Question no. 1

In a vernier callipers, one main scale division is x cm and n divisions of the vernier scale coincide with (n–1) divisions of the main scale. The least count (in cm) of the calipers is

(1) $\left(\frac{n-1}{n}\right)x$

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

(3) $\frac{x}{n}$

(4) $\frac{x}{(n-1)}$

$n\,VSD = (n-1)\,MSD$

$1\,VSD = \frac{(n-1)}{n}\,msd$

$LC = 1\,MSD - 1\,VSD$

$= x - \left[\frac{(n-1)}{n}x\right]$

$= \frac{xn - nx + x}{n} = x/n$

Question no. 2

The dimensional formula of electric potential is

(1) $[ML^2T^{-3}A^{-1}]$ (2) $[M^{-1}L^2T^{-2}A]$

(3) $[M^{-1}L^2T^{-2}A^{-1}]$ (4) $[ML^2T^2A]$

$$\frac{WD}{Q} = \frac{f \cdot \text{displacement}}{\text{Ampere} \times \text{Time}}$$

$$= \frac{(MLT^{-2})(L)}{[A][T]}$$

$$= ML^2T^{-3}A^{-1}$$

Question no. 3

If force (F), velocity (V) and time (T) are taken as fundamental units, then the dimensions of mass are

(1) $[FVT^{-1}]$ (2) $[FVT^{-2}]$

(3) $[FV^{-1}T^{-1}]$ (4) $[FV^{-1}T]$

$m = f^1 V^{-1} T^1$

$T^0 = T^{-2a-b+c}$

$0 = -2(1) - (-1) + c$

$-2 + 1 + c = 0$

$c = 1$

$m \propto f^a V^b T^c$

$[M^1 L^0 T^0] = [MLT^{-2}]^a [LT^{-1}]^b T^c$

$a = 1$

$L^{a+b} = L^0$ $\quad a + b = 0$

$b = -1$

Question no. 4

The displacement x (in metre) of a particle of mass m (in kg) moving in one dimension under the action of a force, is related to time t (in sec) by $t = \sqrt{x} + 3$. The displacement of the particle when its velocity is zero, will be

(1) 4 m

(2) 0 m

(3) 6 m

(4) 2 m

$t = \sqrt{x} + 3$

$V = \frac{dx}{dt} = 2(t-3) \cdot 1$

$V = 2t - 6$

$0 = 2t - 6$

$t = 3$

$\sqrt{x} = t - 3$

$x = (t-3)^2$

$x = (3-3)^2 = 0$

Question no. 5

A stone falls freely under gravity. It covers distances h_1, h_2 and h_3 in the first 5 seconds, the next 5 seconds and the next 5 seconds respectively. The relation between h_1, h_2 and h_3 is

(1) $h_2 = 3h_1$ & $h_3 = 3h_2$ (2) $h_1 = h_2 = h_3$

(3) $h_1 = 2h_2 = 3h_3$ ~~(4)~~ $h_1 = \frac{h_2}{3} = \frac{h_3}{5}$

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

$h_1 = \frac{1}{2} \cdot g(5)^2 = 125$

$(h_1 + h_2) = \frac{1}{2} g(10)^2$

$(h_1 + h_2 + h_3) = \frac{1}{2} \cdot g \cdot (15)^2$

$h_2 = \frac{1}{2}g(10)^2 - h_1 = 500 - 125 = 375$

$h_1 : h_2 : h_3 = 125 : 375 : 625$

$1 \quad 3 \quad 5$

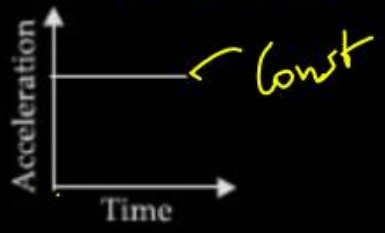
$\frac{h_1}{1} = \frac{h_2}{3} = \frac{h_3}{5}$

$225 \times 5 = 1125$

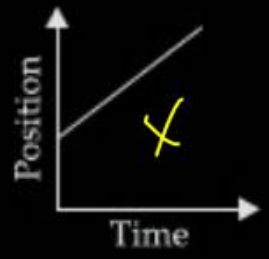
$h_3 = 1125 - (500) = 625$

Question no. 6

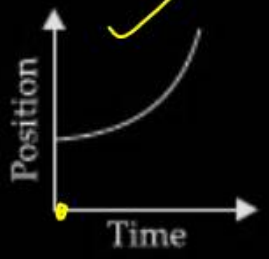
The acceleration-time graph of a particle is given as follows then its correct position–time graph will be



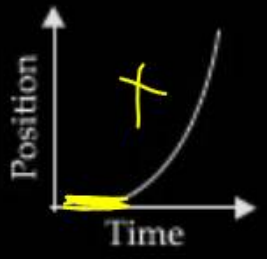
(1)



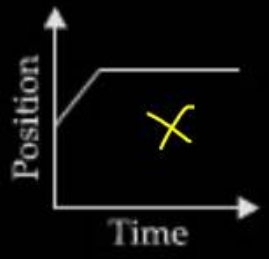
(2)



(3)



(4)



Question no. 7

A particle has initial velocity $\left(3\hat{i}+4\hat{j}\right)$ and has acceleration $\left(0.4\hat{i}+0.3\hat{j}\right)$. Its speed after 10 s is

(1) 7 units

(2) $7\sqrt{2}$ units

(3) 8.5 units

(4) 10 units

$$\vec{V} = \vec{u} + \vec{a}t$$

$$V = (3\hat{i}+4\hat{j}) + (0.4\hat{i}+0.3\hat{j})10$$

$$= 3\hat{i}+4\hat{j}+4\hat{i}+3\hat{j}$$

$$\vec{V} = 7\hat{i}+7\hat{j}$$

$$|V| = \sqrt{7^2+7^2}$$

$$= 7\sqrt{2}$$

Question no. 8

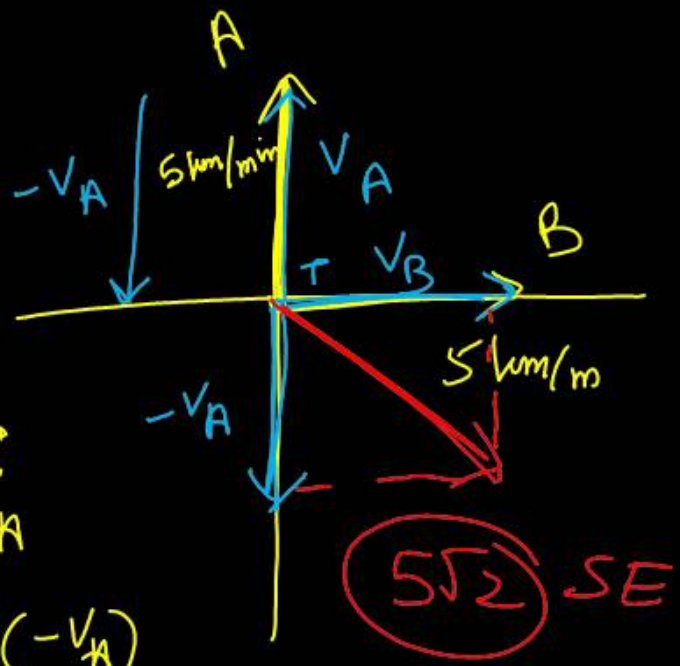
Two cars A and B start moving from the same point with same velocity v=5 km/minute. Car A moves towards north and car B is moving towards east. What is the relative velocity of B with respect to A?

(1) $5\sqrt{2}$ km/min towards south-east

(2) $5\sqrt{2}$ km/min towards north-west

(3) $5\sqrt{2}$ km/min towards south-west

(4) $5\sqrt{2}$ km/min towards north-east



$$V_{BA} = \vec{V}_B - \vec{V}_A$$

$$= V_B + (-V_A)$$

Question no. 9

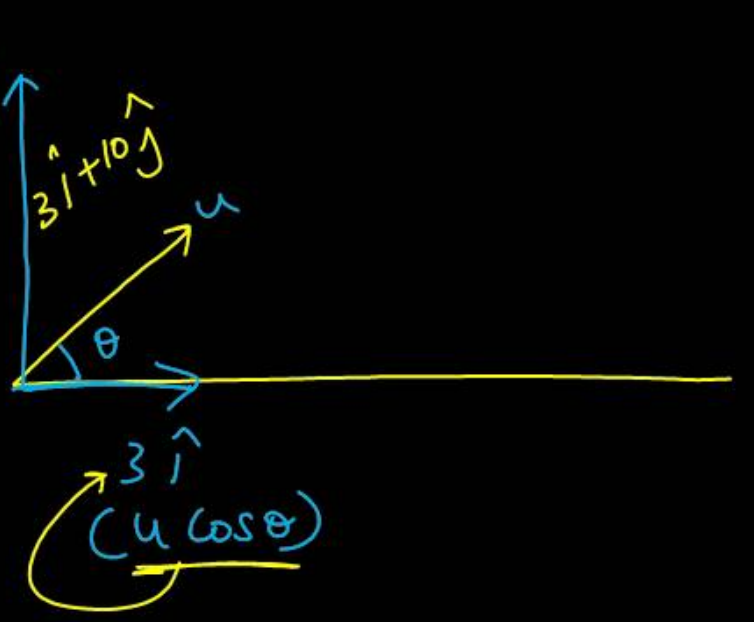
A body is projected from the ground with a velocity $\vec{v} = \left(3\hat{i} + 10\hat{j}\right) ms^{-1}$. The maximum height attained and the range of the body respectively are (given g=10 ms^{-2})

(1) 5 m and 6 m

(2) 3 m and 10 m

(3) 6 m and 5 m

(4) 3 m and 5 m



$$H_{max} = \frac{u^2 \sin^2\theta}{2g}$$

$$= \frac{(10)^2}{2\times 10} = 5$$

Question no. 10

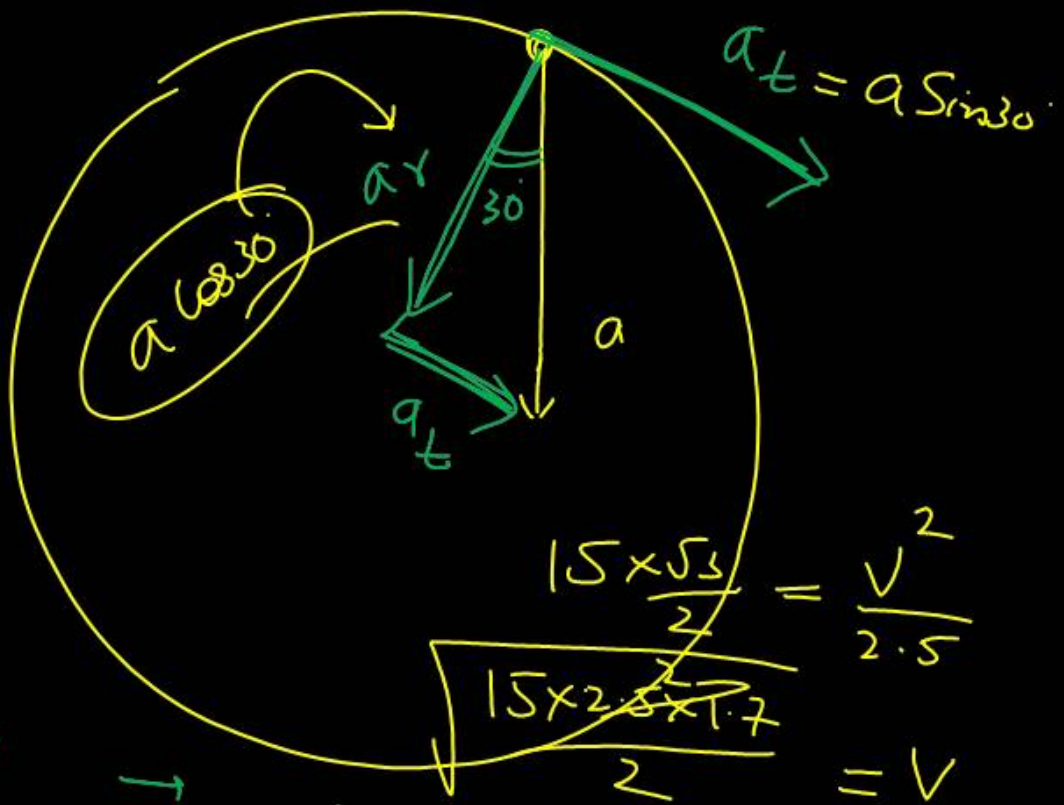
In the given figure, a = 15 ms^{-2} represents the total acceleration of a particle moving in the clockwise direction in a circle of radius R=2.5 m at a given instant of time. The speed of the particle is

(1) 4.5 ms^{-1}

(2) 5.0 ms^{-1}

(3) 5.7 ms^{-1}

(4) 6.2 ms^{-1}



Question no. 11

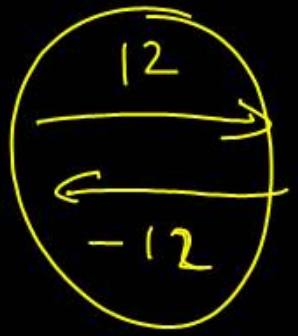
A batsman hits back a ball straight in the direction of the bowler without changing its initial speed of 12 m/s. if the mass of the ball is 0.15 kg the magnitude of the impulse imparted to the ball is

(1) 36 N s

(2) 3.6 N s

(3) 0.36 N s

(4) 0.036 N s



$$I = \Delta\vec{p} = m(\Delta v)$$

$$= m(v_f - v_i)$$

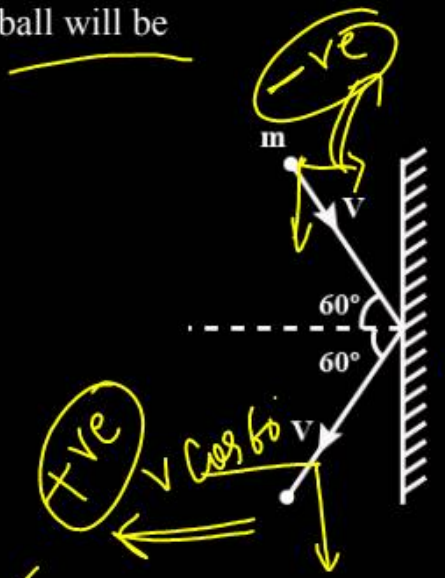
$$= \frac{15}{100} \times [12 - (-12)]$$

$$= \frac{\cancel{15}^{3}}{\cancel{100}_{20}} \times \overset{12}{\cancel{24}} = \frac{36}{10}$$

$$= 3.6$$

Question no. 12

A rigid ball of mass m strikes a rigid wall at 60° and gets reflected without loss of speed as shown in the figure. The value of impulse imparted by the wall on the ball will be



(1) mV

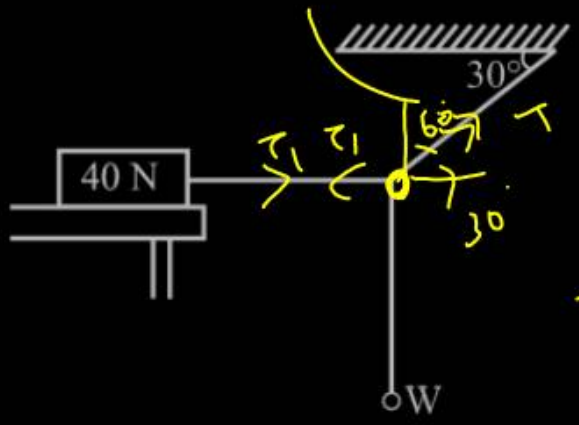
(2) 2 mV

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

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

Question no. 13

In the figure given, the system is in equilibrium. What is the maximum value that W can have if the friction force on the 40 N block cannot exceed 12.0 N?



$\Sigma f_x = 0$

$\Sigma f_y = 0$

$T \sin 30 = W$

$T \cos 30 = T_1$

$\tan 30^\circ = \frac{W}{T_2}$

$T_1 = \mu N$

$W = 12 \times \frac{1}{\sqrt{3}}$

$= 4\sqrt{3} \times \frac{\sqrt{3}}{\sqrt{3}}$

$= 4 \times 1.7$

(1) 3.45 N (2) 6.92 N

(3) 10.35 N (4) 12.32 N

Question no. 14

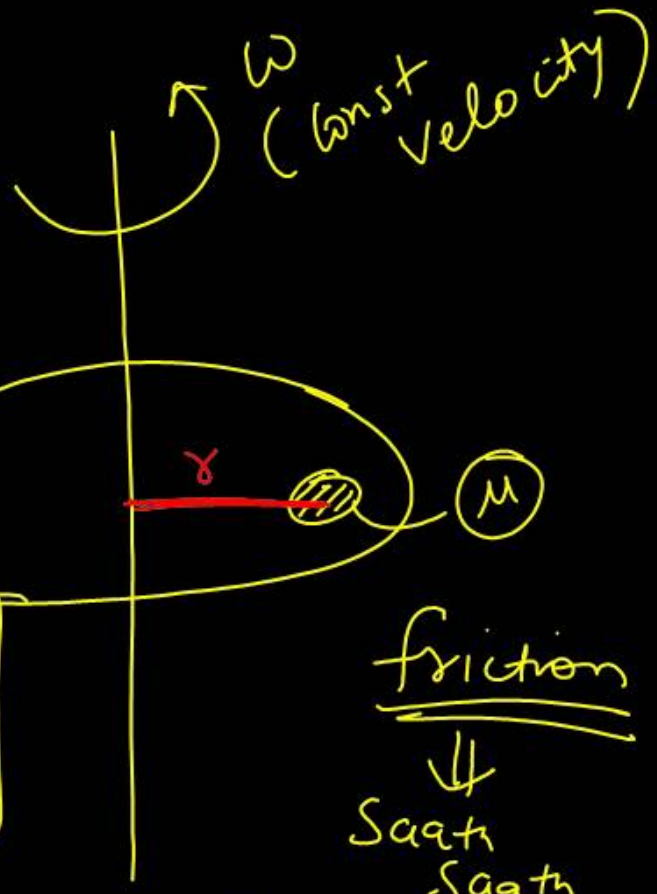
A gramophone record is revolving with an angular velocity ω. A coin is placed at a distance r from the centre of the record. The coefficient of static friction is μ . The coin will revolve with the record if

(1) $r = \mu g \omega^2$

(2) $r < \frac{\omega^2}{\mu g}$

(3) $r \leq \frac{\mu g}{\omega^2}$

(4) $r \geq \frac{\mu g}{\omega^2}$



$f = m\omega^2 r$

friction ⇓ Saath Saath rekha

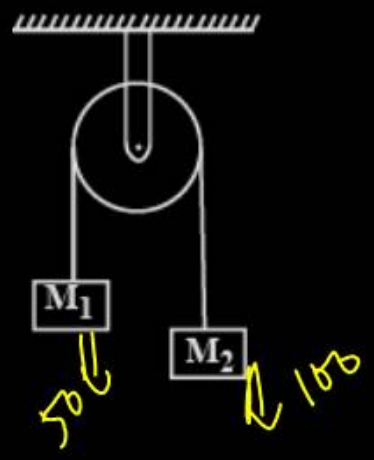
Condⁿ $f_{applied} \leq f_{max}$

$m\omega^2 r \leq \mu mg$

$r \leq \frac{\mu g}{\omega^2}$

Question no. 15

Two masses $M_1 = 5$ kg and $M_2 = 10$ kg are connected at the ends of an inextensible string passing over a frictionless pulley as shown. When the masses are released, then the acceleration of the masses will be



$a = \frac{\text{net driving force}}{\text{total mass}} = \frac{5g - 10}{15} = \frac{10}{3} = \frac{g}{3}$

(1) g

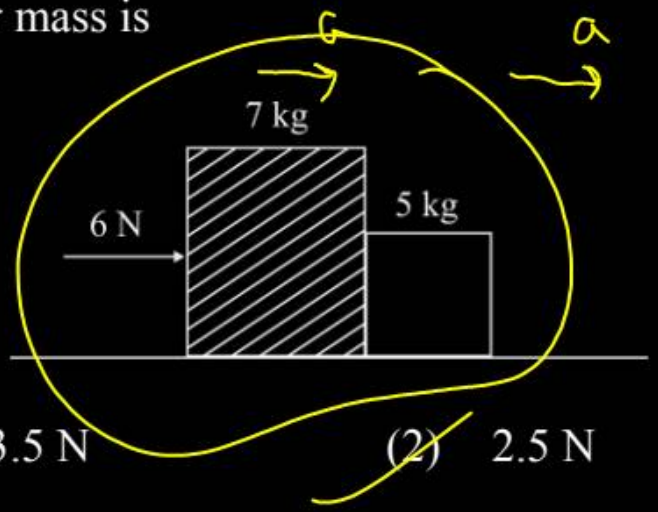
(2) g/2

(3) g/3

(4) g/4

Question no. 16

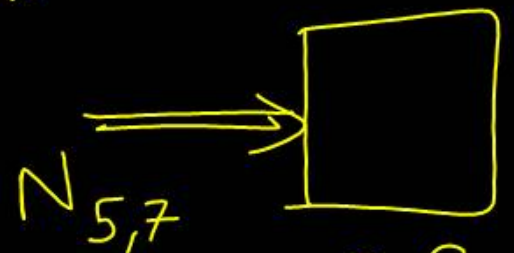
Two blocks of masses 7 kg and 5 kg are placed in contact with each other on a smooth surface. If a force of 6 N is applied on the heavier mass, the force on the lighter mass is



(1) 3.5 N (2) 2.5 N

(3) 6 N (4) 5 N

$a = \frac{6}{7+5} = \frac{6}{12} = \frac{1}{2}\,m/s^2$



$\Sigma f_x = ma$

$N_{5,7} = 5 \cdot \frac{1}{2} = 2.5N$

Question no. 17

If the linear momentum is increased by 50%, then kinetic energy, will increase by

(1) 50%

(2) 100%

(3) 125%

(4) 25%

$KE = \frac{p^2}{2m}$

$KE_i = \frac{p^2}{2m}$ $KE_f = \frac{(1.5p)^2}{2m}$

$= \frac{2.25p^2}{2m}$

$p_i = p$

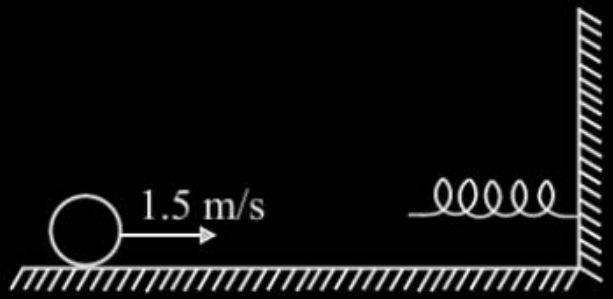
$p_f = p + \frac{50}{100}p = 1.5p$

$\% \Delta KE = \frac{KE_f - KE_i}{KE_i} \times 100$

$= \frac{1.25\frac{p^2}{2m}}{\frac{p^2}{2m}} \times 100 = 125\%$

Question no. 18

A ball of mass 5 kg moving with a speed of 1.5 m/s on a horizontal smooth surface collides with a nearly weightless spring of force constant k = 5 N/m. The maximum compression of the spring would be



(1) 0.5 m (2) 0.15 m

(3) 1.5 m (4) 0.12 m

WET

$W_C + W_{nC} + W_{ext} = \Delta KE$

$-\Delta U = \Delta KE$

COME

$KE_i + U_i = KE_f + U_f$

$KE = EPE$

$\frac{1}{2}mv^2 = \frac{1}{2}kx^2$

$5 \times 1.5 \times 1.5 = x^2$

$\Rightarrow x = 1.5$

Question no. 19

A pump on the ground floor of a building can pump up water to fill the tank of 30 m^3 in 15 min. If the tank is 40 m above the ground, and the efficiency of the pump is 30%, the power consumed by the pump is

($g = 10\ ms^{-1}$)

(1) 4.4 kW

(2) 44 kW

(3) 440 kW

(4) 0.44 kW

$$\eta = \frac{30}{100} = \frac{\text{Output}}{\text{Input}}$$

$$\text{Output Power} = \frac{mgh}{15\times 60} = \frac{\rho \times V \times g \times h}{900} = \frac{1000\times 30\times 10\times 40}{900}$$

$$\text{Input} = \frac{100}{30} \times \frac{1000\times 30\times 10\times 40}{900}$$

$$= \frac{400}{9} \times 1000$$

Question no. 20

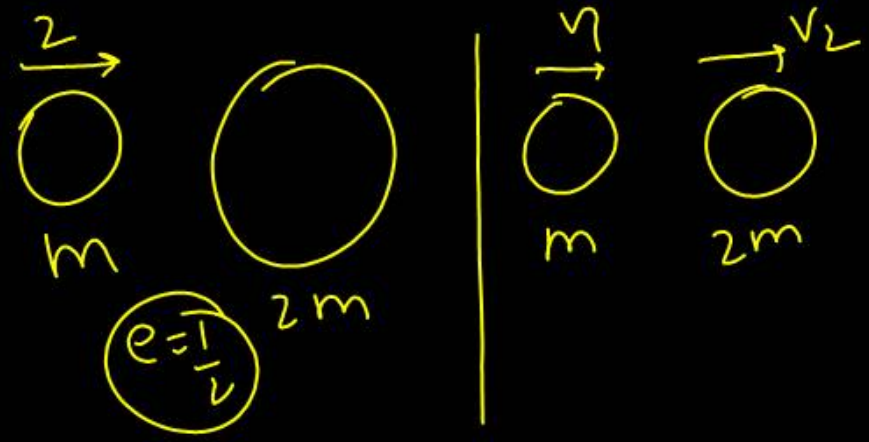
A ball moving with velocity 2 m/s collides head on with another stationary ball of double the mass. If the coefficient of restitution is 0.5, then their velocities (in m/s) after collision will be

(1) 0, 1 ✓

(2) 1, 1

(3) 1, 0.5

(4) 0, 2



$$2m = mv_1 + 2mv_2$$

$$2 = v_1 + 2v_2 \quad \text{— (1)}$$

$$\frac{1}{2} = \frac{v_2 - v_1}{2}$$

$$v_2 - v_1 = 1 \quad \text{— (2)}$$

$$2 = v_1 + 2v_2$$

$$1 = -v_1 + v_2$$

$$3 = 3v_2$$

$$v_2 = 1$$

$$v_1 = 0$$

Question no. 21

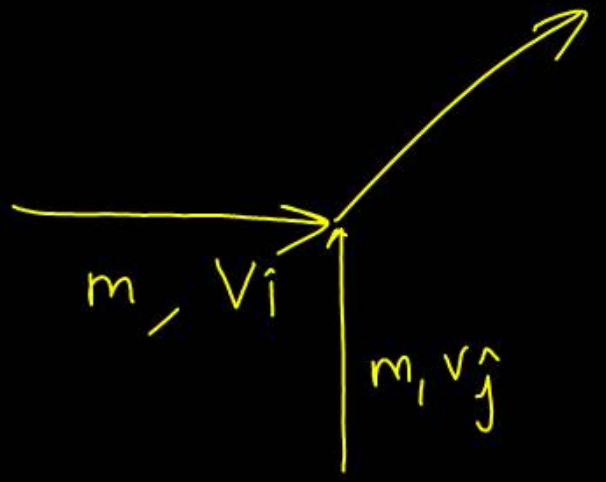
A particle of mass m moving with speed v towards east strikes another particle of same mass moving with same speed v towards north. After striking, the two particles fuse together. With what speed this new particle of mass 2 m will move in north-east direction?

