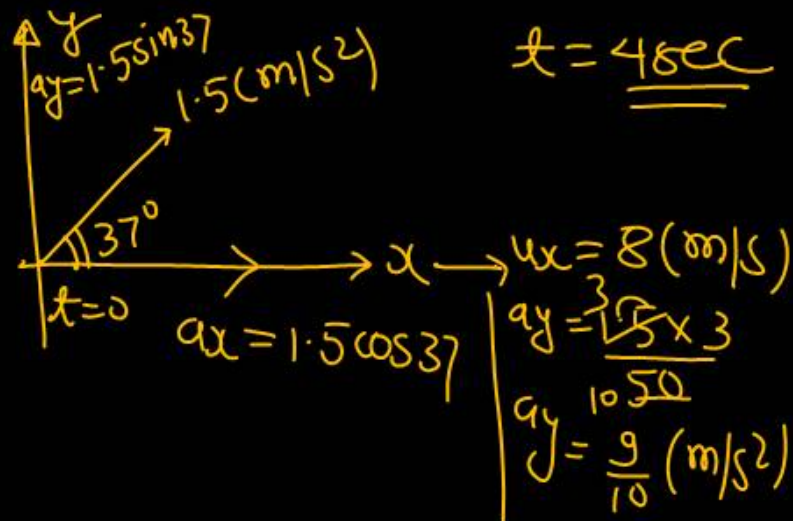


Question no. 1

A particle moves in the X-Y plane with a constant acceleration 1.5 m/s^2 in the direction making an angle of 37° with the X-axis. At $t = 0$ the particle is at the origin and its velocity is 8.0 m/s along the X-axis. Find the position of the particle at $t = 4.0 \text{ s}$.

- (1) 41.6 m, 7.2 m (2) 50.3 m, 8.2 m
 (3) 60.2 m, 8.2 m (4) 11.2 m, 8 m



$t = \underline{4 \text{ sec}}$

$a_x = 1.5 \cos 37$
 $a_x = \frac{1.5 \times 4}{50}$
 $a_x = \frac{1.8 \times 4}{1050}$
 $a_x = 1.2 \text{ (m/s}^2\text{)}$

Taking x-direction:

$S_x = u_x t + \frac{1}{2} a_x t^2$
 $S_x = 8 \times 4 + \frac{1}{2} \times a_x \times (4)^2$
 $S_x = 32 + a_x \times 8$
 $S_x = 32 + 1.2 \times 8$
 $S_x = 32 + 9.6$

$\begin{array}{r} 32.0 \\ 9.6 \\ \hline 41.6 \end{array}$

$S_x = 41.6 \text{ m}$

Taking y-direction:

$S_y = u_y t + \frac{1}{2} a_y t^2$
 $S_y = 0 \times 4 + \frac{1}{2} a_y t^2$
 $S_y = \frac{1}{2} \times \frac{9}{10} \times (4)^2$
 $S_y = \frac{8 \times 9}{10}$
 $= \underline{7.2 \text{ (m)}}$

Question no. 2

A car is moving in a circular horizontal track of radius 10m with a constant speed of 10 m/s. A bob is suspended from the roof of the car by a light wire of length 1.0 m. The angle made by the wire with the vertical is

- (1) 0° (2) $\frac{\pi}{3}$
 (3) $\frac{\pi}{6}$ ✓ (4) $\frac{\pi}{4}$

$$r = 10 \text{ m}$$

$$v = 10 \text{ (m/s)}$$

$$\tan \theta = \frac{v^2}{rg}$$

$$\tan \theta = \frac{v^2}{rg}$$

$$\tan \theta = \frac{100}{10 \times 10}$$

$$\tan \theta = 1$$

$$\theta = \frac{\pi}{4}$$

Question no. 3

110 joules of heat is added to a gaseous system, whose internal energy is 40 J; then the amount of external work done is

- (1) 150 J (2) 70 J
 (3) 110 J (4) 40 J

$$\Delta Q = +110 \text{ J}$$

$$\Delta U = 40 \text{ (J)}$$

$$\Delta Q = \Delta U + W$$

$$110 = 40 + W$$

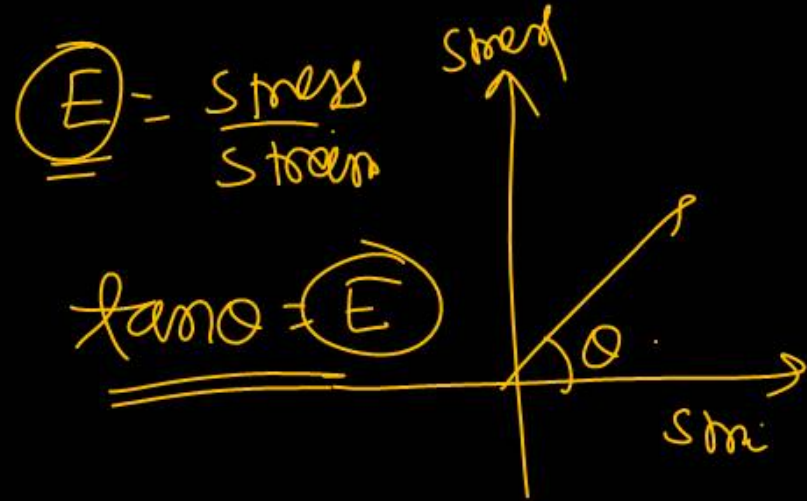
$$W = 70 \text{ (J)}$$

According to Hooke's law of elasticity, if stress is increased, then the ratio stress of strain

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

$$\text{Stress} \propto \text{Strain}$$

$$\text{Stress} = E \times \text{Strain}$$



Streamline flow is more likely for liquids with

- (1) high density and high viscosity
- (2) low density and high viscosity
- (3) high density and low viscosity
- (4) low density and low viscosity

$$\textcircled{R} = \frac{\rho V D}{\eta}$$

↗ low density
 ↗
 ↗

$$\text{low } \textcircled{R} \propto \rho \text{ low}$$

$$\text{low } \textcircled{R} \propto \frac{1}{\eta \text{ (high)}}$$

low density high

Question no. 6

A physical quantity z depends on four observables a ,

b , c and d , as $z = \frac{a^2 b^{\frac{2}{3}}}{\sqrt{c} d^3}$. The percentage of error in

the measurement of a , b , c and d are 2%, 1.5%, 4% and 2.5% respectively. The percentage of error in z is:

- (1) 12.25% (2) 16.5%
 (3) 13.5% ✓ (4) 14.5%

$$z = \frac{a^2 \cdot b^{\frac{2}{3}}}{\sqrt{c} \cdot d^3}$$

$$\frac{\Delta z}{z} = 2 \frac{\Delta a}{a} + \frac{2}{3} \frac{\Delta b}{b} + \frac{1}{2} \frac{\Delta c}{c} + 3 \frac{\Delta d}{d}$$

$$= (2 \times 2 + \frac{2}{3} \times 1.5 + \frac{1}{2} \times 4 + 3 \times 2.5) \%$$

$$\Rightarrow 4 + 1 + 2 + 3 \times 2.5$$

$$\Rightarrow 7 + 7.5$$

$$= \underline{\underline{14.5}} \%$$

Question no. 7

Which of the following graphs gives the equation

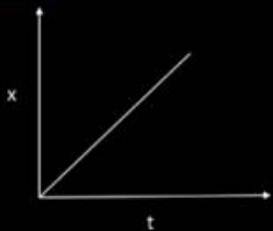
$$x = v_0 t + \frac{1}{2} a t^2$$

$$x = v_0 t + \frac{1}{2} a t^2$$

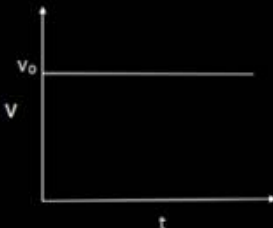
$$\frac{dx}{dt} = v_0 + \frac{1}{2} a \times 2t$$

$$v = v_0 + at$$

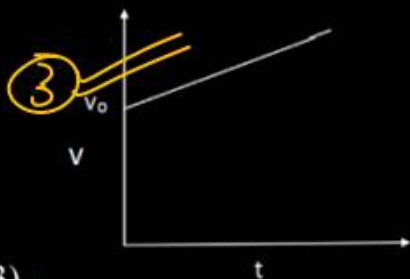
$$y = c + mc$$



(1)



