A and B will have different intensities while B and C will have equal frequencies
- (4) B and C will have equal intensities while A and B will have same frequencies.

Question no. 44

The following figure shows a logic gate circuit with two inputs A and B and the output C. The voltage waveforms of A, B and C are as shown below.



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

Question no. 45

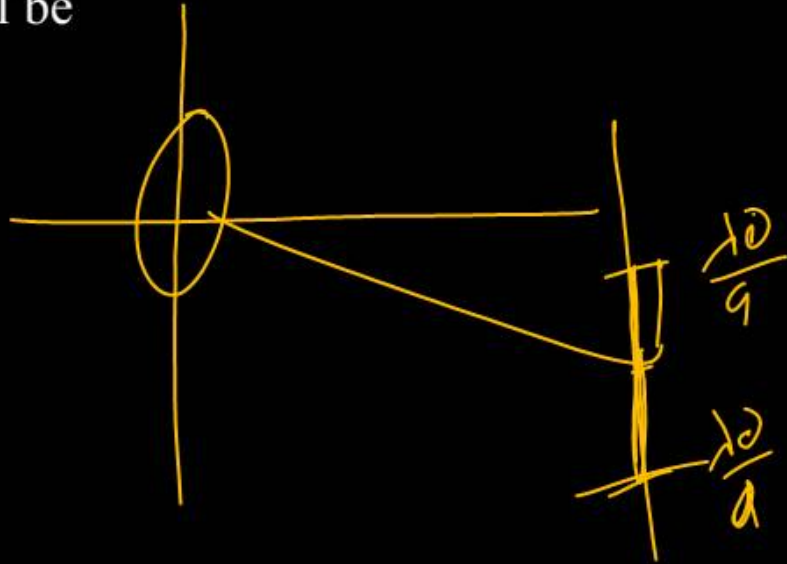
For a parallel beam of monochromatic light wavelength ' λ ' diffraction is produced by a single slit whose width ' a ' is of the order of the wavelength of the light. If ' D ' is the distance of the screen from the slit, the width of the central maxima will be

(1) $\frac{2D\lambda}{a}$

(2) $\frac{D\lambda}{a}$

(3) $\frac{Da}{\lambda}$

(4) $\frac{\lambda}{Da}$



Question no. 46

Dissolving 120 g of a compound (mol. wt. 60) in 1000 g of water gave a solution of density 1.12 g/mL. The molarity of the solution is:

- (1) 1.00 M ✓ (2) 2.00 M
 (3) 2.50 M (4) 4.00 M

$$M = \frac{120}{60} \times \frac{1000}{1000}$$

(2)

$$W_s = 1000 + 120 \text{ g}$$

$$= 1120 \text{ g}$$

(d) = $\frac{W_s}{\text{Volume}}$

$$\text{Volume} = \frac{1120000}{1.12}$$

Which of the following sets of quantum numbers is
not allowed?

(1) $n = 3, l = 2, m_l = 0, s = +\frac{1}{2}$

(2) $n = 3, l = 2, m_l = -2, s = +\frac{1}{2}$

(3) $n = 3, l = 3, m_l = -3, s = -\frac{1}{2}$

(4) $n = 3, l = 0, m_l = 0, s = -\frac{1}{2}$

$$n > l \geq m$$

The enthalpy of neutralisation of NH_4OH with HCl is $-51.46 \text{ kJ mol}^{-1}$ and the enthalpy of neutralisation of NaOH with HCl is $-55.90 \text{ kJ mol}^{-1}$. The enthalpy of ionization of NH_4OH is

- (1) $-107.36 \text{ kJ mol}^{-1}$ (2) $-4.44 \text{ kJ mol}^{-1}$
 (3) $+107.36 \text{ kJ mol}^{-1}$ (4) $+4.44 \text{ kJ mol}^{-1}$

$$(-55.90) + \Delta H = \Delta H_{\text{Neutral}}$$

$$(-55.90) + \Delta H_{\text{ion}} = -51.46$$

$$+55.90 - 51.46 = +4.44$$

Consider the following E° values

$$E^\circ_{\text{Fe}^{3+}/\text{Fe}^{2+}} = +0.77\text{V}; E^\circ_{\text{Sn}^{2+}/\text{Sn}} = -0.14\text{V}$$

Under standard conditions the potential for the reaction



- (1) 0.91 V (2) 1.40 V
 (3) 1.68 V (4) 0.63 V

$$E^\circ_{\text{cell}} = E^\circ_{\text{cathode}} - E^\circ_{\text{anode}}$$

$$= (0.77) - (-0.14)$$

$$= 0.77 + 0.14$$

$$0.91$$

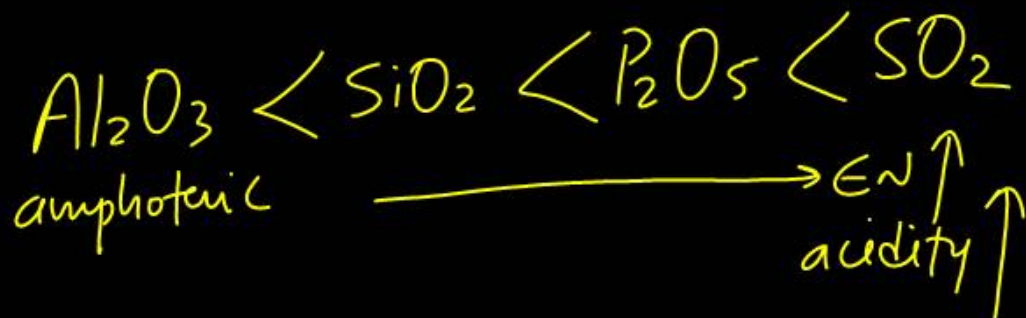
Question no. 50

Among Al_2O_3 , SiO_2 , P_2O_5 and SO_2 , the correct order of acid strength is

- (1) $\text{Al}_2\text{O}_3 < \text{SiO}_2 < \text{SO}_2 < \text{P}_2\text{O}_5$
- (2) $\text{SiO}_2 < \text{SO}_2 < \text{Al}_2\text{O}_3 < \text{P}_2\text{O}_5$
- (3) $\text{SO}_2 < \text{P}_2\text{O}_5 < \text{SiO}_2 < \text{Al}_2\text{O}_3$
- (4) $\text{Al}_2\text{O}_3 < \text{SiO}_2 < \text{P}_2\text{O}_5 < \text{SO}_2$

4

acidity of oxides \propto EN



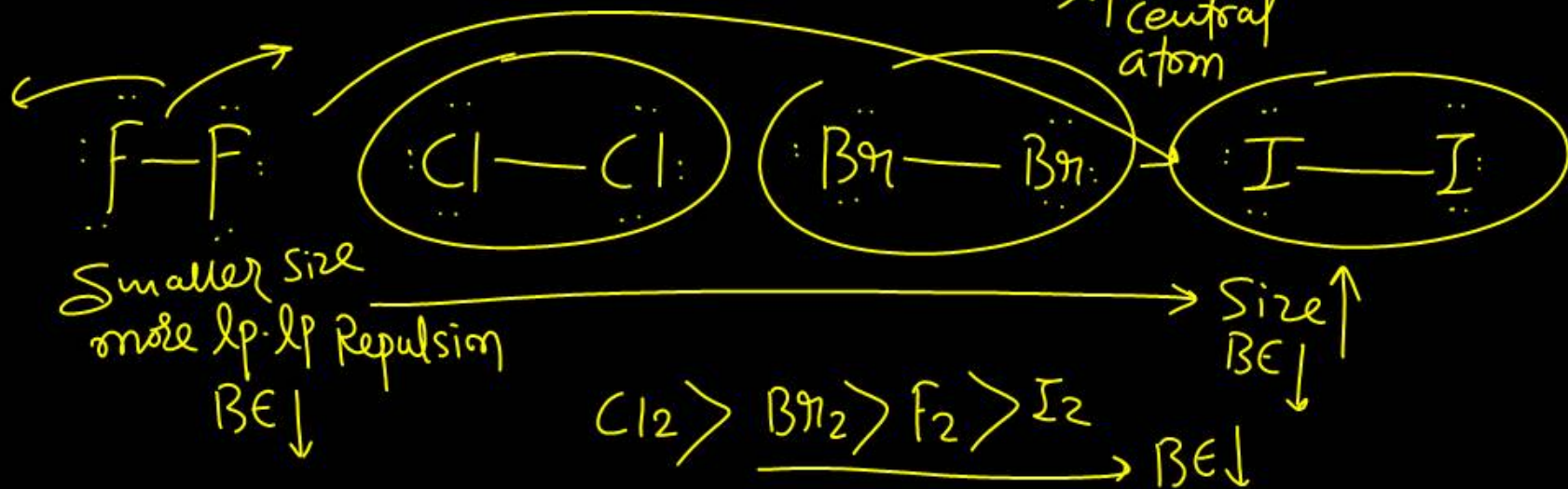
Question no. 51

The correct order of bond dissociation enthalpy of halogens is:

- (1) $\text{Cl}_2 > \text{Br}_2 > \text{F}_2 > \text{I}_2$ (2) $\text{F}_2 > \text{Cl}_2 > \text{Br}_2 > \text{I}_2$
 (3) $\text{Cl}_2 > \text{F}_2 > \text{Br}_2 > \text{I}_2$ (4) $\text{I}_2 > \text{Br}_2 > \text{Cl}_2 > \text{F}_2$

①

$$\text{BE} \propto \frac{1}{\text{Size}} \propto \frac{1}{\text{lp on central atom}} \propto \text{Bond order}$$



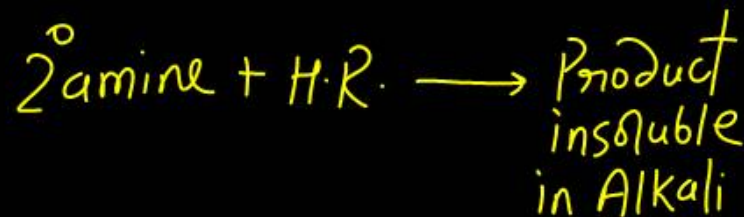
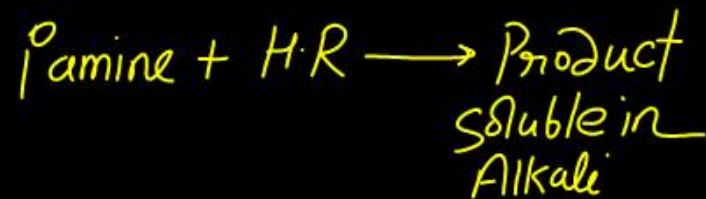
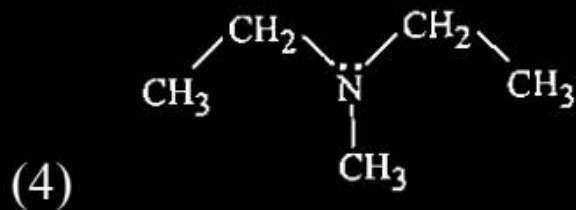
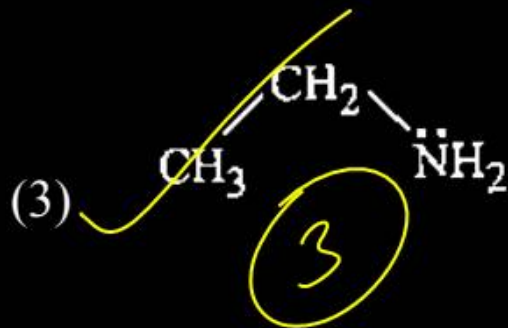
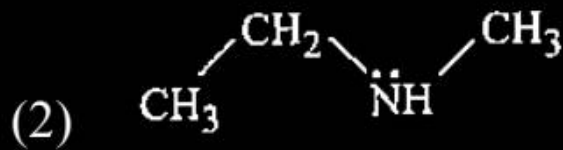
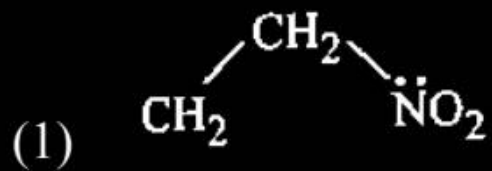
The incorrect statement is :

- (1) Manganate and permanganate ions are tetrahedral
- (2) In manganate and permanganate ions, the π -bonding takes place by overlap of p-orbitals of oxygen and d-orbitals of manganese
- (3) Manganate and permanganate ions are paramagnetic
- (4) Manganate ion is green in colour and permanganate ion is purple in colour



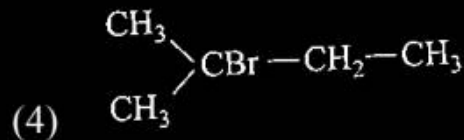
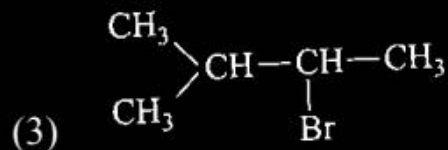
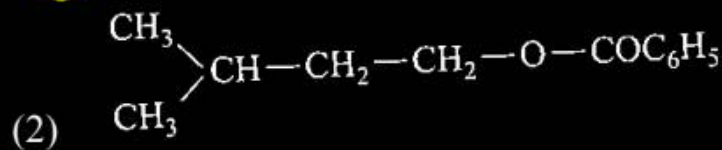
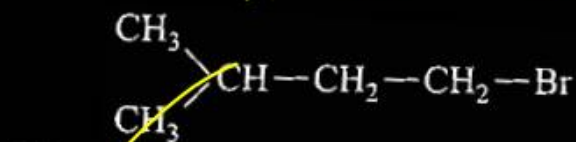
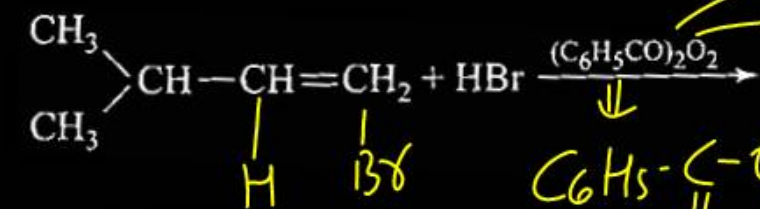
Question no. 53

Identify the compound that will react with Hinsberg's reagent to give a solid which dissolves in alkali

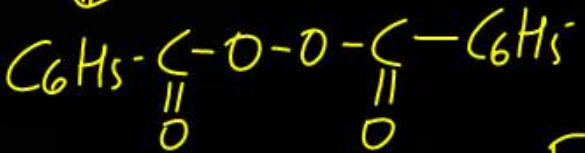


Question no. 54

The major product of the following chemical reaction is



KHARASH/PEROXIDE effect
A.M.R

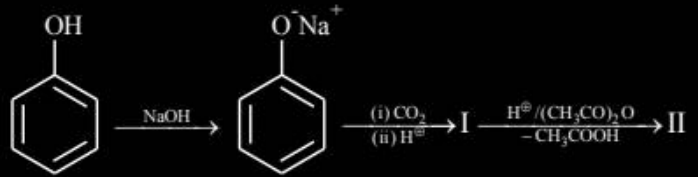


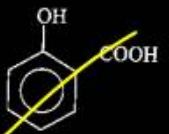
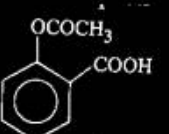
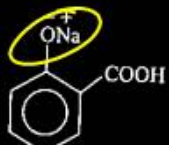
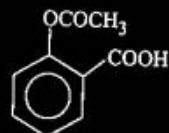
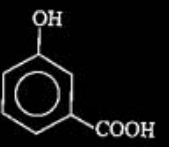
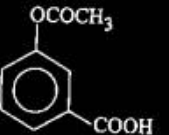
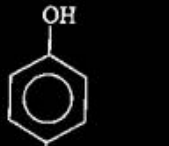