(1) v

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

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

(4) $v\sqrt{2}$



$$m\vec{v}_i + m\vec{v}_j = 2m(\vec{v}_f)$$

$$\frac{v}{2}\hat{i} + \frac{v}{2}\hat{j} = \vec{v}_f$$

$$|\vec{v}_f| = \sqrt{\left(\frac{v}{2}\right)^2 + \left(\frac{v}{2}\right)^2} = \sqrt{\frac{v}{2}} = \frac{v}{\sqrt{2}}$$

Question no. 22

A neutron is moving with a velocity u. It collides ~~head~~ on and elastically with an atom of mass number A. If the initial kinetic energy of the neutron is E, how much kinetic energy will be retained by neutron after collision?

(1) $\left(\frac{A-1}{A+1}\right)^2 E$

(2) $\left(\frac{A+1}{A-1}\right)^2 E$

(3) $\left(\frac{A-1}{A}\right)^2 E$

(4) $\left(\frac{A+1}{A}\right)^2 E$

$n\,VSD = (n-1)\,MSD$

$1\,VSD = \frac{(n-1)}{n}\,MSD$

$LC = 1\,MSD - 1\,VSD$

$= x - \left[\frac{(n-1)}{n}x\right]$

$= \frac{xn - nx + x}{n} = \frac{x}{n}$

Question no. 23

Two bodies of mass 1 kg and 3kg have position vectors $\hat{i}+2\hat{j}+\hat{k}$ and $-3\hat{i}-2\hat{j}+\hat{k}$ respectively. The centre of mass of this system has a position vector:

(1) $-2\hat{i}-\hat{j}+\hat{k}$

(2) $2\hat{i}-\hat{j}-2\hat{k}$

(3) $-\hat{i}+\hat{j}+\hat{k}$

(4) $-2\hat{i}+2\hat{k}$

$\frac{WD}{Q} = \frac{f \cdot \text{displacement}}{\text{Area} \times \text{Time}}$

$= \frac{(ML T^{-2})(L)}{[A][T]}$

$= ML^2 T^{-3} A^{-1}$

Question no. 24

A child is standing with folded hands at the centre of a platform rotating about its central axis. The kinetic energy of the system is K. The child now stretches his arms so that the moment of inertia of the system gets doubled. The kinetic energy of the system now is

(1) 2K

(2) $b\frac{K}{2}$

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

(4) 4K

$m = f^1 V^{-1} T^1$

$T^0 = T^{-2a-b+c}$

$0 = -2(1) - (-1) + c$

$-2+1+c=0$

$c = 1$

$m \propto f^a V^b T^c$

$[M^1 L^0 T^0] = [MLT^{-2}]^a [LT^{-1}]^b T^c$

$L^{a+b} = L^0$

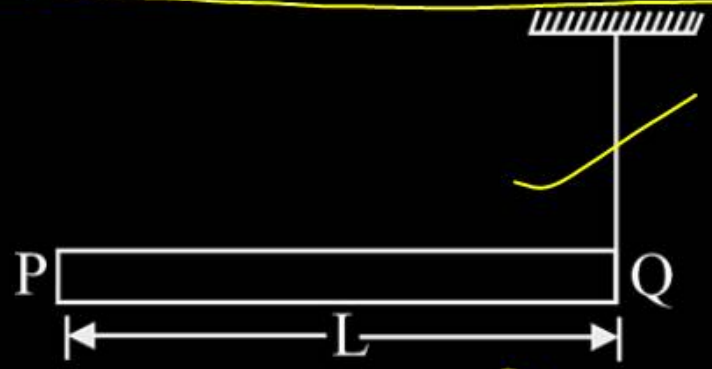
$a+b=0$

$a=1$

$b=-1$

Question no. 25

A rod PQ of mass M and length L is hinged at end P. The rod is kept horizontal by a massless string tried to point Q as shown in figure. When string is cut, the initial angular acceleration of the rod is



(1) $\frac{2g}{L}$ (2) $\frac{2g}{3L}$

(3) $\frac{3g}{2L}$ (4) $\frac{g}{L}$

$t = \sqrt{x} + 3$

$\sqrt{x} = t - 3$

$x = (t-3)^2$

$v = \frac{dx}{dt} = 2(t-3) \cdot 1$

$v = 2t - 6$

$0 = 2t - 6$

$t = 3$

Question no. 26

A body weighs 90 N on surface of the earth. The height above the surface of the earth of radius R, where the weight is 30 N, will be

(1) 0.73 R

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

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

(4) $\sqrt{3}R$

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

$h_1 = \frac{1}{2} \cdot g(5)^2 = 125$

$(h_1 + h_2) = \frac{1}{2} g(10)^2$

$(h_1 + h_2 + h_3) = \frac{1}{2} \cdot g \cdot (15)^2$

$h_2 = \frac{1}{2} g(10)^2 - h_1 = 500 - 125 = 375$

$h_1 : h_2 : h_3 = 125 : 375 : 625$

$1 \quad 3 \quad 5$

$\frac{h_1}{1} = \frac{h_2}{3} = \frac{h_3}{5}$

$125 \times 5 = 625$

$h_3 = 1125 - (500) = 625$

Question no. 27

A particle of mass m is kept at rest at a height 3R from the surface of earth, where R is radius of earth and M is mass of earth. The minimum speed with which it should be projected, so that it does not return back, is (g is acceleration due to gravity on the surface of earth)

(1) $\left(\frac{GM}{2R}\right)^{1/2}$

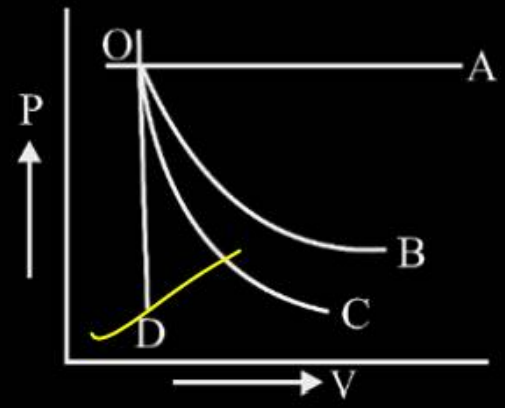
(2) $\left(\frac{gR}{4}\right)^{1/2}$

(3) $\left(\frac{2g}{R}\right)^{1/2}$

(4) $\left(\frac{Gm}{R}\right)^{1/2}$

Question no. 28

A graph of pressure versus volume for an ideal gas for different processes is as shown. In the graph curve OC represents



(1) isochoric process (2) isothermal process

(3) isobaric process (4) adiabatic process

$\vec{V} = \vec{u} + \vec{a}t$

$V = (3\hat{i} + 4\hat{j}) + (0.4\hat{i} + 0.3\hat{j})10$

$= 3\hat{i} + 4\hat{j} + 4\hat{i} + 3\hat{j}$

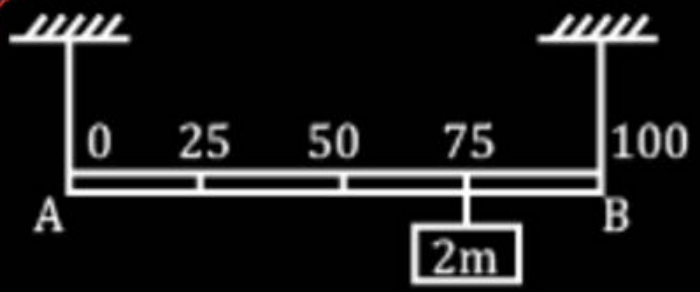
$\vec{V} = 7\hat{i} + 7\hat{j}$

$|V| = \sqrt{7^2 + 7^2}$

$= 7\sqrt{2}$

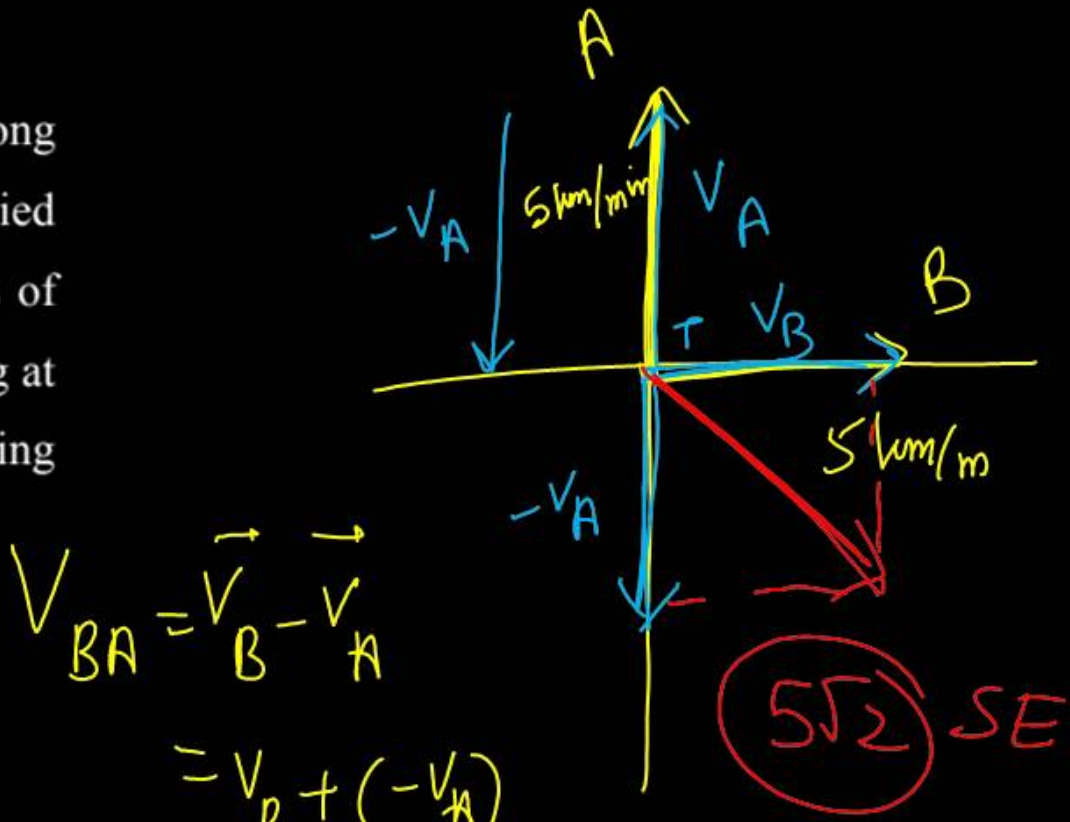
Question no. 29

The figure shows a rigid and uniform one meter long rod AB held in horizontal position by two strings tied to its ends and attached to the ceiling. The rod is of mass 'm' and has another weight of mass 2 m hung at a distance of 75 cm from A. The tension in the string at A is:



(1) 0.5 mg (2) 2 mg

(3) 0.75 mg (4) 1 mg

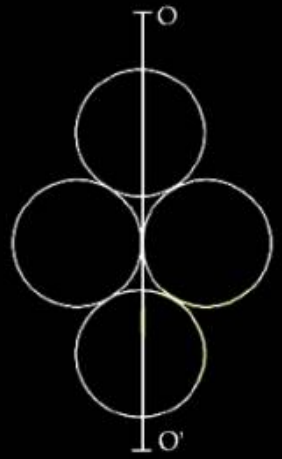


$$V_{BA} = \vec{V}_B - \vec{V}_A$$

$$= V_B + (-V_A)$$

Question no. 30

Four identical discs each of mass 'M' and diameter 'D' are arranged in a plane. What will be moment of inertia of this system about an axis OO' lying in the plane of discs as shown?

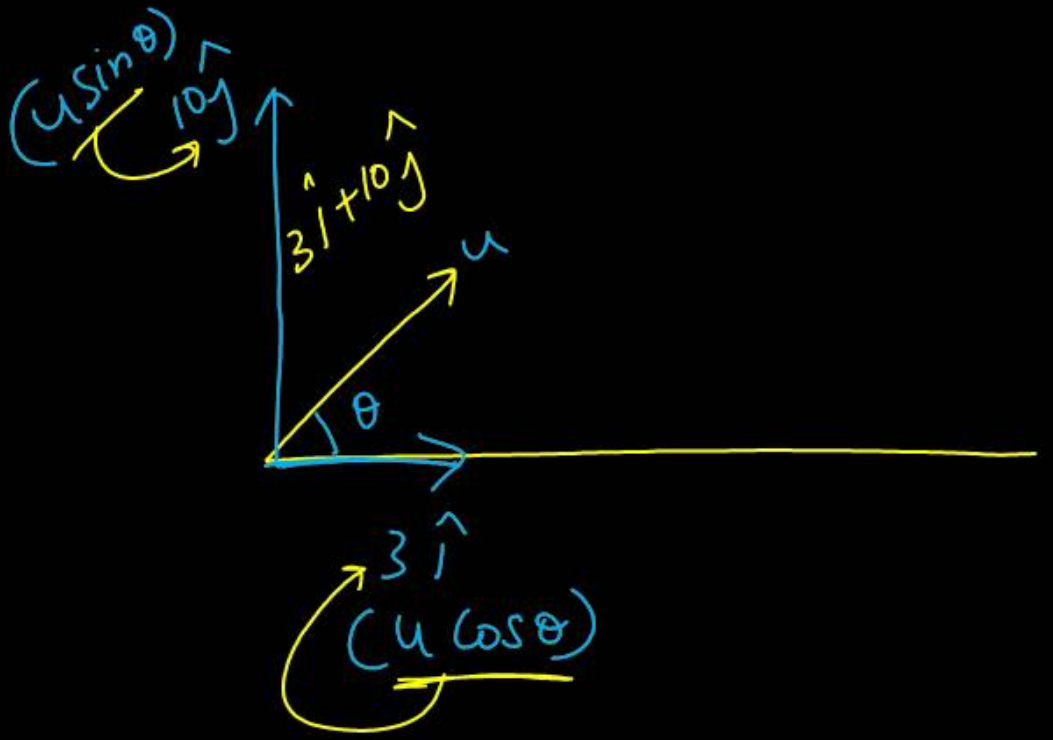


(1) $\frac{3}{4}MD^2$

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

(3) $\frac{6}{5}MD^2$

(4) $\frac{3}{2}MD^2$



$$H_{max} = \frac{u^2\sin^2\theta}{2g}$$

$$= \frac{(10)^2}{2\times 10} = 5$$

Question no. 31

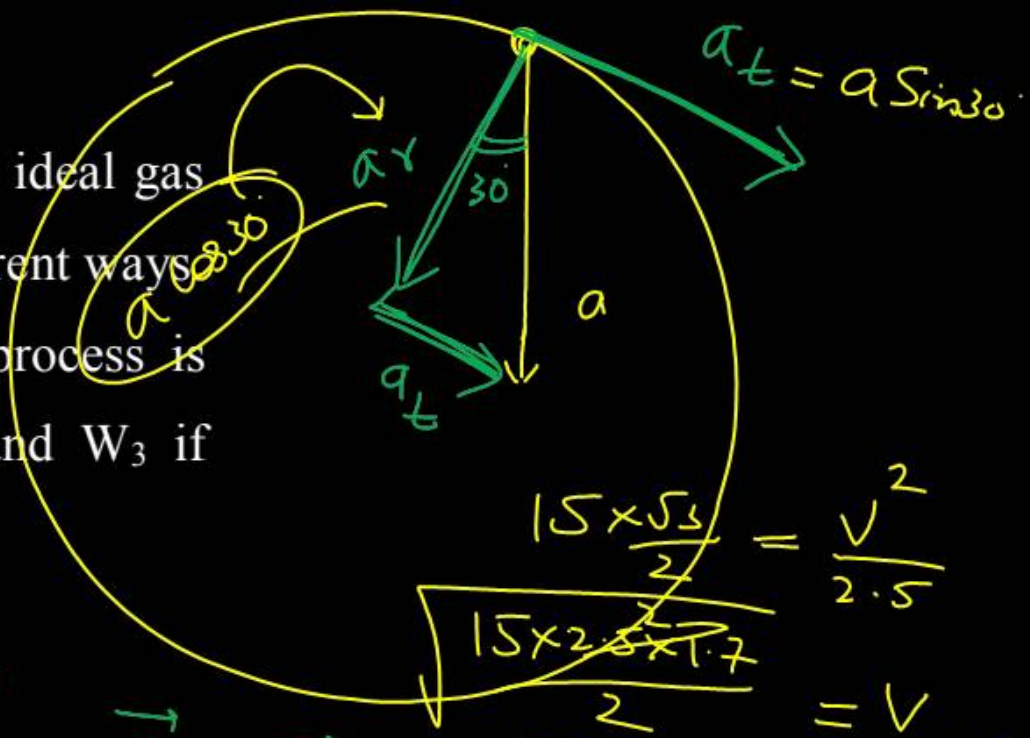
Starting with the same initial conditions, an ideal gas expands from volume V_1 to V_2 in three different ways. The work done by the gas is W_1 if the process is purely isothermal, W_2 if purely isobaric and W_3 if purely adiabatic. Choose the correct option

(1) $W_1 < W_2 < W_3$

(2) $W_2 < W_3 < W_1$

(3) $W_3 < W_1 < W_2$

(4) $W_2 < W_1 < W_3$



$\vec{a}_{net} = \vec{a}_t + \vec{a}_r$

$\tan 30 = \frac{a_t}{a_r}$

$\frac{15 \times \sqrt{3}}{2} = \frac{V^2}{2.5}$

$\frac{15 \times 2.5 \times 1.7}{2} = V$

$\sqrt{30} = 5.7\ V$

Question no. 32

Match the thermodynamic processes taking place in a system with the correct conditions. In the table; ΔQ is the heat supplied, ΔW is the work done and ΔU is change in internal energy of the system.

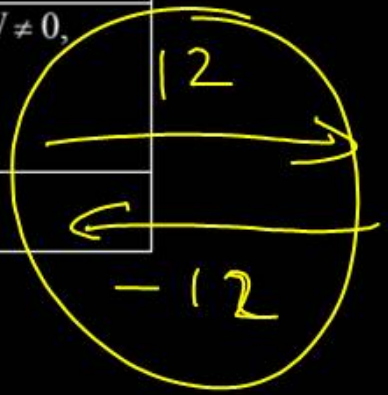
	Process		Condition
I.	Adiabatic	A.	$\Delta W=0$
II.	Isothermal	B.	$\Delta Q=0$
III.	Isochoric	C.	$\Delta U \neq 0$, $\Delta W \neq 0$, $\Delta Q \neq 0$,
IV.	Isobaric	D.	$\Delta U=0$

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

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

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

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



$$I = \Delta\vec{p} = m(\Delta v)$$

$$= m(v_f - v_i)$$

$$= \frac{15}{100} \times [12 - (-12)]$$

$$= \frac{\cancel{15}^{3}}{\cancel{100}_{20}} \times \frac{12}{24} = \frac{36}{10}$$

$$= 3.6$$

Question no. 33

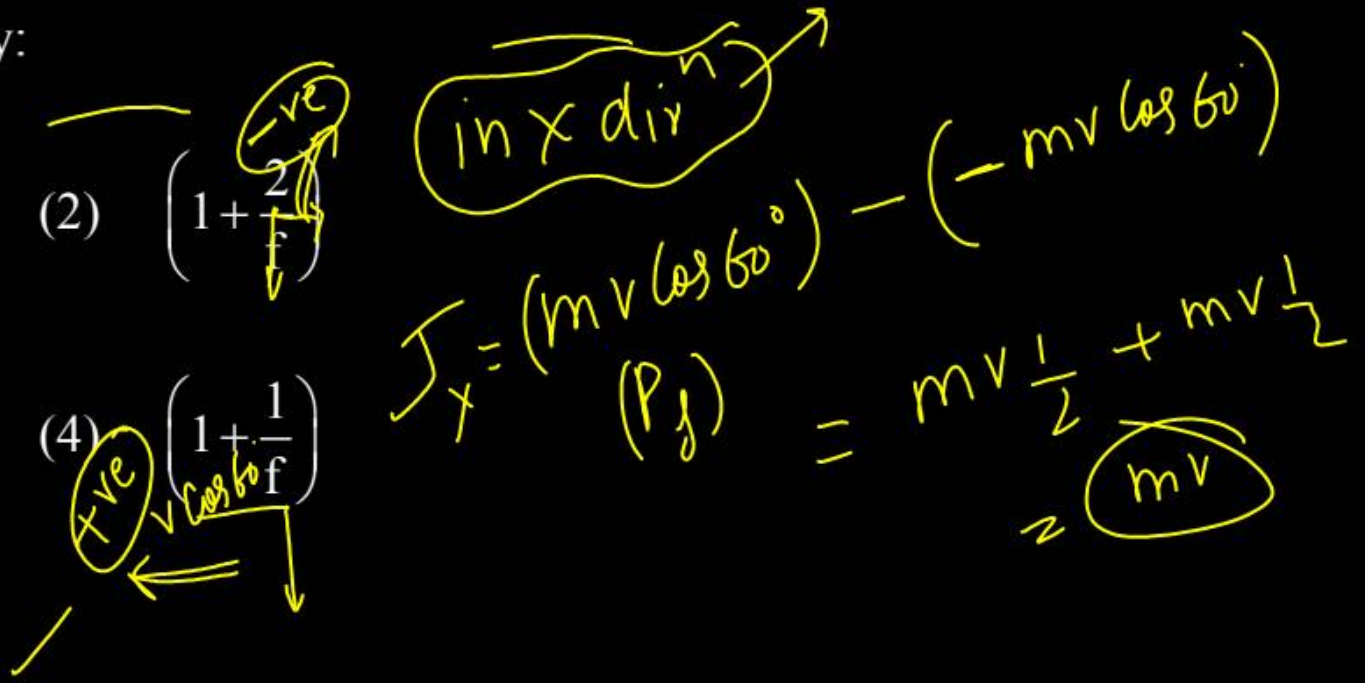
The ratio of specific heats $\left(\frac{C_P}{C_V}\right)$ in terms of degree of freedom (f) is given by:

(1) $\left(1+\frac{f}{3}\right)$

(2) $\left(1+\frac{2}{f}\right)$

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

(4) $\left(1+\frac{1}{f}\right)$



Question no. 34

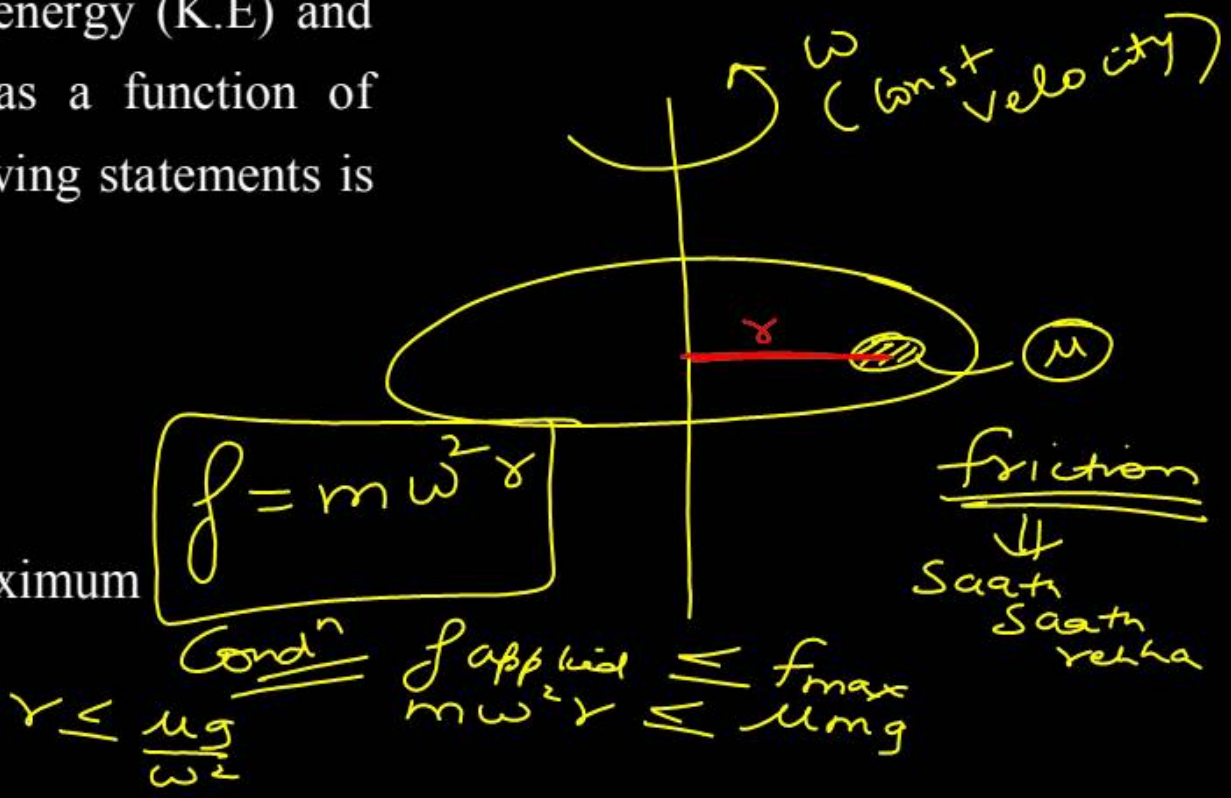
A body executes simple harmonic motion. The potential energy (P.E), the kinetic energy (K.E) and total energy (T.E) are measured as a function of displacement x. Which of the following statements is true?