(2)



(3)

(4) None of these

A bullet is fired with a speed of 1500 m/s in order to hit a target 100 m away. If $g = 10 \text{ m/s}^2$. The gun should be aimed

- (1) 15 cm above the target
- (2) 10 cm above the target
- (3) 2.2 cm above the target
- (4) directly towards the target

$$y = \frac{1}{2} g \cdot \frac{x^2}{u^2}$$

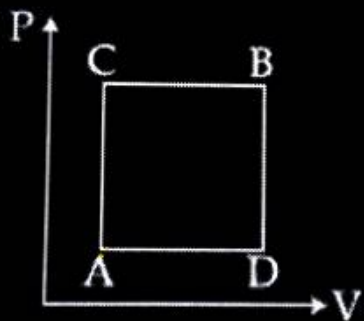
$$y = \frac{1}{2} \times 10 \times \frac{100 \times 100}{1500 \times 1500}$$

$$y = \frac{1}{2} \times \frac{10}{15 \times 15} \times 100$$

$$y = \frac{100}{45} \Rightarrow y = 2.2 \text{ cm}$$

Question no. 9

A gas can be taken from A to B via two different processes ACB and ADB. When path ACB is used 60 J of heat flows into the system and 30 J of work is done by the system. If path ADB is used work done by the system is 10 J. The heat flow into the system in path ADB is:



$$\Delta U_{ACB} = \Delta U_{ADB}$$

(1) ~~40 J~~

(2) 80 J

(3) 100 J

(4) 20 J

ACB $\Delta Q = 60 \text{ J}$

$W = 30 \text{ J}$

$\Delta U_{ACB} = ?$

$\Delta Q = \Delta U_{ACB} + W$

$60 = \Delta U_{ACB} + 30$

$\Delta U_{ACB} = 30 \text{ (J)}$

ADB:

$\Delta Q = \Delta U_{ADB} + W$

$= 30 + 10$

40 J

Question no. 10

Radius of a capillary tube is 2×10^{-3} m. A liquid of weight 6.28×10^{-4} N may remain in the capillary then the surface tension of liquid will be

- (1) 5×10^3 N/m (2) 5×10^{-2} N/m
(3) 5 N/m (4) 50 N/m

$$T = \frac{F}{\text{circled } \ell}$$



$$W = T \times 2\pi r$$

$$6.28 \times 10^{-4} = T \times 2\pi \times 2 \times 10^{-3}$$

~~$$6.28 \times 10^{-4} = T \times 2 \times 3.14 \times 2 \times 10^{-3}$$~~

$$\frac{10^{-4}}{2 \times 10^{-3}} = T$$

$$T = 0.5 \times 10^{-1}$$

$$T = 5 \times 10^{-2} \text{ (N/m)}$$

Question no. 11

The displacement of a particle in SHM is

$$x = \underline{10} \sin \left(2t - \frac{\pi}{6} \right) \text{ metre. When its displacement is 6}$$

m, the velocity of the particle (in ms^{-1}) is

- (1) 8 (2) 24
 (3) ~~16~~ (4) 10

$$a = 10 \text{ m.}$$

$$x = 6$$

$$\omega = 2$$

$$V = \omega \sqrt{a^2 - x^2}$$

$$V = 2 \sqrt{100 - 36}$$

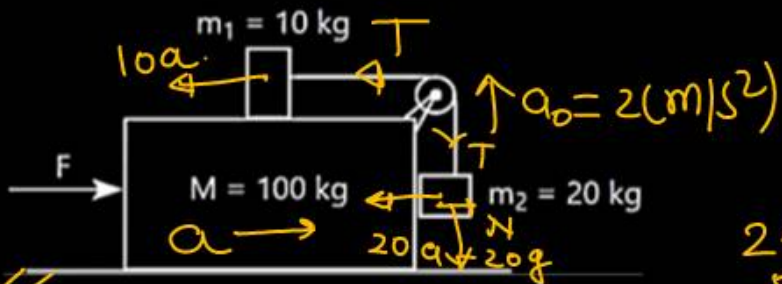
$$V = 2 \sqrt{64}$$

$$V = 2 \times 8$$

$$V = 16 \text{ (m/s)}$$

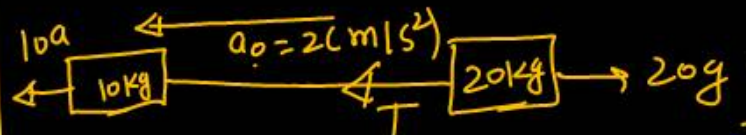
Question no. 12

Three masses $M = 100 \text{ kg}$, $m_1 = 10 \text{ kg}$ and $m_2 = 20 \text{ kg}$ are arranged in a system as shown in figure. All the surface are frictionless and strings are inextensible and weightless. All pulleys are also weightless and frictionless. A force F is applied on the system so that the mass m_2 moves upward with an acceleration of 2 ms^{-2} . The value of F is :



- (1) 3360 N (2) 3380 N
(3) 3120 N (4) 3240 N

$$\begin{array}{r} 240 \\ 520 \\ \hline 760 \end{array}$$



$$10a - 20g = 30 \times 2$$

$$10a - 200 = 60$$

$$10a = 260$$

$$a = 26$$

$$T - 20g = 20 \times 2$$

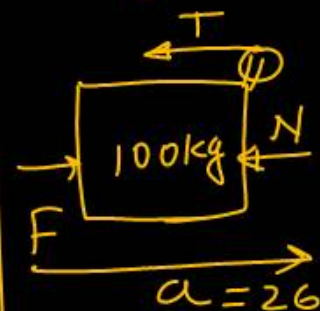
$$T - 200 = 40$$

$$\boxed{T = 240 \text{ N}}$$

$$N = 20 \times a$$

$$N = 20 \times 26$$

$$\boxed{N = 520 \text{ (N)}}_{m_2}$$



$$F - T - N = 100 \times 26$$

$$F - 240 - 520 = 2600$$

$$F = 2600 + 760$$

$$2600$$

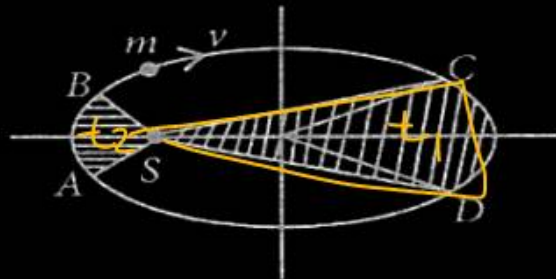
$$760$$

$$\hline 3360$$

$$F = 3360 \text{ N}$$

Question no. 13

The figure shows elliptical orbit of a planet m about the sun S . The shaded area SCD is twice this shaded area SAB . If t_1 is the time for the planet to move from C to D and t_2 is the time to move from A to B then



(1) $t_1 = 4t_2$

(2) $t_1 = 2t_2$

(3) $t_1 = t_2$

(4) $t_1 > t_2$

$$A \propto t$$

$$SCD = 2 \times SAB$$

$$t_1 = 2t_2$$

Question no. 14

A particle moves on the X-axis according to the equation $x = A \cos(\omega t + kx) + B \sin(\omega t + kx)$. The motion is simple harmonic with amplitude