F.R.A.R

①

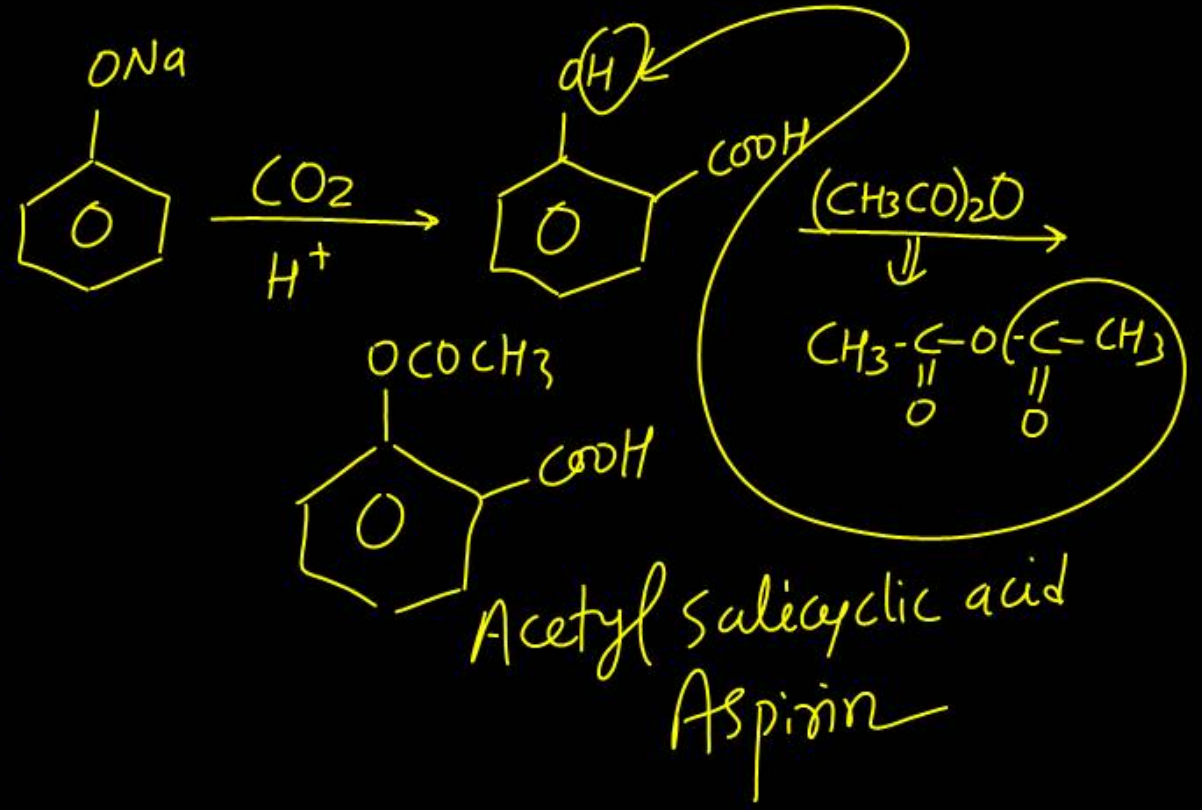
Question no. 55

In the given reaction, Products I and II will be



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

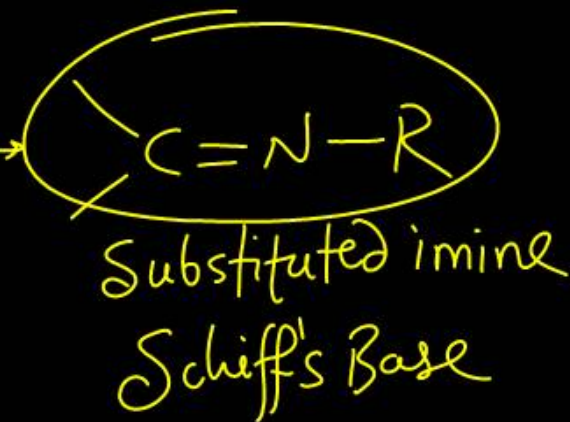
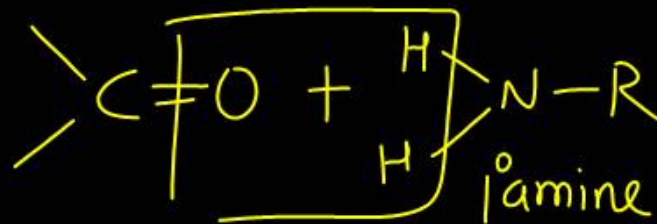
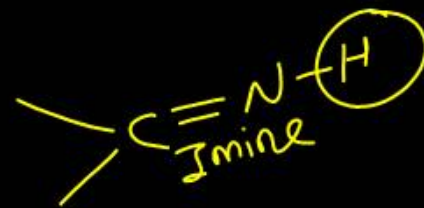
(1)



Schiff's base is prepared from

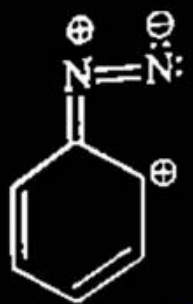
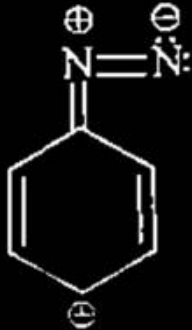
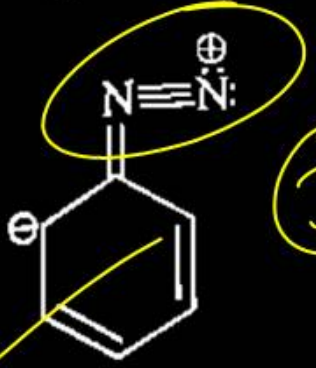
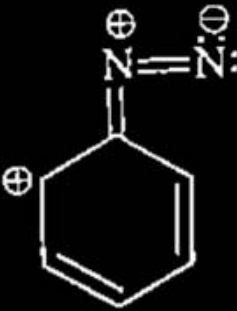
- (1) Carbonyl compound and primary amine
- (2) Carbonyl compound and secondary amine
- (3) Carbonyl compound and tertiary amine
- (4) All of these

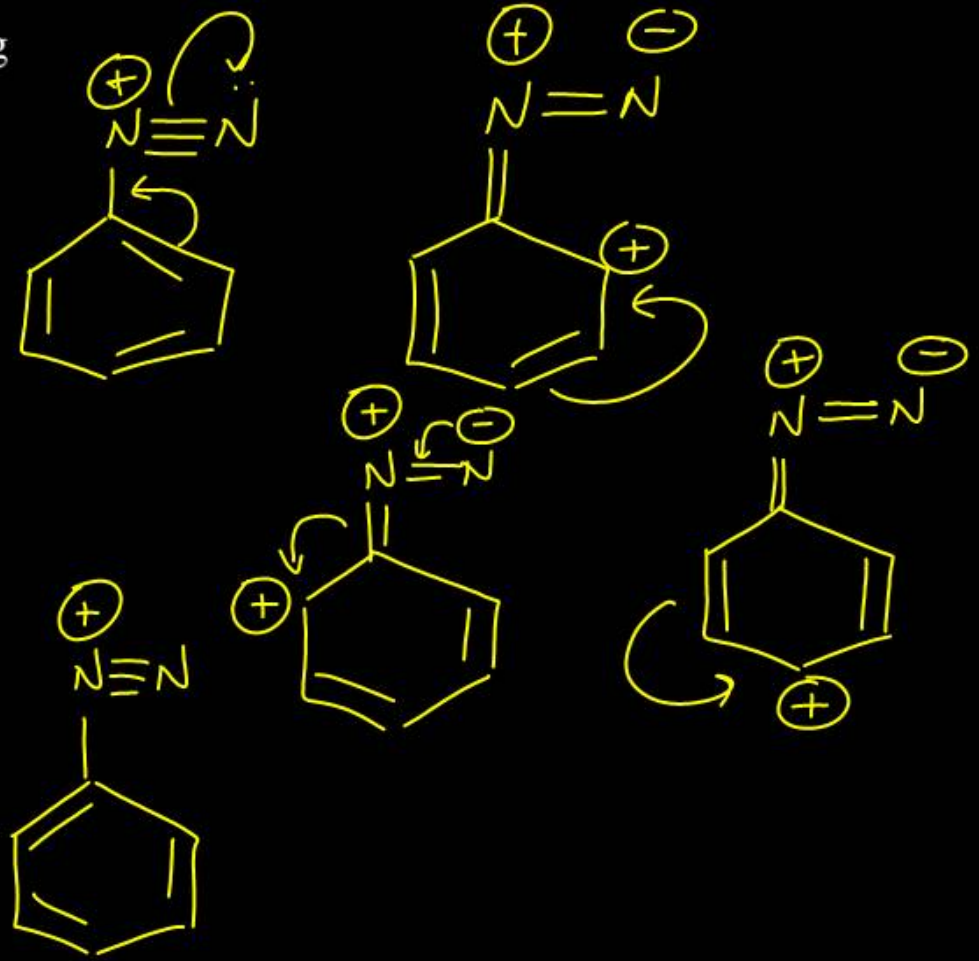
(1)



Question no. 57

The stability of arenediazonium ion is explained on the basis of resonance. Which of the following resonating structure is incorrect?

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



Question no. 58

The amount of oxygen in 3.6 moles of water is:

(1) 115.2 g

(2) 57.6 g

(3) 28.8 g

(4) 18.4 g



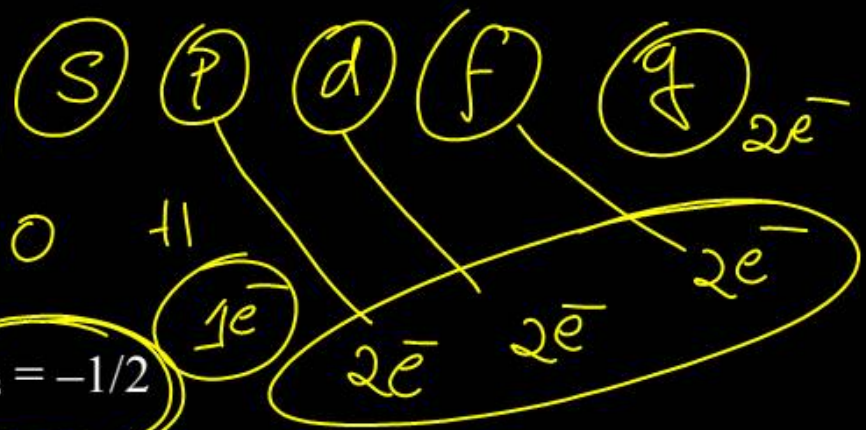
$$n = \frac{W_B}{M_B}$$

3.6×16

Given

(A) $n = 5, m_l = +1$

(B) $n = 4, l = 1, m_l = -1, m_s = -1/2$



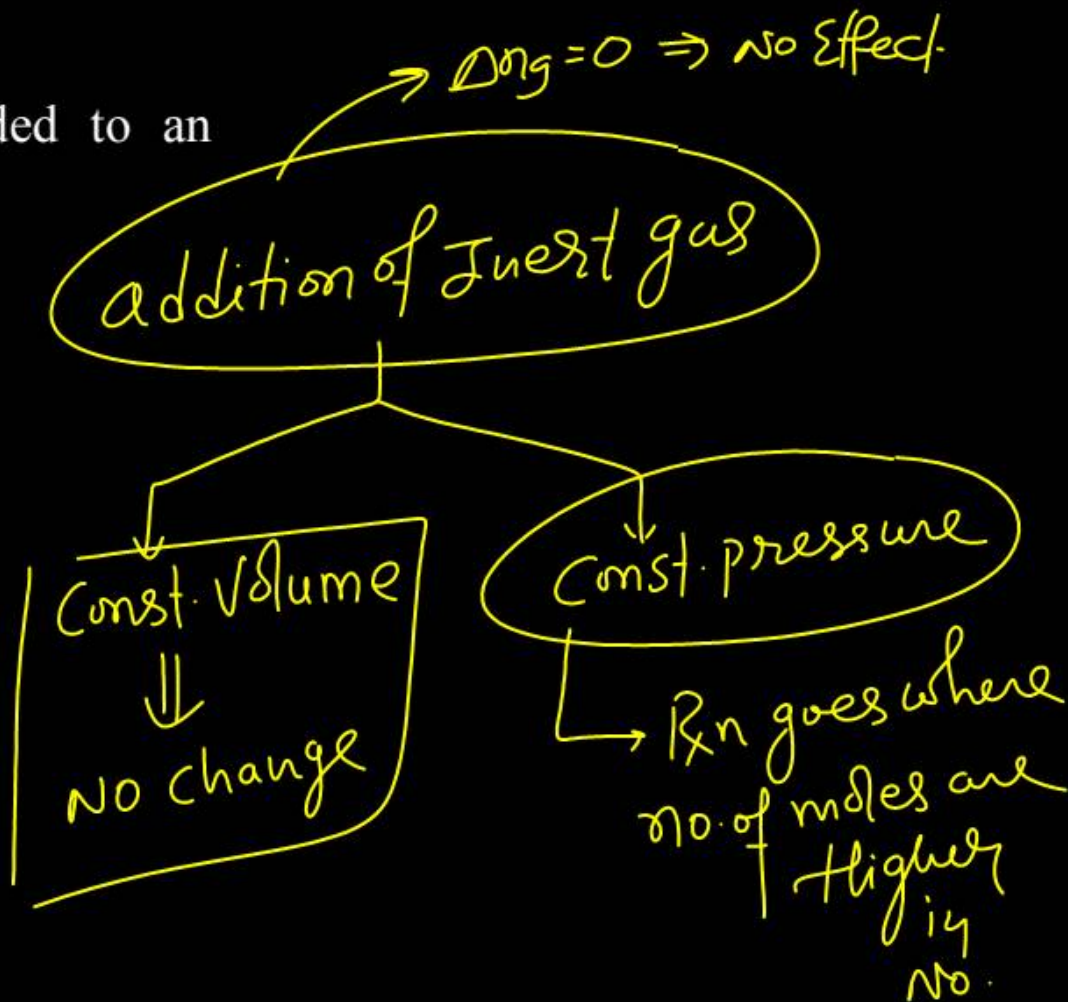
The maximum number of electron (s) is an atom that can have the quantum numbers as given in (A) and (B) are respectively:

- (1) 25 and 1
- (2) 8 and 1
- (3) 2 and 4
- (4) 4 and 1

What happens when an inert gas is added to an equilibrium keeping volume unchanged?

- (1) More product will form
- (2) Less product will form
- (3) More reactant will form
- (4) Equilibrium will remain unchanged

4



Question no. 61

For the reaction $2A + 3B + \frac{3}{2}C \rightarrow 3P$, which statement

is correct?

(1) ~~$-\frac{dn_A}{dt} = -\frac{3}{2} \frac{dn_B}{dt} = -\frac{3}{4} \frac{dn_C}{dt}$~~

(2) $-\frac{dn_A}{dt} = -\frac{dn_B}{dt} = -\frac{dn_C}{dt}$

(3) ~~$-\frac{dn_A}{dt} = -\frac{2}{3} \frac{dn_B}{dt} = -\frac{4}{3} \frac{dn_C}{dt}$~~

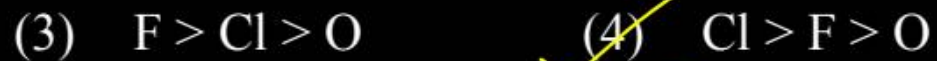
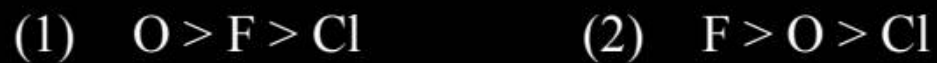
(4) $-\frac{dn_A}{dt} = -\frac{2}{3} \frac{dn_B}{dt} = -\frac{3}{4} \frac{dn_C}{dt}$

$$\text{Rate} = -\frac{d[A]}{2 dt} = \frac{1}{3} \frac{d[B]}{dt} = \frac{2}{3} \frac{d[C]}{dt} = \frac{1}{3} \frac{dP}{dt}$$

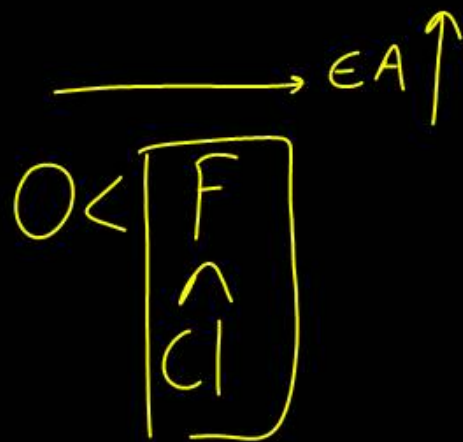
$$= -\frac{d[A]}{dt} = -\frac{2}{3} \frac{d[B]}{dt} = -\frac{4}{3} \frac{d[C]}{dt} = \frac{2}{3} \frac{d[P]}{dt}$$

3

The correct order of electron affinity is:



✓
(4)



Question no. 63

Match List-I with List-II :

	List - I (Molecule)		List - II (Hybridization; shape)
A.	XeO ₃ <i>sp³</i>	I.	sp ³ d; linear
B.	XeF ₂	II.	sp ³ ; pyramidal
C.	XeOF ₄	III.	sp ³ d ³ ; distorted octahedral
D.	XeF ₆	IV.	sp ³ d ² ; square pyramidal

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

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

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

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

①

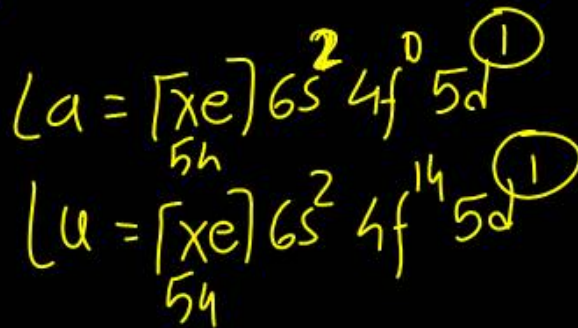
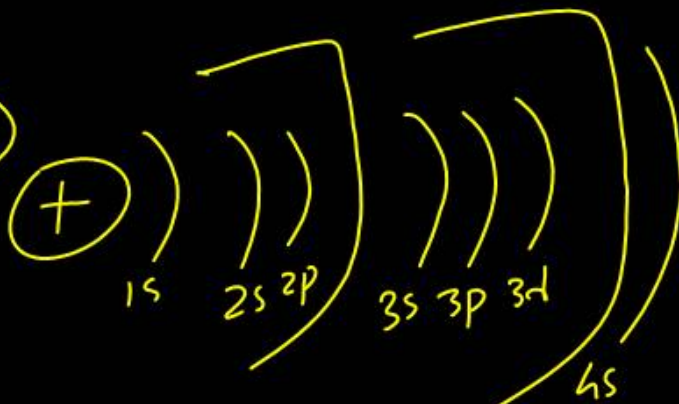
No. of σ bond + No. of LP