(1) K.E. is maximum when x=0

(2) T.E. is zero when x=0

(3) K.E is maximum when x is maximum

(4) P.E is maximum when x=0



Question no. 35

In the wave equation the

$$y = 0.5 \sin \frac{2\pi}{\lambda}(400t - x)$$ m

velocity of the wave will be:

(1) 200 m/s

(2) 200 $\sqrt{2}$ m/s

(3) 400 m/s

(4) 400 $\sqrt{2}$ m/s

Question no. 36

Tube A has both end open while tube B has one end closed, otherwise they are identical. The ratio of fundamental frequency of tube A and B is

(1) 1 : 2

(2) 1 : 4

(3) 2 : 1

(4) 4 : 1

$KE = \frac{P^2}{2m}$

$KE_i = \frac{P^2}{2m}$ $KE_f = \frac{(1.5P)^2}{2m} = \frac{2.25P^2}{2m}$

$P_i = P$

$P_f = P + \frac{50}{100}P = 1.5P$

$\%\Delta KE = \frac{KE_f - KE_i}{KE_i} \times 100$

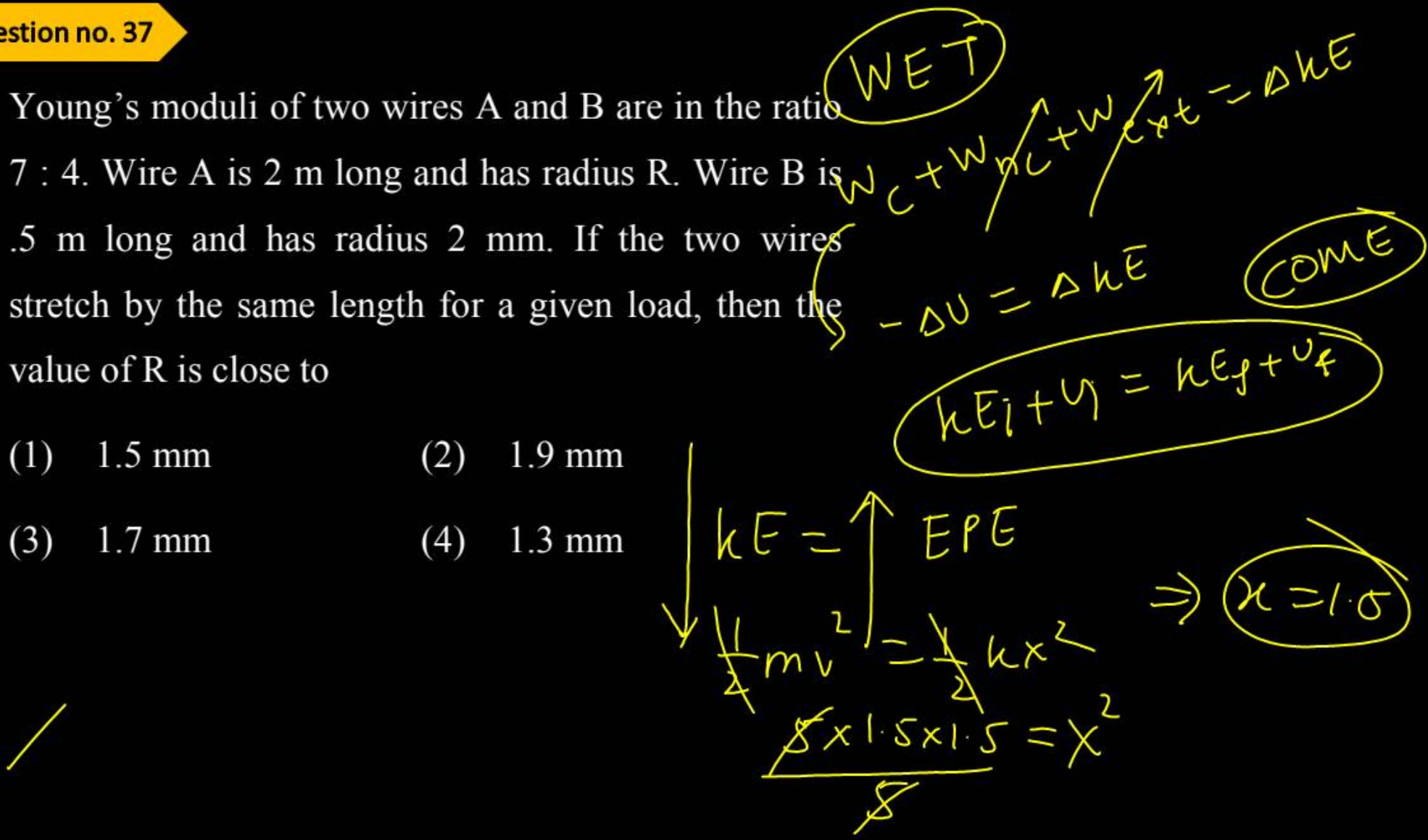
$= \frac{1.25P^2}{2m} \times 100 = 125\%$

Question no. 37

Young's moduli of two wires A and B are in the ratio 7 : 4. Wire A is 2 m long and has radius R. Wire B is .5 m long and has radius 2 mm. If the two wires stretch by the same length for a given load, then the value of R is close to

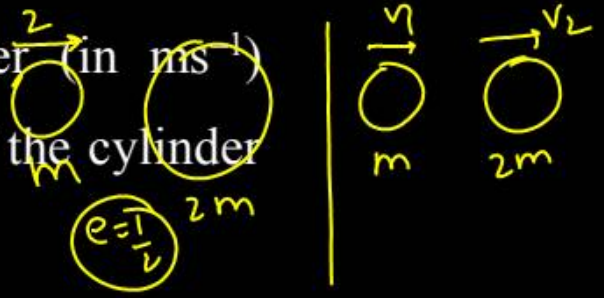
(1) 1.5 mm (2) 1.9 mm

(3) 1.7 mm (4) 1.3 mm



Question no. 38

A cylinder pf height 20 m is completely fillled with water. The velcocity of efflux of water (in ms^{-1}) through a small hole on the side wall of the cylinder near its bottom is



(1) 10

(2) 20

(3) 25.2

(4) 5

$2m = mv_1 + 2mv_2$

$2 = v_1 + 2v_2$ — ①

$\frac{1}{2} = \frac{v_2 - v_1}{2}$

$v_2 - v_1 = 1$ — ②

$2 = v_1 + 2v_2$

$1 = -v_1 + v_2$

$3 = 3v_2$

$v_2 = 1$

$v_1 = 0$

Question no. 39

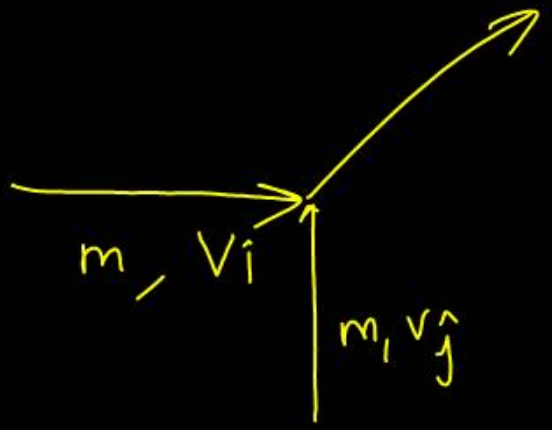
A solid cylinder rolls without slipping down an inclined plane at an angle 30° with the horizontal. The acceleration of the cylinder is

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

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

(3) g

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



$$m\vec{v}_i + m\vec{v}_j = 2m\left(\vec{v}_f\right)$$

$$\frac{v}{2}\hat{i} + \frac{v}{2}\hat{j} = \vec{v}_f$$

$$|\vec{v}_f| = \sqrt{\left(\frac{v}{2}\right)^2 + \left(\frac{v}{2}\right)^2} = \sqrt{\frac{v}{2}} = \frac{v}{\sqrt{2}}$$

Question no. 40

A mass m moving horizontally (along the x-axis) with velocity v collides and sticks to a mass of 3m moving vertically upward (along the y-axis) wit velocity 2v. The final velocity of the combination is

(1) $\frac{3}{2}v\hat{i}+\frac{1}{4}v\hat{j}$

(2) $\frac{1}{4}v\hat{i}+\frac{3}{2}v\hat{j}$

(3) $\frac{1}{3}v\hat{i}+\frac{2}{3}v\hat{j}$

(4) $\frac{2}{3}v\hat{i}+\frac{1}{3}v\hat{j}$

$m_1u_1 + m_2u_2 = mv$

$m \times v(\hat{i}) + 3m\, 2v(\hat{j}) = 4mv$

$mv(\hat{i}) + 6mv(\hat{j}) = 4mv$

$V = \frac{mv\hat{i}}{4m} + \frac{6mv(\hat{j})}{4m}$

$V_{net} = \frac{1}{4}v\hat{i} + \frac{3}{2}v\hat{j}$

Question no. 41

Two springs A and B are identical but A is harder than B ($k_A > k_B$). Let W_A and W_B represent the work done when the springs are stretched through the same distance and W'_A and W'_B are the work done when these are stretched by equal forces, then which of the following is true

$k_A > k_B$

(1) $W_A > W_B$ and $W'_A = W'_B$

(2) $W_A > W_B$ and $W'_A < W'_B$

(3) $W_A > W_B$ and $W'_A > W'_B$

(4) $W_A < W_B$ and $W'_A < W'_B$

(I)

$W = \frac{1}{2}kx^2$

x = Constant

$W \propto k$

$k_A > k_B$

$W_A > W_B$

I st

(II)

$F = kx$

$x = \frac{F}{k}$

$W = \frac{1}{2}k\frac{F^2}{k^2}$

$W = \frac{F^2}{2k}$

$W \propto \frac{1}{k}$

$k_A > k_B$

$W'_B > W'_A$

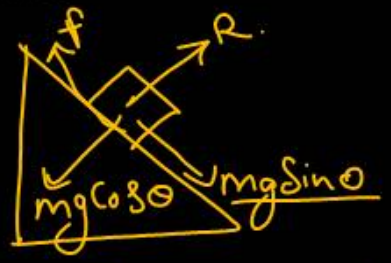
II nd

Question no. 42

A block is released from an inclined plane of inclination 45°. Find out the acceleration of the block down the incline, if coefficient of friction between block and the incline is 0.5

(1) $5\sqrt{2}$ m/s^2 (2) $\sqrt{2}$ m/s^2

(3) $\frac{10}{\sqrt{2}}$ m/s^2 (4) $\frac{5}{\sqrt{2}}$ m/s^2



$R = mg\cos\theta$

$f = \mu mg\cos\theta$

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

$a = g\sin\theta - \mu g\cos\theta$

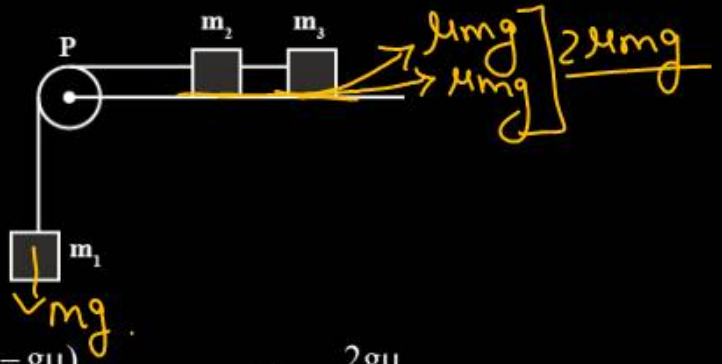
$a = 10 \times \frac{1}{\sqrt{2}} - 0.5 \times 10 \times \frac{1}{\sqrt{2}}$

$a = \frac{1}{\sqrt{2}}(10 - 5) = \frac{5}{\sqrt{2}}$

Question no. 43

A system consists of there masses m_1, m_2 and m_3 connected by a string passing over a pulley P. The mass m_1 hangs freely an m_2 and m_3 are on a rough horizontal table (the coefficient of friction $= \mu$). The pulley is frictionless and of negligible mass. The downward acceleration of mass m_1 is

(Assume $m_1 = m_2 = m_3 = m$)



$$a = \frac{mg - 2\mu mg}{3m}$$

$$a = \frac{mg(1-2\mu)}{3m}$$

$$a = \frac{g(1-2\mu)}{3}$$

(1) $\frac{g(1-g\mu)}{9}$

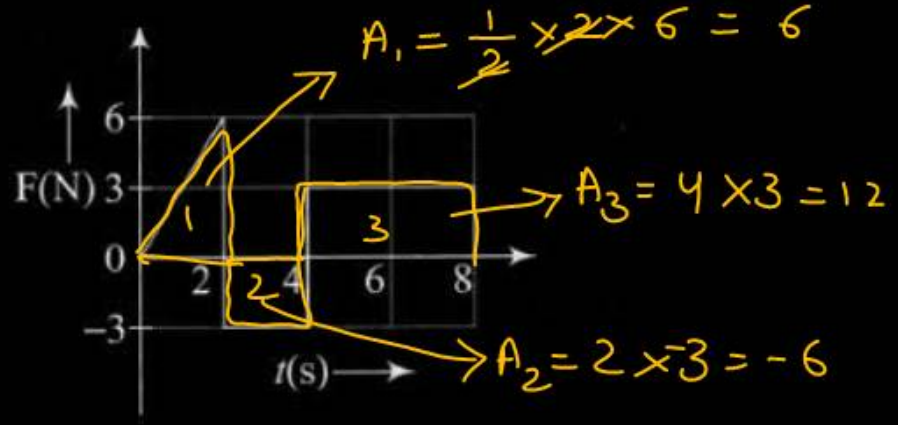
(2) $\frac{2g\mu}{3}$

(3) $\frac{g(1-2\mu)}{3}$

(4) $\frac{g(1-2\mu)}{2}$

Question no. 44

The force F acting on a particle of mass m is indicated by the force-time graph shown below. The change in momentums of the particle over the time interval from zero to 8 s is



$A_1 = \frac{1}{2} \times 2 \times 6 = 6$

$A_3 = 4 \times 3 = 12$

$A_2 = 2 \times -3 = -6$

$\Delta P = \vec{F} \cdot \Delta t$

$\Delta P = A_1 - A_2 + A_3$

$= 6 - (-6) + 12$

$= 12\ N \cdot s$

(1) 24 N s

(2) 20 N s

(3) 12 N s

(4) 6 N s

Question no. 45

The mean free path for a gas, with molecular diameter d and number denstiy n can be expressed as:

(1) $\frac{1}{\sqrt{2}n\pi d^2}$

(2) $\frac{1}{\sqrt{2}n^2\pi d^2}$

(3) $\frac{1}{\sqrt{2}n^2\pi^2 d^2}$

(4) $\frac{1}{\sqrt{2}n\pi d}$

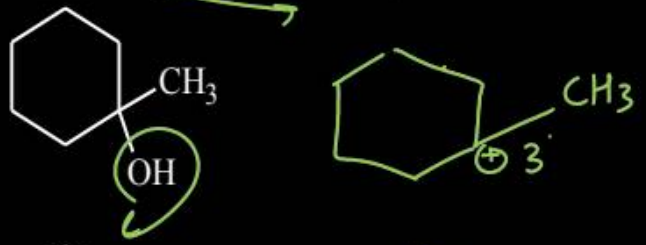
$\lambda = \frac{1}{\sqrt{2}\pi n d^2}$

d = diameter

Question no. 46

Among these alcohols, which of the following orders is correct about their ease of dehydration under acidic condition?

(i) 

(ii) 

(iii) 

$CH_3-CH_2-OH \xrightarrow{H^+} CH_3-\overset{\oplus}{C}H_2 + OH^{\ominus}$

Reactivity of Alcohol for Dehydration $\propto$ Stability of $C^{\oplus}$

$3 > 2 > 1$

2

(1) I > II > III

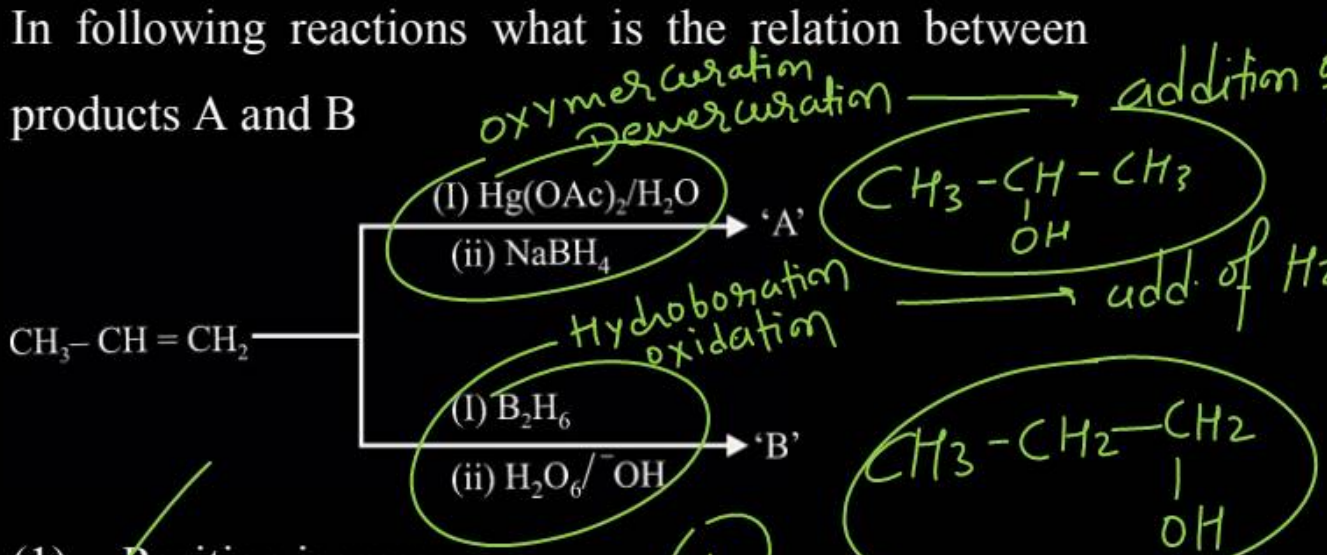
(2) III > II > I

(3) II > III > I

(4) II > I > III

Question no. 47

In following reactions what is the relation between products A and B



(1) Position isomers

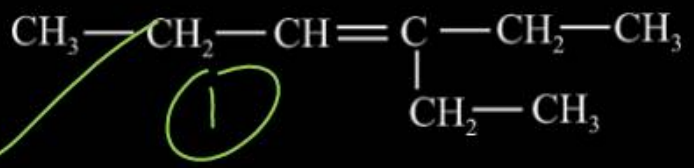
(2) Functional group isomers

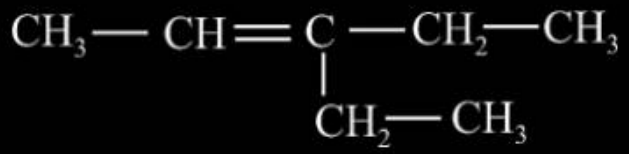
(3) Metamers

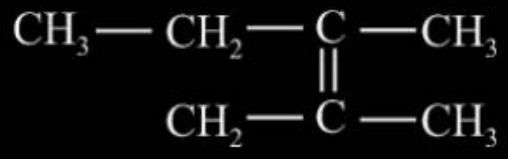
(4) Geometrical isomers

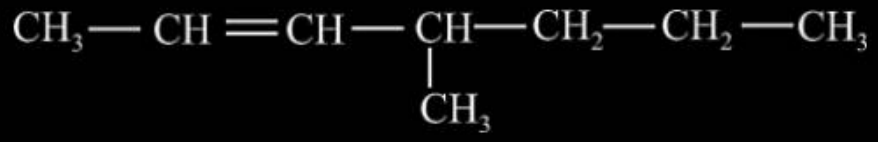
Question no. 48

Propanal and pentan-3-one are ozonolysis products of

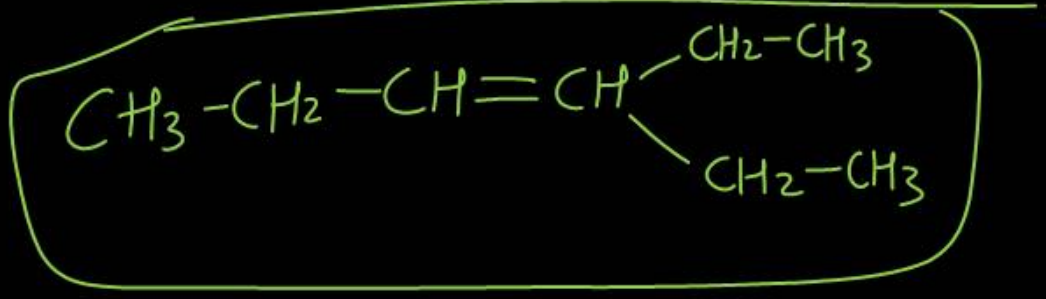
(1) 

(2) 

(3) 

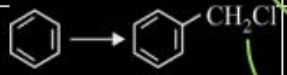
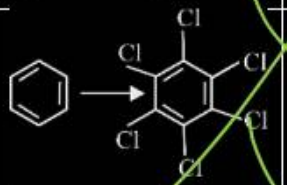
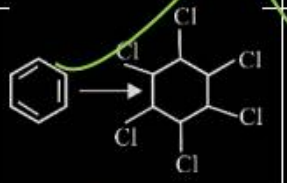
(4) 

Alkene ⟶ $CH_3-CH_2-CH=O + O=C$ 



Question no. 49

Match Column I with Column II and choose the correct combination from the options given.

	Column I		Column II
A.		p.	Cl_2, UV/500 K
B.		q.	Cl_2/anhyd.$AlCl_3$
C.		r.	CH_2Cl_2, anhy.$AlCl_3$
D		s.	Cl_2, anhyd. $AlCl_3$ (Dark, Cold)

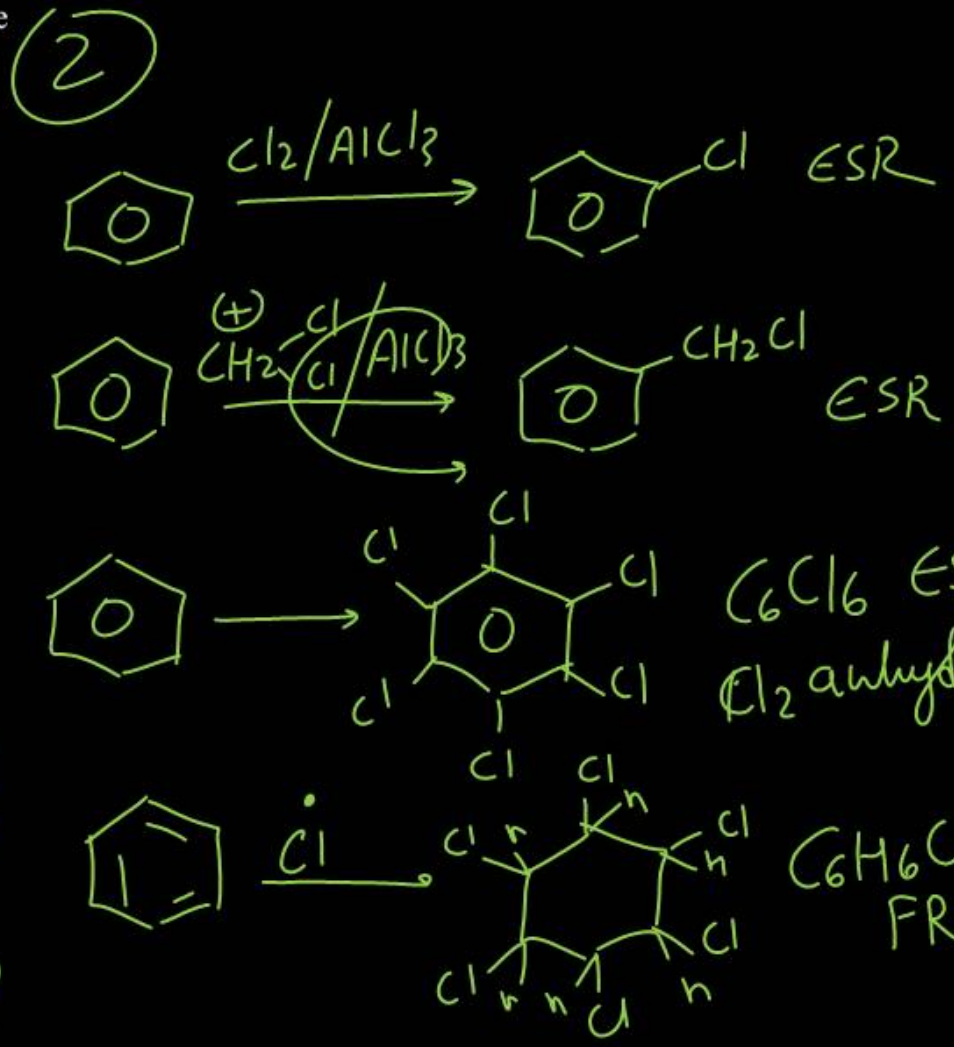
(1) A → s; B → r; C → q; D → p

(2) A → q; B → r; C → s; D → p

(3) A → r; B → p; C → q; D → s

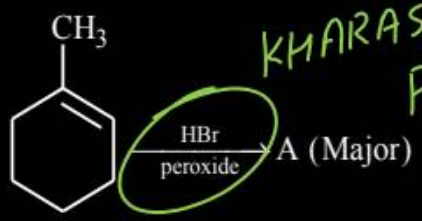
(4) A → q; B → p; C → s; D → r

A-q
B-r
C-s
D-p

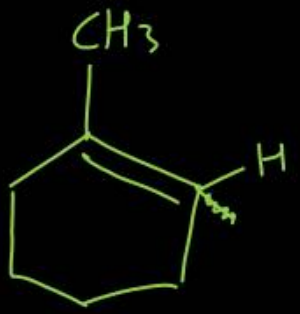


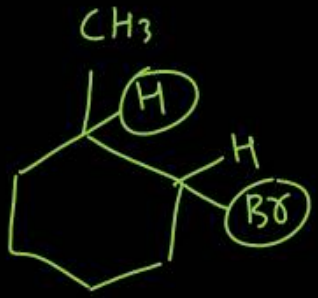
Question no. 50

In the given reaction, identify A.