(1) A

(2) B

(3) A + B

(4) $\sqrt{A^2 + B^2}$

$$\begin{aligned}
 A_{\text{net}} &= \sqrt{A^2 + B^2 + 2AB \cos \phi} \\
 &= \sqrt{A^2 + B^2 + 2AB \cos \frac{\pi}{2}} \\
 &= \sqrt{A^2 + B^2}
 \end{aligned}$$

Question no. 15

A pendulum clock loses 12 s a day if the temperature is 40°C and gains 4 s a day if the temperature is 20°C . The temperature at which the clock will show correct time, and the co-efficient of linear expansion (α) of the metal of the pendulum shaft are respectively:

- (1) 30°C ; $\alpha = 1.85 \times 10^{-3}/^{\circ}\text{C}$
- (2) 55°C ; $\alpha = 1.85 \times 10^{-2}/^{\circ}\text{C}$
- (3) 25°C ; $\alpha = 1.85 \times 10^{-5}/^{\circ}\text{C}$
- (4) 60°C ; $\alpha = 1.85 \times 10^{-4}/^{\circ}\text{C}$

we know that :

$$\frac{\Delta T}{T} = \frac{1}{2} \alpha (\theta - \theta_0) \times 86400$$

$$\left(\frac{\Delta T}{T}\right) \propto (\theta - \theta_0)$$

$$12 \propto (40 - \theta_0) \quad \text{--- (1)}$$

$$4 \propto (\theta_0 - 20) \quad \text{--- (2)}$$

$$3 = \frac{40 - \theta_0}{\theta_0 - 20}$$

$$3\theta_0 - 60 = 40 - \theta_0$$

$$4\theta_0 = 100$$

$$\checkmark \theta_0 = 25^{\circ}\text{C}$$

$$\frac{\Delta T}{T} = \frac{1}{2} \alpha (\theta - \theta_0) \times 86400$$

$$4 = \frac{1}{2} \alpha (25 - 20) \times 86400$$

$$4 = \alpha \times 5 \times 43200$$

$$\alpha = \frac{4}{5 \times 43200}$$

$$\checkmark \alpha = 1.85 \times 10^{-5} /^{\circ}\text{C}$$

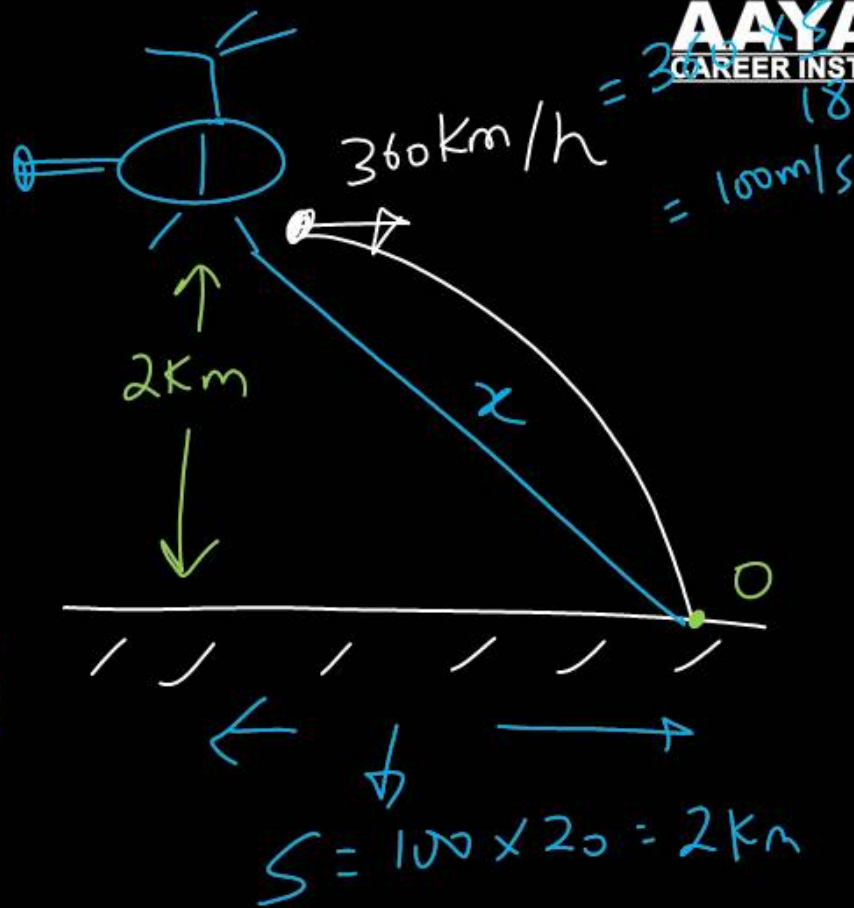
Question no. 16

A helicopter flying horizontally with a speed of 360 km/h at an altitude of 2 km, drops an object at an instant. The object hits the ground at a point O, 20 s after it is dropped. Displacement of 'O' from the position of helicopter where the object was released is:

- (1) $2\sqrt{5}$ km (2) 4 km
 (3) 7.2 km (4) $2\sqrt{2}$ km

4

$x = 2\sqrt{2}$ km



Question no. 17

The equation of alternating current is:

$I = 50\sqrt{2} \sin(\overset{\omega t}{400\pi t})$ amp. Then the frequency and root mean square value of current are respectively

- (1) 200 Hz, 50 amp
- (2) 400π Hz, $50\sqrt{2}$ amp
- (3) 200 Hz, $50\sqrt{2}$ amp
- (4) 50 Hz, 200 amp

1

$$\omega = 400\pi$$

$$2\pi f = 400\pi$$

$$f = 200 \text{ Hz}$$

$$\begin{aligned} I_{\text{rms}} &= I_0 / \sqrt{2} \\ &= 50\sqrt{2} / \sqrt{2} \\ &= 50 \text{ A} \end{aligned}$$

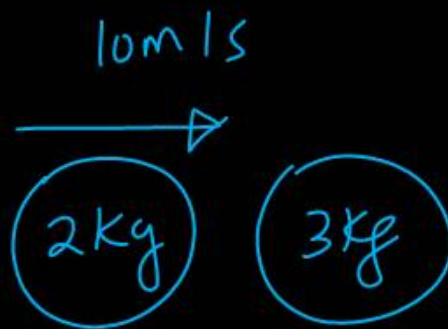
Question no. 18

A metal ball of mass 2 kg moving with a velocity of 36 km/h has a head on collision with a stationary ball of mass 3 kg. If after the collision, the two balls move together, the loss in kinetic energy due to collision is

- (1) 140 J (2) 100 J
 (3) 60 J (4) 40 J

$e = 0$

3



$$\Delta KE = \frac{1}{2} \frac{m_1 m_2}{m_1 + m_2} (1 - e^2) (\vec{u}_1 - \vec{u}_2)^2$$