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

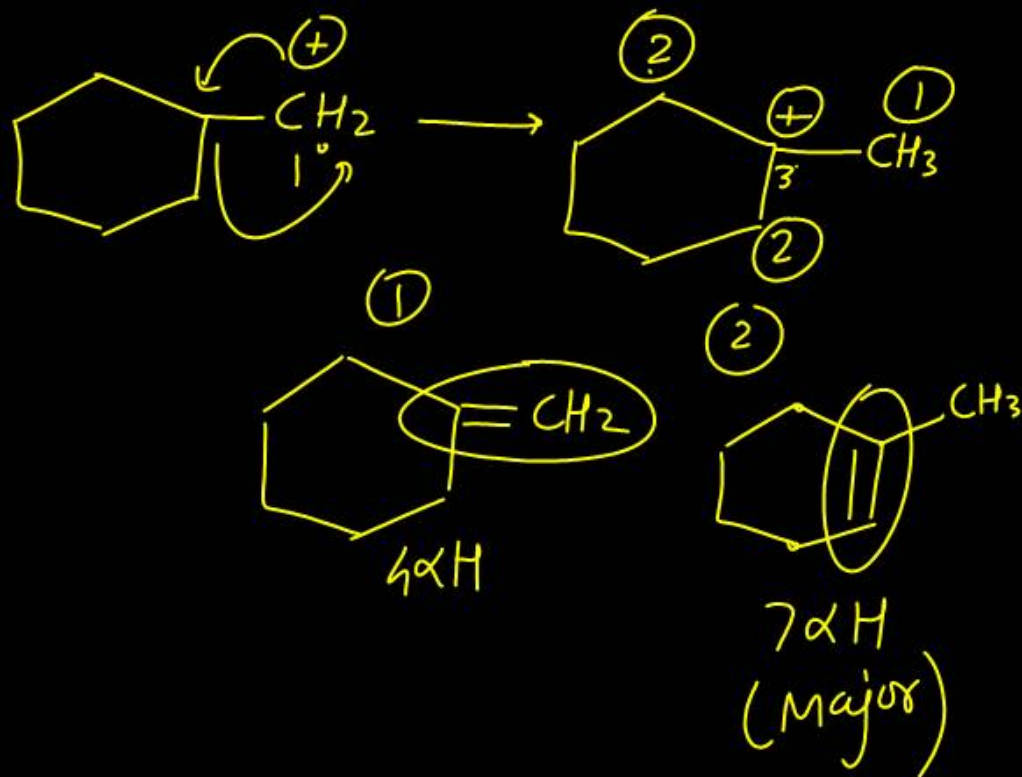
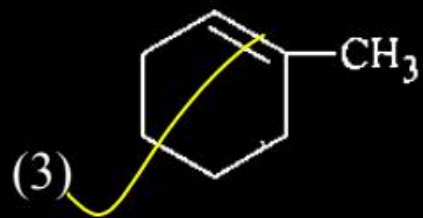
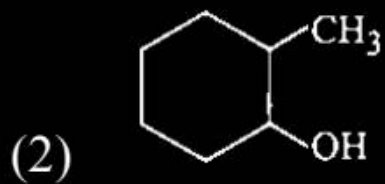
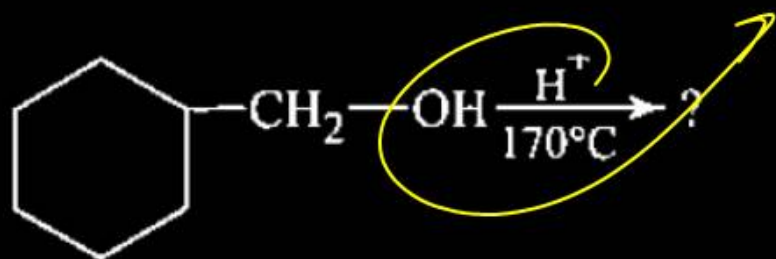
identify the incorrect statement among the following.

- (1) 4f and 5f orbitals are equally shielded.
- (2) d-Block elements show irregular and erratic chemical properties among themselves.
- (3) La and Lu have partially filled d-orbitals and no other partially filled orbitals.
- (4) The chemistry of various lanthanoids is very similar.

$$5f > 4f$$



The major product in the following reaction is



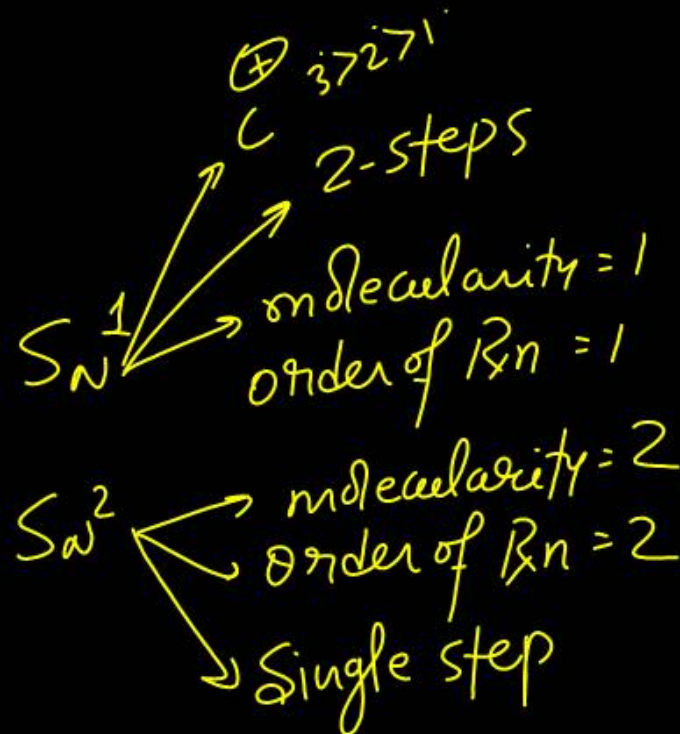
Question no. 66

Read the following statements and choose the correct code.

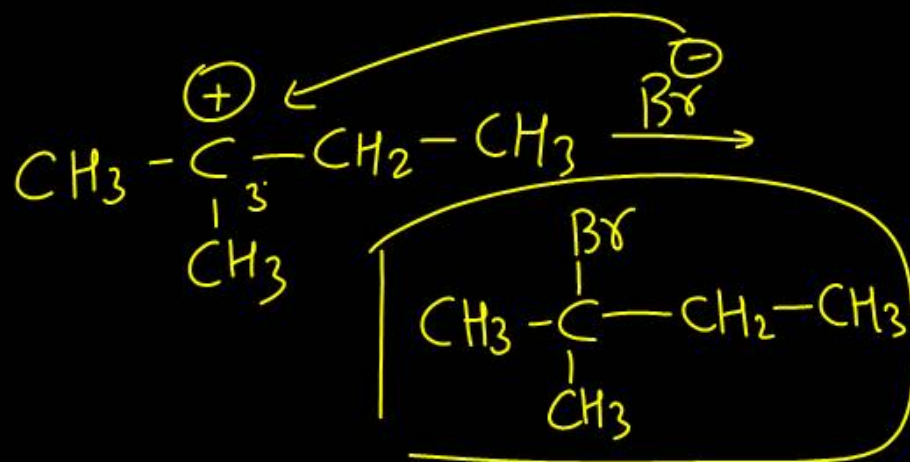
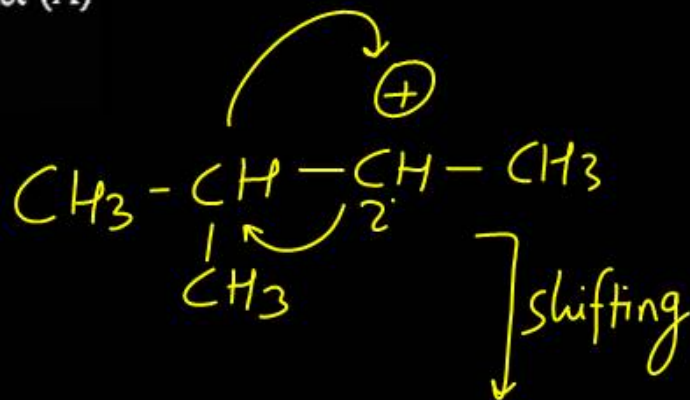
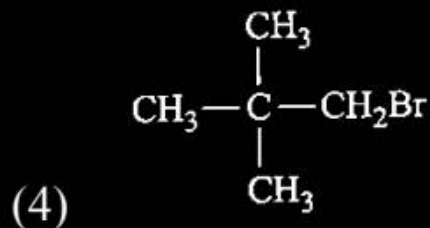
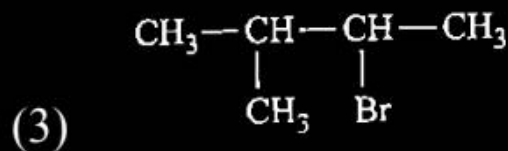
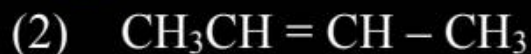
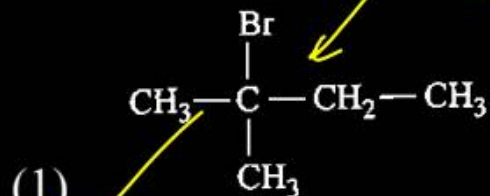
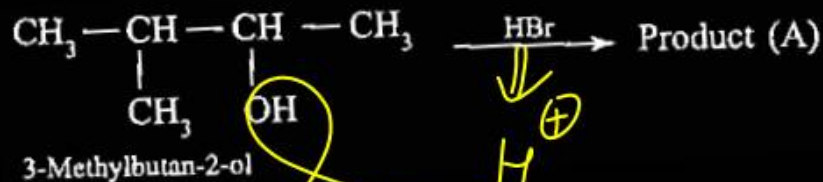
- (i) S_N2 reactions follows a second order kinetics where as S_N1 reactions follows the first order kinetics.
- (ii) S_N1 reactions follows the second order kinetics whereas S_N2 follows the first order kinetics.
- (iii) S_N2 reactions take place in a single step whereas S_N1 reactions take place in a two steps.
- (iv) Tertiary alkyl halides are least reactive towards S_N2 reactions but they show high reactivity towards S_N1 reaction.

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

4

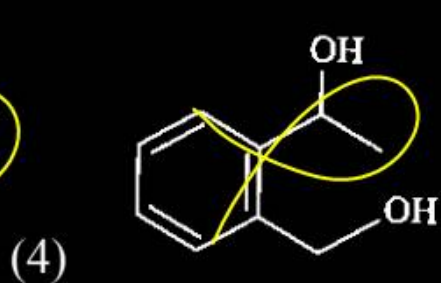
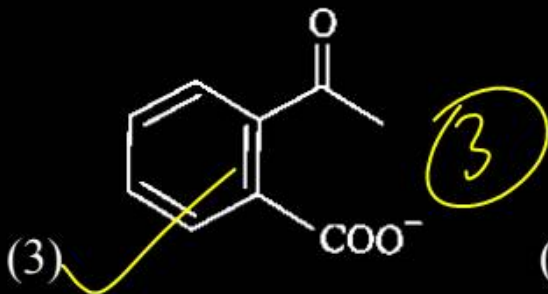
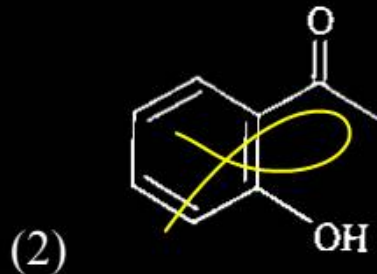
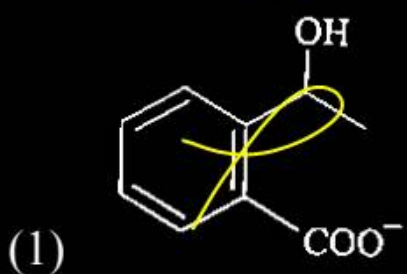
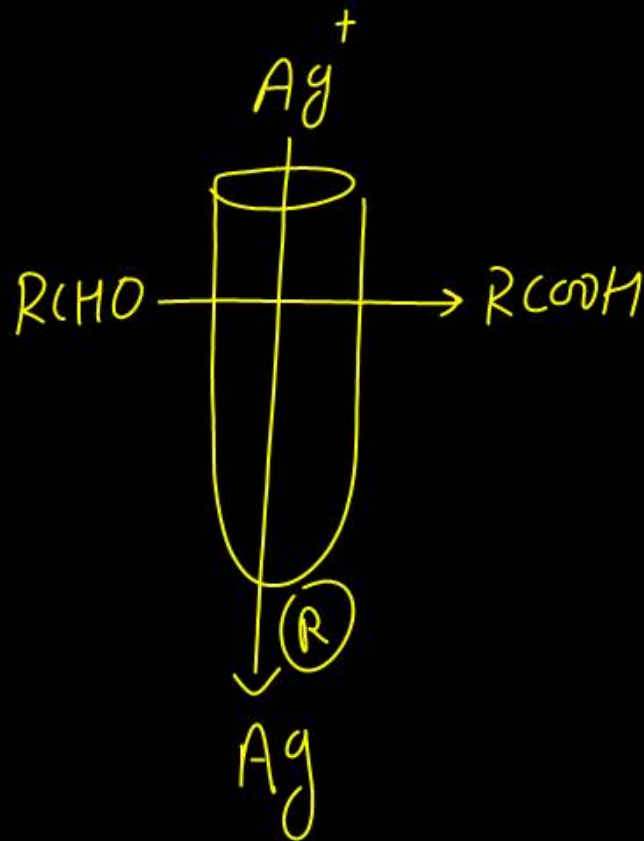
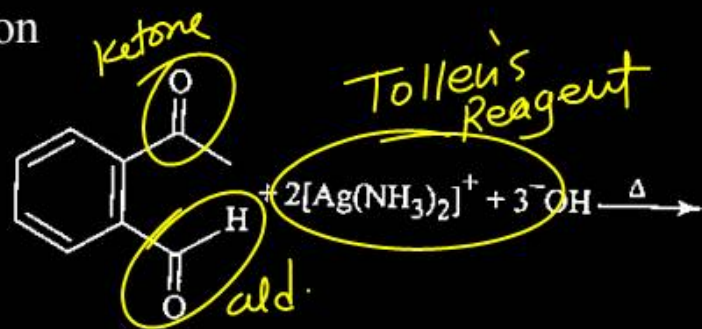


Identify major product (A) in the following reaction:



Question no. 68

Identify the major product obtained in the following reaction



The average molar mass of chlorine is 35.5 g mol^{-1} .

The ratio of ^{35}Cl to ^{37}Cl in naturally occurring chlorine is close

(1) 4 : 1

~~(2) 3 : 1~~

(3) 2 : 1

(4) 1 : 1

35

37

75%

25%

3

1

$x\%$

$$35.5 = \frac{(35 \times x) + (37(100-x))}{100}$$

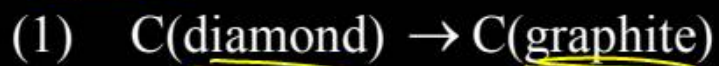
$$3550 = 35x + 3700 - 37x$$

$$3550 - 3700 = 35x - 37x$$

$$-150 = -2x$$

75%

For which of the following processes, ΔS is negative?



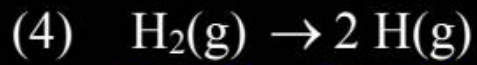
+ve



-ve



+ve



+ve

Oxidation number of potassium in K_2O , K_2O_2 and KO_2 respectively, is:

(1) $+2$, $+1$ and $+\frac{1}{2}$

(2) $+1$, $+1$ and $+1$

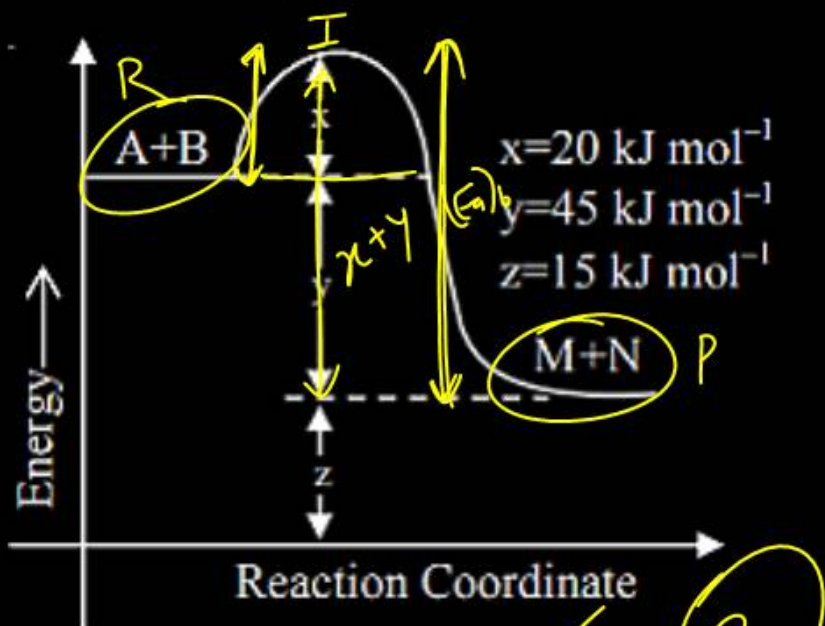
(3) $+1$, $+4$ and $+2$

(4) $+1$, $+2$ and $+4$

Question no. 72

According to the following figure, the magnitude of the enthalpy change (in kJ mol^{-1}) of the reaction

$A+B \rightarrow M+N$ is equal to –



$$(Ea)_f = x = 20 \text{ kJ/mol}$$

$$(Ea)_b = y + x = 65 \text{ kJ/mol}$$

$$\Delta H = (Ea)_f - (Ea)_b$$

$$= 65 - 45$$

$$= +20$$

(1) 45

(2) 20

(3) 15

(4) 60

2

Question no. 73

Bonding in which of the following diatomic molecules(s) become(s) stronger, on the basis of MO Theory, by removal of an electron?