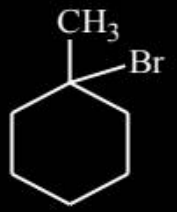


KHARASH Effect
FRAR → antimarkownikov Rule

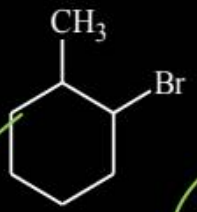




(1)

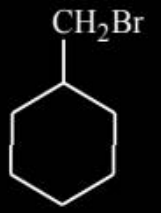


(2)

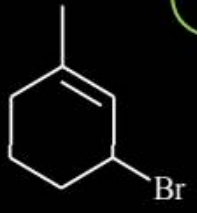


2

(3)

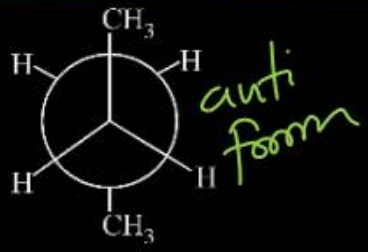


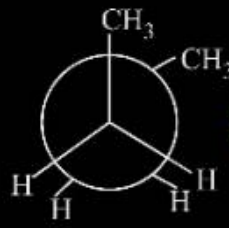
(4)

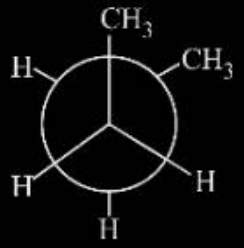


Question no. 51

Arrange the following conformational isomers of n-butane in order of their increasing potential energy.

(i) 

(ii) 

(iii) 

(iv) 

(1) I < III < IV < II

(2) I < IV < III < II

(3) II < IV < III < I

(4) II < III < IV < I

Question no. 52

Which of the following cannot exhibit hyperconjugation?

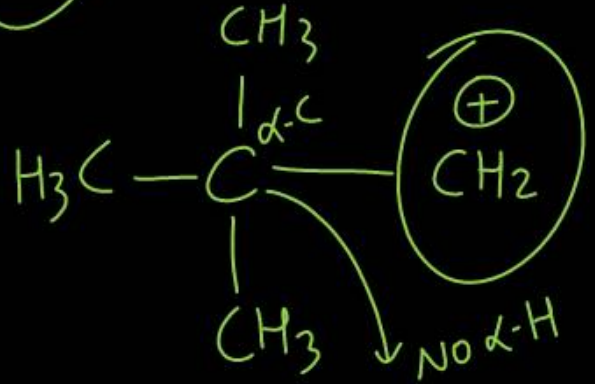
(1) $CH_3\dot{C}H_2$

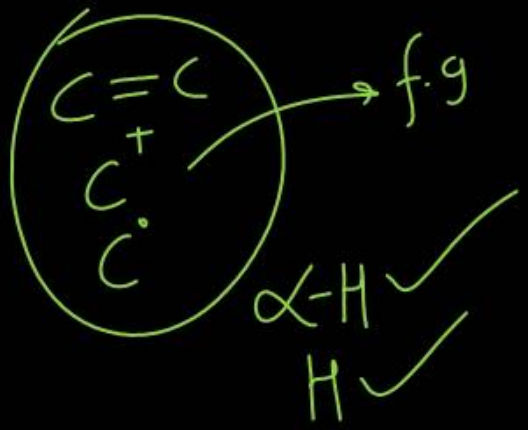
(2) $CH_3-\overset{+}{C}H-CH_3$

(3) $CH_3CH=CH_2$

(4) $(CH_3)_3C-\overset{+}{C}H_2$

H-Effect
C–H Bond & =
C–H Bond & +ve
C–H Bond & ·free e⁻
Alternate conjugate



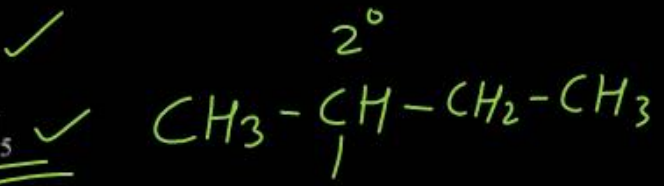


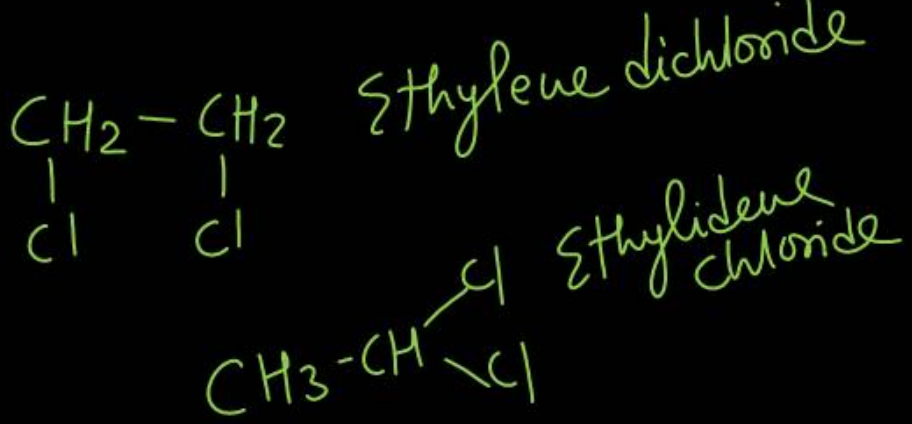
Question no. 53

Which of the following is not correctly matched?

(1)	Acetonitrile;	$CH_3–CN$
(2)	Allyl chloride ;	$CH_2=CH–CH_2Cl$
(3)	s-Butyl group:	$CH_3—CH(—)—C_2H_5$
(4)	Ethyledene chloride ;	$CH_2Cl–CH_2Cl$

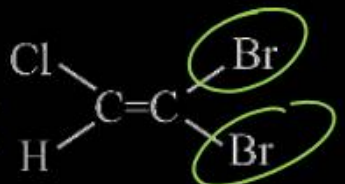
(4)

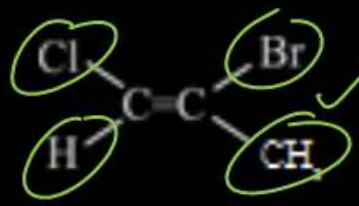


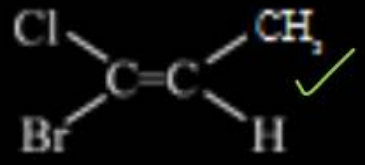


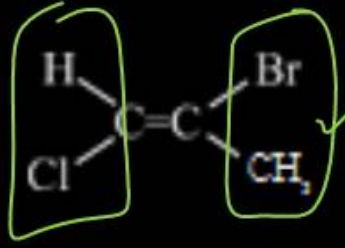
Question no. 54

Which is a pair of geometrical isomers?

(I) 

(II) 

(III) 

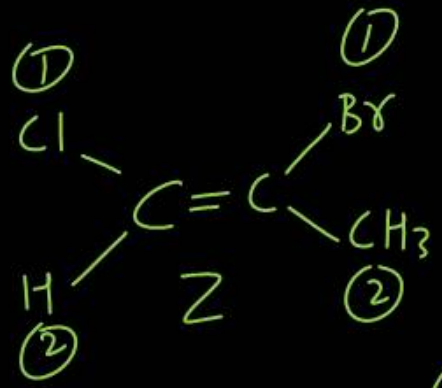
(IV) 

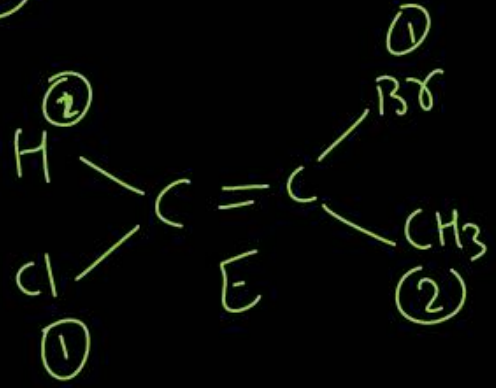
(1) I and IV

(2) I and III

(3) II and IV

(4) III and IV





Question no. 55

Inductive effect involves

(1) Displacement of σ –electrons

(2) Delocalization of π – electrons

(3) Delocalization of σ –electrons

(4) Displacement of π – electrons

Question no. 56

Which of the following is correct regarding the – I – effect of the substituents?

(1) $-NR_2 < -OR < -F$

(2) $-NR_2 > -OR > -F$

(3) $-NR_2 < -F < -OR$

(4) $-NR_2 > -OR > -F$

EN ↑↑ ⇒ -I effect ↑

(1)

$-F > -OR > -NR_2$

→ -I effect ↓

Question no. 57

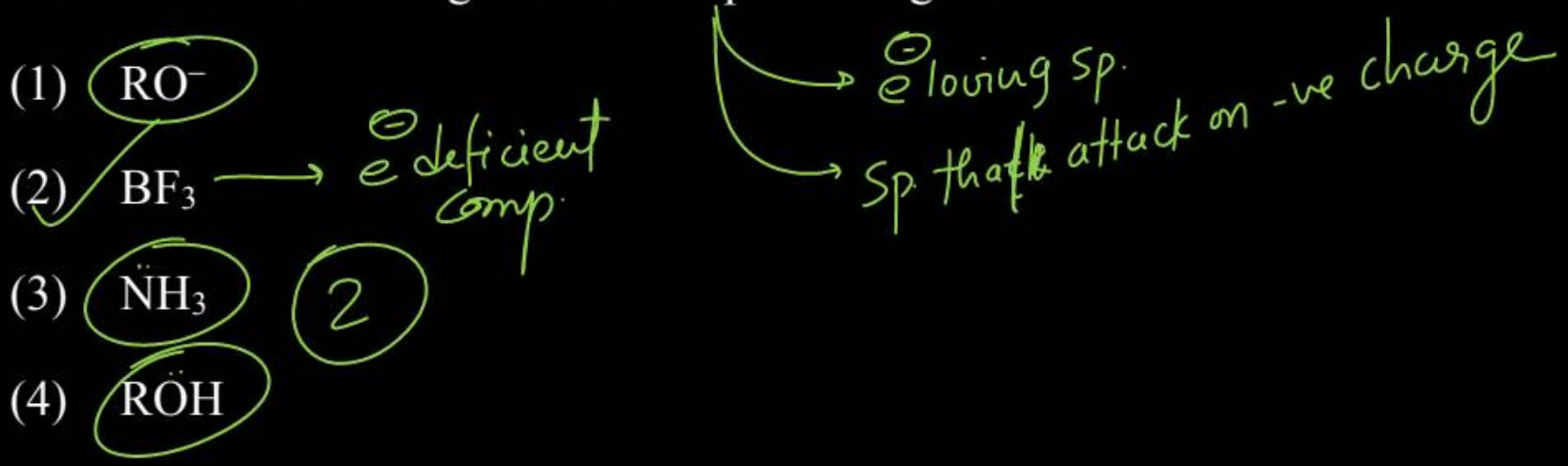
Which of the following is an electrophilic reagent?

(1) RO^-

(2) BF_3

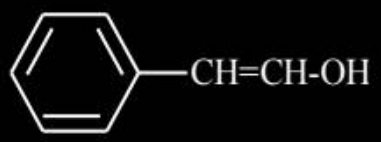
(3) NH_3

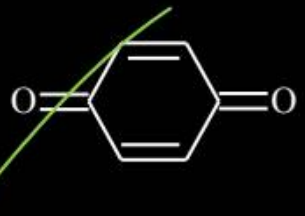
(4) ROH

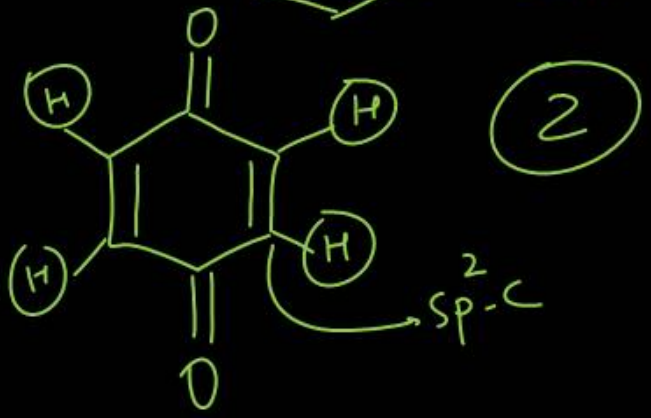


Question no. 58

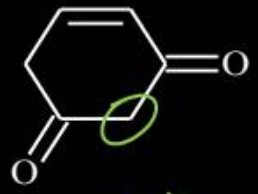
Tautomerism is not exhibited by

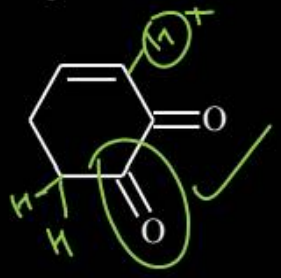
(1) 

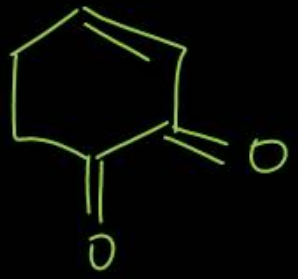
(2) 



2

(3) 

(4) 



Question no. 59

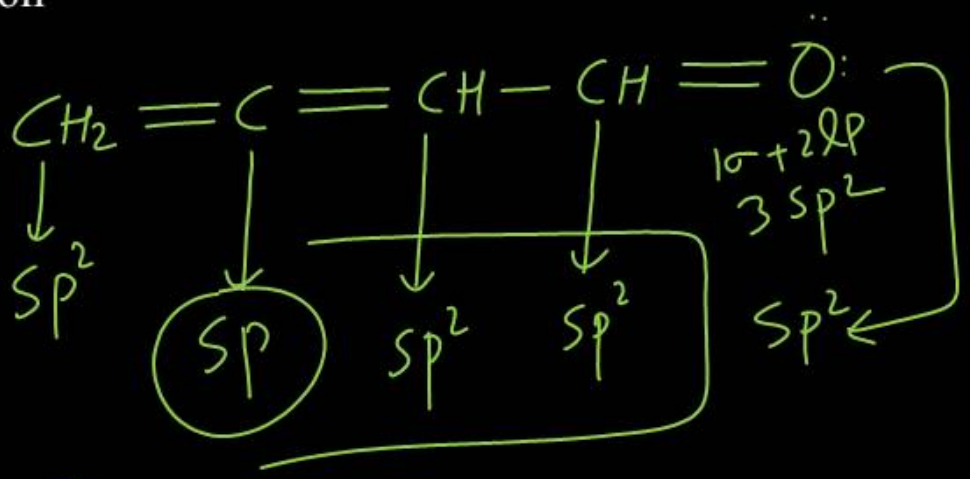
Select the response that correctly identifies the number of carbon atoms of each type of hybridization in the compound given below:

$H_2C = C = CH - CH = O$

	sp^3	sp^2	sp
(1)	2	2	0
(2)	1	3	0
(3)	0	3	1
(4)	1	2	1

3

No. of σ bond + No. of lp



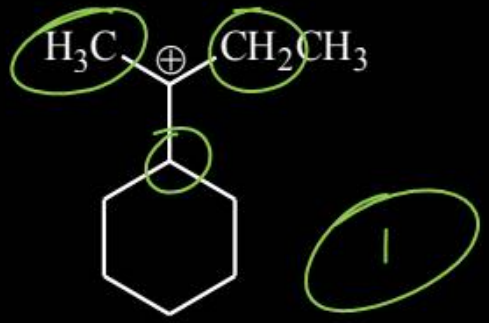
Sp^3 - C O

Sp^3 - C - 3

Sp - C = 1

Question no. 60

The total number of contribution structures showing hyper conjugation (involving C – H bonds) for the following carbocation is



No. of H-structures = No. of α-H

(1) 6

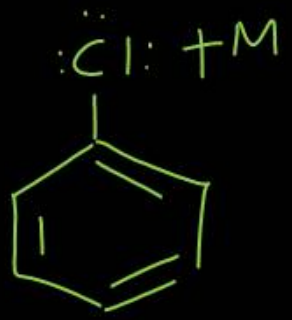
(2) 5

(3) 4

(4) 3

Question no. 61

Chlorobenzene is o, p–directing in electrophilic substitution reaction. The directing influence is explained by



(1) + M–effect of Ph

(2) + I – effect of Cl

(3) + M – effect of Cl

(4) – I – effect of Ph

Question no. 62

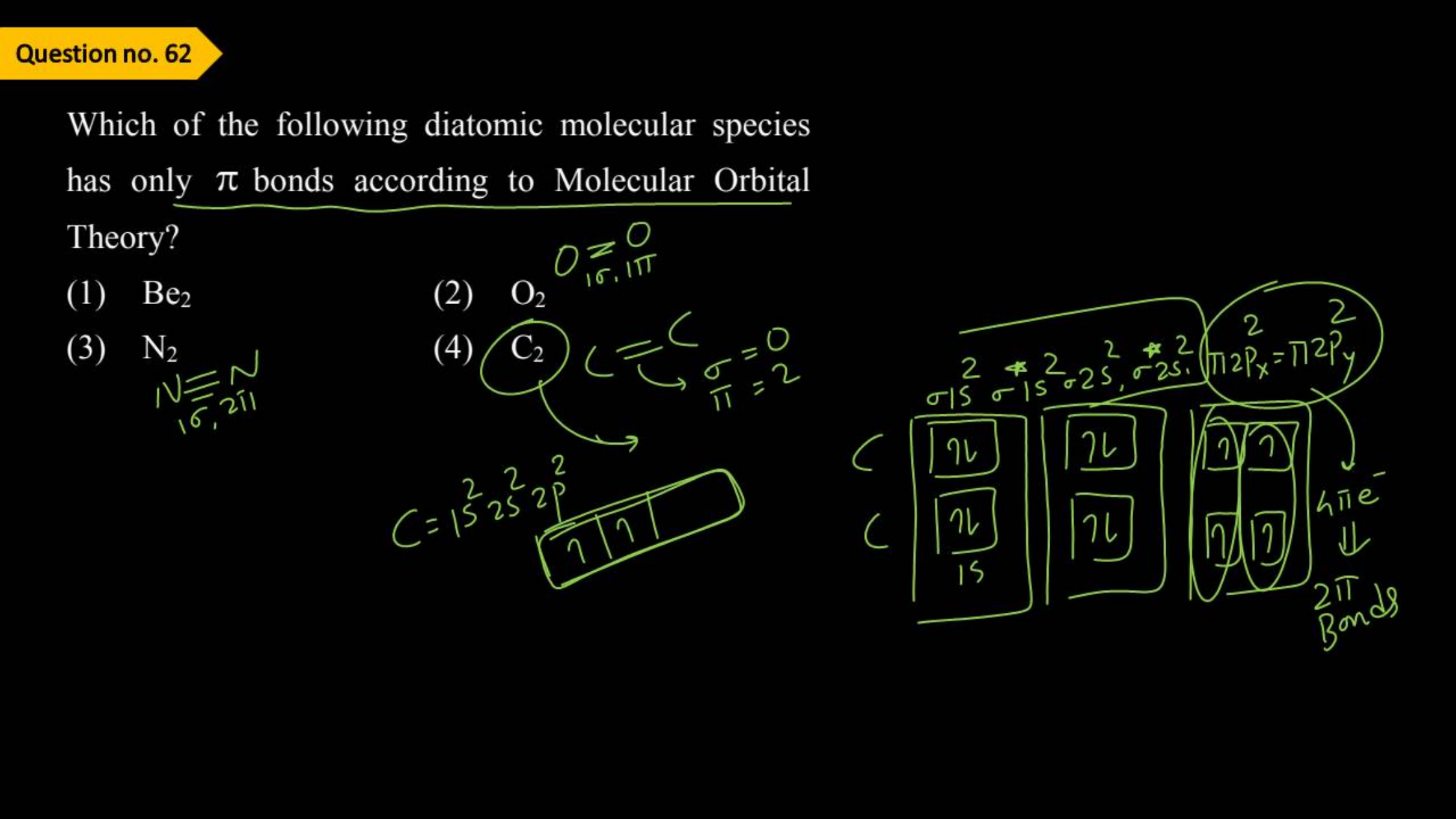
Which of the following diatomic molecular species has only π bonds according to Molecular Orbital Theory?

(1) Be_2

(2) O_2

(3) N_2

(4) C_2



Question no. 63

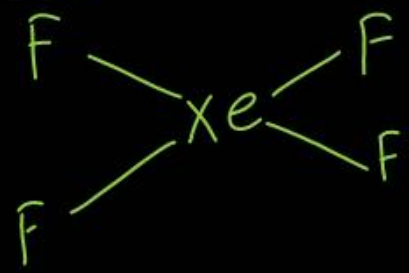
Which of the following molecule has maximum number of 90° bond angle?

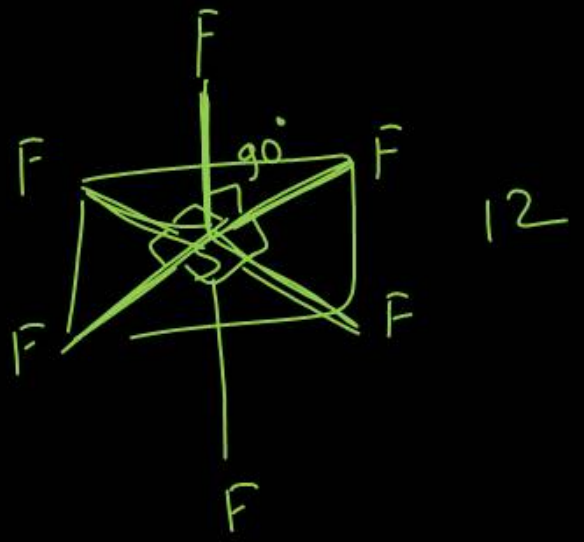
(1) XeF_4 (2) XeF_5^-

(3) SF_6 (4) IF_7

sp^3d^2 ⇒ octahedral ⇒ max 90°

3





12

Question no. 64

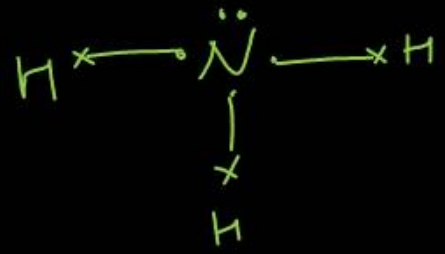
Which one is the electron deficient compound?

(1) ICl

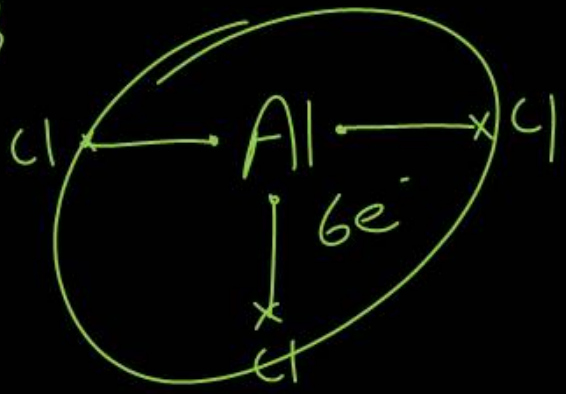
(2) NH_3

(3) $AlCl_3$

(4) PCl_3

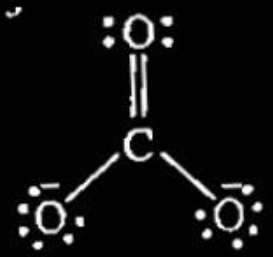


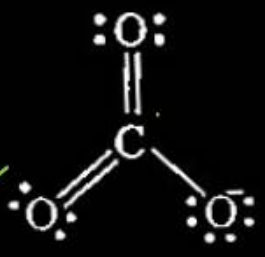
$Al_{13} = 2, 8, 3$

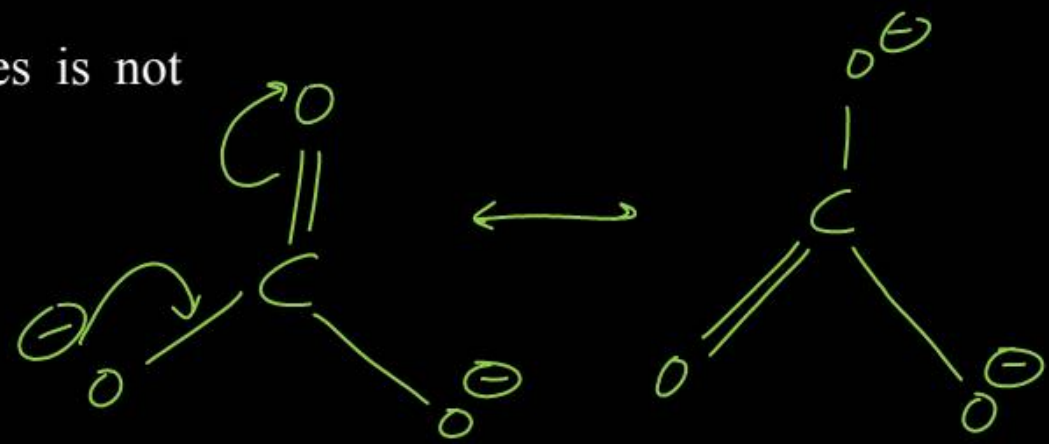


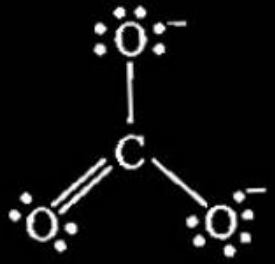
Question no. 65

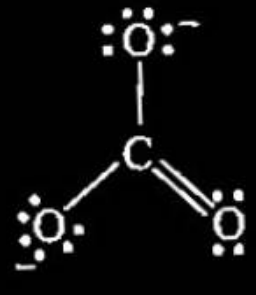
Which of the following resonating structures is not correct for CO_3^{2-} ?