$$= \frac{1}{2} \times \frac{6}{5} (1 - 0) (10 - 0)^2$$

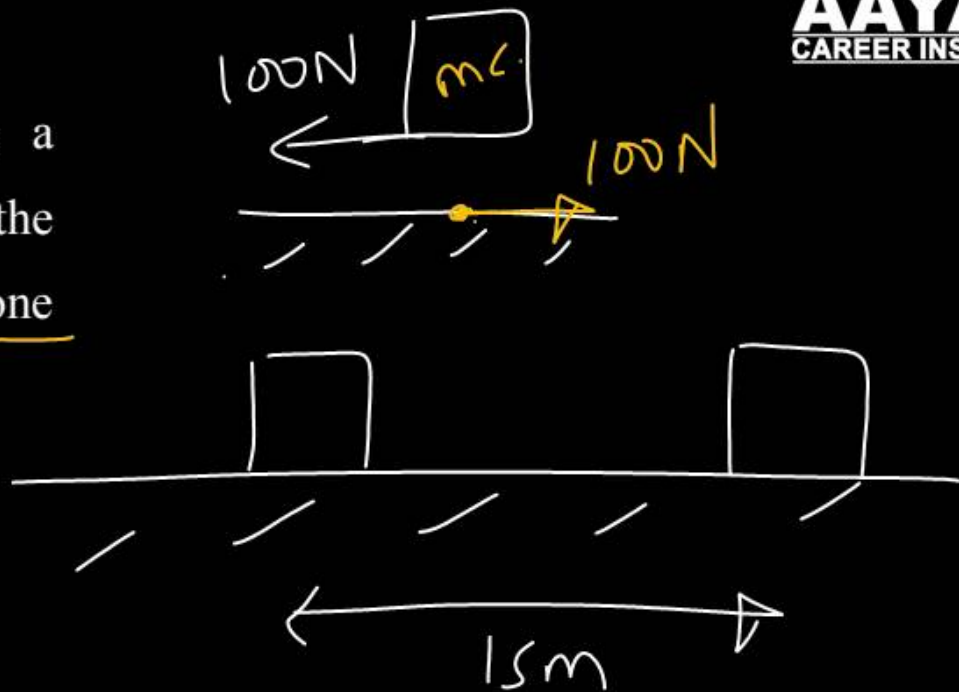
$$= \frac{6}{10} \times 100 = 60 \text{ J}$$

Question no. 19

A motorcyclist skids and stops after covering a distance of 15 m. The stopping force acting on the motorcycle by the road is 100 N, then the work done by the motorcycle on the road is

- (1) 1500 J (2) -1500 J
 (3) 750 J (4) Zero

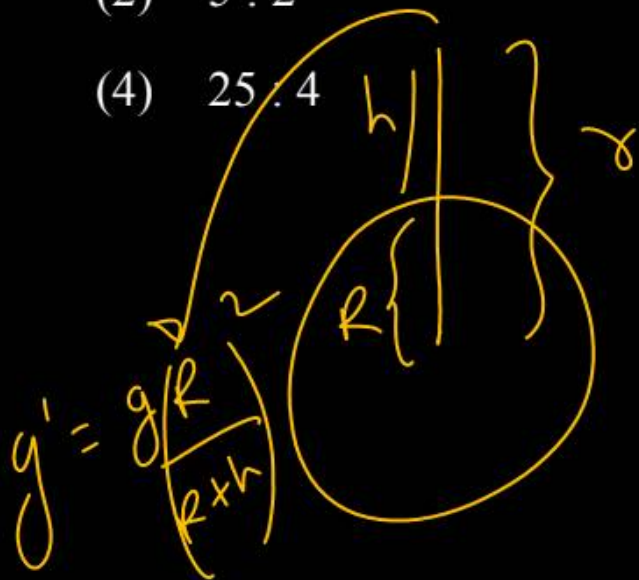
✓
 4.



Question no. 20

The ratio of the acceleration due to gravity at heights 1280 km and 3200 km above the surface of the earth is –

- (1) 25 : 16 (2) 5 : 2
(3) 1 : 1 (4) 25 : 4



$$\frac{g_1}{g_2} = \left(\frac{r_2}{r_1} \right)^2 = \left(\frac{3200 + 6400}{1280 + 6400} \right)^2$$

$$\frac{g_1}{g_2} = \left(\frac{9600}{7680} \right)^2 = \left(\frac{5}{4} \right)^2$$

$$= 25/16$$

1.

Question no. 21

Two balls with same mass and initial velocity, are projected at different angles in such a way that maximum height reached by first ball is 8 times that of the second ball. T_1 and T_2 are the total flying times of first and second ball, respectively, then the ratio of T_1 and T_2 is:

- (1) $2\sqrt{2}:1$ (2) $2:1$
 (3) $\sqrt{2}:1$ (4) $4:1$

1

$$H_1 = 8H_2$$

$$\frac{u_{y1}^2}{2g} = \frac{8u_{y2}^2}{2g}$$

$$u_{y1} = 2\sqrt{2}u_{y2}$$

$$\frac{T_1}{T_2} = \frac{\frac{2u_{y1}}{g}}{\frac{2u_{y2}}{g}} = \frac{u_{y1}}{u_{y2}} = \frac{2\sqrt{2}u_{y2}}{u_{y2}} = 2\sqrt{2}$$

Question no. 22

A gas in a container A is in thermal equilibrium with another gas having equal moles in container B. If we denote the corresponding pressures and volumes by the suffixes A and B, then which of the following statement is most likely to be true?

- (1) $P_A = P_B, V_A \neq V_B$
- (2) $P_A \neq P_B, V_A = V_B$
- (3) $P_A / V_A = P_B / V_B$
- (4) $P_A V_A = P_B V_B$

4.

$$T_A = T_B$$

$$\frac{P_A V_A}{nR} = \frac{P_B V_B}{nR}$$

Question no. 23

A vernier calipers has 1 mm marks on the main scale. It has 20 equal divisions on the Vernier scale which match with 16 main scale divisions. For this Vernier calipers, the least count is

- (1) 0.02 mm (2) 0.05 mm
 (3) 0.1 mm (4) 0.2 mm

$$\begin{aligned}
 LC &= 1 \text{MSD} - 1 \text{VSD} \\
 &= 1 \text{mm} - \frac{16}{20} \text{mm} \\
 &= \frac{1}{5} \text{mm} \\
 &= 0.2 \text{mm}
 \end{aligned}$$

(4)

$$20 \text{VSD} = 16 \text{MSD}$$

$$1 \text{VSD} = \frac{16}{20} \text{MSD}$$

$$1 \text{VSD} = \frac{16}{20} \times 1 \text{mm}$$

$$1 \text{VSD} = \frac{16}{20} \text{mm}$$

A particle of mass m is moving with velocity \vec{v}_1 , it is given an impulse such that the velocity becomes \vec{v}_2 .

Then impulse is equal to

(1) $m(\vec{v}_2 - \vec{v}_1)$

(2) $m(\vec{v}_1 - \vec{v}_2)$

(3) $m(\vec{v}_1 + \vec{v}_2)$

(4) $0.5m(\vec{v}_2 - \vec{v}_1)$



$$\vec{J} = \vec{p}_f - \vec{p}_i$$

$$\vec{J} = m\vec{v}_2 - m\vec{v}_1 = m(\vec{v}_2 - \vec{v}_1)$$

Question no. 25

The relation between time 't' and distance 'x' is $t = \alpha x^2 + \beta x$, where α and β are constants. The relation between acceleration (a) and velocity (v) is :

- (1) $a = -2\alpha v^3$ (2) $a = -4\alpha v^4$
 (3) $a = -3\alpha v^2$ (4) $a = -5\alpha v^5$