- (A) NO (B) N₂
 (C) O₂ (D) C₂
 (E) B₂
- (1) (A), (B), (C) only (2) (B), (C), (E) only
 (3) (A), (C) only (4) (D) only

3

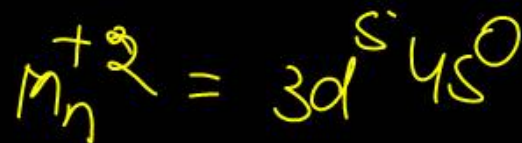
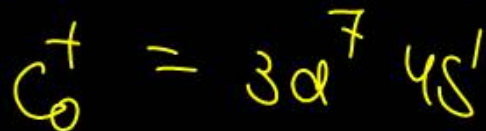
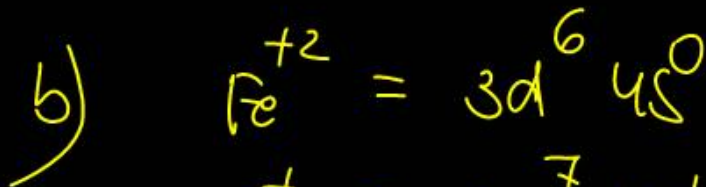
$\text{BE} \uparrow$

$\text{BE} \propto \text{BO}$

NO (15e ⁻) 2.5	→	NO ⁺ (14e ⁻) 3	BO ↑
N ₂ (14e ⁻) 3	→	N ₂ ⁺ (13e ⁻) 2.5	BO ↓
O ₂ (16e ⁻) 2	→	O ₂ ⁺ (15e ⁻) 2.5	BO ↑
C ₂ (12e ⁻) 2	→	C ₂ ⁺ (11e ⁻) 1.5	BO ↓
B ₂ (10e ⁻) 1	→	B ₂ ⁺ (9e ⁻) 0.5	BO ↓

In which of the following pairs, the outer most electronic configuration will be the same?

- (1) Ni^{2+} and Cu^+ (2) Fe^{2+} and Co^+
 (3) Cr^+ and Mn^{2+} (4) V^{2+} and Cr^+

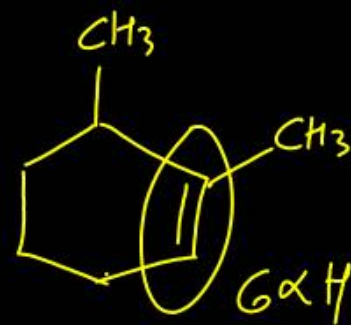
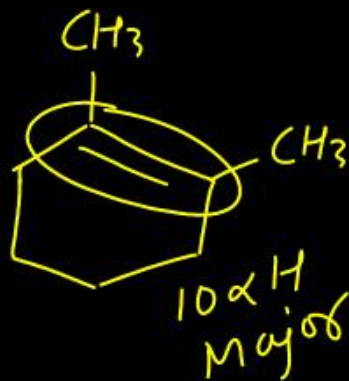
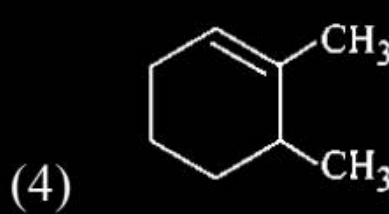
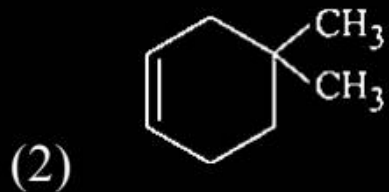
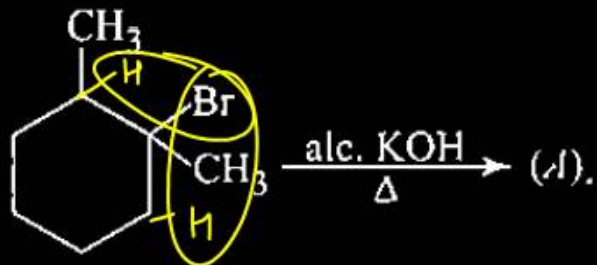


The compound formed in the positive test for nitrogen with the Lassaigne solution of an organic compound is

- (1) $\text{Fe}_4[\text{Fe}(\text{CN})_6]_3$ (2) $\text{Na}_3[\text{Fe}(\text{CN})_6]$
(3) $\text{Fe}(\text{CN})_3$ (4) $\text{Na}_4[\text{Fe}(\text{CN})_5\text{NOS}]$

Prussian Blue

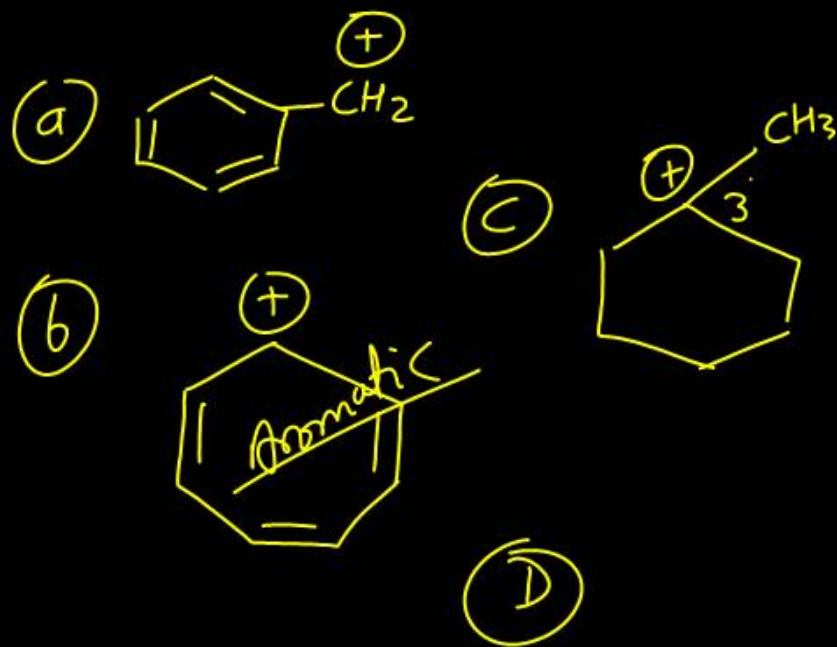
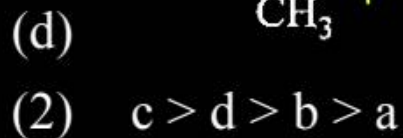
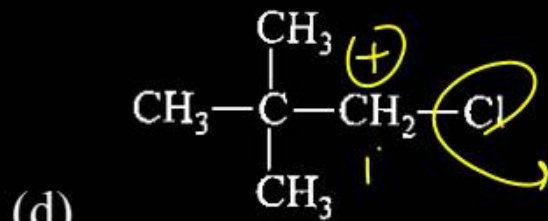
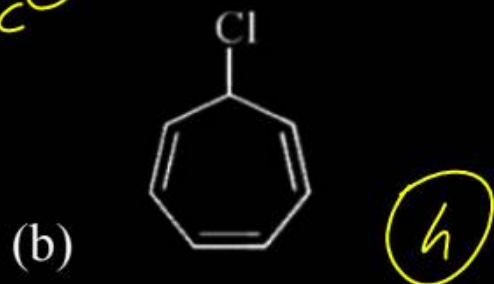
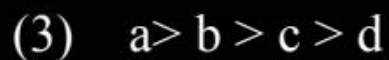
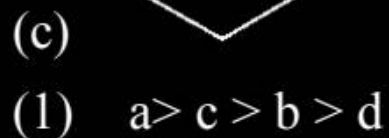
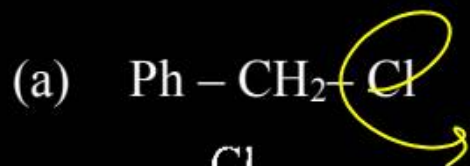
The major product (A) is



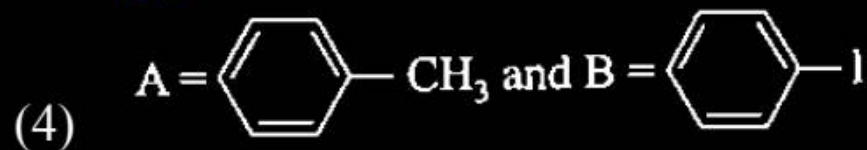
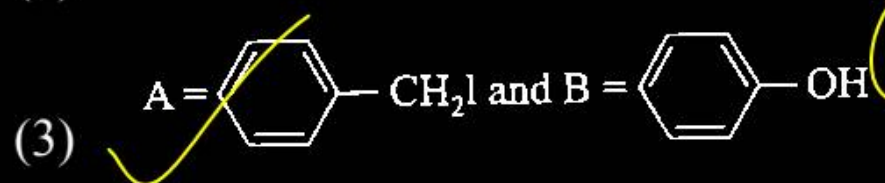
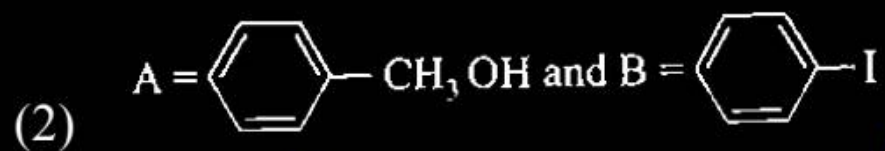
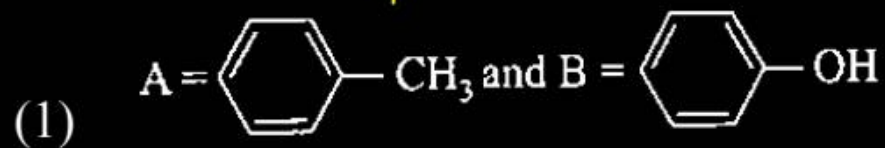
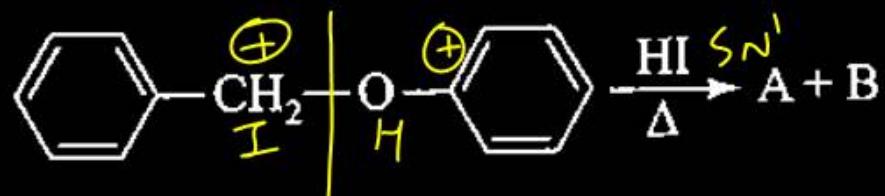
★ Bonus

Arrange the following compounds in decreasing order of reactivity in S_N1 reaction.

\propto Stability of c^+



Identify product A and B in following reaction:



Which of the following reaction is used for the preparation of amine having one C-atom more than the starting material?

- (1) $\text{CH}_3-\text{CH}_2-\text{Cl} \xrightarrow[\text{(iii) LiAlH}_4]{\text{(i) KCN}}$ $\text{CH}_3-\text{CH}_2-\text{CN} \longrightarrow \text{CH}_3-\text{CH}_2-\text{CH}_2-\text{NH}_2$
- (2) $\text{CH}_3-\text{CH}_2-\text{CN} \xrightarrow{\text{LiAlH}_4} \text{CH}_3-\text{CH}_2-\text{CH}_2-\text{NH}_3$
- (3) $\text{CH}_3-\text{CH}_2-\text{NO}_2 \xrightarrow{\text{LiAlH}_4} \text{CH}_3-\text{CH}_2-\text{NH}_2$
- (4) $\text{CH}_3-\overset{\text{O}}{\parallel}{\text{C}}-\text{NH}_2 \xrightarrow{\text{LiAlH}_4} \text{CH}_3-\text{CH}_2-\text{NH}_2$

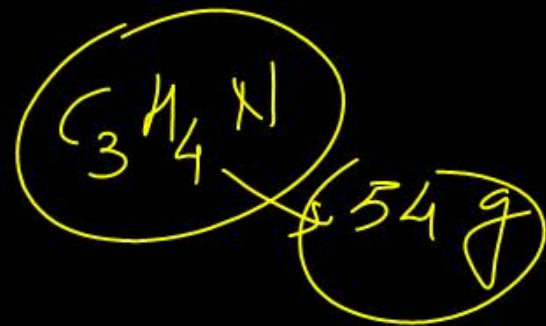
In a compound C, H and N atoms are present in 9 : 1 : 3.5 by weight. Molecular weight of compound is 108

Molecular formula of compound is

- (1) $C_2H_6N_2$ (2) C_3H_4N
 (3) $C_6H_8N_2$ ✓ (4) $C_9H_{12}N_3$

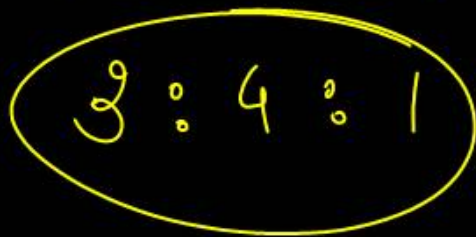
$$9 : 1 : 3.5$$

$$18 : 2 : 7$$



$$\frac{18}{12} : \frac{2}{1} : \frac{7}{14}$$

$$1.5 : 2 : \frac{1}{2}$$



A process will be spontaneous at all temperatures if:

$$\Delta G^{\circ} = \Delta H^{\circ} - T(\Delta S^{\circ})$$

-ve

(1) $\Delta H < 0$ and $\Delta S < 0$

(2) $\Delta H > 0$ and $\Delta S < 0$

(3) $\Delta H < 0$ and $\Delta S > 0$

(4) $\Delta H > 0$ and $\Delta S > 0$

-ve + ve

+ve + ve

+ve

-ve - ve

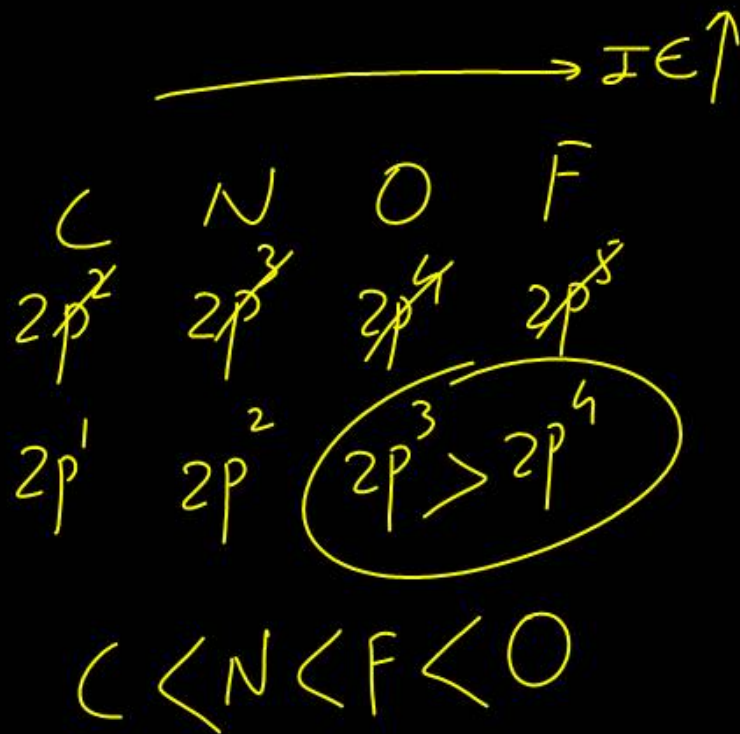
-ve

+ve ~~+ve~~

Which is the correct order of second ionization potential of C, N, O and F in the following?

- (1) $O > N > F > C$ (2) $O > F > N > C$
 (3) $F > O > N > C$ (4) $C > N > O > F$

2



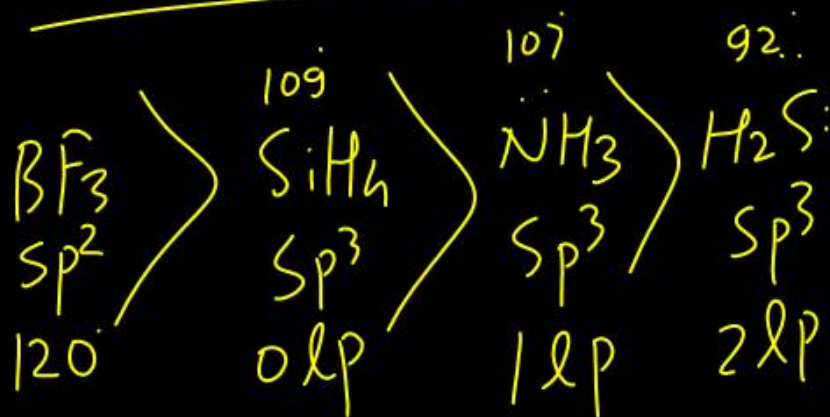
The correct order of bond angles (smallest first) in

H_2S , NH_3 , BF_3 and SiH_4 is

- (1) $\text{H}_2\text{S} < \text{NH}_3 < \text{SiH}_4 < \text{BF}_3$
 (2) $\text{NH}_3 < \text{H}_2\text{S} < \text{SiH}_4 < \text{BF}_3$
 (3) $\text{H}_2\text{S} < \text{SiH}_4 < \text{NH}_3 < \text{BF}_3$
 (4) $\text{H}_2\text{S} < \text{NH}_3 < \text{BF}_3 < \text{SiH}_4$

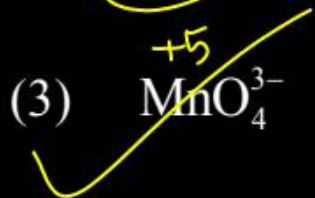
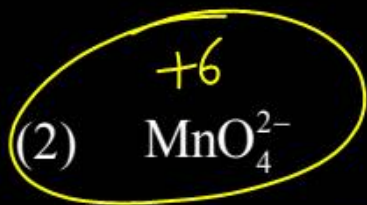
①

$$\text{B.A} \propto \frac{1}{\text{No. of Hybrid Orbitals}} \propto \frac{1}{\text{lp on CA}} \propto \text{EN}$$



→ lp ↑ BA ↓

Which one of the following species is stable in aqueous solution?