(1) 

(2) 



(3) 

(4) 

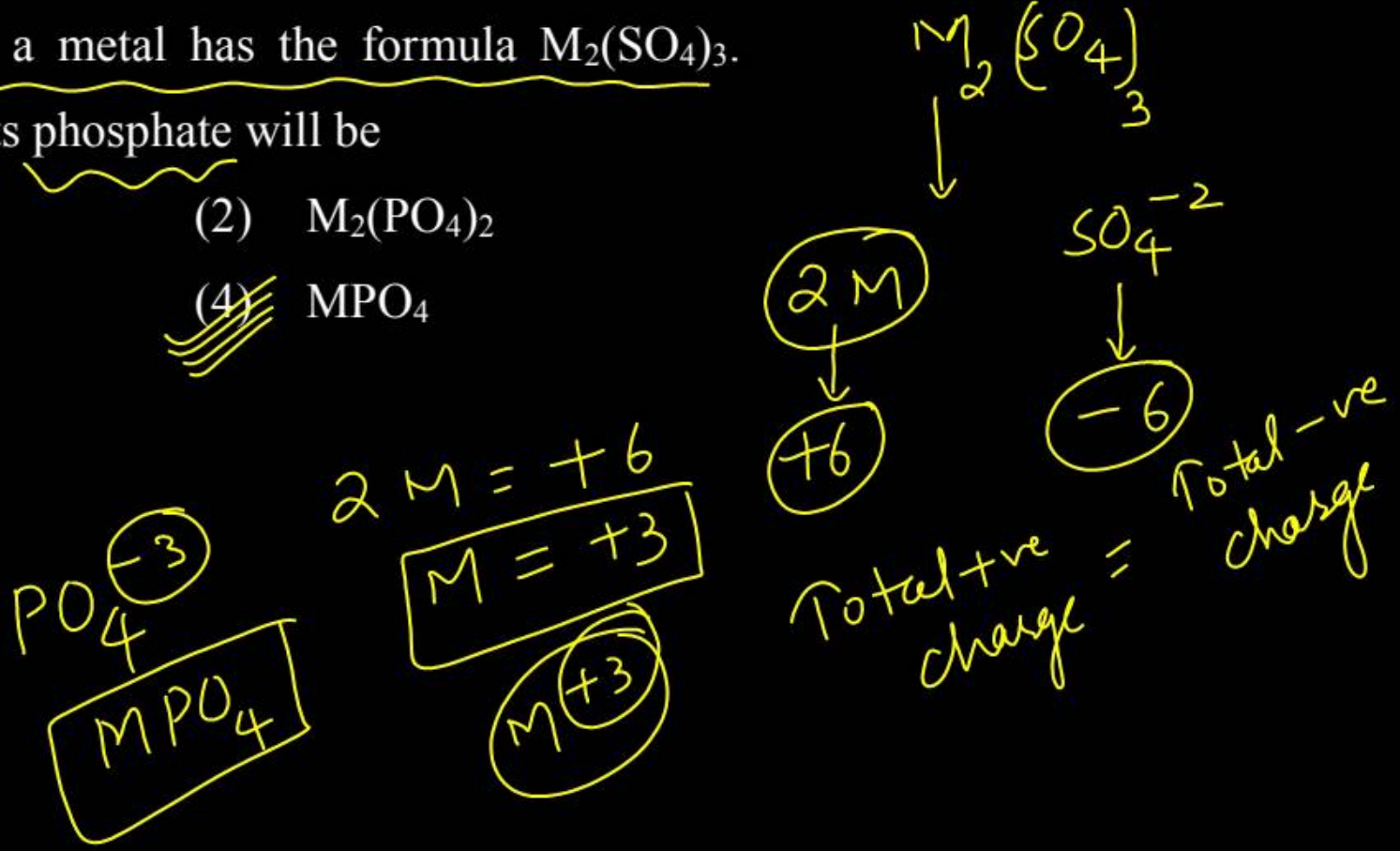
Question no. 66

The sulphate of a metal has the formula $M_2(SO_4)_3$.

The formula of its phosphate will be

(1) $M(HPO_4)_2$ (2) $M_2(PO_4)_2$

(3) $M_2(PO_4)_3$ (4) MPO_4



Question no. 67

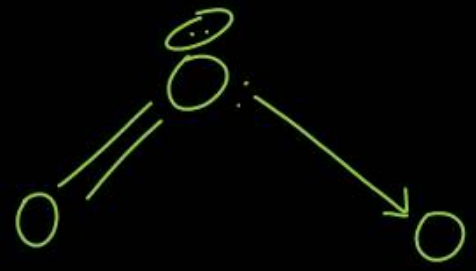
Which of the following sets of molecules contain the same number of lone pairs of electrons in the central atom?

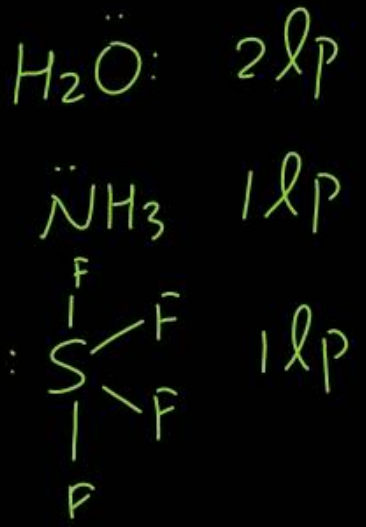
(1) SO_2, ClF_3, BrF_3

(2) SF_4, NH_3, O_3

(3) ClF_3, XeF_2, H_2O

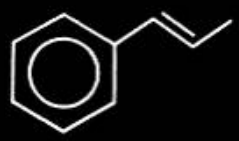
(4) H_2O, SF_4, NH_3





Question no. 68

How many σ and π bonds are there in following molecule?



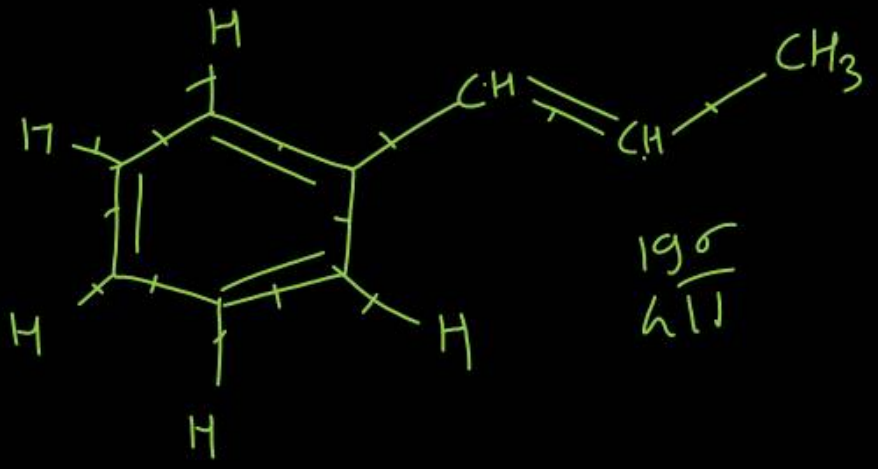
(1) 14 σ , 8 π

(2) 18 σ , 8 π

(3) 19 σ , 4 π

(4) 14 σ , 2 π

3



19σ
4π

Question no. 69

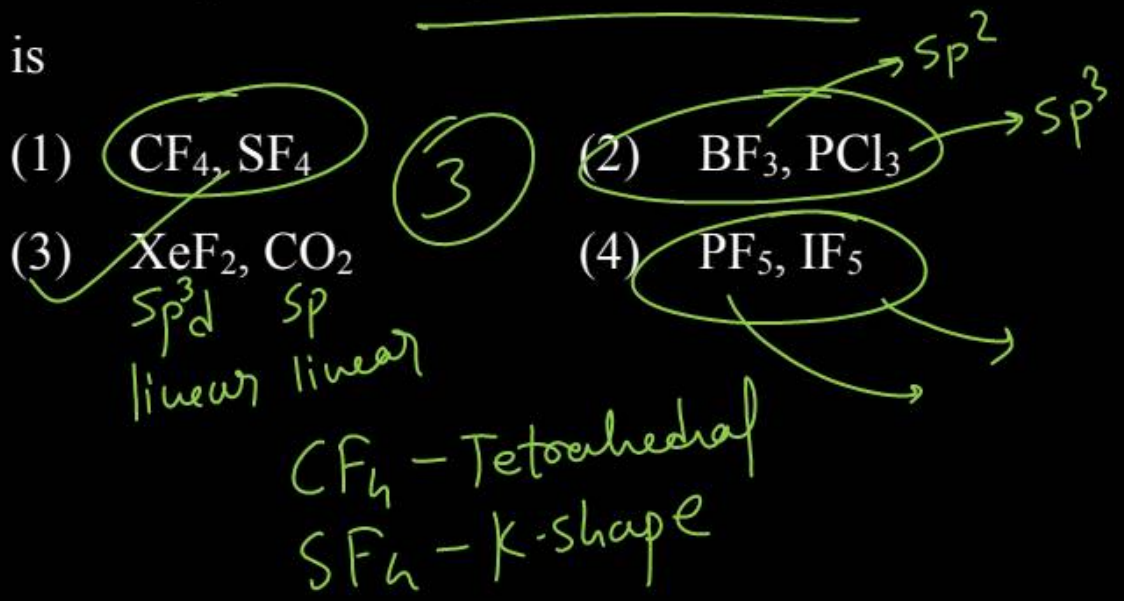
Pair of species having identical shapes for molecules is

(1) CF_4, SF_4

(2) BF_3, PCl_3

(3) XeF_2, CO_2

(4) PF_5, IF_5



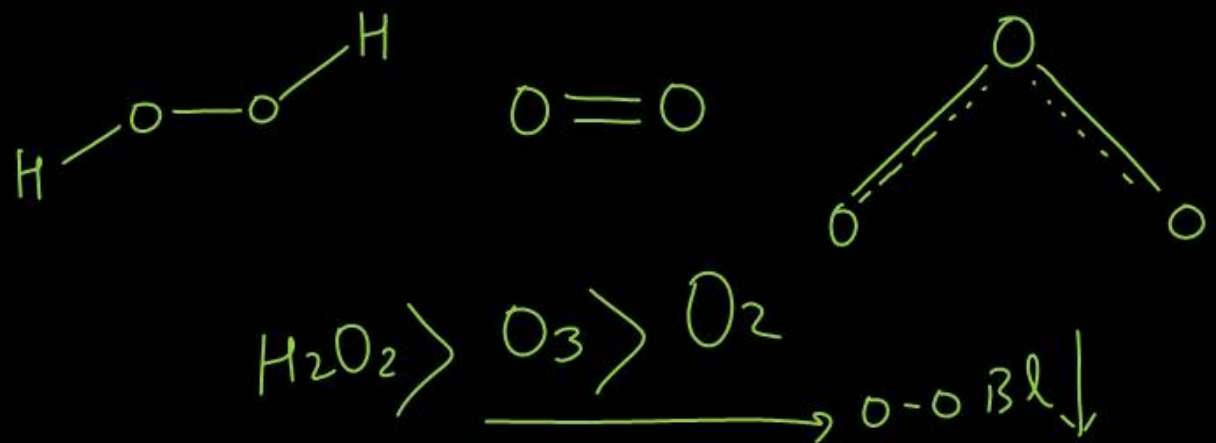
Question no. 70

The correct order of O – O bond length in O_2, H_2O and O_3 is

(1) $O_2 > O_3 > H_2O_2$ (2) $H_2O_2 > O_3 > O_2$

(3) $O_3 > O_2 > H_2O_2$ (4) $O_3 > H_2O_2 > O_2$

2



Question no. 71

Which of the following has the strongest H-bond?

(1) O – H ----S

(2) S – H ----O

(3) F – H ----F

(4) F – H ----O

Question no. 72

The percentage of s-character in the hybrid orbitals sp, sp^2 and sp^3 follows the pattern

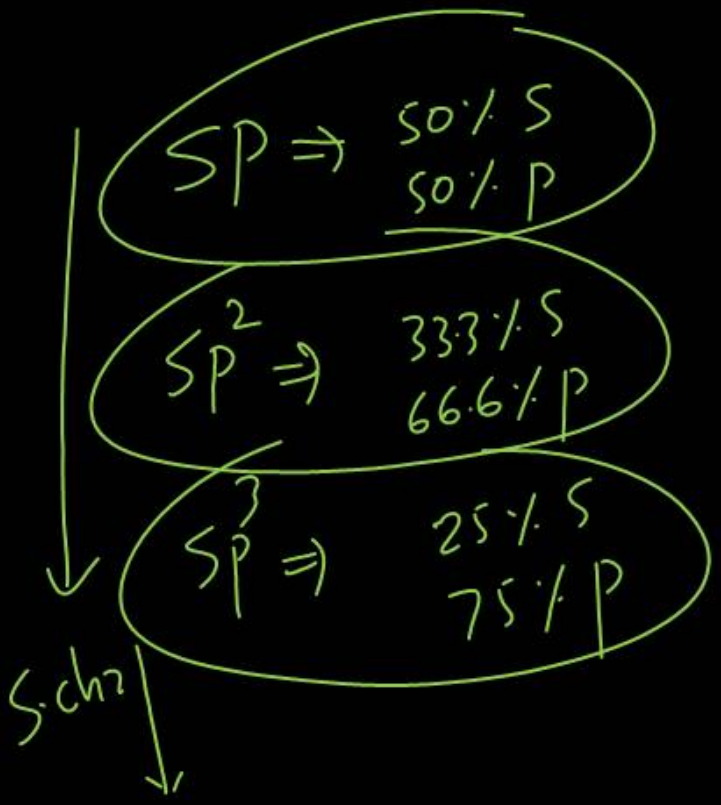
(1) $sp^3 > sp^2 > sp$

(2) $sp > sp^2 > sp^3$

(3) $sp = sp^2 > sp^3$

(4) $sp = sp^2 = sp^3$

2



Question no. 73

Identify the correct order of the size of the following :

(1) $Ca^{2+} > Ar < K^{+} < Cl^{-} < S^{2-}$

(2) $Ca^{2+} > K^{+} < Ar < S^{2-} < Cl^{-}$

(3) $Ca^{2+} < K^{+} < Ar < Cl^{-} < S^{2-}$

(4) $Ar < Ca^{2+} > K^{+} < Cl^{-} < S^{2-}$

isoelectronic
SP

size $\alpha \frac{-ve}{+ve}$

3

Question no. 74

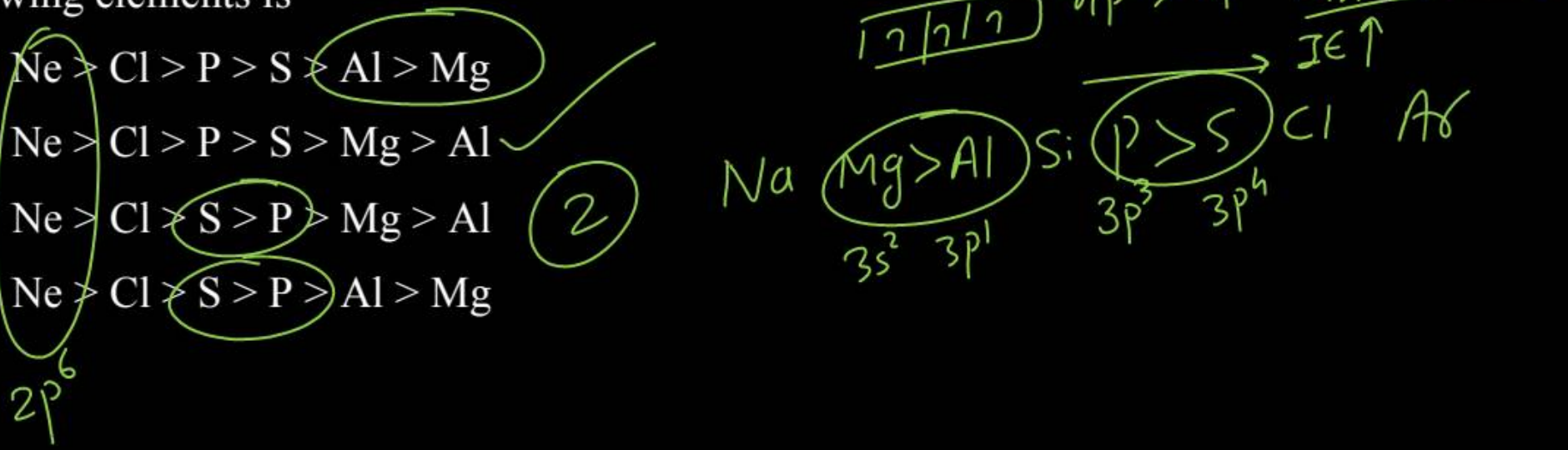
The decreasing order of the ionization enthalpy of the following elements is

(1) Ne > Cl > P > S > Al > Mg

(2) Ne > Cl > P > S > Mg > Al

(3) Ne > Cl > S > P > Mg > Al

(4) Ne > Cl > S > P > Al > Mg



Question no. 75

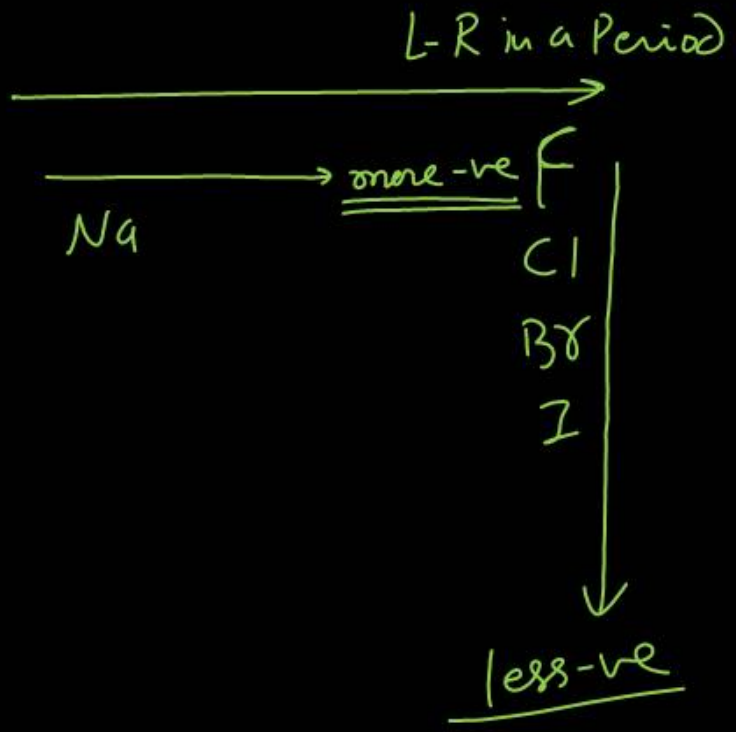
How does the electron gain enthalpy vary across a period and down a group?

(1) More positive across a period and less positive down a group

(2) More negative across a period and less negative down a group

(3) Less positive across a period and less negative down a group

(4) Less negative across a period and less negative down a group



Question no. 76

For which of the following reactions, ΔH is equal to ΔU ?

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

(2) $2HI(g)\rightarrow H_2(g)+I_2(g)$

(3) $2SO_2(g)+O_2(g)\rightarrow 2SO_3(g)$

(4) $2NO_2(g)\rightarrow N_2O_4(g)$

$\Delta H = \Delta E + \Delta n_g RT$

$\Delta H = \Delta E$

0

$\Delta n_g = n_P - n_R$

$= 2 - 2$

$= 0$

Question no. 77

The shortest wavelength of H atom in the Lyman series is λ_1. The longest wavelength in the Balmer series of He^+ is:

(1) $\frac{36\lambda_1}{5}$

(2) $\frac{5\lambda_1}{9}$

(3) $\frac{9\lambda_1}{5}$

(4) $\frac{27\lambda_1}{5}$

Shortest wavelength → Energy max.

$n_2 = \infty$, $n = 1$

$\frac{1}{\lambda} = RZ^2\left[\frac{1}{n_1^2} - \frac{1}{n_2^2}\right]$

$n_1 = 1$ $n_2 = \infty$ $Z = 1$

$\frac{1}{\lambda_1} = R \times 1^2\left[\frac{1}{1^2} - \frac{1}{\infty^2}\right]$

$\frac{1}{\lambda_1} = R$ $\lambda_1 = 1/R$

longest → minimum energy, 1st line, $n_1 = 2$

for Balmer series $n_1 = 2$ $n_2 = 3$

$\frac{1}{\lambda_2} = RZ^2\left[\frac{1}{n_1^2} - \frac{1}{n_2^2}\right] = R \times 2^2\left[\frac{1}{2^2} - \frac{1}{3^2}\right]$

$\frac{1}{\lambda_2} = R \times 4\left[\frac{1}{4} - \frac{1}{9}\right] = 4R\left[\frac{5}{36}\right]$

$\frac{1}{\lambda_2} = \frac{5R}{9}$ $\lambda_2 = \frac{9}{5R}$

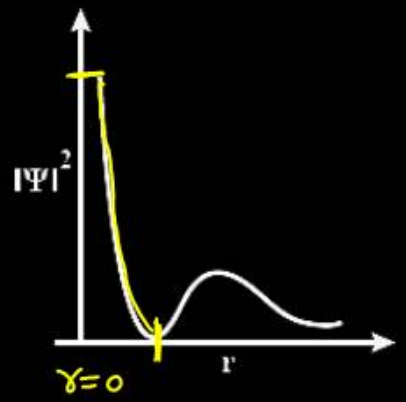
$\lambda_1 = 1/R$

$\lambda_2 = \frac{9}{5}\cdot\frac{1}{R}$ → λ_1

$\lambda_2 = \frac{9}{5}\lambda_1$

Question no. 78

The graph between $|\psi|^2$ and r (radial distance) is shown below. This represents :



(1) 3 s orbital

(2) 2 s orbital

(3) 1 s orbital

(4) 2 p orbital

$\psi^2 \rightarrow$ Probability of finding e^-

'S' $\rightarrow$ orbital

1 node present

Node $= n - l - 1$ S $(l=0)$

$1 = n - 0 - 1$

$1 = n - 1$

$n = 2$

2S

Question no. 79

The correct decreasing order of energy, for the orbitals having, following set of quantum numbers:

(A) $n = 3, l = 0, m = 0$ (B) $n = 4, l = 0, m = 0$

(C) $n = 3, l = 1, m = 0$ (D) $n = 3, l = 2, m = 1$

(1) (D) > (B) > (C) > (A)

(2) (B) > (D) > (C) > (A)

(3) (C) > (B) > (D) > (A)

(4) (B) > (C) > (D) > (A)

3d > 4s > 3p > 3s

D > B > C > A

Question no. 80

Consider the ground state of Cr atom (X = 24). The number of electrons with the azimuthal quantum numbers, $l = 1$ and $l = 2$ are, respectively

(1) 16 and 4 (2) 12 and 5

(3) 12 and 4 (4) 16 and 5

$_{24}Cr \rightarrow 1s^2 2s^2 2p^6 3s^2 3p^6 4s^1 3d^5$

$l = 1$ = P orbital = 2P + 3P = 6 + 6 = 12e

$l = 1 = 12e^-$

$l = 2$ d orbital = $5e^-$

Question no. 81

The ratio of number of oxygen atoms (O) in 16.0 g ozone (O_3), 28.0 g carbon monoxide (CO) and 16.0 oxygen (O_2) is (Atomic mass : C = 12, O = 16 and Avogadro's constant $N_A = 6.0 \times 10^{23}\ mol^{-1}$)

(1) 3 : 1 : 2

(2) 1 : 1 : 2

(3) 3 : 1 : 3

(4) 1 : 1 : 1

$$\text{mol}_{O_3} = \frac{w}{M_w} = \frac{16}{48} \times N_A \times 3 = N_A$$

$$\text{mol} = \frac{28}{28} \times N_A \times 1 = N_A \text{ atom}$$

$$\text{mol} = \frac{16}{32} \times N_A \times 2 = N_A \text{ atom}$$

$$16$$

Ratio = 1 : 1 : 1

Question no. 82

For a reaction, $N_2(g) + 3\ H_2(g) \rightarrow 2\ NH_3(g)$; identify dihydrogen ($H_2$) as a limiting reagent in the following reaction mixtures.

(1) 56 g of N_2 + 10 g of H_2

(2) 35 g of N_2 + 8 g of H_2

(3) 28 g of N_2 + 6 g of H_2

(4) 14 g of N_2 + 4 g of H_2

LR

$N_2 + 3H_2 \longrightarrow 2NH_3$

	1	3	2
stoi.			

			?
Given	56gm	10 gm	
mol	$\frac{56}{28} = 2$	$\frac{10}{2} = 5$	
	$\frac{2}{1} = 2$	$\frac{5}{3} = 1.66$	

L.R. =

Question no. 83

A gaseous hydrocarbon gives upon combustion 0.72 g of water and 3.08 g of CO_2. The empirical formula of the hydrocarbon is :

(1) C_2H_4 (2) C_3H_4

(3) C_6H_5 (4) C_7H_8

$$\text{mol } H_2O = \frac{0.72}{18} = 0.04$$

$$\text{mol of } H = 2 \times 0.04 = 0.08$$

$$\text{mol } CO_2 = \frac{3.08}{44} = 0.07$$

$$\text{mol of } C = 0.07$$

mol ratio H & C

$$\frac{H}{C} = \frac{0.08}{0.07} = \frac{8}{7}$$

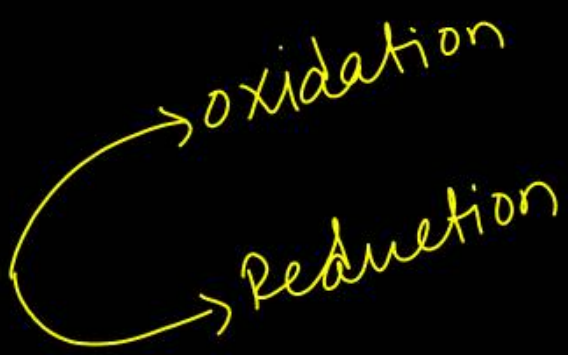
C_7H_8

Question no. 84

The compound that cannot act both as oxidising and reducing agent is :

(1) H_3PO_4 (2) HNO_2

(3) H_2SO_3 (4) H_2O_2



$H_3^{+5}PO_4$ P max. o.s = +5 oxidation X

Question no. 85

Consider the following reversible chemical reactions:

$A_2(g) + B_2(g) \underset{}{\overset{K_1}{\rightleftharpoons}} 2AB(g)$ ..... (1)

$6\,AB(g) \underset{}{\overset{K_2}{\rightleftharpoons}} 3A_2(g) + 3B_2(g)$ ..... (2)

The relation between K_1 and K_2 is:

(1) $K_1K_2 = \frac{1}{3}$

(2) $K_2 = K_1^3$

(3) $\frac{1}{K_1^3} = K_2$

(4) $K_1K_2 = 3$

Question no. 86

Change in volume of the system does not alter which of the following equilibria?

(1) $N_2(g) + O_2 \rightleftharpoons 2NO(g)$ $\Delta n_g = 0$

(2) $PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$

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

(4) $SO_2Cl_2(g) \rightleftharpoons SO_2(g) + Cl_2(g)$

$\Delta n_g = 0$

No effect of V ΔP

Question no. 87

Which of the following statements/relationships is not correct in thermodynamic changes?

(1) $\Delta U = 0$ for isothermal reversible expansion of a gas

(2) $w = -nRT \ln \frac{V_2}{V_1}$ for isothermal reversible expansion of an ideal gas

(3) $w = nRT \ln \frac{V_2}{V_1}$ for isothermal reversible expansion of an ideal gas

(4) For a system of constant volume, heat involved directly changes to internal energy.

Question no. 88

Which of the following has $p\pi - d\pi$ bonding?