① $t = \alpha x^2 + \beta x$
 $\frac{dt}{dt} = \alpha 2x \frac{dx}{dt} + \beta \frac{dx}{dt}$

$$1 = 2\alpha x v + \beta v$$

$$v = \frac{1}{2\alpha x + \beta}$$

$$a = v \frac{dv}{dx}$$

$$\star \frac{dv}{dx} = \frac{d(2\alpha x + \beta)^{-1}}{dx}$$

$$= -1(2\alpha x + \beta)^{-2} 2\alpha$$

$$= \frac{-2\alpha}{(2\alpha x + \beta)^2}$$

$$= -2\alpha v^2$$

$$a = v \frac{dv}{dx} = v(-2\alpha v^2)$$

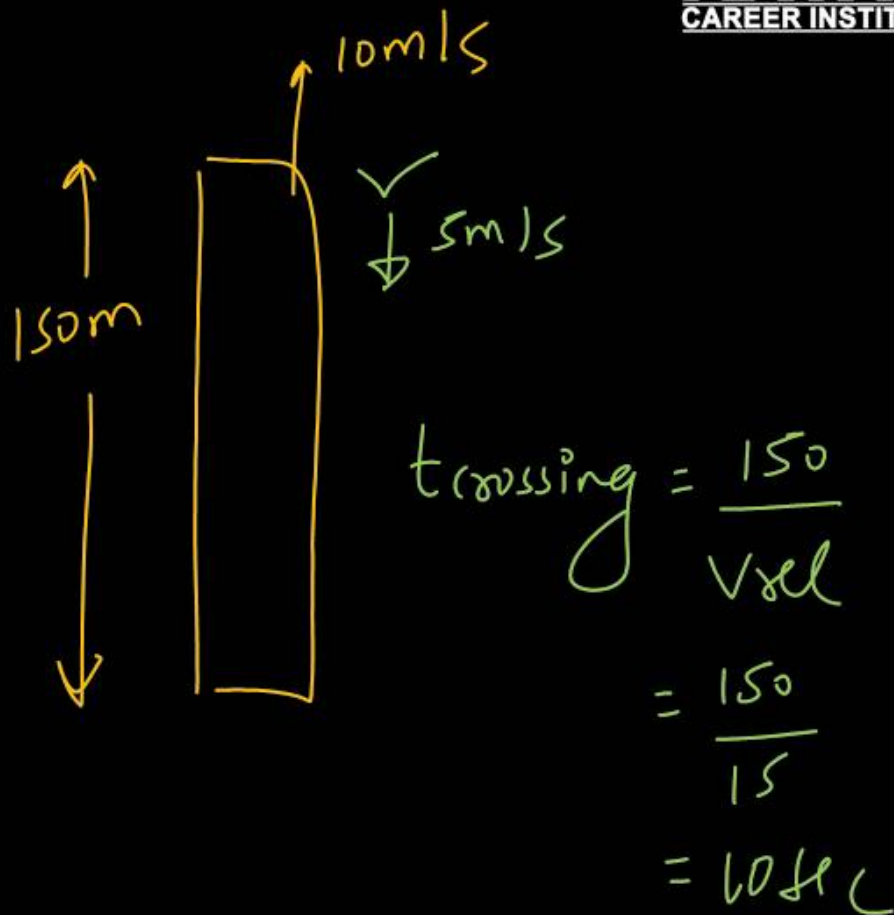
$$= -2\alpha v^3$$

Question no. 26

A train of 150 m length is going towards north direction at a speed of 10 ms^{-1} . A parrot flies at a speed of 5 ms^{-1} towards south direction parallel to the railway track. The time taken by the parrot to cross the train is equal to

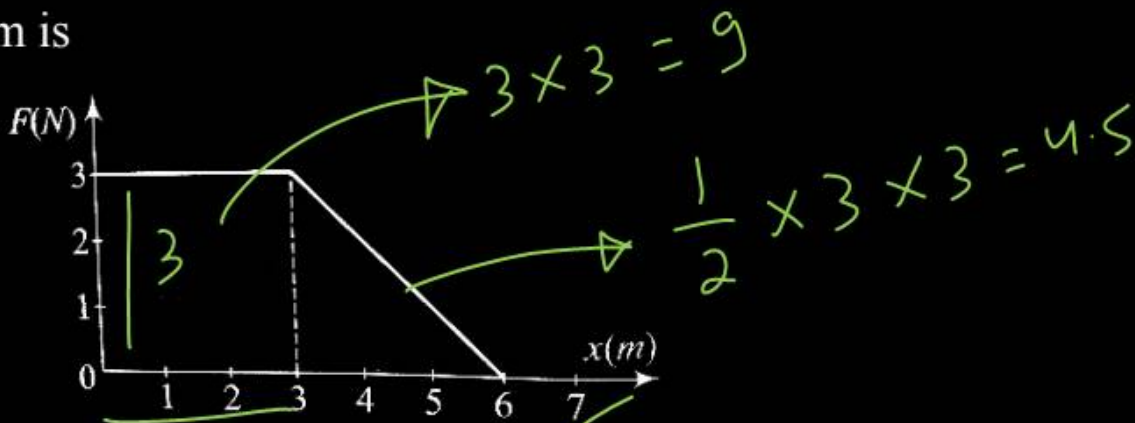
- (1) 12 s (2) 8 s
 (3) 15 s (4) 10 s

4.



Question no. 27

A force F acting on an object varies with distance x as shown here. The force is in N and x in m. The work done by the force in moving the object from $x = 0$ to $x = 6$ m is



$$W = 9 + 4.5$$

$$= 13.5 \text{ J}$$

2.

- (1) 18.0 J (2) 13.5 J
(3) 9.0 J (4) 4.5 J

Question no. 28

Assuming no heat losses, the heat released by the condensation of x g of steam at 100°C can be used to convert y g of ice at 0°C into water at 100°C , the ratio $x : y$ is:

(1) 1 : 1

(2) 1 : 2

(3) 1 : 3

(4) 3 : 1

3

$mL_v = m'L_f + m's\Delta T$ **AAYAM**
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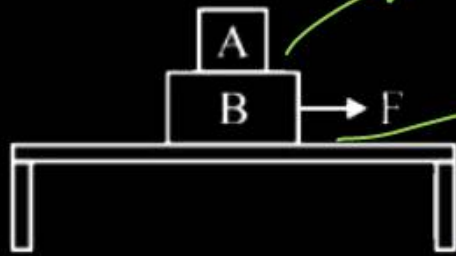
$540x = y80 + y \times 1 \times 100$

$540x = 180y$

$\frac{x}{y} = \frac{1}{3}$

Question no. 29

Two blocks A and B of masses $M_A = 1 \text{ kg}$ and $M_B = 3 \text{ kg}$ are kept on the table as shown in figure. The coefficient of friction between A and B is 0.2, and between B and the surface of the table is also 0.2. The maximum force F that can be applied on B horizontally, so that the block A does not slides over the block B is :



- (1) 8 N
- (2) 16 N
- (3) 40 N
- (4) 12 N

2

Handwritten solution:

Free body diagram for the 4 kg block (Block B):

- Force F acts to the right.
- Friction force 8 acts to the left.
- Acceleration a acts to the right.

Equation (1): $F - 8 = 4a$

Free body diagram for the 1 kg block (Block A):

- Friction force 2 acts to the right.
- Acceleration a acts to the right.

Equation (2): $a = \frac{2}{1} = 2 \text{ m/s}^2$

Substituting $a = 2$ into equation (1):

$$F - 8 = 8$$

$$F = 16 \text{ N}$$

Question no. 30

A tuning fork arrangement (pair) produces 4 beats/sec with one fork of frequency 288 cps. A little wax is placed on the unknown fork and it then produces 2 beats/sec. The frequency of the unknown fork is

- (1) 286 cps (2) 292 cps
(3) 294 cps (4) 288 cps

2.

f_1
288 cps → f_2
292
↓
284 cps

292 ^{wax} → 290

$$|290 - 288| = 2 \text{ Beats/sec}$$

Question no. 31

The equation of a wave on a string of linear mass density 0.04 kg m^{-1} is given by

$$y = 0.02 \text{ (m)} \sin \left[2\pi \left(\frac{t}{0.04 \text{ (s)}} - \frac{x}{0.50 \text{ (m)}} \right) \right]$$