Question no. 86

Match the List-I with List-II

List-I (Cations)		List-II (Group reagents)	
(A) Pb^{2+}, Cu^{2+}	(i)	H_2S gas in presence of dilute HCl	
(B) Al^{3+}, Fe^{3+}	(ii)	$(NH_4)_2CO_3$ in presence of NH_4OH	
(C) Co^{2+}, Ni^{2+}	(iii)	NH_4OH in presence of NH_4Cl	
(D) Ba^{2+}, Ca^{2+}	(iv)	H_2S in presence of NH_4OH	

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

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

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

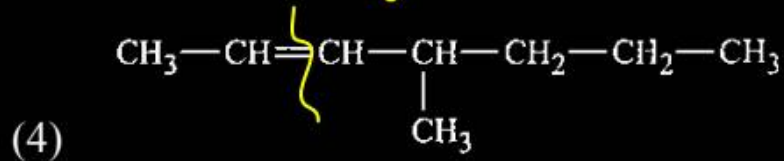
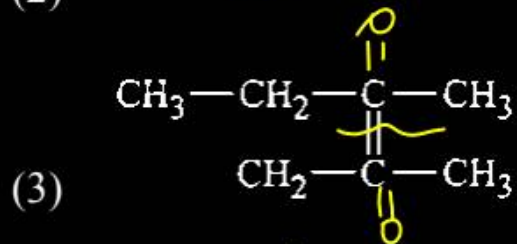
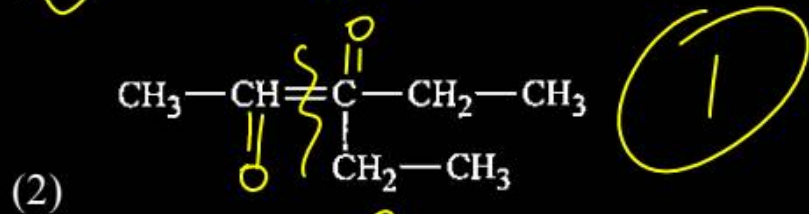
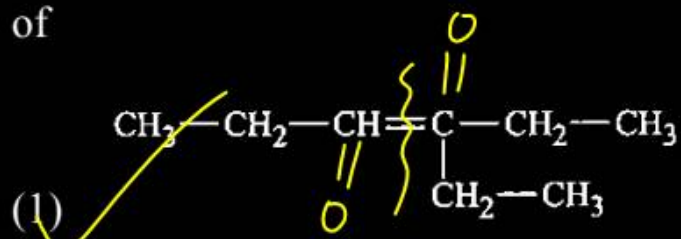
(4) A-i, B-iii, C-iv, D-ii

I	dil. HCl	Ag^+, Hg^{+2}, Pb^{+2}	chloride
II	acidic H_2S gas	Cu^{+2}, Pb^{+2}	sulphide
III	$NH_4Cl + NH_4OH$	$Al^{+3}, Ce^{+3}, Fe^{+3}$	Hydroxide
IV	Basic H_2S	$Co^{+2}, Mn^{+2}, Ni^{+2}$	Sulphide
V	$NH_4_2CO_3$	Zn^{+2} $Ba^{+2}, Sr^{+2}, Ca^{+2}$	Carbonate
VI		Mg^{+2}	

Question no. 87

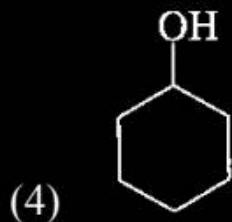
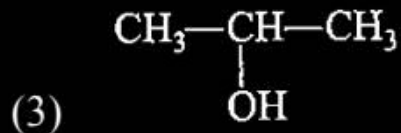
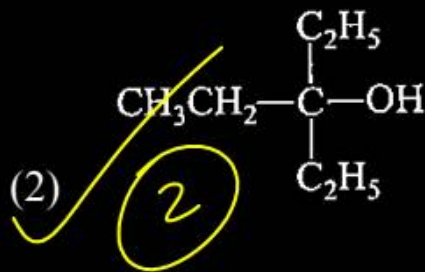
Propanal and pentan-3-one are ozonolysis products

of

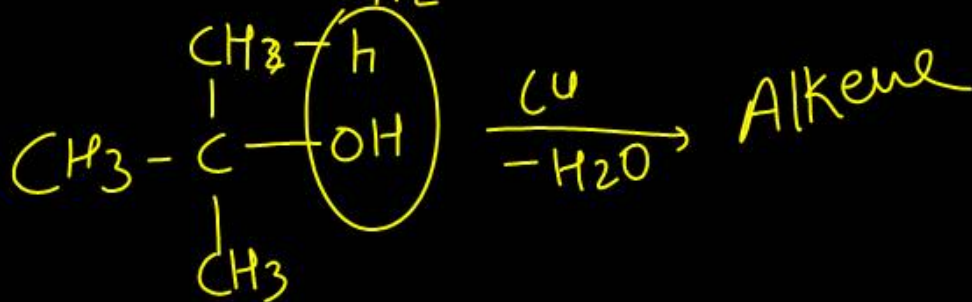
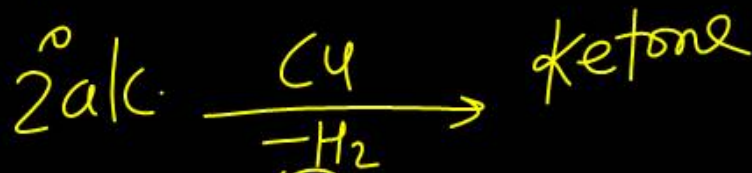
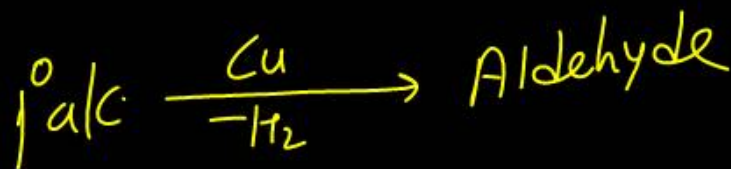


Question no. 88

Which alcohol on heating with Cu at 573 K gives alkene as a major product?

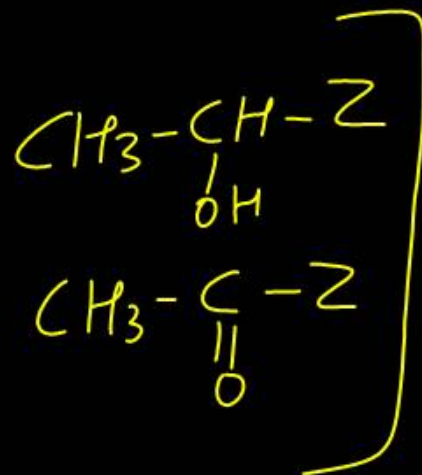


$\text{Cu} \Rightarrow$ Alcohol
dehydrogenation



Question no. 89

Following compounds are given below:



Which of the above compound(s), on being warmed with iodine solution and NaOH will give iodoform?

(1) I, III and IV

(2) Only II

(3) I, II and III

(4) I and IV

3

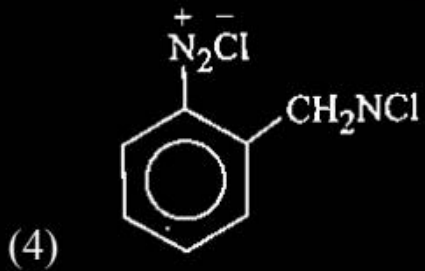
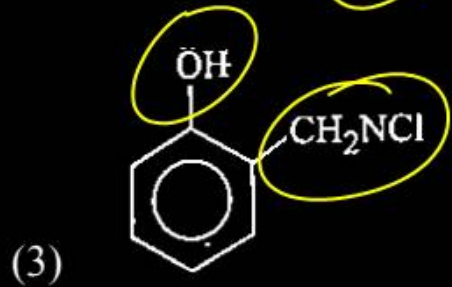
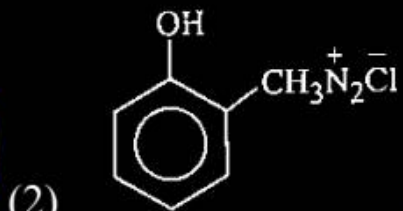
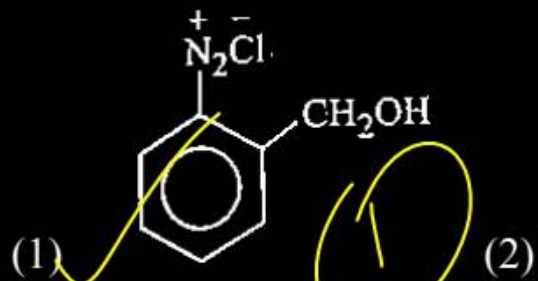
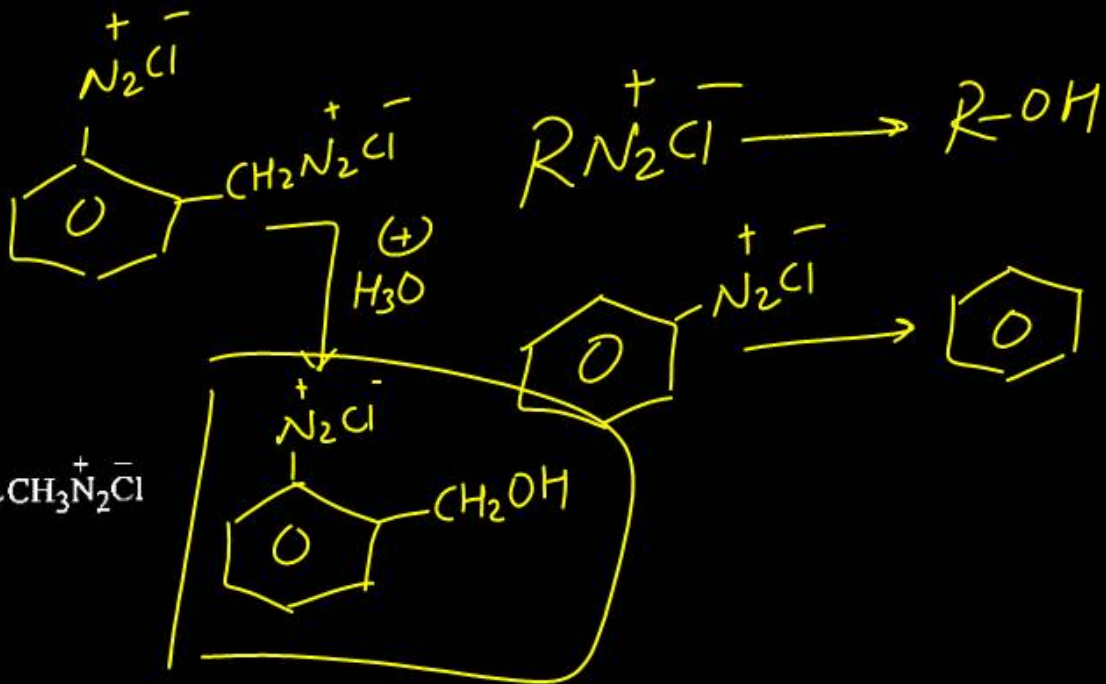
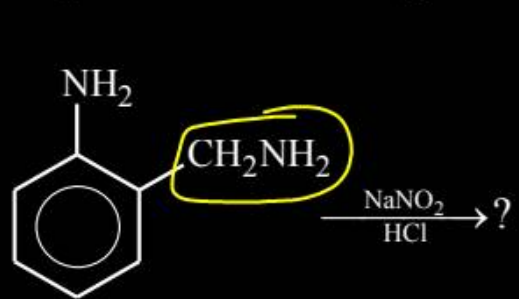
alc.
2thand
Alkan-2-ol

Ald.
acetaldehyde

ketone
acetone

Question no. 90

Identify the product in following reaction.



The taxonomic unit 'Phylum' in the classification of animals is equivalent to which hierarchical level in classification of plants?

- (1) ~~Class~~ (2) ~~Order~~
(3) Division (4) ~~Family~~

3



Which of the following are the common parasites of class Basidiomycetes?

- (1) Ustilago and puccinia
- (2) Agaricus and ~~Trichoderma~~
- (3) ~~Alternaria~~ and ~~Colletotrichum~~
- (4) ~~Colletotrichum~~ and Puccinia



Which of the following is a flagellated protozoan?

(1) Amoeba

(2) Entamoeba

(3) Plasmodium

(4) Trypanosoma



Consider the following statements about mycoplasma.

I. They are pleomorphic bacteria, which lack cell wall.

II. Mycoplasma is the smallest living organism.

III. They cannot survive without oxygen.

IV. Many mycoplasmas are pathogenic in animals and plants.

Which of the statements given above are correct?

(1) I, II and ~~III~~

(2) II, III and IV

(3) I, II and IV

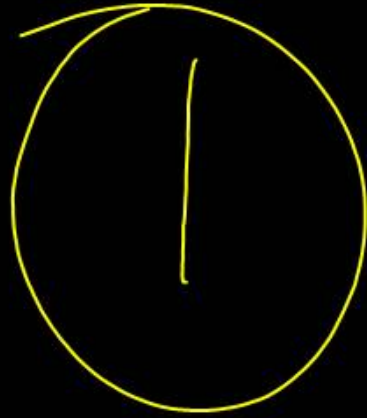
(4) I, II, III and IV



I, II, IV
3

Phylogenetic system of classification is based upon

- (1) evolutionary relationship of organisms
- (2) cytological information
- (3) structural embryology
- (4) All of the above



Sporophytic generation is dominant phase in the life cycle of

- (1) ~~Marchantia~~ (B) (2) ✓ ferns
(3) ~~mosses~~ (B) (4) ~~liverworts~~ (B)

2

Question no. 97

Consider the following statements regarding gymnosperms and choose the correct option.

- I. In gymnosperms, the male and female gametophytes have in independent existence. ✗
- II. The multicellular female gametophyte is retained within the megasporangium. ✓
- III. The gymnosperms are heterosporous. ✓

Of these statements

- (1) I and II are ~~true~~, but III is false
- (2) I and III are ~~true~~, but II is false
- (3) II and III are ~~false~~, but I is true
- ✓ (4) II and III are true, but I is false

4

Metagenesis is seen in

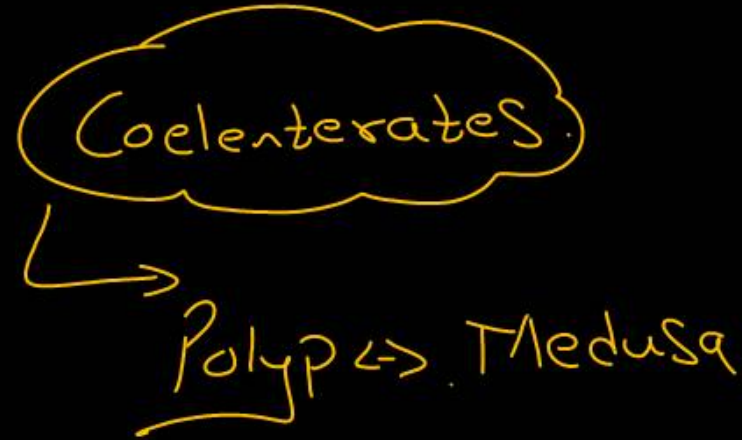
(1) Hydra

(2) Aurelia

(3) Obelia

(4) Adamsia

3



Choose the correct statement.

- (1) All mammals are viviparous ✗
- (2) All cyclostomes do not possess jaw and paired fins ✓
- (3) All reptiles have a three-chambered heart ✗
- (4) All pisces have gills convered by an operculum ✗

Fishes

2

Bony
Cartix ✗

Question no. 100

Match the following columns.

	Column I		Column II
A.	Choanocytes	1.	Platyhelminthes
B.	Cnidoblasts	2.	Ctenophora
C.	Flame cells	3.	Porifera
D.	Nephridia	4.	Coelenterata
E.	Comb plates	5.	Annelida

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

4

✓

Question no. 101

Cotyledon of maize grain is called

(1) coleorhiza

(2) coleoptile

(3) ~~scutellum~~

(4) plumule

Monocotyledon
Scutellum

3

Question no. 102

Identify the different types of aestivation (A, B, C and D) and select the correct option.