(1) NO_3^-

(2) SO_3^{2-} → $d\pi - p\pi$

(3) BO_3^{3-}

(4) CO_3^{2-}

2

2nd period elements don't have vacant d-orbitals

Question no. 89

i. $C(\text{graphite}) + O_2(g) \rightarrow CO_2(g);\ \Delta rH^0 = x\ kJmol^{-1}$ Eqn ①

ii. $C(\text{graphite}) + \frac{1}{2}O_2(g) \rightarrow CO(g);\ \Delta_r H^0 = y\ kJmol^{-1}$ Eqn ②

iii. $C\ (\text{graphite}) + \frac{1}{2}O_2(g) \rightarrow CO_2(g);\ \Delta_r H^0 = z\ kJmol^{-1}$ Eqn ③

$CO + \frac{1}{2}O_2(g) \longrightarrow CO_2(g);\ \Delta H^\circ_r = z$ ✓

Eqn ① − Eqn ② = Eqn ③

$x - y = z$

$\boxed{x = y + z}$

Based on the above thermochemical equations, find out which one of the following algebraic relationships is correct?

(1) $x = y + z$

(2) $z = x + y$

(3) $y = 2z - x$

(4) $x = y - z$

Question no. 90

The correct order of EN of N, O, F and P is

(1) F > N > P > O

(2) F > O > P > N

(3) F > O > N > P

(4) N > O > P > F

F > O > N > P

Question no. 91

ICBN stands for

(1) Indian Council of British Nature

(2) International Code for Biological Nomenclature

(3) International Code for Botanical Nomenclature

(4) Indian Code for Botanical Nomenclature

Question no. 92

Which of the following sets belongs to the same class of algae?

(1) Ectocarpus, Ulothrix, Porphyra

(2) Chara, Polysiphonia, Fucus

(3) Sargasssum, Gracilaria, Laminaria

(4) Chlamydomonas, Spirogyra, Volvox

Question no. 93

Which of the following features is not present in the phylum-Arthropoda?

(1) Chitinous exoskeleton

(2) Metameric segmentation

(3) Parapodia

(4) Jointed appendages

$k_A > k_B$

X

✓

(I) $W = \frac{1}{2} k x^2$

x = Constant

$W \propto k$

$k_A > k_B$

$W_A > W_B$

I st

(II) $F = kx$

$x = \frac{F}{k}$

$W = \frac{1}{2} k \frac{F^2}{k^2}$

$W = \frac{F^2}{2k}$

$W \propto \frac{1}{k}$

$k_A > k_B$

$W_B > W_A$

II nd

Question no. 94

Vascular bundles in dicot stem are

(1) Open, collateral, endarch

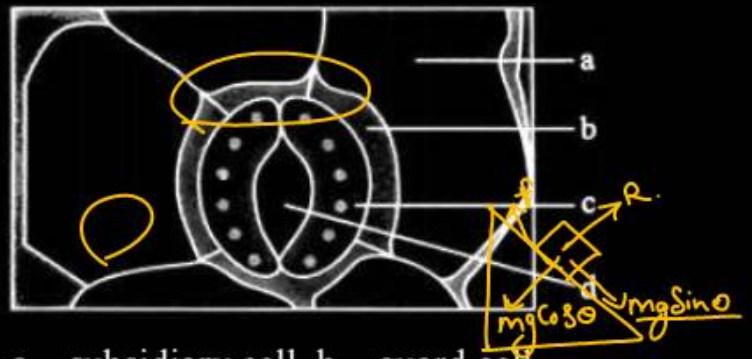
(2) Closed, collateral, endarch

(3) Open, collateral, exarch

(4) Closed, collateral, exarch

Question no. 95

Recognise the figure and find out the correct matching.



(1) a – subsidiary cell, b – guard cell,
c – epidermal cell, d – stomal pore

(2) b – subsidiary cell, a – guard cell,
c – epidermal cell, d – stomal pore

(3) b – subsidiary cell, c – guard cell,
a – epidermal cell, d – stomal pore

(4) a – subsidiary cell, d – guard cell,
b – epidermal cell, a – stomal pore

Question no. 96

DNA occur in

(1) Mitochondria, Plastids and Chromosomes

(2) Chromosomes, Mitochondria and Ribosomes

(3) Chromosomes, Mitochondria and Cell Membrane

(4) Chromosomes, Ribosomes and Cytoplasm

Question no. 97

Macromolecule chitin is

(1) Sulphur containing polysaccharide

(2) Simple polysaccharide

(3) Nitrogen containing polysaccharide

(4) Phosphorous containing polysaccharide

Question no. 98

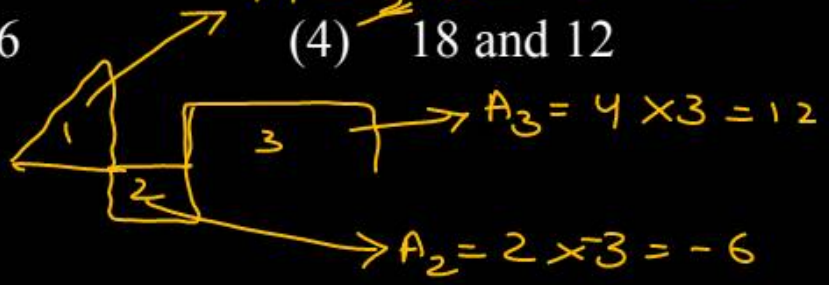
In calvin cycle for synthesis of a molecules of glucose, the requirement of ATP and NADPH is respectively

(1) 15 and 10

(2) 12 and 18

(3) 12 and 6

(4) 18 and 12



$\Delta P = F \cdot \Delta t$

$\Delta P = A_1 - A_2 + A_3$

$= 6 - (-6) + 12$

$= 12\ N \cdot s$

Question no. 99

Final electron acceptor in respiration is

(1) Hydrogen (2) Oxygen

(3) Cytochromes (4) Dehydrogenases

$$\lambda = \frac{1}{\sqrt{2}\pi n d^2}$$

d = diameter

Question no. 100

Which is not a function of cytokinin?

(1) Delay in senescence

(2) Breaking seed dormancy

(3) Promoting bud dormancy

(4) Promoting stomatal opening

Question no. 101

Which is the correct sequence of steps in respiration?

a. Transport of gases by the blood

b. Breathing or pulmonary ventilation

c. Cellular respiration

d. Diffusion of O_2 and CO_2 between blood and tissues

e. Diffusion of O_2 and CO_2 across alveolar membrane

(1) b → e → a → d → c

(2) b → a → e → c → d

(3) b → d → a → e → c

(4) b → e → d → a → c

Question no. 102

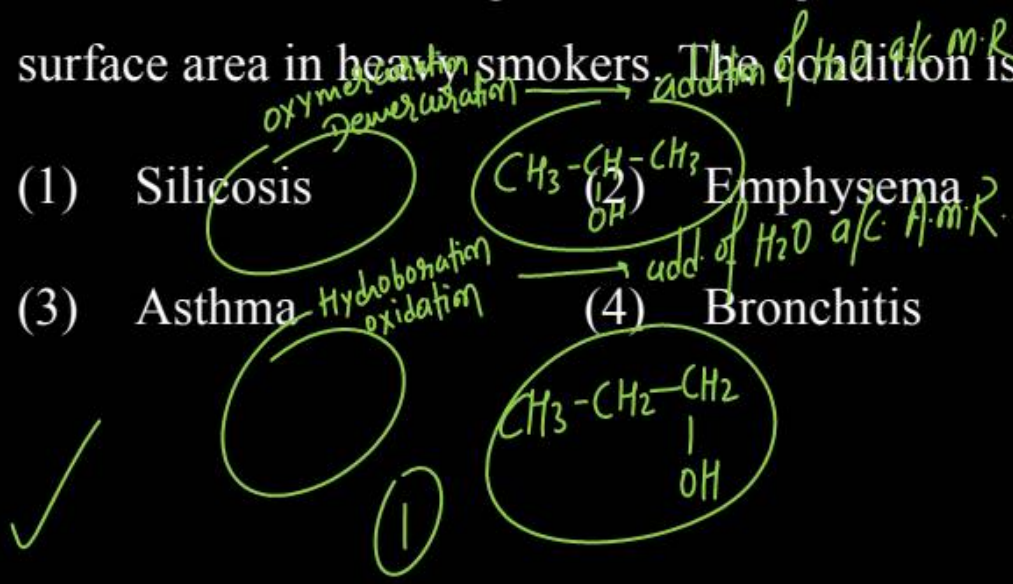
Alveoli become enlarged and damaged with reduced surface area in heavy smokers. The condition is called

(1) Silicosis

(2) Emphysema

(3) Asthma

(4) Bronchitis



Question no. 103

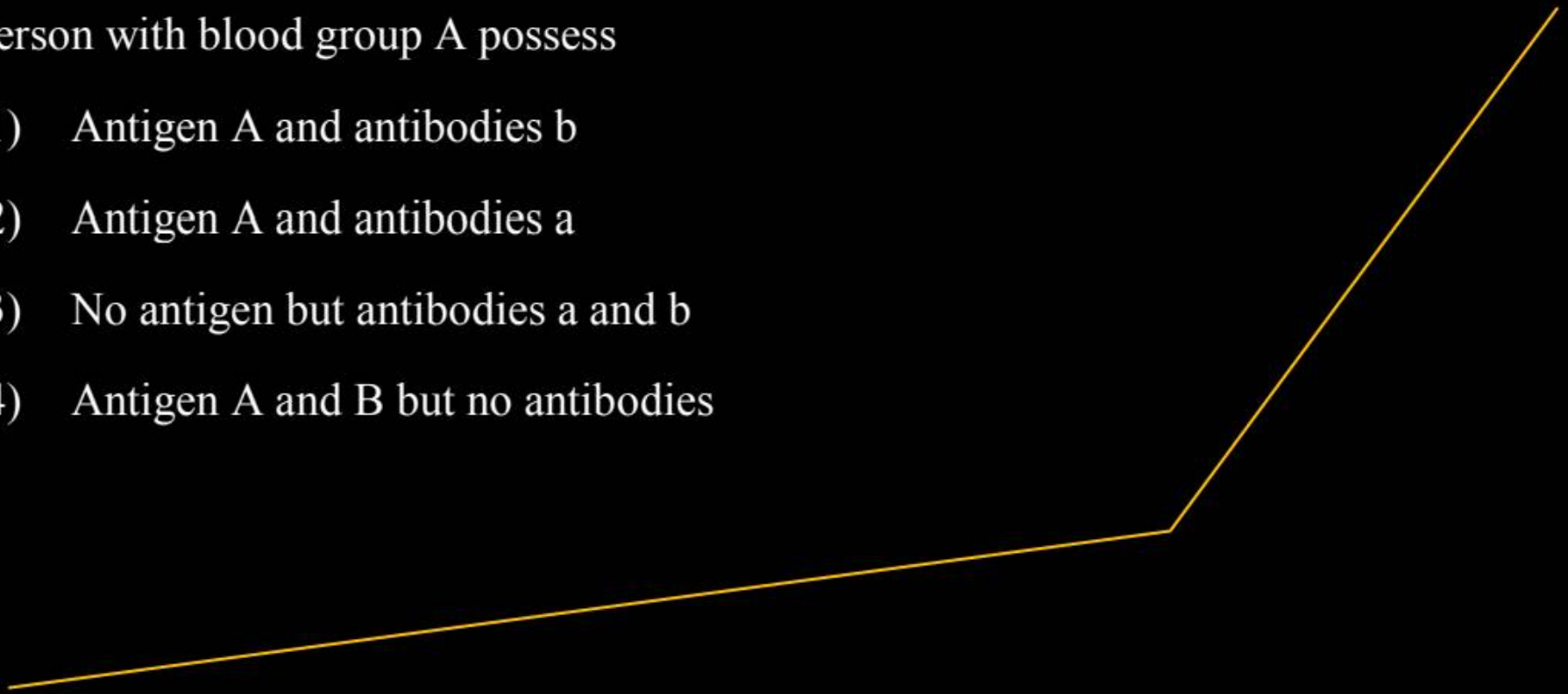
Person with blood group A possess

(1) Antigen A and antibodies b

(2) Antigen A and antibodies a

(3) No antigen but antibodies a and b

(4) Antigen A and B but no antibodies



Question no. 104

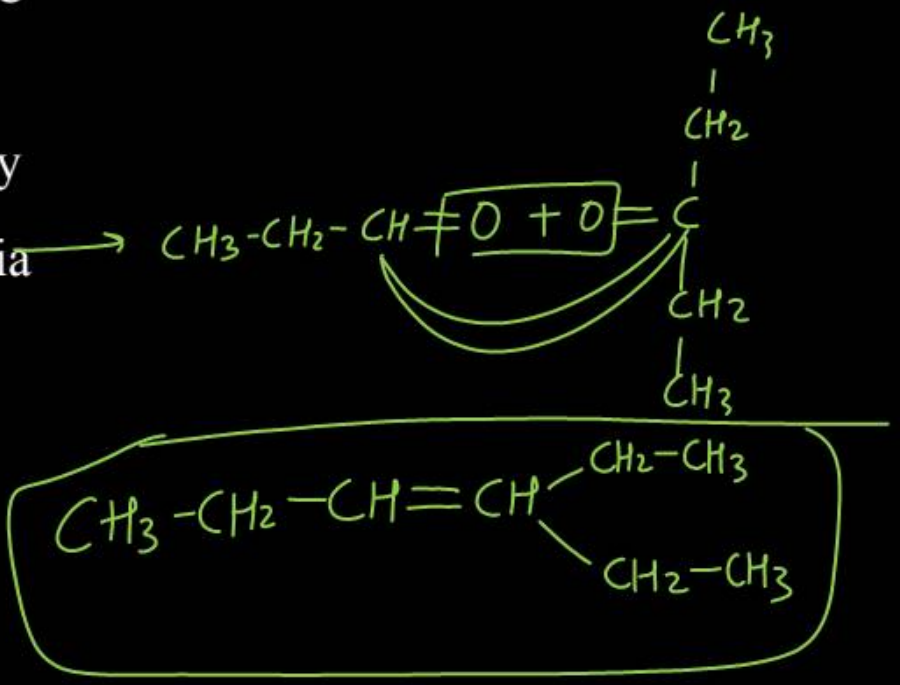
A large quantity of one of the following is removed from our body by lungs

(1) CO_2 only

(2) H_2O only

(3) CO_2 and H_2O

(4) Ammonia



Question no. 105

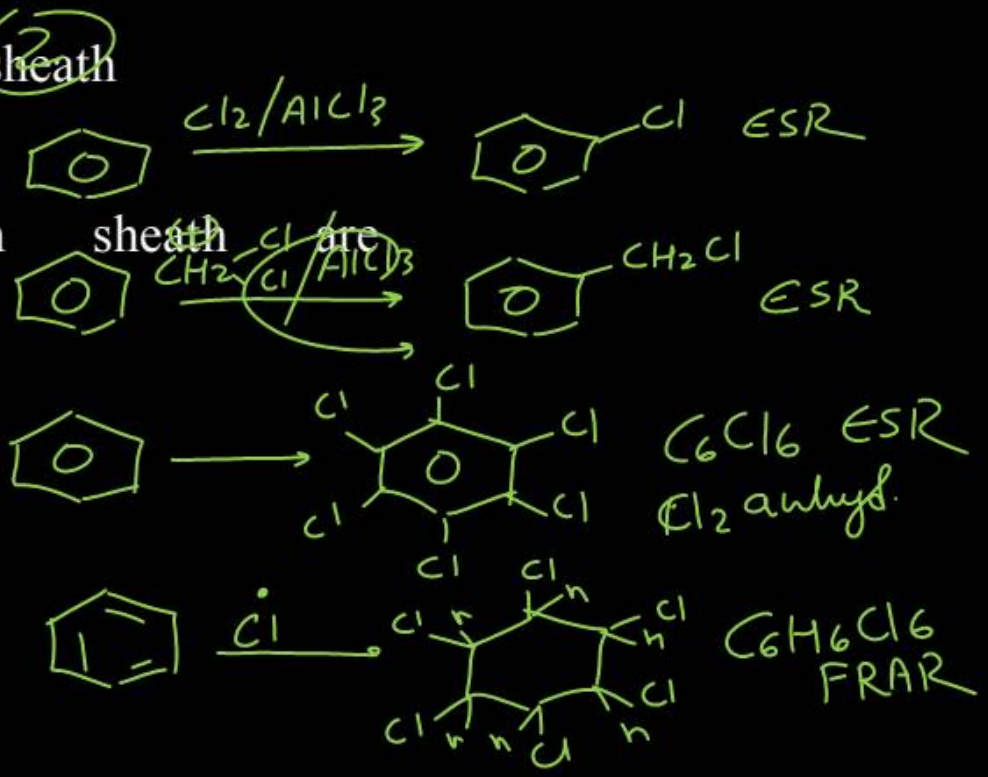
Node of Ranvier occurs where

(1) Nerve is covered with myelin sheath

(2) Neurilemma is discontinuous

(3) Neurilemma and myelin sheath are discontinuous

(4) Myelin sheath is discontinuous



Question no. 106

Read the following statements :

A. The male or female cones or stroili may be bone on same tree in Pinus.

B. In Cycas male cones and megasporophylls are borne on different trees.

C. Stem of Cycas is branched and of Pinus and Cedrus is unbranched.

D. In gymnosperms generally tap roots are found.

Select the correct statements :

(1) A, B

(2) A, B, D

(3) A, B, C

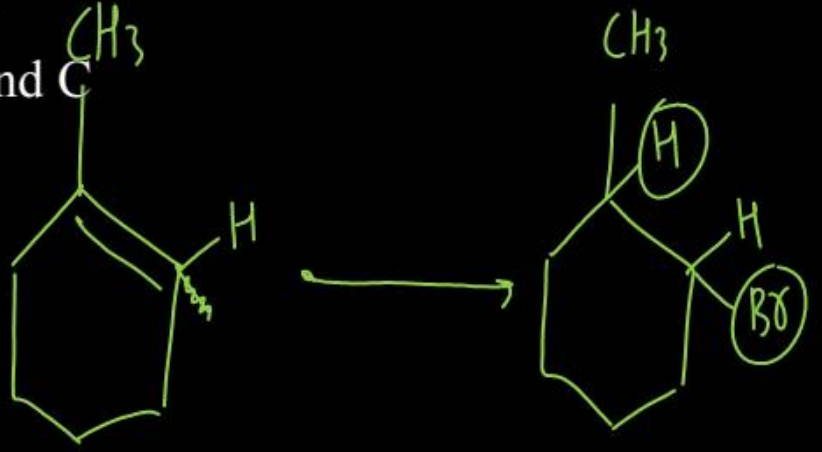
(4) C, D

Question no. 107

Diploblastic, radially symmetrical, marine animal showing bioluminescent property is

(1) Comb jelly (2) Jelly fish

(3) Sea walnut (4) Both A and C



Question no. 108

Based on the position of calyx, corolla and androecium in respect of the ovary on thalamus, the flowers are described as hypogynous, perigynous and epigynous. The following condition is found in

(1) Mustard, China rose and brinjal

(2) Plum, rose and peach

(3) Guava, cucumber and the ray florets of sunflower

(4) Rose, China rose and sunflower

Question no. 109

The correct sequence of layers from outerside to inside of a typical monocot root is

(1) Epidermis, endodermis, cortex, vascular bundles, pericycle and pith

(2) Epidermis, endodermis, cortex, pericycle, vascular bundles and pith

(3) Epidermis, cortex, endodermis, pericycle, vascular bundles and pith

(4) Pericycle, epidermis, endodermis, pith, cortex and vasuclar bundles

Question no. 110

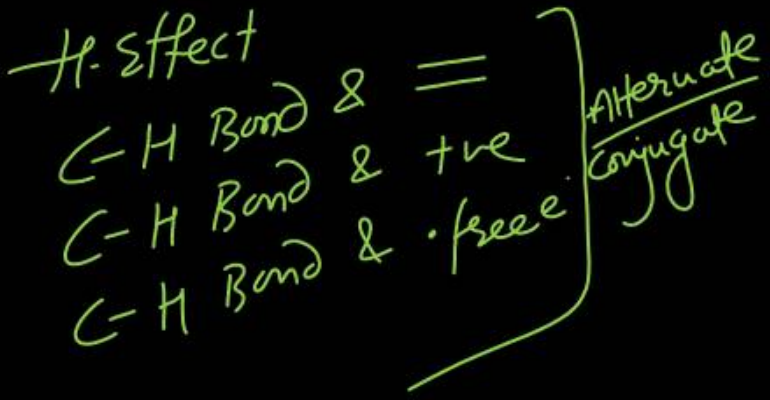
In cockroaches, the respiratory system consists of a network of trachea that open outside through small holes that are present on lateral side of the body are called.

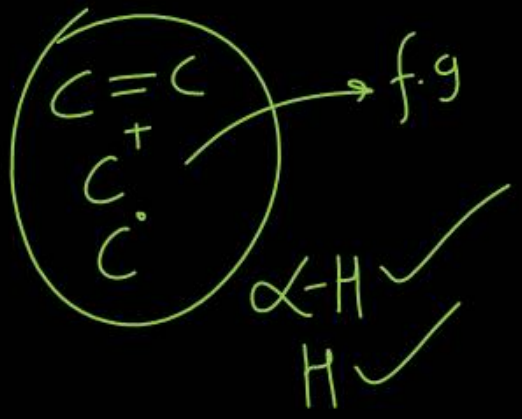
(1) Tracheoles and are of 9 pairs

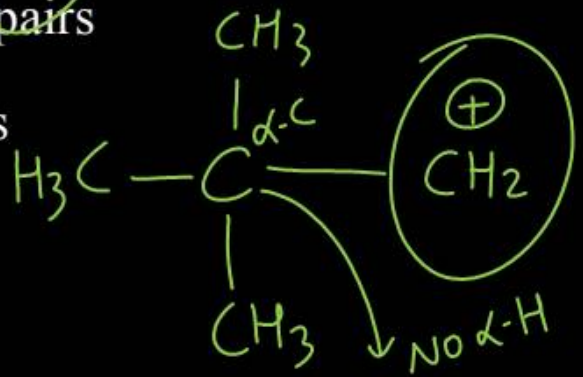
(2) Spiracles and are of 10 pairs

(3) Sphincters and are of 8 pairs

(4) Ostia and are of 13 pairs







Question no. 111

The main arena of various activities of a cell is

(1) Mitochondrion

(2) Cytoplasm

(3) Nucleus

(4) Plasma membrane

Question no. 112

Which is not a characteristics of telophase?

A. Chromatin condenses to form chromosomes.

B. Nucleolus, Golgi complex and ER reform.

C. Nuclear envelope assemble around chromosome clusters.

D. Centromeres split and chromatids separate.

E. Chromosome are seen.

(1) A, B, D only

(2) A, D only

(3) B, C only

(4) C, D, E only

Question no. 113

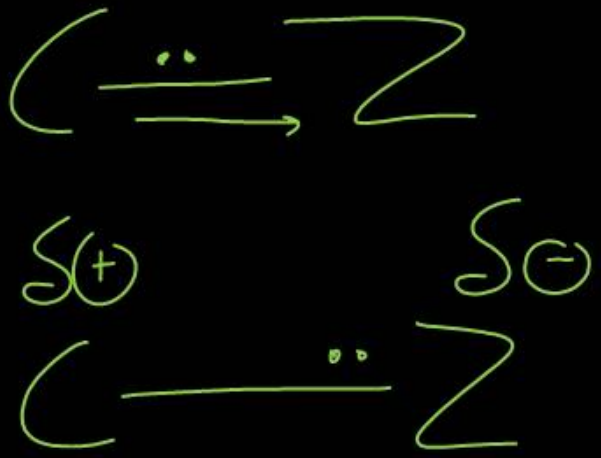
Photorespiration is favoured by

(1) High oxygen and low carbon dioxide

(2) High carbon dioxide and low oxygen

(3) High temperature and low oxygen

(4) High humidity and temperature



Question no. 114

Plants follow different pathways in response to environment or phase of life to form different kind of structures. This ability is called

(1) Development
(2) Differentiation
(3) Plasticity
(4) Photoperiodism

Question no. 115

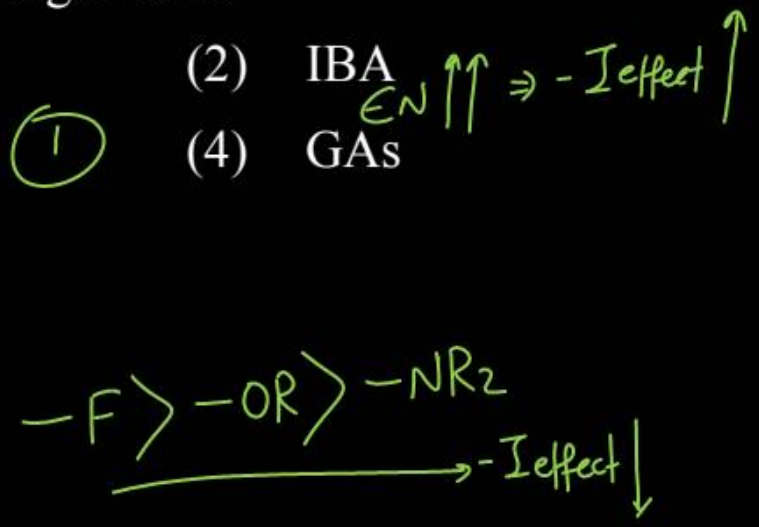
ABA acts as an antagonist to

(1) NAA

(2) IBA

(3) IAA

(4) GAs

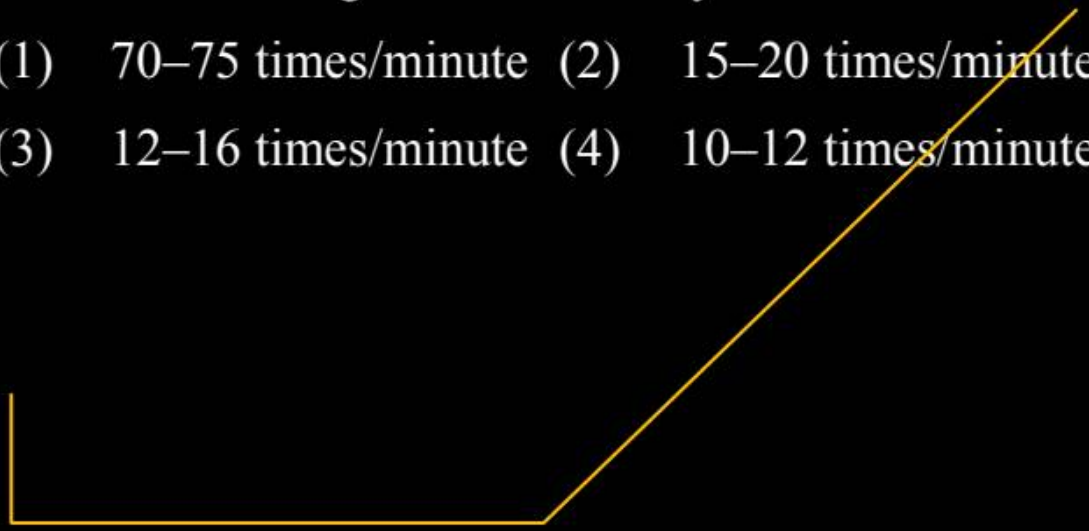


Question no. 116

Normal breathing rate of a healthy human is

(1) 70–75 times/minute (2) 15–20 times/minute

(3) 12–16 times/minute (4) 10–12 times/minute



Question no. 117

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

	Column I		Column II
a.	Respiratory rhythm centre	1.	Pons
b.	Pneumotaxic centre	2.	Cerebellum
c.	Apneustic centre	3.	Medulla
d.	Chemosensitive area	4.	Cerebrum