The tension in the string is $y = A \sin(\omega t - kx)$

- (1) 4.0 N
- (2) 12.5 N
- (3) 0.5 N
- (4) 6.25 N

$$V = \frac{\omega}{k}$$

$$\omega = \frac{2\pi}{0.04}$$

$$k = \frac{2\pi}{0.5}$$

$$V = \frac{25}{2}$$

$$V = \sqrt{\frac{T}{\mu}}$$

$$V^2 = \frac{T}{\mu}$$

$$T = V^2 \times \mu$$

$$T = \frac{625}{4} \times \frac{0.04}{100}$$

$$T = 6.25$$

Question no. 32

If C_p and C_v are specific heat capacities at constant pressure and constant volume respectively, then for an adiabatic process of an ideal gas which of the

following relation is correct. $\left(\gamma = \frac{C_p}{C_v} \right)$

(1) ~~$PV = \text{constant}$~~

(2) ~~$PV^\gamma = \text{constant}$~~

(3) $PV^\gamma = \text{constant}$

(4) ~~$\frac{P}{V^{2\gamma}} = \text{constant}$~~

Question no. 33

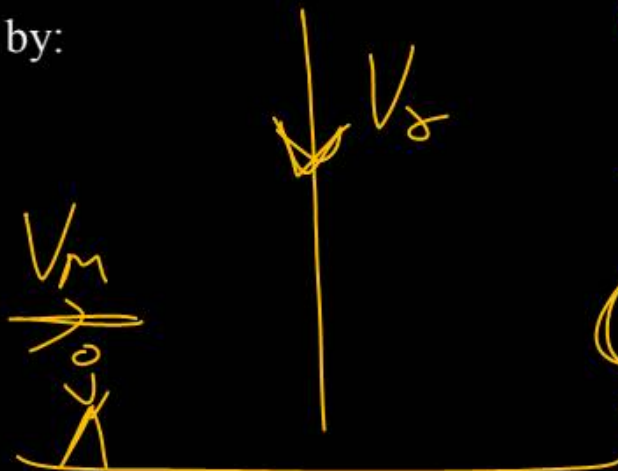
If V_r is the velocity of rain falling vertically and V_m is the velocity of a man walking on a level road, and θ is the angle with the vertical at which he should hold the umbrella to protect himself, then the relative velocity of rain w.r.t. the man is given by:

(1) $V_{rm} = \sqrt{V_r^2 + V_m^2 + 2V_r V_m \cos \theta}$

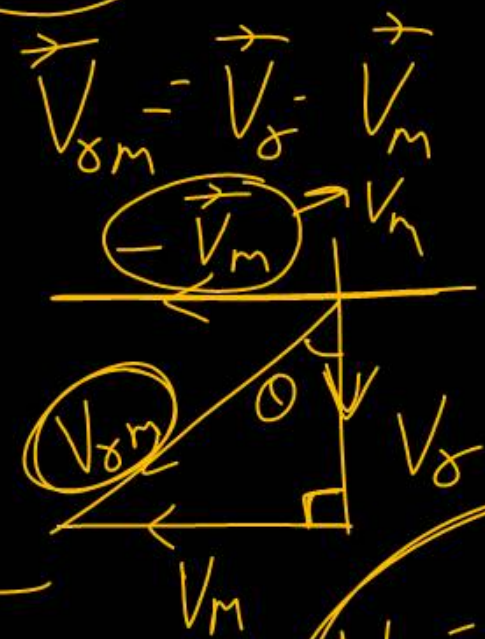
(2) $V_{rm} = \sqrt{V_r^2 + V_m^2 - 2V_r V_m \cos \theta}$

(3) $V_{rm} = \sqrt{V_r^2 + V_m^2}$

(4) $V_{rm} = \sqrt{V_r^2 - V_m^2}$



$V_{\delta m} = ?$



$V_{\delta m} = \sqrt{V_\delta^2 + V_m^2}$

Question no. 34

A wheel is rotating at 1800 rpm about its own axis.

When the power is switched off, it comes to rest in 2

minutes. The angular retardation in rad s^{-2} is

(1) 2π

(2) π

$$\omega = \omega_0 + \alpha t$$

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

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

~~$$2\pi \times 30 = 0$$~~

$$0 = 2\pi \times 30 + \alpha \times 60 \times 2$$

$$\alpha = \frac{2\pi \times 30}{60 \times 2} = -\frac{\pi}{2}$$

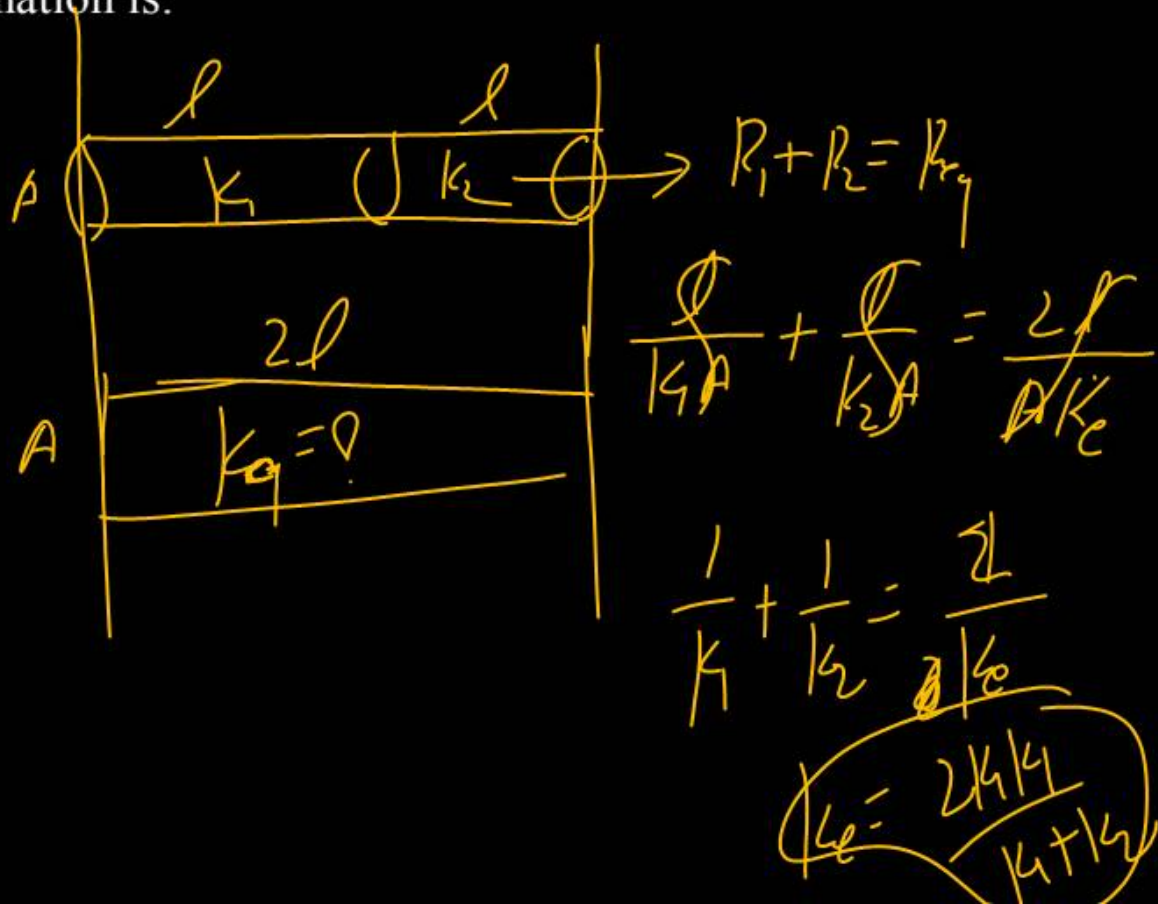
Two identical metal wires of thermal conductivities K_1 and K_2 respectively are connected in series. The effective thermal conductivity of the combination is:

(1) $\frac{2K_1K_2}{K_1 + K_2}$

(2) $\frac{K_1 + K_2}{2K_1K_2}$

(3) $\frac{K_1 + K_2}{K_1K_2}$

(4) $\frac{K_1K_2}{K_1 + K_2}$



Question no. 36

A student noticed the following readings while measuring the internal diameter of a tube with a vernier callipers :