- (1) A–valvate, B–Twisted, C–Imbricate, D–Vexillary
- (2) A–Imbricate, B–Twisted, C–Valvate, D–Vexillary
- (3) A–Twisted, B–Imbricate, C–Vexillary, D–Vexillary
- (4) A–Twisted, B–Imbricate, C–Valvate, D–Vexillary

4

- I. These tissues are found as layers or patches.
- II. It consists of cell, which are thickened at the corners. *collen*.
- III. It often contains chloroplast.
- IV. Intercellular spaces are absent. *collen*.
- IV. They provide mechanical support to growing parts of plant. *collen*.

The above characters are attributed to

- (1) vascular tissue
- ~~(2) collenchyma~~
- (3) parenchyma
- (4) simple sclerenchyma

2

In male cockroaches, sperms are stored in which part of the reproductive system?

- (1) Seminal vesicles
- (2) Mushroom glands
- (3) Testes
- (4) Vas deferens



Nuclear envelope is a derivative of

- (1) membrane of Golgi complex
- (2) microtubules
- ~~(3) rough endoplasmic reticulum~~
- (4) smooth endoplasmic reticulum



Which is the most abundant protein in whole of the biosphere? *living world*

(1) Collagen

(2) Trypsin

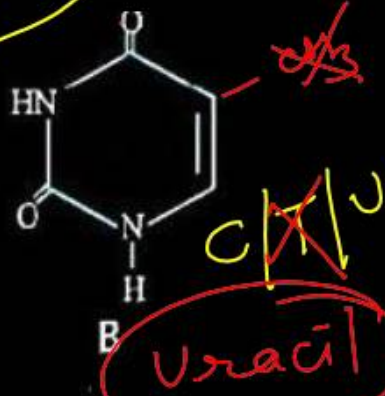
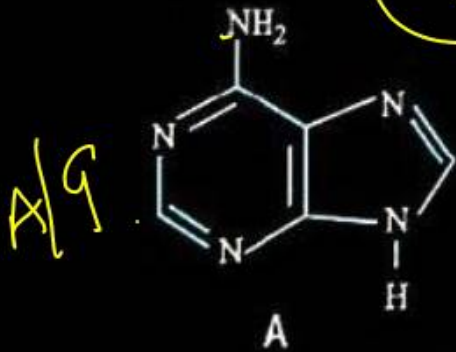
(3) Insulin

(4) RuBisCO

4

Identify A and B.

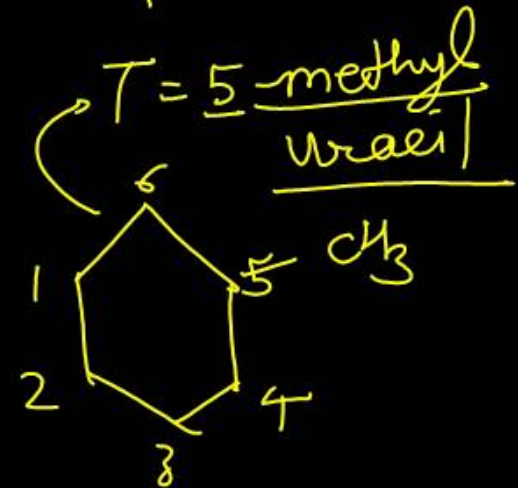
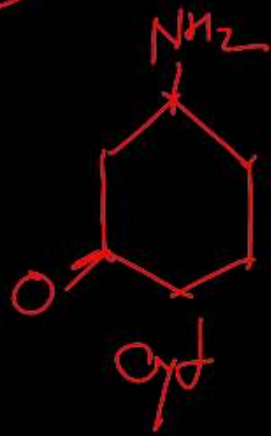
3



Purines
A
G
double ring

Pyrimidines
C
T
U
single ring

	A	B
(1)	Cytosine	Uracil
(2)	Adenine	Thymine
(3)	Adenine	Uracil
(4)	Guanine	Thymine



Select the correct statements regarding S-phase of interphase.

- I. Occurs between G_1 and G_2 . ✓
- II. DNA replication begins in the nucleus. ✓
- III. Centrioles duplicate in the cytoplasm. ✓
- VI. As DNA is doubled, number of chromosomes also doubles. ✗

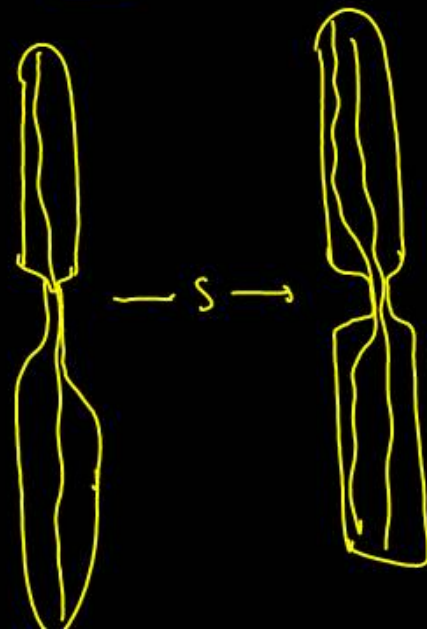
$G_1 \rightarrow S \rightarrow G_2$

DNA
Histones
Centriole

The option with correct statements is

- (1) IV and III
- (2) I, II, III and IV
- (3) II, III and IV
- (4) I, II and III

4



Which of the following statements is true for cells in G₀- stage of cell cycle?

- (1) Cells in G₀-stage are metabolically more active
- (2) Cells are metabolically ~~inactive~~
- (3) ~~Cells are~~ metabolically active, but no longer proliferate in normal condion
- (4) ~~None of the above~~



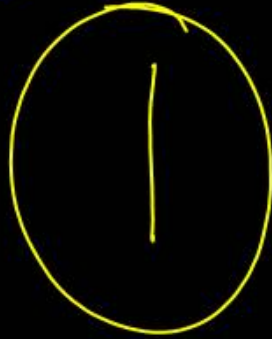
Law of limiting factor in relation to photosynthesis is proposed by

(1) Blackman

(2) Wiseman

(3) Calvin

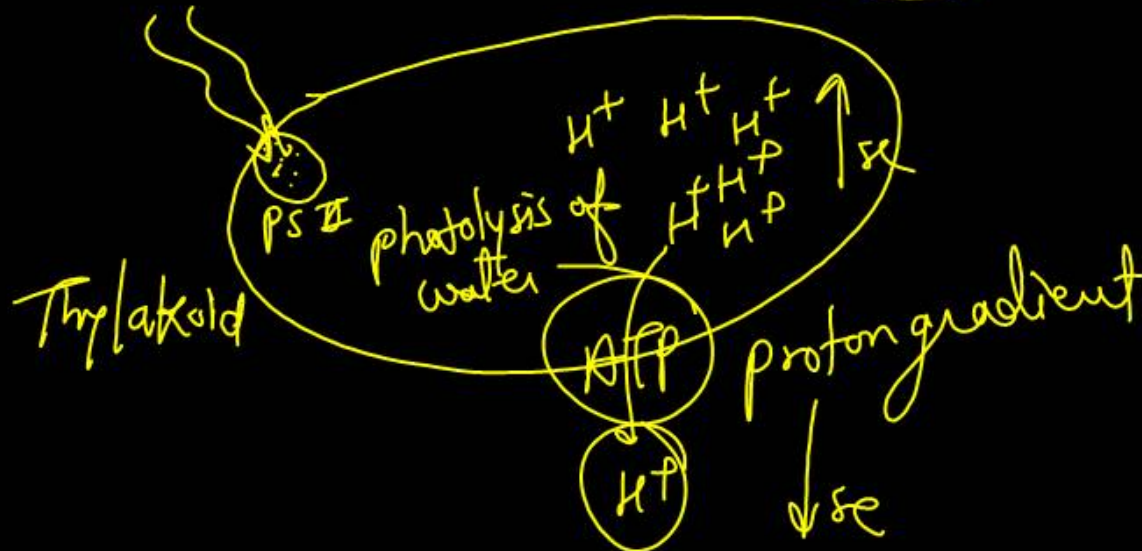
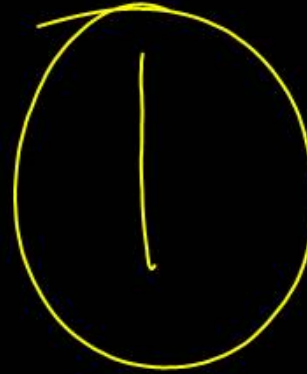
(4) Emerson



CO_2
0.03% - 0.05%
30 times

Energy required for ATP synthesis in PS-II comes from

- (1) proton gradient
- (2) electron gradient
- (3) reuction of glucose
- (4) oxidation chemical



Question no. 112

Dark reaction in photosynthesis is called so because

- (1) it can occur in dark also
- (2) it does not depend on light energy
- (3) it cannot occur during daylight
- (4) it occurs more rapidly at night

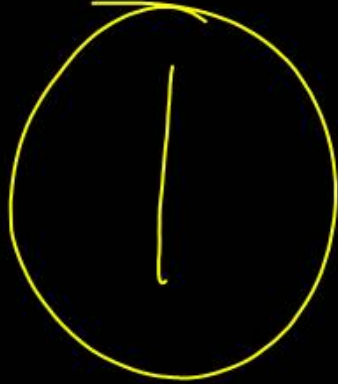
light Rx
dark Rx

1

Question no. 113

Last electron acceptor during ETS is

- (1) O_2 ✓ (2) cyt-a
(3) cyt-a₂ (4) cyt-a₃



How many ATP is released respectively when NADH and FADH_2 molecules get oxidised?

ETS

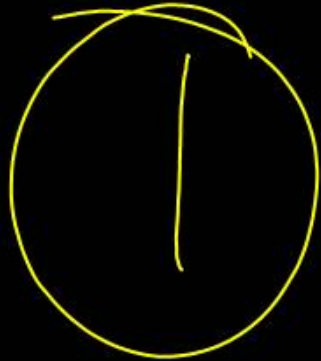
- (1) ~~3 ATP, 2 ATP~~ (2) 2 ATP, 3 ATP
(3) 5 ATP, 4 ATP (4) 3 ATP, 5 ATP

1

1 NADH = 3 ATP
1 FADH_2 = 2 ATP

Which one of the following growth regulators is known as 'stress hormone'?

- (1) Abscisic acid (2) Ethylene
(3) GA₃ (4) Indole acetic acid



The affect of apical dominance can be ~~overcome~~ by which of the following hormone?

- (1) IAA (2) Ethylene
(3) Gibberellin (4) ~~Cytokinin~~

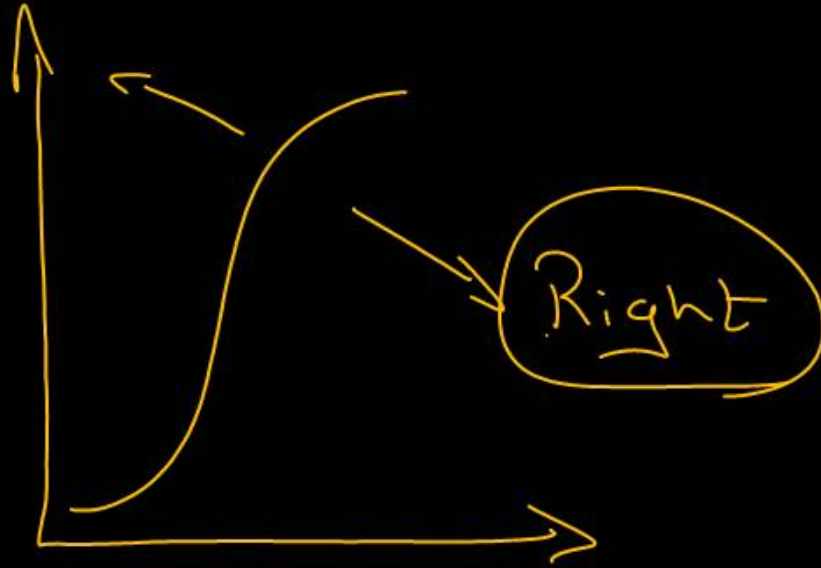
4

Question no. 117

The oxygen–haemoglobin dissociation curve will show a right shift in case of

- (1) ✓ high $p\text{CO}_2$
- (2) high $p\text{O}_2$
- (3) low $p\text{CO}_2$
- (4) less H^+ concentration

1



Question no. 118

Match the following columns.

	Column I		Column II
A.	Earthworms	1.	Network of tubes
B.	Aquatic arthropods	2.	Lungs
C.	Molluscs	3.	Gills
D.	Terrestrial organisms	4.	Moist cuticle
E.	Insects		

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

2

Question no. 119

Match the following columns.

	Column I		Column II
A.	Inspiratory Capacity (IC)	1.	Total air, a person can inspire after normal expiration.
B.	Expiratory Capacity (EC)	2.	Maximal volume of the air, a person can breath in after a forced expiration.
C.	Functional Residual Capacity (FRC) <u>FRC</u>	3.	Volume of the air that will remain in lungs after a normal expiration.
D.	Vital Capacity (VC)	4.	Total volume of air a person can expire after a normal inspiration.

2

A B C D

(1) 1 2 3 4

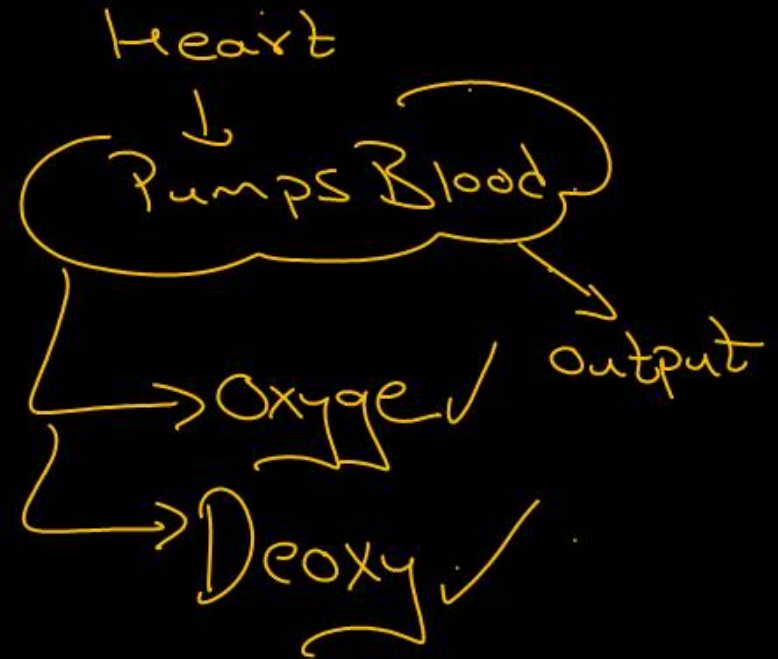
(2) 1 4 3 2

(3) 1 4 2 3

(4) 4 1 3 2

Cardiac output is

- (1) ✓ volume of the blood pumped out by each ventricle per minute
- (2) volume of the blood contained in the entire heart
- (3) volume of the oxygenated blood pumped by heart
- (4) volume of the deoxygenated blood pumped by heart



Question no. 121

The correct route through which pulse making impulse travels in the hearts is

(1) SA node → Purkinje fibres → bundle of His →
AV node → heart muscles

(2) ✓ SA node → AV node → bundle of His →
Purkinje fibres → heart muscles

(3) ✗ AV nod → bundle of His → SA node →
Purkinje fibres → heart muscles

(4) ✗ AV node → SA node → Purkinje fibres →
bundle of His → heart muscles

2

Question no. 122

On an average the amount of urea in gram excreted out per day is

- (1) ✓ 25–30 gm (2) 30–35 gm
(3) 20–25 gm (4) 35–40 gm

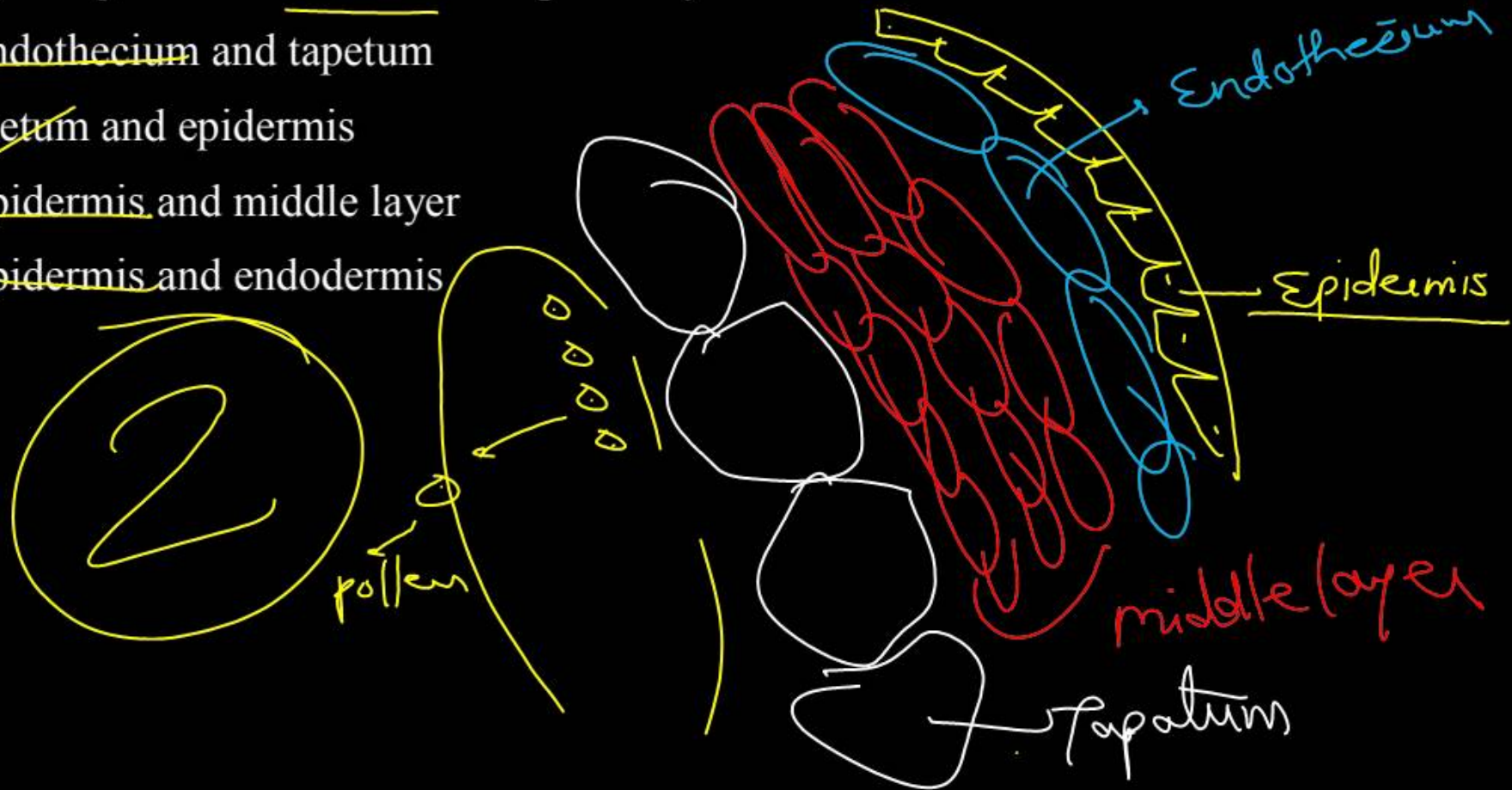
①

Urea excreted per day

25–30 gm

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

- (1) endothecium and tapetum
- (2) taetum and epidermis
- (3) epidermis and middle layer
- (4) epidermis and endodermis



Match columns I and II and select the correct option using the codes given below.