(1) a–2, b–3, c–4, d–1

(2) a–3, b–1, c–2, d–3

(3) a–1, b–3, c–4, d–2

(4) a–3, b–1, c–1, d–3

Question no. 118

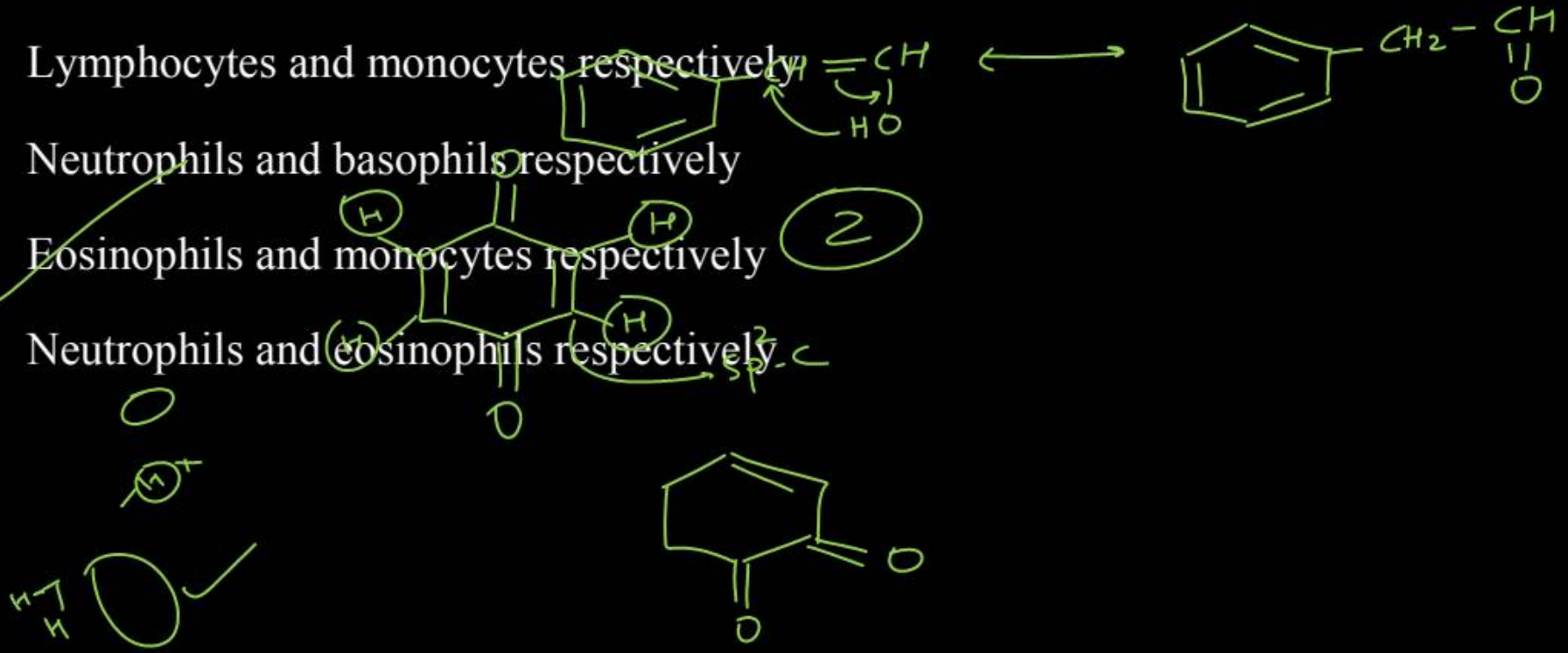
Most abundant and least abundant WBCs are

(1) Lymphocytes and monocytes respectively

(2) Neutrophils and basophils respectively

(3) Eosinophils and monocytes respectively

(4) Neutrophils and eosinophils respectively



Question no. 119

The globular head of HMM is an active ATPase enzyme and has

a. ATP binding sites

b. Actin binding sites

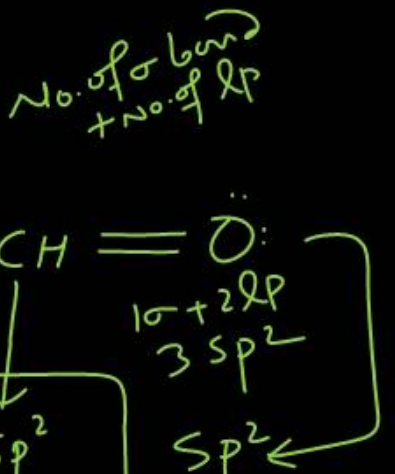
c. Myosin binding sites

d. Troponin binding sites

e. Calcium binding sites

(1) a and b (2) a and c

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



sp^3 - C O

sp^3 - C - 3

sp - C = 1

Question no. 120

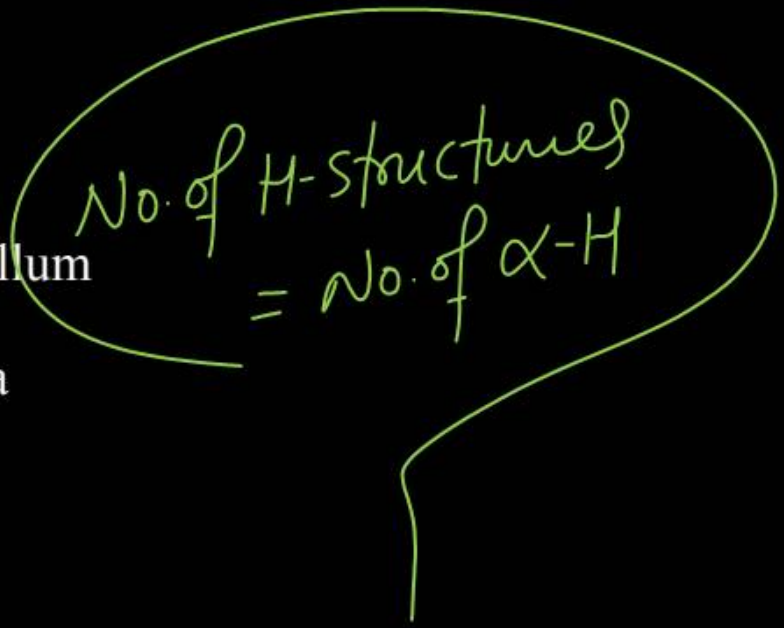
Brain stem is made of

(1) Mid brain, pons, cerebellum

(2) Mid brain, pons, medulla oblongata

(3) Diencephalon, medulla oblongata, cerebellum

(4) Cerebellum, cerebrum, medulla oblongata



Question no. 121

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

	Column I		Column II
A.	Haplontic life-cycle	I.	Gymnosperms and angiosperms
B.	Diplontic life-cycle	II.	Spirogyra
C.	Haplo-diplontic life-cycle	III.	Bryophytes and pteridophytes

(1) A – I, B – II, C – III

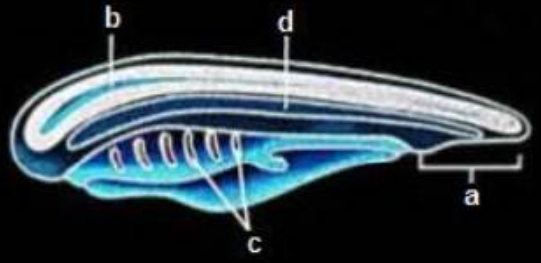
(2) A – III, B – I, C – II

(3) A – II, B – I, C – III

(4) A – II, B – III, C – I

Question no. 122

Recognise the figure and find out the correct matching.



i. Nerve cord ii. Notochord

iii. Post anal tail iv. Gill slits

(1) A – iii, B – ii, C – iv, D – i

(2) A – iii, B – ii, C – i, D – iv

(3) A – iii, B – i, C – iv, D – ii

(4) A – ii, B – i, C – iv, D – iii

Question no. 123

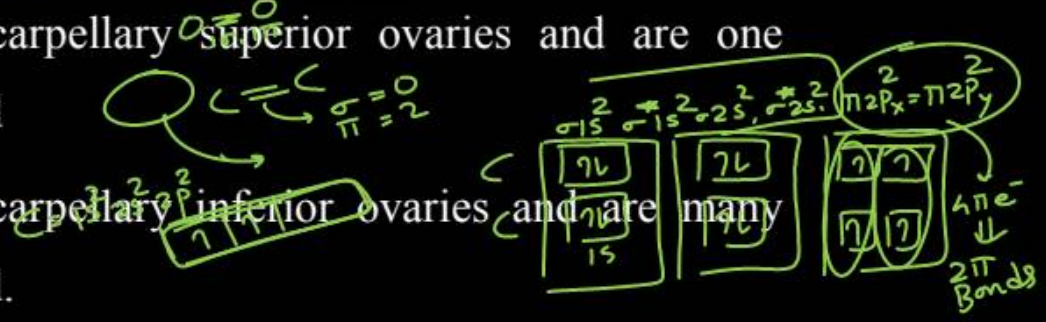
Drup fruit develops from

(1) Monocarpellary superior ovaries and are one seeded

(2) Monocarpellary inferior ovaries and are many seeded.

(3) Monocarpellary superior ovaries and are many seeded.

(4) Bicarpellary superior ovaries and are many seeded.



Question no. 124

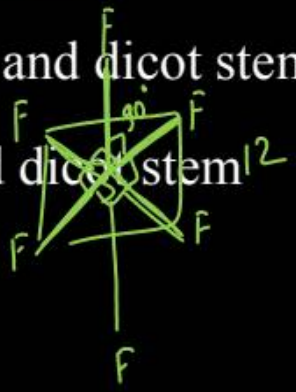
Well developed pith is found in

(1) Monocot root and monocot stem

(2) Monocot stem and dicot root

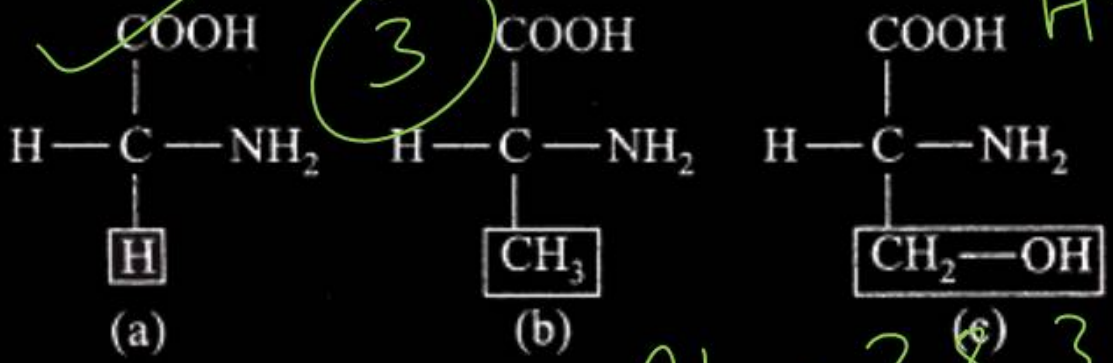
(3) Monocot root and dicot stem

(4) Dicot root and dicot stem



Question no. 125

Recognise the figure and find out the correct matching.



(1) a – serine, b – glycine, c – alanine

(2) a – glycine, b – serine, c – alanine

(3) a – glycine, b – alanine, c – serine

(4) a – alanine, b – serine, c – glycine

Question no. 126

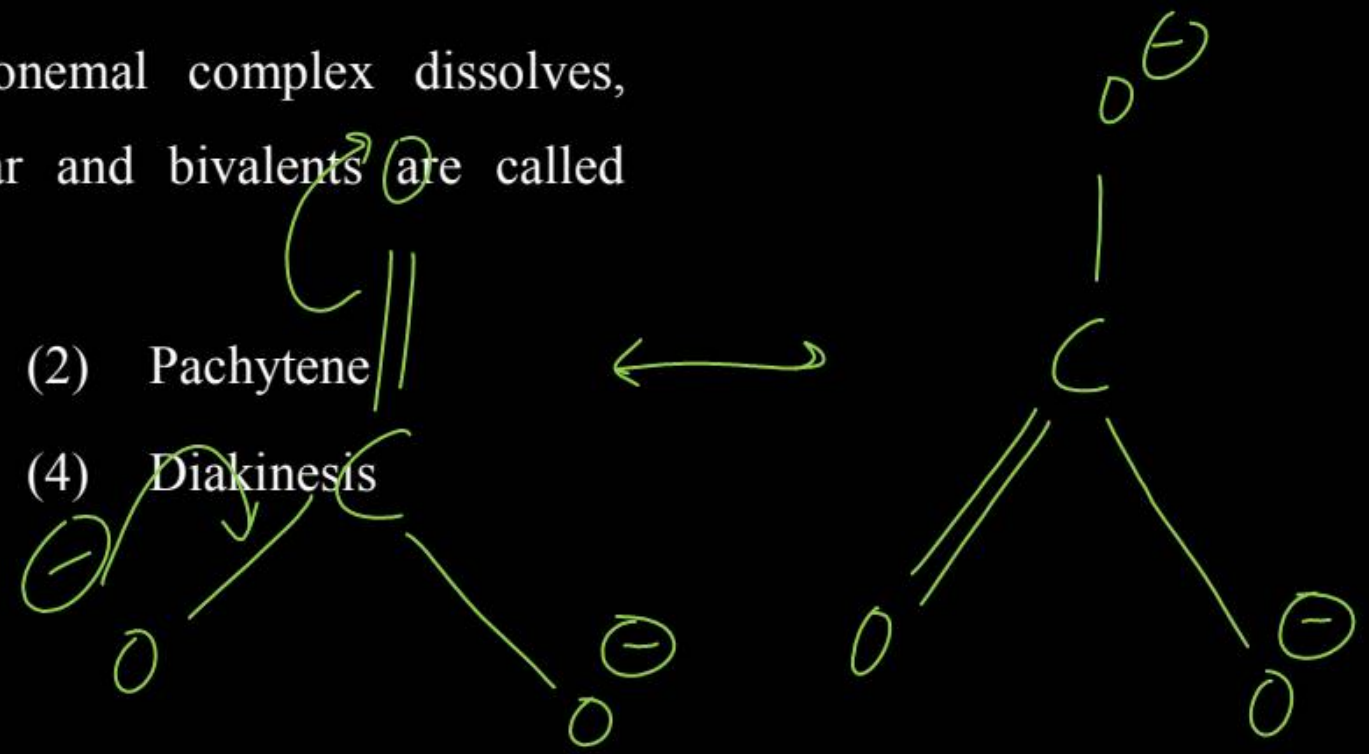
In which stage synaptonemal complex dissolves, chromatids become clear and bivalents are called tetrads.

(1) Zygotene

(2) Pachytene

(3) Diplotene

(4) Diakinesis



Question no. 127

Consider the following statements :

A. Plant cells have centrioles which are absent in almost all animal cells.

B. Ribosomes are the site of protein synthesis.

C. The middle lamella is the layer mainly of calcium carbonate which holds the different neighbouring cells together.

D. In animal cells lipid like steroidal hormones are synthesized by smooth endoplasmic reticulum.

Of the above statements:

(1) A and B only are correct.

(2) A and D are only correct.

(3) B and D only are correct.

(4) C and D only are correct.

Question no. 128

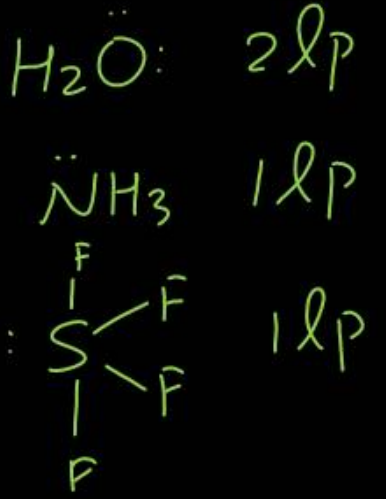
In Kranz anatomy, the bundle sheath cells have

(1) Thick walls, many intercellular spaces and no chloroplasts

(2) Thick walls, no intercellular spaces and a large number of chloroplasts

(3) Thick walls, no intercellular spaces and few chloroplasts

(4) Thin walls, many intercellular spaces and several chloroplasts



Question no. 129

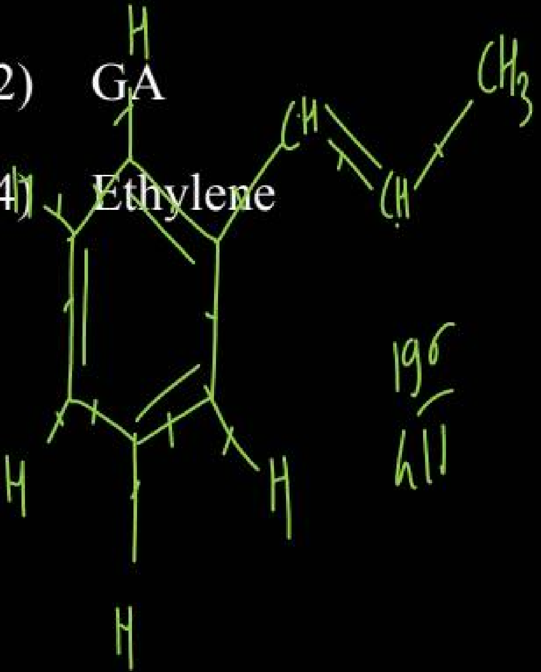
Bud dormancy is induced by

(1) IAA

(2) GA

(3) ABA

(4) Ethylene



Question no. 130

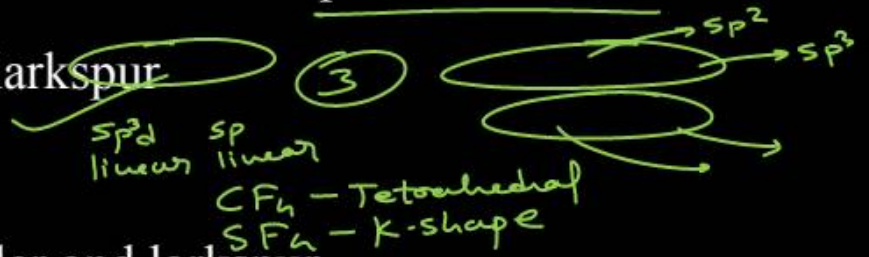
In some plants, the shapes of leaves produced in air different from those produced in water. This the heterophyllous development as seen in

(1) Cotton, coriander and buttercup

(2) Buttercup and larkspur

(3) Buttercup only

(4) Cotton, coriander and larkspur



Question no. 131

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

	Column - I		Column - II
a.	IC	1.	EC + IRV
b.	EC	2.	RV + VC
c.	FRC	3.	VC – ERV
d.	VC	4.	ERV + RV
e.	TLC	5.	TV + ERV

(1) a–3, b–5, c–4, d–1, e–2

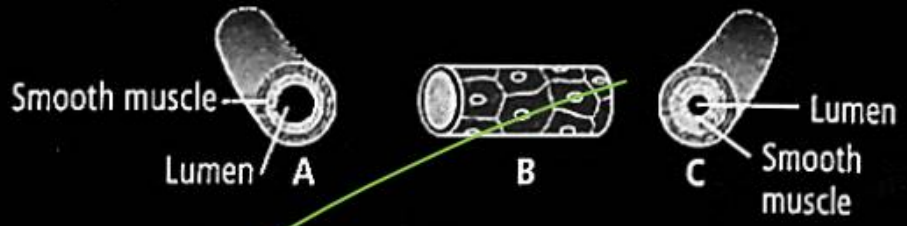
(2) a–5, b–2, c–3, d–5, e–e

(3) a–4, b–3, c–1, d–5, e–2

(4) a–3, b–5, c–2, d–4, e–1

Question no. 132

Recognise the figure and find out the correct matching.



(1) a–artery, b–vein, c–capillary

(2) c–artery, a–vein, b–capillary

(3) b–artery, c–vein, a–capillary

(4) a–artery, c–vein, b–capillary

3

Question no. 133

Malpighian body/renal corpuscle is constituted by

(1) Glomerulus only

(2) Glomerulus and Bowman's capsule

(3) Glomerulus and efferent vessel

(4) Glomerulus and afferent vessel

Question no. 134

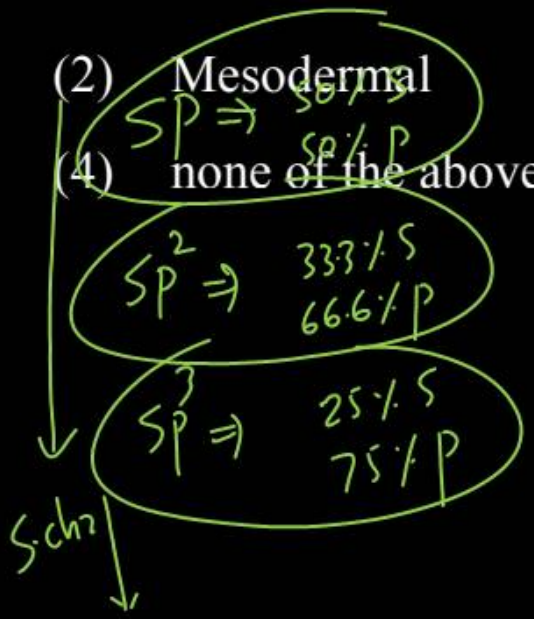
Origin of muscle is

(1) Ectodermal

(2) Mesodermal

(3) Endodermal

(4) none of the above

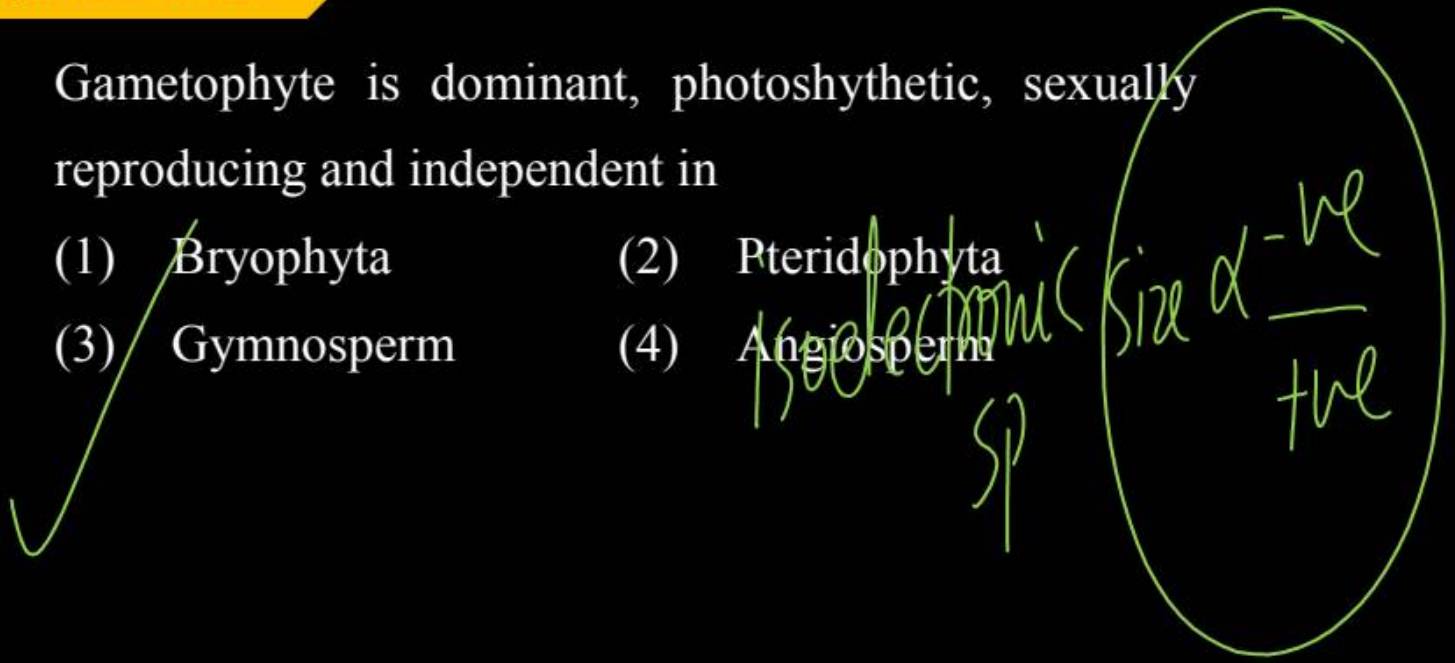


Question no. 135

Gametophyte is dominant, photoshythetic, sexually reproducing and independent in

(1) Bryophyta (2) Pteridophyta

(3) Gymnosperm (4) Angiosperm

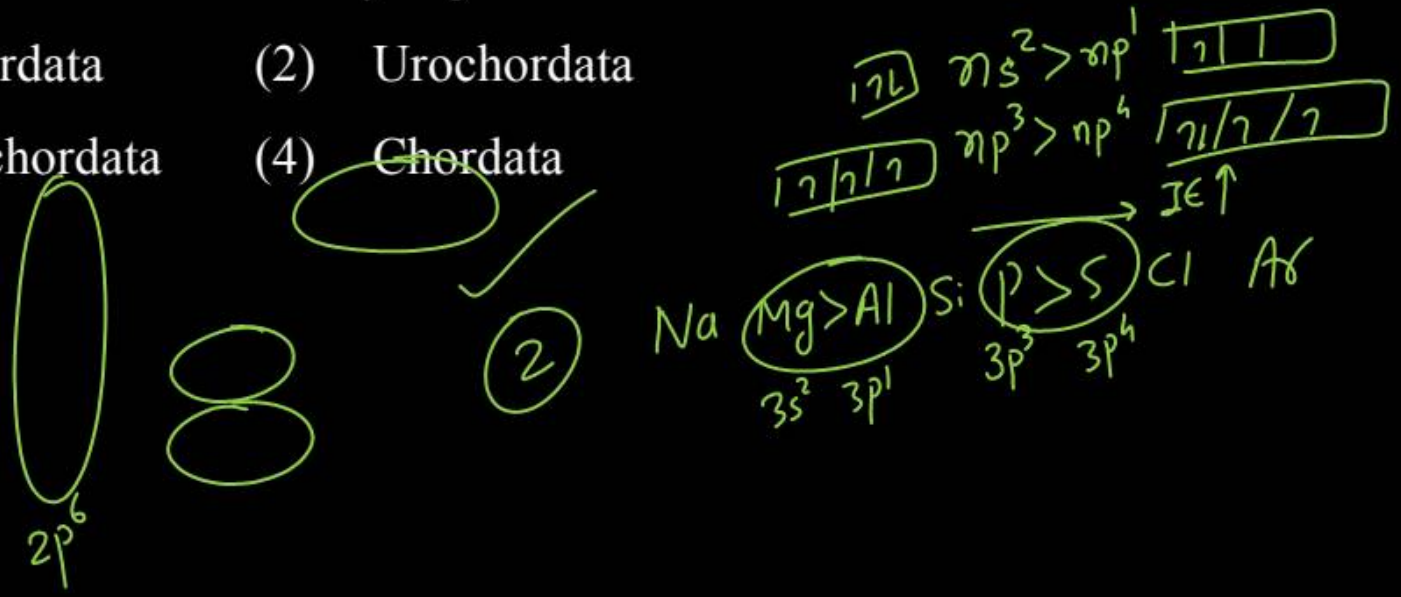


Question no. 136

Proboscis gland are the excretory organ of

(1) Hemichordata (2) Urochordata

(3) Cephalochordata (4) Chordata



Question no. 137

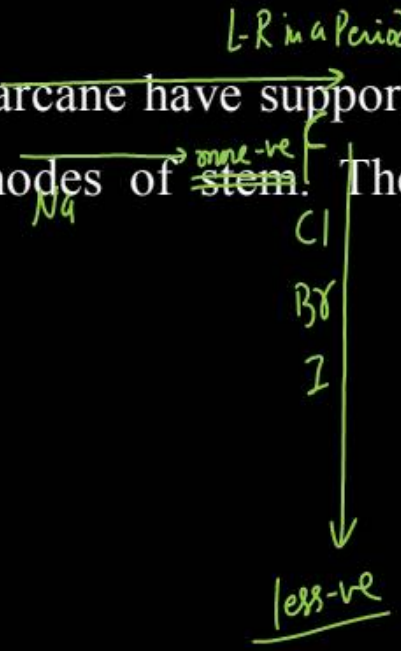
The stem of Maize and Sugarcane have support roots coming out of the lower nodes of stem. They are called.