Reading of main scale (in cm) = 1.9

Reading of vernier scale (in cm) = 0.04

Positive zero error (in cm) = 0.01

The value of the internal diameter is

- | | |
|-------------|-------------|
| (1) 1.93 cm | (2) 1.95 cm |
| (3) 1.85 cm | (4) 1.87 cm |

$$\text{Final Reading} = \text{M.S.R} + \text{V.S.R} - \text{Error}$$

$$\Rightarrow 1.9 + 0.04 - 0.01$$

$$\Rightarrow \underline{\underline{1.93 \text{ cm}}}$$

Question no. 37

A 1 kg block and a 0.5 kg block move together on a horizontal frictionless surface. Each block exerts a force of 6 N on the other. The blocks move with a uniform acceleration of



- (1) 3 ms^{-2} (2) 6 ms^{-2}
 (3) 9 ms^{-2} (4) 12 ms^{-2}

Handwritten solution:

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

$$a = 12 \text{ m/s}^2$$

The root mean square velocity of hydrogen molecules at 300 K is 1930 metre/sec. Then the r.m.s velocity of oxygen molecules at 1200 K will be

- (1) 482.5 metre/sec (2) 965 metre/sec
(3) 1930 metre/sec (4) 3860 metre/sec

$$V_r = \sqrt{\frac{3RT}{M}} \rightarrow \frac{V_{H_2}}{V_{O_2}} = \sqrt{\frac{T_{H_2}}{T_{O_2}} \times \frac{M_{O_2}}{M_{H_2}}}$$

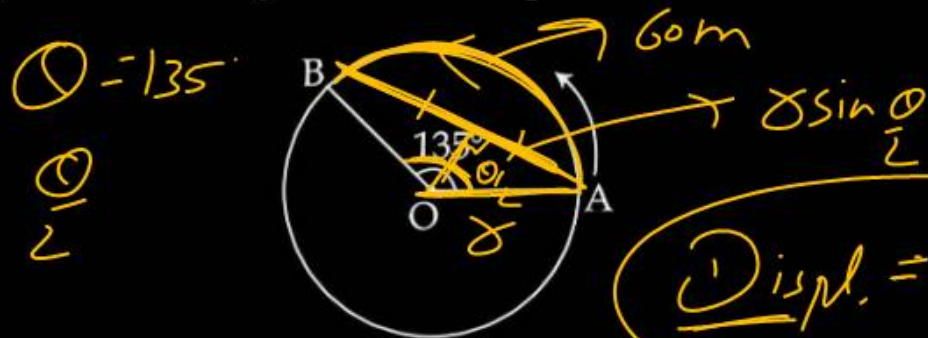
$$\frac{1930}{V_{O_2}} = \sqrt{\frac{300}{1200} \times \frac{32}{4}} = 2$$

$$V_{O_2} = \frac{1930}{2}$$

$$V_{O_2} = 965 \text{ m/s}$$

$\sin^{-1}(0.7) = 44.4^\circ$

A person moved from A to B on a circular path as shown in figure. If the distance travelled by him is 60 m, then the magnitude of displacement would be:



$$\text{Displ.} = 2r \sin \frac{\theta}{2}$$

- (1) 42 m
- (3) 19 m

- (2) 47 m
- (4) 40

$$\frac{135 \times \pi}{180} = \frac{\theta}{r}$$

$$r = \frac{60 \times 180}{135 \times \pi}$$

$$\theta = \frac{80}{\pi}$$

$$d = \frac{2 \times 80}{3.14} \times \frac{4}{2.3}$$

$$\cos 2\theta = 1 - 2\sin^2 \theta$$

$$\cos \theta = 1 - 2\sin^2 \frac{\theta}{2}$$

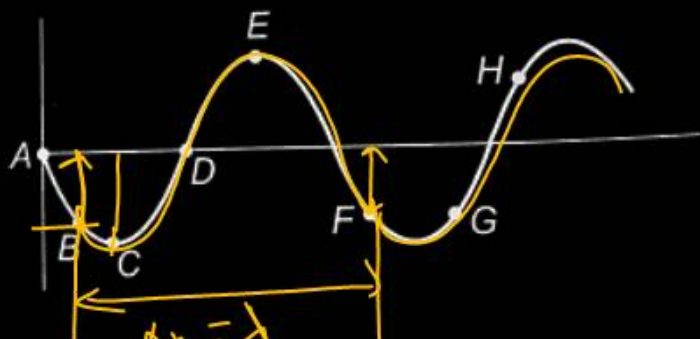
$$\sin \frac{\theta}{2} = \sqrt{\frac{1 - \cos \theta}{2}}$$

$$\sin \frac{135}{2} = \sqrt{\frac{1 + 0.7}{2}}$$

$$\sin \frac{135}{2} = \sqrt{\frac{1.7}{2}}$$

The diagram below shows the propagation of a wave.

Which points are in same phase?



(1) F and G

(2) C and E

(3) B and G

(4) B and F

Question no. 41

$$f=5$$

One kg of a diatomic gas is at a pressure of 8×10^4 N/m². The density of the gas is 4 kg/m^3 . What is the energy of the gas due to its thermal motion?

(1) $5 \times 10^4 \text{ J}$

(2) $6 \times 10^4 \text{ J}$

(3) $7 \times 10^4 \text{ J}$

(4) $3 \times 10^4 \text{ J}$

$$U_T = \frac{f \bar{P} V}{2}$$

$$U_T = \frac{f P V}{2}$$

$$M = V \rho$$

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

$$U_T = \frac{5 \times 8 \times 10^4}{2} \times \frac{1}{4}$$

$$U_T = 5 \times 10^4$$

Question no. 42

The two ends of a metal rod are maintained at temperatures 100°C and 110°C . The rate of heat flow in the rod is found to be 4.0 J/s . If the ends are maintained at temperatures 200°C and 210°C , the rate of heat flow will be

(1) 16.8 J/s

(2) 8.0 J/s

(3) 4.0 J/s

(4) 44.0 J/s

Q $I = \frac{\Delta T}{R}$


$\Delta T_1 = 10 \rightarrow R_1$


$\Delta T_2 = 10 \rightarrow R_2$

$I_1 = I_2 = 4$

Question no. 43

If rain falls vertically with a velocity V_r and wind blows with a velocity v_w from east to west, then a person standing on the roadside should hold the umbrella in the direction