	Column - I		Column - II
A.	Male gametophyte	I.	Ovule
B.	Female gametophyte	II.	Locule
C.	Megasporangium	III.	Pollen grain
D.	Ovarian cavity	IV.	Embryo sac

A B C D

A B C D

(1) III ~~IV~~ I II

(2) IV II III I

(3) III ~~IV~~ ~~II~~ I

(4) IV III I II

A - III

B - IV

C - I

D - II

1

What would be the number of chromosomes in the cells of the aleurone layer in a plant with 8 chromosomes in its synergids?

(1) 16

(2) 24

(3) 32

(4) 8

Endosperm = $3n$
 $= 3 \times 8$
 $= 24$

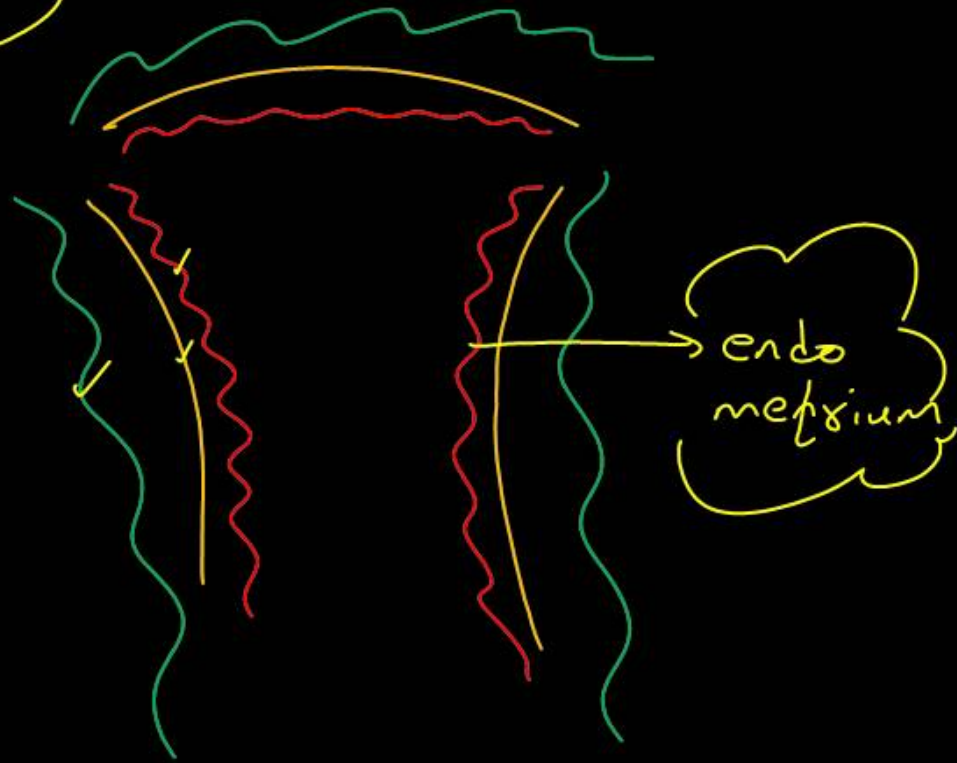
$n = 8$

2

The uterine layer that undergoes cyclical changes during menstrual cycle is

- (1) myometrium
- (2) endometrium
- (3) perimetrium
- (4) both (1) and (2)

2



What change(s) occur in ovary and/or uterus during follicular phase of menstrual cycle?

- (1) Formation of Graafian follicle
- (2) Formation of corpus luteum
- (3) Regeneration of endometrium
- (4) Both (1) and (3)

4

Ovarian
change
Uterine
change

Capacitation refers to changes in the

- (1) ovum before fertilization
- (2) ovum after fertilisation
- (3) sperm after fertiisation
- (4) ~~sperm~~ before fertilsiation

4

Sperm enters female
Reproductive tract
→ Capacitation

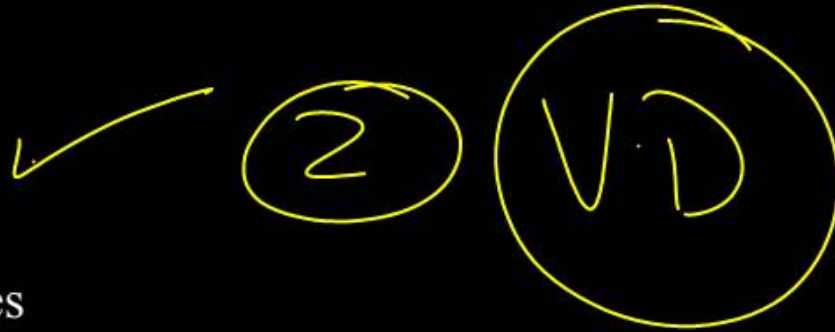
Which of the following is a correct statement?

- (1) IUDs suppress gametogenesis X
- (2) IUDs once inserted need not be replaced X
- (3) IUDs are generally inserted by the user herself X Doctor
- (4) IUDs increase phagocytosis of sperms in the uterus ✓

4

Sexually transmitted diseases are alternatively known as

- (1) contagious diseases
- (2) venereal diseases
- (3) viral diseases
- (4) degenerative diseases



In case of a couple where the male is having a very low sperm count, which technique will be suitable for fertilization?

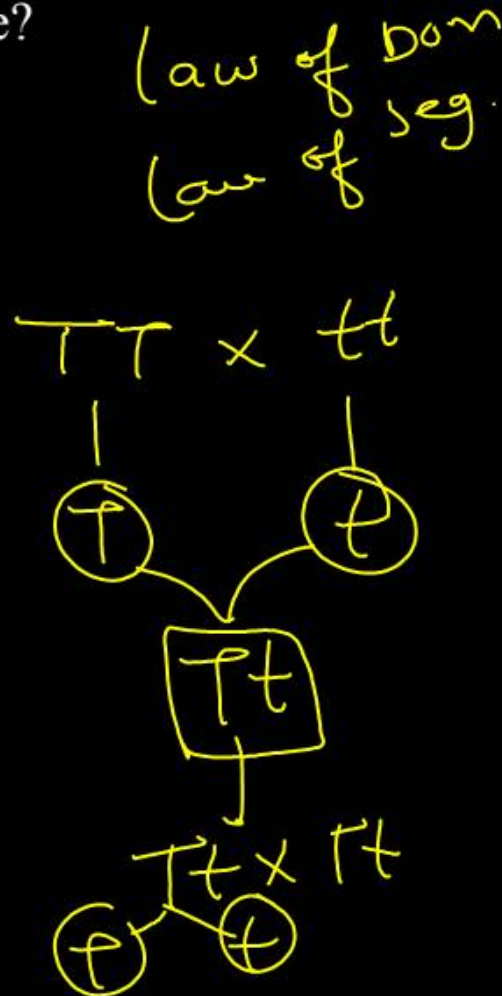
- (1) intracytoplasmic sperm injection
- (2) Intrauterine transfer
- (3) Gamete intracytoplasmic fallopian transfer
- (4) Artificial insemination ✓

4

Based on his observations of monohybrid cross,
Mendel proposed which law of inheritance?

- (1) Law of dominance ✓
- (2) Law of segregation ✓
- (3) Law of independent assortment ~~bihybrid~~
- (4) Both (1) and (2)

4

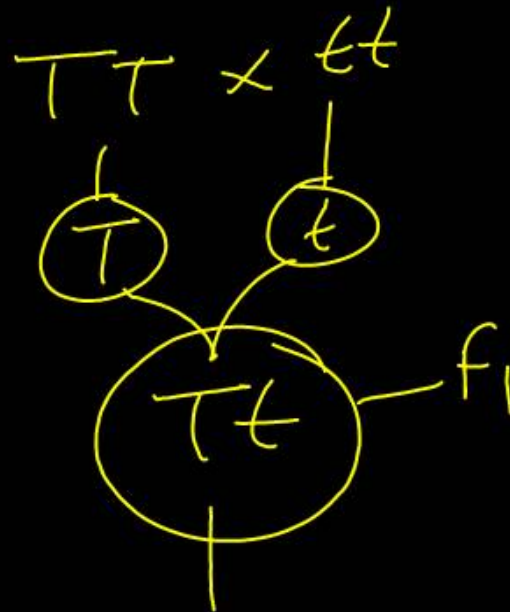


Assertion : The law of dominance is used to explain the expression of only one of the parental characters in a monohybrid cross.

Reason : It also explains the ~~proportion~~ of 3 : 1 obtained at F_2 generation.

- (1) Both assertion and reason are true and reason is the correct explanation of assertion.
- (2) Both assertion as reason are true but reason is not correct explanation of assertion.
- (3) Assertion is true, but ~~reason~~ is false.
- (4) Both assertion and reason are false

3



3:1
Tall dwarf

In Drosophila, males possess

- (1) XO chromosomes (2) XX chromosomes
(3) XY chromosomes (4) YY chromosomes

3

$2n = 8$ (4 pairs)
 $\sigma = 6 + XY$
 $\phi = 6 + XX$

A classical example of point mutation is

- (1) gout (2) night blindness
(3) sickle cell anaemia (4) Turner's syndrome

✓ SCA



Phenylketonuria ^{PKU} is an inborn error in which affected individual lacks an enzyme that converts

- (1) phenylalanine into tyrosine
- (2) tyrosine into phenylalanine
- (3) glutamic acid into valine
- (4) valine into glutamic acid

Phenylalanine
hydroxylase

1

What is the genetic disorder in which an individual has an overall masculine development, gynaecomastia and is sterile?

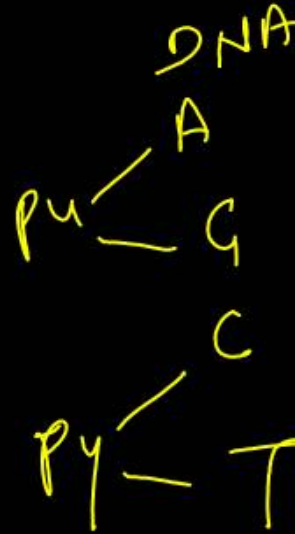
- (1) Turner's syndrome
- (2) ~~Klinefelter's syndrome~~
- (3) Edward's syndrome
- (4) Down's syndrome

2

Which among the following nitrogenous base is found in both DNA and RNA?

- (1) ~~Adenine and Thymine~~
- (2) ~~Thymine and Uracil~~
- (3) ~~Thymine and Cytosine~~
- (4) Cytosine and Guanine

4



~~Uracil (U)~~

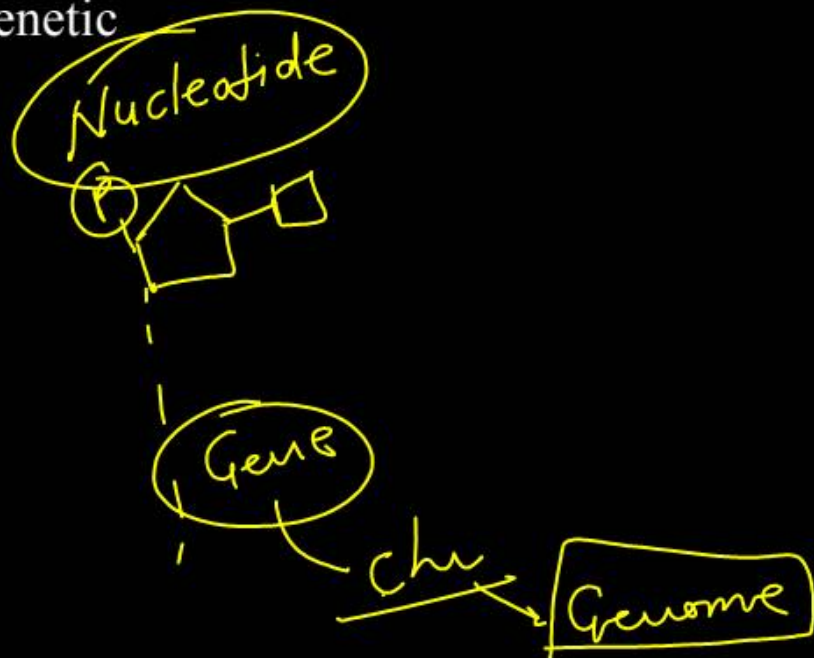


~~Thymine (T)~~

Identify the correct order of organization of genetic material from largest to smallest:

- (1) Chromosome, genome, nucleotide, gene
- (2) Chromosome, gene, genome, nucleotide
- (3) Genome, chromosome, ~~nucleotide~~, gene
- (4) Genome, ~~chromosome~~, gene, nucleotide

✓
4



Match the following RNA polymerases with their transcribed products:

	Column - I		Column - II
A.	RNA polymerase I	I.	tRNA
B.	RNA polymerase II	II.	rRNA
C.	RNA polymerase III	III.	hnRNA

Select the correct option

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

4

Which of the following features of genetic code does allow bacteria to produce human insulin by recombinant DNA technology?

- (1) Genetic code is ~~redundant~~
- (2) Genetic code is ~~nearly~~ universal
- (3) Genetic code is specific
- (4) Genetic code is not ambiguous

2

Which of the following is the starter codon?