(1) Stilt roots

(2) Prop roots

(3) Pneumatophores

(4) Adventitious roots



Question no. 138

A living mechanical tissue having cellulosic wall thickening is

(1) Sclerenchyma

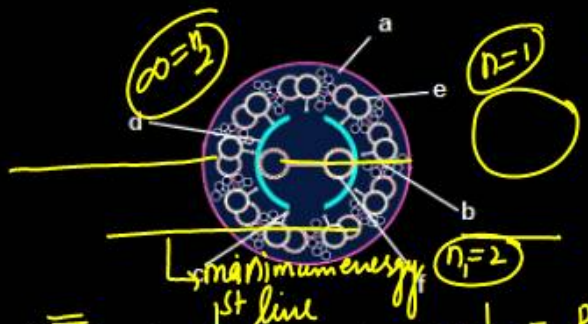
(2) Collenchyma

(3) Parenchyma

(4) Aerenchyma

Question no. 139

Recognise the figure and find out the correct matching.



(1) d – plasma membrane, b – radial spoke,
a – central sheath, c – interdoublet bridge,
f–peripheral microtubule, e–central microtubule

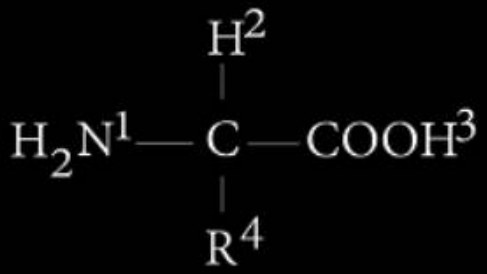
(2) d – plasma membrane, c – radial spoke,
a – central sheath, b – interdoublet bridge,
e–peripheral microtubule, f–central microtubule

(3) a – plasma membrane, b – radial spoke,
d – central sheath, c – interdoublet bridge,
e–peripheral microtubule, f–central microtubule

(4) a – plasma membrane, c – radial spoke,
d – central sheath, b – interdoublet bridge,
e–peripheral microtubule, f–central microtubule

Question no. 140

Which two groups of the following formula are involved in peptide linkage between different amino acids?



(1) 2 and 3
(2) 1 and 3
(3) 1 and 3
(4) 2 and 4

$\psi^2 \rightarrow$ Probability of finding e^-

'S' $\rightarrow$ orbital

1 node present-

Node $= n - \ell - 1$ S $(\ell = 0)$

$1 = n - 0 - 1$

$1 = n - 1$

$n = 2$

2S

Question no. 141

Which one occurs both during cyclic and non–cyclic modes of photophosphorylation?

(1) Involvement of both PS I and PS II

(2) Formation of ATPs

(3) Release of O_2

(4) Formation of NADPH

3d > 4s > 3p > 3s

D > B > C > A

Question no. 142

Enzymes taking part in glycolysis are present in

(1) Mitochondria

(2) Cytoplasm

(3) Both mitochondria and cytoplasm

(4) Vacuole

$_{24}Cr \rightarrow 1s^2 2s^2 2p^6 3s^2 3p^6 4s^1 3d^5$

$l = 1 =$ P orbital $= 2P + 3P = 6 + 6 = 12e^-$

$l = 1 = 12e^-$

$l = 2$ d orbital $= 5e^-$

Question no. 143

Which of the following PGRs are categorised as plant growth promoters?

(1) Auxin, GA and cytokinin

(2) Ethylene and ABA

(3) Ethylene, auxin, GA and cytokinin

(4) Auxin, GA, ABA and cytokinin

$$\text{mol}_{O_3} = \frac{w}{M_w} = \frac{16}{48} \times N_A \times 3 = N_A$$

$$\text{mol} = \frac{28}{28} \times N_A \times 1 = N_A \text{ atom}$$

$$\text{mol} = \frac{16}{16} \times N_A \times 2 = N_A \text{ atom}$$

Ratio = 1 : 1 : 1

Question no. 144

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

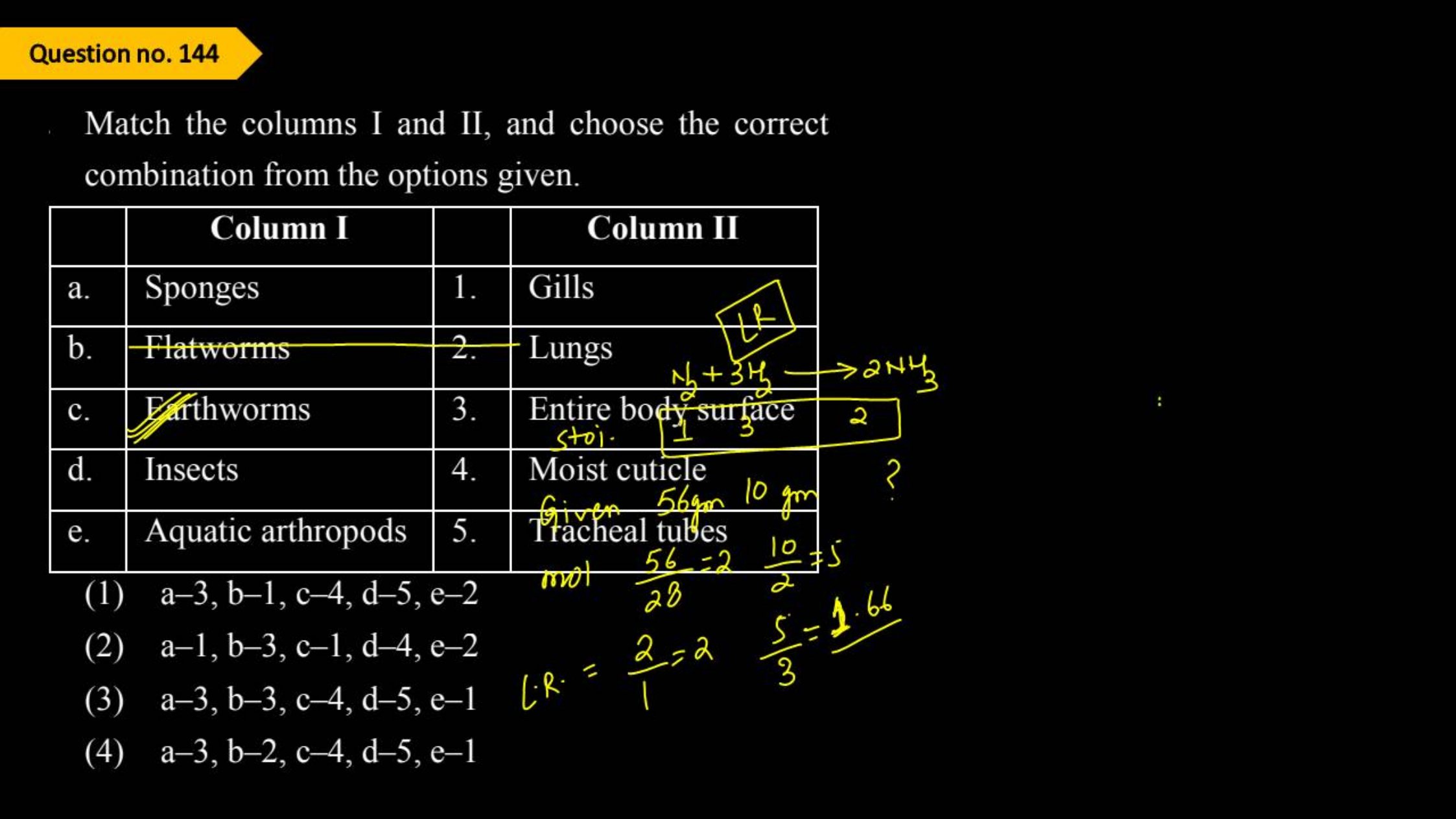
	Column I		Column II
a.	Sponges	1.	Gills
b.	Flatworms	2.	Lungs
c.	Earthworms	3.	Entire body surface
d.	Insects	4.	Moist cuticle
e.	Aquatic arthropods	5.	Tracheal tubes

(1) a–3, b–1, c–4, d–5, e–2

(2) a–1, b–3, c–1, d–4, e–2

(3) a–3, b–3, c–4, d–5, e–1

(4) a–3, b–2, c–4, d–5, e–1



Question no. 145

Which is not true?

(1) pCO_2 of deoxygenated blood is 95 mm Hg

(2) pCO_2 of alveolar air is 40 mm Hg

(3) pO_2 alveolar air is 104 mm Hg

(4) pO_2 of oxygented blood is 95 mm Hg

$\text{mol } H_2O = \frac{0.72}{18} = 0.04$

$\text{mol } H = 2 \times 0.04 = 0.08$

$\text{mol } CO_2 = \frac{3.08}{44} = 0.07$

$\text{mol of } C = 0.07$

mol ratio H & C

$\frac{H}{C} = \frac{0.08}{0.07} = \frac{8}{7}$

C_7H_8

Question no. 146

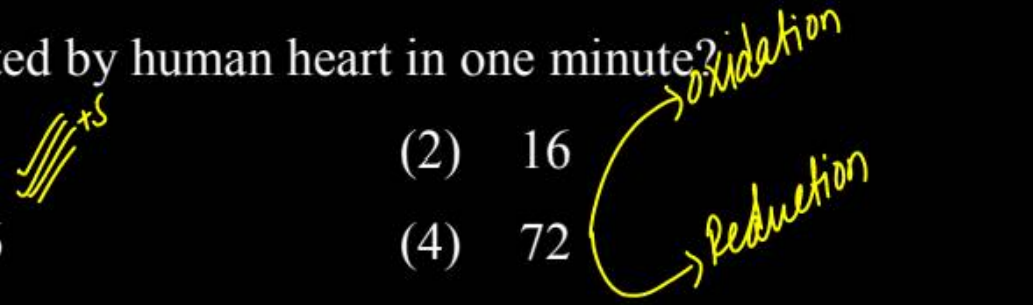
How many double circulations are normally completed by human heart in one minute?

(1) 8

(2) 16

(3) 36

(4) 72



H_3PO_4 (+5)

P max. o.s = +5 Oxidation ✗

Question no. 147

Dialysing unit (artificial kidney) contains a fluid which is almost same as plasma except that it has

(1) High glucose

(2) High urea

(3) No urea

(4) High uric acid

Question no. 148

Depolarisation of nerve cell involves

(1) Influx of K^+

(2) Influx of Na^+

(3) Influx of Ca^{2+} and Cl^-

(4) ~~Efflux of Na^{2+}~~

$\times 3$

$k \quad \frac{1}{(k)^3}$

$k_2 = \frac{1}{(k)^3}$

$k_2 = \frac{1}{(k)^3}$

Question no. 149

The cell wall is composed of two thin overlapping shells which fit together like a soap case in

(1) desmids

(2) diatoms

(3) dinoflagellates

(4) slime moulds

Question no. 150

Dikaryophase is a specific characteristic of

(1) all Fungi

(2) Phycomycetes and Ascomycetes

(3) Basidiomycetes and Deuteromycetes

(4) Ascomycetes and Basidiomycetes

Question no. 151

The term 'systematics' refers to

(1) identification and study of organ systems

(2) identification and preservation of plants and animals

(3) diversity of kinds of organisms and their relationship

(4) study of habitats of organisms and theird classification

Question no. 152

The heterosporous pteridophytes are

(1) Lycopodium and Pteris

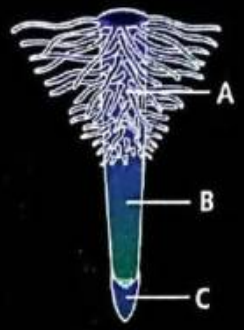
(2) Selaginella and Psilotum

(3) Selaginella and Salvinia

(4) Dryopteris and Adiantum

Question no. 153

Which of the following statements is correct with respect to the given figure showing different zones of a typical root?



(1) Part B mainly helps in absorption of water.

(2) Quiscent centre is present in part B.

(3) Part A is most suitable for anatomical studies for anatomical studio of root.

(4) Differentiation of cells can be observed in part C.

Question no. 154

Root developed from parts of the pant other than radicle are called

(1) tap roots
(2) fibrous roots
(3) adventitious
(4) nodular roots

Question no. 155

Select the pair which contains monocotyledonous families.

(1) Solalaceae and Brassicaceae

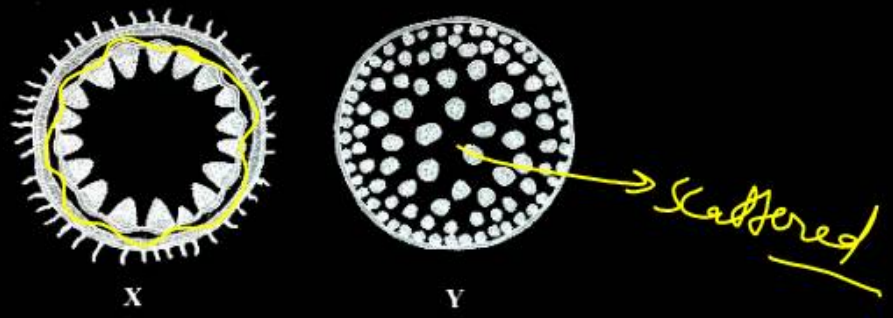
(2) Fabaceae and Asteraceae

(3) Poaceae

(4) None of these

Question no. 156

Figures X and Y represent the transverse sections of _____ and _____ respectively.



	X	Y
(1)	dicot root	dicot stem
(2)	monocot root	monocot stem
(3)	dicot stem	monocot stem
(4)	monocot stem	dicot stem

Question no. 157

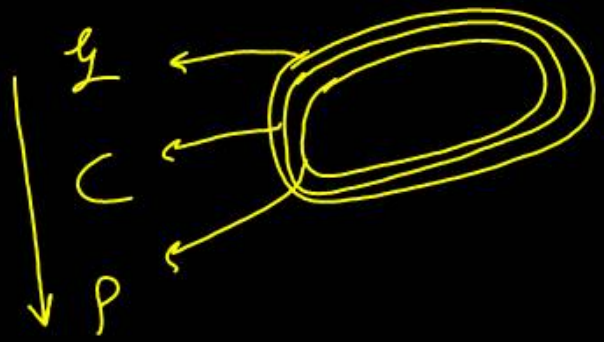
Correct sequence of layers of bacterial cell envelope from outward to inward is

(1) Cell wall → Glycocalyx → Cell membrane

(2) Cell membrane → Glycocalyx → Cell wall

(3) Glycocalyx → Cell wall → Cell membrance

(4) Glycocalyx → Cell membrane → Cell wall



Question no. 158

Refer to the given reaction.

$$\underset{\text{Maltose}}{C_{12}H_{22}O_{11} + H_2O} \xrightarrow{\text{Enyzme A}} \underset{\text{Glucose}}{2C_6H_{12}O_6}$$

Enzyme A used in the reaction, belongs to which class of enzymes?

(1) Dehydrogenases (2) Tranferases

(3) Hydrolases (4) Lyases

Question no. 159

Assertion : Amino acids are called α-amino acids.

Reason : Amino acids are organic compounds containing an amino group and an acidic group as substituents on the α-carbon.

(1) If both assertion and reason are true and reason is the correct explanation of assertion.

(2) If both assertion and reason are true but reason is not the correct explanation of assertion.

(3) If assertion is true but reason is false.

(4) If both assertion and reason are false.

A - R.

1

Question no. 160

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

	List-I		List-II
A.	Distengration of nuclear membrane	i.	Anapahse
B.	Appearance of nucleolus	ii.	Prophase
C.	Division of centromere	iii.	Telophase
D.	Replication of DNA	iv.	S-phase

(1) A – ii, B – iii, C – i, D - iv

(2) A – ii, B – iii, C – iv, D - i

(3) A – iii, B – ii, C – i, D - iv

(4) A – iii, B – ii, C – iv, D – i

Question no. 161

Read the given statements and select the correct option.

Statement 1 : In photosynthesis, during ATP synthesis, protons accumulate in the lumen of thylakoid.

Statement II : In respiration, during ATP synthesis, protons accumulate in the intermembranal space of mitochondria.

(1) Both statement 1 and 2 are correct.

(2) Statement 1 is correct but statement 2 is incorrect.

(3) Statement 1 is incorrect but statement 2 is correct.

(4) Both statements 1 and 2 are incorrect.

Question no. 163

Mark the correct pair of muscles involved in the normal breathing in humans.

(1) External and internal intercostal muscles

(2) Diaphragm and abdominal muscles

(3) Diaphragm and external intercostal muscles

(4) Diaphragm and intercostal muscles

:- Normal
Di — Inter
Coastal.

4

:- Force
Abdominal.

Question no. 164

Mark the pair of substances among the following which is essential for coagulation of blood.

(1) Heparin and calcium ions

(2) Calcium ions and platelet factors

(3) Oxalates and citrates

(4) Platelet factors and heparin

Question no. 165

Muscles with characteristic striations and involuntary are

(1) muscles in the well of alimentary canal

(2) muscles of the heart

(3) muscles assisting locomotion

(4) muscles of the eyelids

∴ Band - Present.

2

Question no. 166

Excretion of potassium is governed primarily by

(1) potassium reabsorption in proximal convoluted tubule

(2) potassium secretion in proximal convoluted tubule

(3) potassium secretion in distal convoluted tubule

(4) potassium reabsorption in distal convoluted tubule

Question no. 167

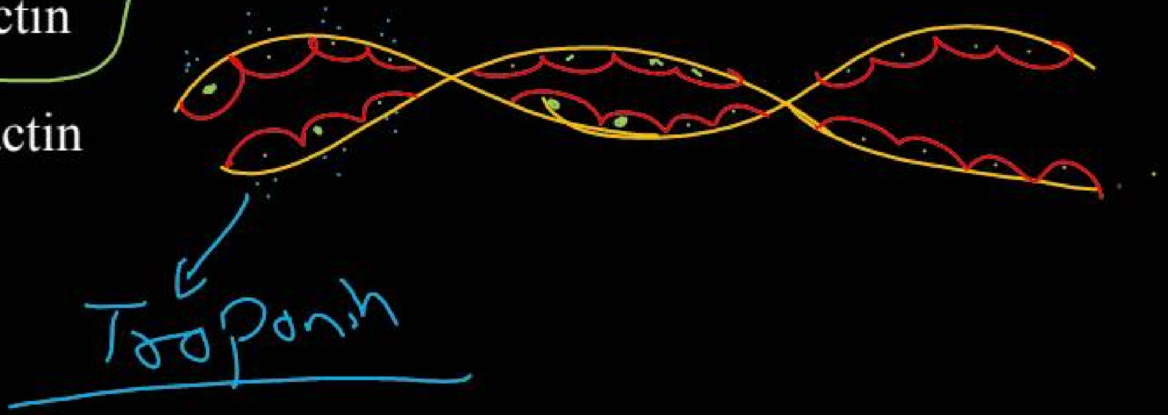
In the resting muscle fibre, troponin partially covers

(1) calcium binding sites on troponin

(2) actin binding sites on myosin

(3) myosin binding sites on actin

(4) calcium binding sites on actin



Question no. 168

The slow twitch muscle fibres which are rich in myoglobin and have abundant mitochondria are

(1) White skeletal muscles

(2) Cardiac muscles

(3) Red skeletal muscles

(4) Involuntary muscles

3

Slow
Mito ↑
Myoglobin ↑

Question no. 169

An area in the brain which is associated with strong emotions is

(1) Cerebral cortex
(2) Cerebellum
(3) Limbic system
(4) Medulla

Question no. 170

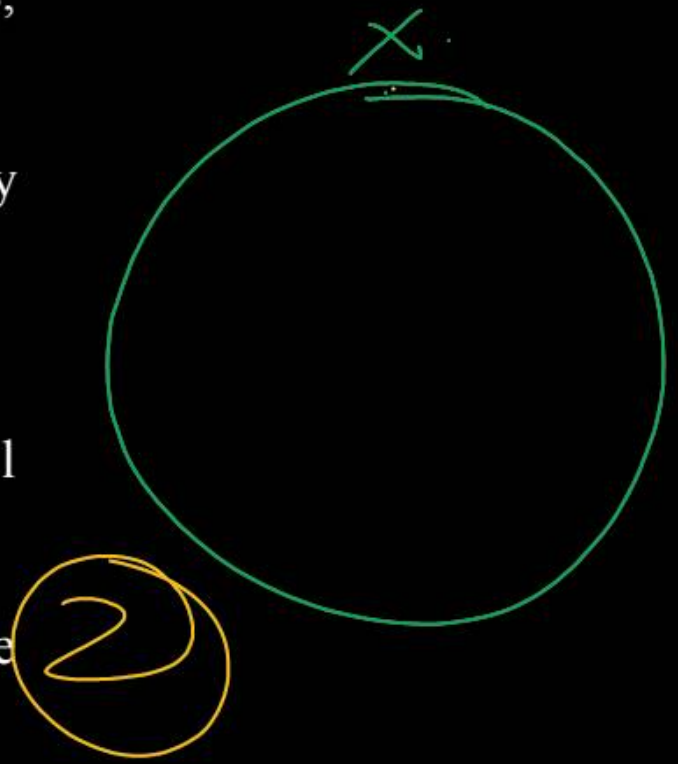
According to the accepted concept of hormone action, if receptor molecules are removed from target organs, then the target organ will

(1) continue to respond to the hormone without any difference

(2) not respond to the hormone

(3) continue to respond to the hormone but will require higher concentration

(4) continue to respond to the hormone but in the opposite way



Question no. 171

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

	Column I		Column II
A.	FSH	i.	Transported axonally to neurohypophysis from hypothalamus
B.	MSH	ii	Acts on melanocytes and regulates pigmentation of skin
C.	Vasopressin (ADH)	iii	Stimulates the growth and development of ovarian follicles in female
D.	Pars intermedia	iv.	In human, it is almost merged with pars distalis

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

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

Question no. 172

Mary is about to face in interview. But during the first five minutes before the interview she experience sweating, increases rate of heart beat, respiration, etc. Which hormone is responsible for her restlessness?

(1) Estrogen and progesterone

(2) Oxytocin and vasopressin

(3) Adrenaline and noradrenaline

(4) Insulin and glucagon

Emergency

Question no. 173

The following substances are the excretory products in animals . Choose the least toxic form among them.

(1) Urea

(2) Uric acid

(3) Ammonia

(4) Carbon dioxide

2

Question no. 174

The condition of accumulation of urea in the blood is termed as

(1) renal calculi
(2) glomerulonephritis
(3) uremia
(4) ketonuria

3

Renal Failure
→ Blood urea ↑
→ Uremia

Question no. 175

Which range of wavelength (in nm) is called photo-synthetically active radiation (PAR)

(1) 100-300 (2) 390-430

(3) 4000-700 (4) 760-10,000

400-700

400-700 nm

3

Question no. 176

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

(1) Reabsorption from PCT

(2) Reabsorption form collecting duct

(3) Reabsorption / Secretion in DCT

(4) Counter current mechanism in Henle's loop / Vasa recta

4

Question no. 177

The enzyme that is not found in a C_3 plant is

(1) RuBP carboxylase

(2) PEP carboxylase

(3) NADP reductase

(4) ATP synthase

C_4 - plant

CAM

Question no. 178

Match column I with column II and select the correct option from the codes given below:

	Column I		Column II
A.	Natural auxin	i.	NAA
B.	Synthetic auxin	ii.	Zeatin
C.	Bakane disease of rice	iii.	IAA
D.	Natural cytokinin	iv.	GA
		v.	Kinetin

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

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

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

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

Question no. 179

Match column I with column II and select the correct option from the codes given below:

	Column I		Column II
A.	Auxins	i.	Breaking seed dormancy
B.	Gibberellins	ii.	Inducing fruit ripening
C.	Cytokinins	iii.	Formation of abscission layer
D.	Ethylene	iv.	Root initiation
		v.	Chloroplast development in leaves

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

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

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

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

Question no. 180

One haemoglobin carries how many molecules of O_2

(1) 4

(2) 2

(3) 6

(4) 8

1 - Hb = 4 molecules of O_2

1