(1) UCA

(2) UAA

(3) UAG

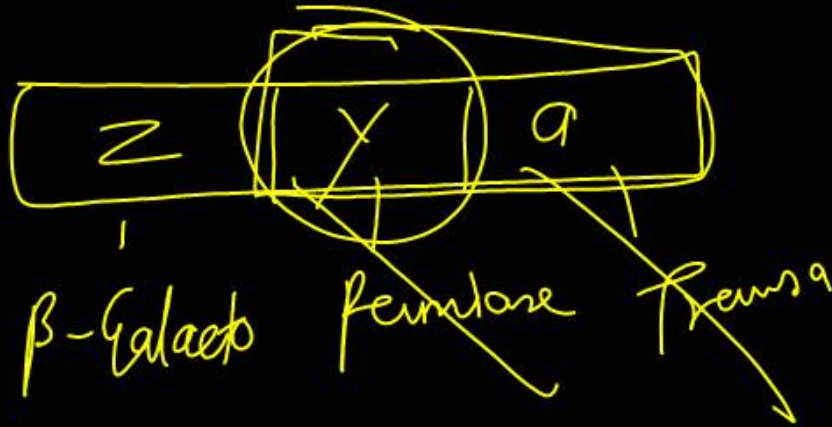
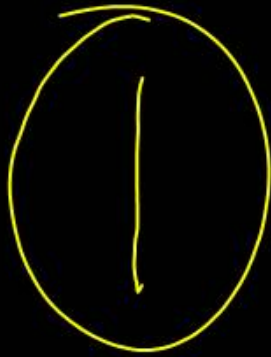
(4) AUG

AUG
GUG

4

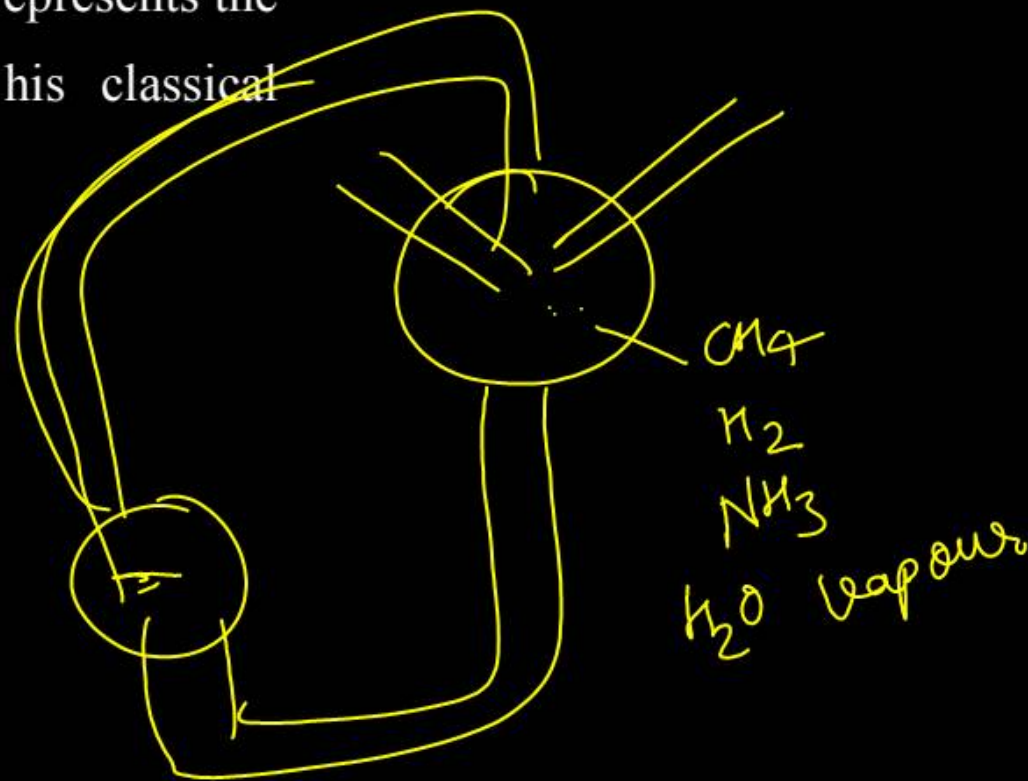
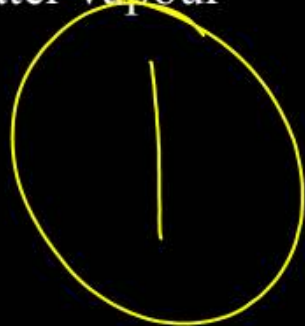
Which enzyme will be produced in a cell if there is a non-sense mutation in the lac Y gene of lac operon?

- (1) β -Galactosidase (2) Lactose permease
(3) Transacetylase (4) Transferase



Which of the following option correctly represents the gaseous mixture taken by Miller in his classical experiment on chemical evolution?

- (1) CH_4 , H_2 , NH_3 and water vapour
- (2) CH_4 , O_2 , NH_3 and water vapour
- (3) O_2 , H_2 , NH_3 and water vapour
- (4) N_2 , O_2 and water vapour



Variations caused by mutation, as proposed by Hugo de Vries, are

- (1) random and directional
- (2) random and directionless
- (3) small and directional
- (4) small and directionless

2

Which of the following options correctly represent the ~~two~~ key features of Darwin's theory of evolution?

two

- (1) Mutation and natural selection.
- (2) Artificial and natural selection.
- (3) Branching descent and natural selection.
- (4) Branching descent and mutation.

3

A population will not exist in Hardy-Weinberg equilibrium if

- (1) there is no migration ✓
- (2) the population is large ✓
- (3) individuals mate selectively ✗
- (4) there are no mutations ✓

3

The chronological order of human evolution from early to the recent is

- (1) Australopithecus > Ramapithecus > Homo habilis > Homo erectus
- (2) Ramapithecus > Australopithecus > Homo habilis > Homo erectus
- (3) Ramapithecus > Homo habilis > Australopithecus > Homo erectus
- (4) Australopithecus > Homo habilis > Ramapithecus > Homo erectus

2

Match Column-I with Column – II and choose the correct option from the codes given below.

	Column – I		Column - II
A.	Food-borne disease	I.	Pneumonia
B.	Air-borne disease	II.	Amoebic dysentery
C.	Vector-borne disease	III.	Malaria

- (1) A – II; B-I; C-III
(2) A-I; B-II; C-III
(3) A-III; B-II; C-I
(4) ~~A-II; B-III; C-I~~

1

Saliva in the mouth is an example of

- (1) ~~physical barrier of immunity.~~
- (2) physiological barrier of immunity.
- (3) ~~cellular barrier of immunity.~~
- (4) ~~cytokine barrier of immunity.~~

Innate immunity
4 Barriers

2

Question no. 151

Cocaine is obtained from

- (1) Papaver somniferum
- (2) Cannabis sativa
- (3) Atropa belladonna
- (4) Erythro^xylum coca ✓

4

HIV is an

- (1) enveloped virus with ~~DNA~~ genome
- (2) enveloped virus with RNA genome ✓
- (3) ~~non~~-enveloped virus with RNA genome
- (4) non-enveloped virus with ~~DNA~~ genome

2

The vitamin whose content increases during curd formation by lactic acid bacteria is

- (1) Vitamin C (2) Vitamin D
(3) Vitamin B₁₂ (4) Vitamin E

✓
3

In 1945, who among the following scientists were awarded the Nobel Prize in Physiology and Medicine for the discovery of antibiotics?

Penicillin.

- (1) Alexander Fleming, Ernest Chain and Howard Florey
- (2) Alexander Fleming only
- (3) Ernest Chain only
- (4) Gregor John Mendel



Question no. 155

Match the biocontrol agents in column I with a suitable description in column II.

	Column - I		Column - II
A.	Bacillus thuringiensis	I.	Voracious feeder of aphids
B.	Trichoderma	II.	Predator of mosquitoes larvae
C.	Ladybird	III.	Biocontrol agent for nematodes
D.	Dragonfly	IV.	Kill the butterfly

A B C D

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

3

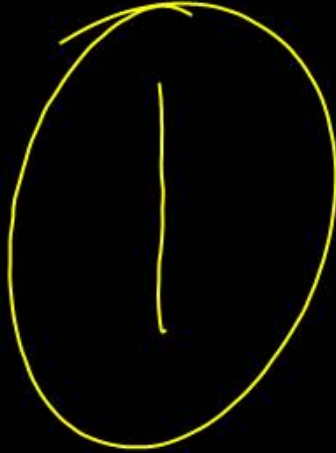
What gases are produced in anaerobic sludge digesters?

- (1) Methane and CO₂
- (2) Methane, Hydrogen sulfide and CO₂
- (3) Hydrogen Sulfide and CO₂
- (4) Methane and CO₂

2

DNA precipitated out of a mixture of biomolecules can be achieved by the treatment with

- (1) Chilled ethanol ✓
- (2) Methanol at room temperature
- (3) Chilled chloroform
- (4) Isopropanol



A novel strategy was adopted to prevent Meloidogyne incognita in tobacco plants that was based on the process of

- (1) DNA interference (2) RNA interference
(3) RNA initiation (4) DNA initiation

2

Question no. 159

Match the population interactions in Column-I with the possible outcome in Column - II.

	Column - I		Column - II
A ↓	Mutualism	I.	+,-
B.	Competition	II.	+, +
C.	Parasitism	III.	+, 0
D.	Commensalism	IV.	-, -

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



Alexander Von Humboldt described for the first time

- (1) Ecological Biodiversity
- (2) Laws of limiting factor
- (3) Species area relationships
- (4) Population Growth equation

3

Question no. 161

Rivet popper hypothesis to explain the effect of species richness on community services was proposed by

- (1) Charles Elton
- (2) David Tilman
- (3) Paul and Ann Ehrlich
- (4) Brain Walker



The Evil Quartet as proposed by Jared Diamond to describe the direct causes of loss of biodiversity includes

- (1) natural calamities ✗
- (2) habitat destruction ✓
- (3) carrying capacity
- (4) natural mass extinctions

2

Question no. 163

How many hotspots of biodiversity in the world have been identified to date by Norman Myers?

(1) 25

(2) 34

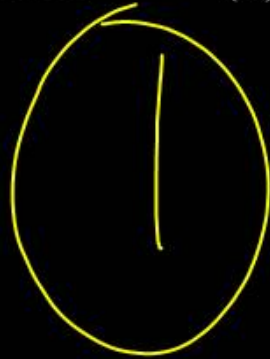
(3) 36

(4) 35



The region of the biosphere reserve, which is legally protected and where no human activity is allowed is known as

- (1) core zone
- (2) buffer zone
- (3) transition zone
- (4) restoration zone



Which one of the following is not a method of in situ conservation of biodiversity?

- (1) ~~Biosphere Reserve~~ (2) ~~Wildlife Sanctuary~~
(3) ~~Botanical Garden~~ (4) ~~Sacred Grove~~

3

The joint found in the head of upper arm and pectoral girdle is

- (1) hinge joint (2) ball and socket joint
(3) gliding joint (4) saddle joint

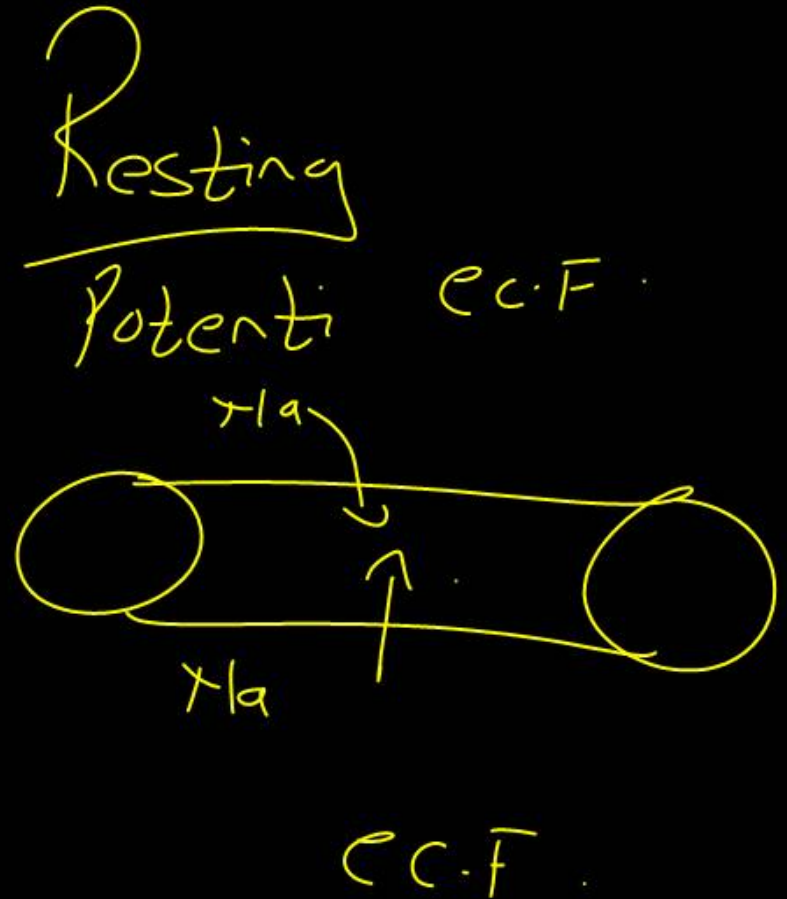
2

Humerus.
Scapula.

During the conduction of a nerve impulse, the action potential results from the movement of

- (1) K^+ ions from extracellular fluid to intracellular fluid
- (2) Na^+ ions from intracellular fluid to extracellular fluid
- (3) K^+ ions from intracellular fluid to extracellular fluid
- (4) ✓ Na^+ ions from extracellular fluid to intracellular fluid

(4)



Question no. 168

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

(1)	Hypothalamus	Production of releasing hormones and regulation of temperature, hunger and thirst.
(2)	Limbic system	Consists of fibre tracts that interconnect different regions of brain, controls movement.
(3)	Medulla oblongata	Controls respirations and cardiovascular reflexes.
(4)	Corpus callosum	Band of fibres connecting left and right cerebral hemispheres.

2

Question no. 169

Select the answer which correctly matches the endocrine gland with the hormone it secretes and its functions / deficiency symptom.

	Endocrine gland	Hormone	Function/Deficiency symptoms
(1)	Anterior pituitary	Oxytocin X	Stimulates uterus contraction during childbirth
(2)	Posterior pituitary	Growth Hormone (GH) X	Oversecretion stimulates abnormal growth
(3)	Thyroid gland ✓	Thyroxine ✓	Lack of iodine in diet results in goiter
(4)	Corpus luteum	Testosterone X	Stimulates spermatogenesis



Which one of the following four glands is correctly match with the accompanying description?

(1)	Thyroid	<u>Hyperactivity</u> in young children causes <u>cretinism</u>
(2)	Thymus	Starts undergoing <u>atrophy</u> after <u>puberty</u>
(3)	Parathyroid	Secretes <u>parathormone</u> , which promotes movement of calcium ions from blood into bones during <u>calcification</u>
(4)	Pancreas	Delta cells of the islets of Langerhans secrete a hormone, which stimulates <u>glycolysis</u> in liver

degenerate

2

Somatostatin

Question no. 171

Coralloid roots have a symbiotic association with

- (1) Photosynthetic green algae
- (2) Nitrogen-fixing cyanobacteria
- (3) Fungus
- (4) Photosynthetic brown algae



Question no. 172

Match the following

	Column – I (Group of bacteria)		Column – II (Their shape)
A.	Coccus	I.	Rod-shaped
B.	Bacillus	II.	Spherical
C.	Spirillum	III.	Spiral
D.	Vibrium	IV.	Comma-shaped

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

2

Which is wrong about pteridophytes?

- (1) Gametophytic phase is dominant.
- (2) Sporohytic is the main plant body.
- (3) Gametophyte is independent.
- (4) Primary roots are ephemeral, replaced by adventitious roots.

Short-lived

1

Which of the following possess vascular tissues but lacks seeds? ~~X~~

- (1) ~~Mosses~~
- (3) ~~Liverworts~~

- (2) ~~Volvox~~
- (4) ~~Ferns~~

vascular tissues → X & P (Plants.)

④

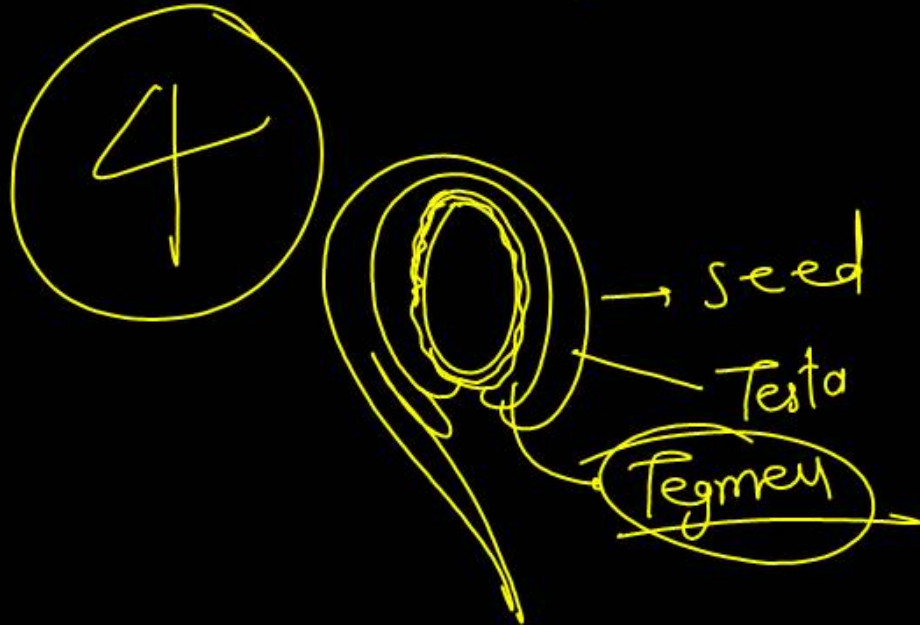
P
X

g
L

A
L

The inner layer of the seed coat is called

- (1) Testa (2) Hilum
(3) Micropyle (4) ~~Tegmen~~



Select the incorrect statement.

- (1) Cuscuta is a parasitic plant.
- (2) Bladderwort and Venus fly trap are examples of insectivorous plants.
- (3) Plantae includes algae, bryophytes, pteridophytes, gymnosperms and angiosperms.
- (4) The mode of nutrition in plants is holozoic.

Autotrophic

4

Which of the following set of animals belong to phylum hemichordate?

- (1) ~~Balanoglossus, Saccoglossus~~
- (2) Roundworm, Tongue worm
- (3) Flat worm, Earthworm
- (4) Dentalium, Chaetopleura

1

The ciliated epithelial cells are required to move particles or mucus in a specific direction. In humans, these cells are mainly present in

- (1) Fallopian tubes and pancreatic duct
- (2) Eustachian tube and salivary duct
- (3) ✓ bronchioles and Fallopian tubes ✓
- (4) bile duct and bronchioles

③

Cilia → Movement Direction

Cotyledon of maize grain is called

- (1) coleorhiza (2) coleoptile
(3) suctellum (4) plumule

3

Consider the following statements.

- I. In racemose inflorescence, the flowers are borne in a basipetal order.
- II. Epigynous flowers are seen in rose plant.
- III. In brinjal, the ovary is superior.

Of these statements, the correct statement(s) is/are

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

3