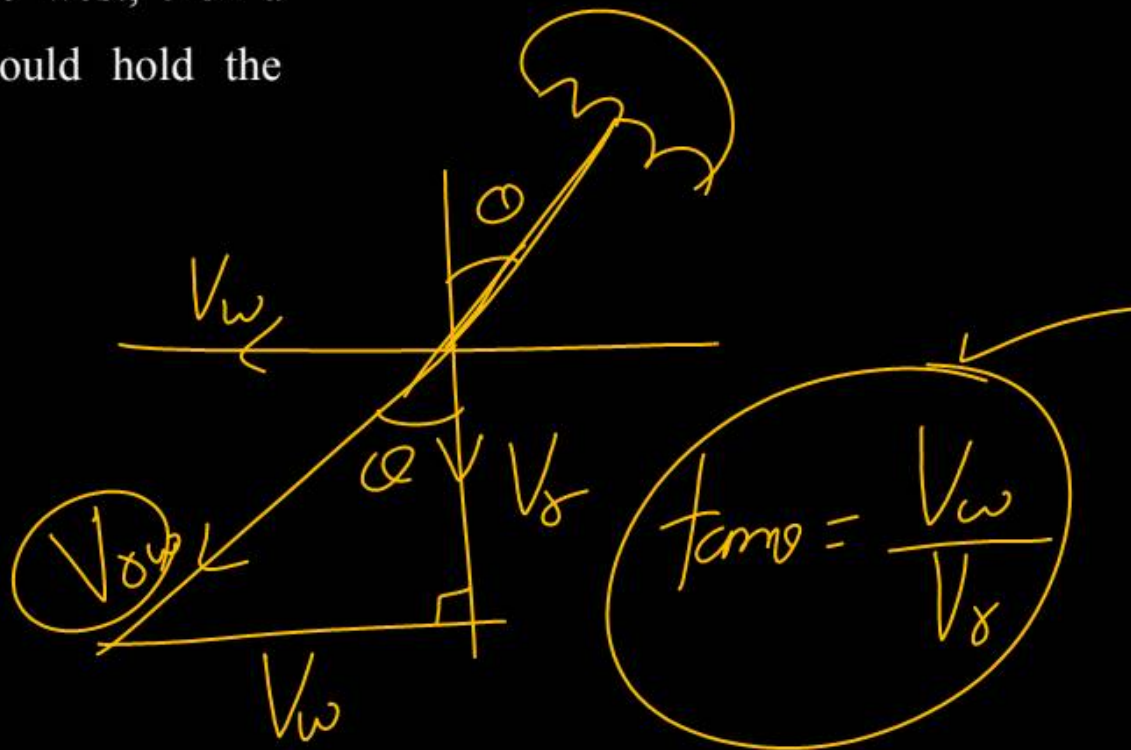
(1)  $\tan \theta = \frac{V_w}{V_r}$



(2) $\tan \theta = \frac{V_r}{V_w}$

(3) $\tan \theta = \frac{V_{rw}}{\sqrt{V_r^2 + V_w^2}}$

(4) $\tan \theta = \frac{V_r}{\sqrt{V_r^2 + V_w^2}}$



Question no. 44

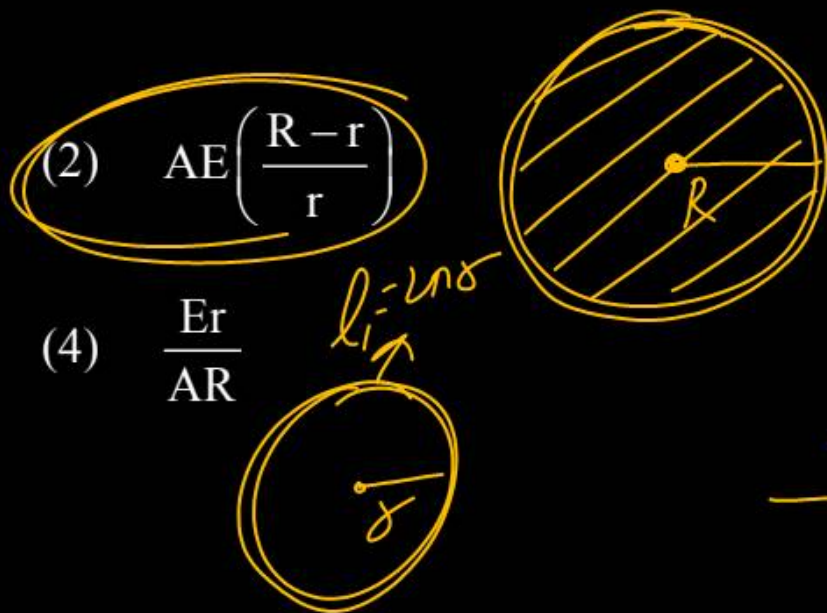
A steel ring of radius r and cross-section area A is fitted on to a wooden disc of radius R ($R > r$). If Young's modulus be E , then the force with which the steel ring is expanded is

(1) $AE \frac{R}{r}$

(2) $AE \left(\frac{R-r}{r} \right)$

(3) $\frac{E}{A} \left(\frac{R-r}{A} \right)$

(4) $\frac{Er}{AR}$



$$E = \frac{F}{A} \frac{l}{\Delta l}$$

$$E = \frac{F \times l}{A \times \Delta l} = \frac{F \times 2\pi r}{A \times 2\pi (R-r)}$$

$$\Delta l = l_2 - l_1$$

$$\Delta l = 2\pi (R-r)$$

$$F = \frac{AE(R-r)}{r}$$

Question no. 45

A projectile is projected with velocity of 25 m/s at an angle θ with the horizontal. After t seconds the inclination of velocity with the horizontal becomes zero. If R represents horizontal range of the projectile, the value of θ will be:

(1) $\frac{1}{2} \sin^{-1} \left(\frac{5t^2}{4R} \right)$

(2) $\frac{1}{2} \sin^{-1} \left(\frac{4R}{5t^2} \right)$

(3) $\tan^{-1} \left(\frac{4t^2}{5R} \right)$

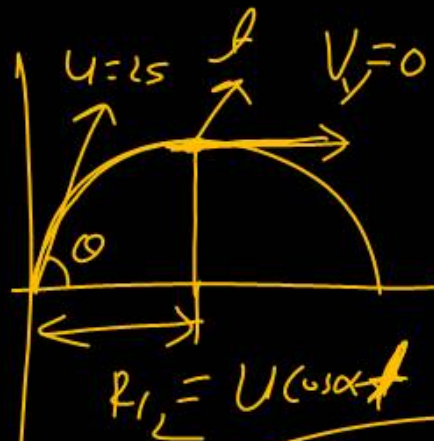
(4) $\cot^{-1} \left(\frac{R}{20t^2} \right)$

Handwritten derivation for option (4):

$$\theta = \cot^{-1} \left(\frac{R}{20t^2} \right)$$

$$\cot \theta = \frac{R}{2 \times t \times 10t}$$

$$\cot \theta = \frac{R}{20t^2}$$



Handwritten equation (I):

$$u \cos \theta = \frac{R}{2 \times t} \rightarrow \text{(I)}$$

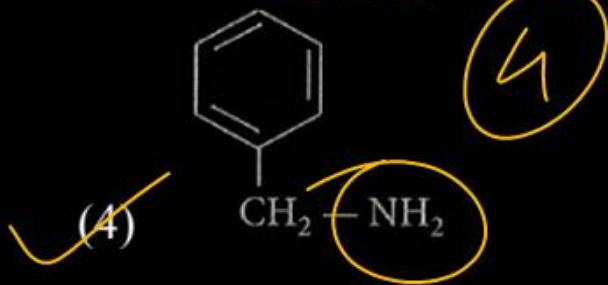
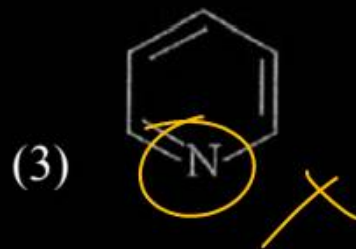
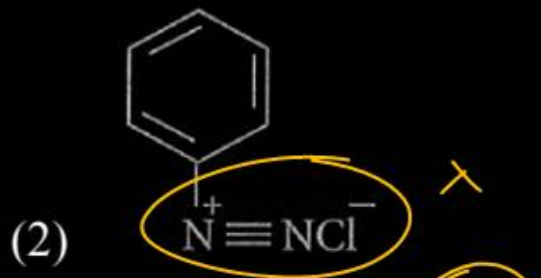
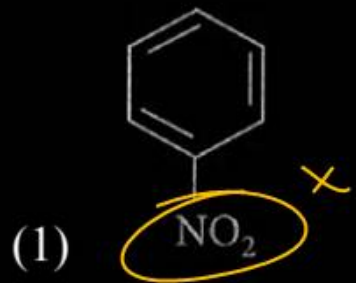
Handwritten equations for vertical motion:

$$v_y = u_y + a_y t$$

$$0 = u \sin \theta - g \times t$$

$$u \sin \theta = g t \rightarrow \text{(II)}$$

Nitrogen can be estimated by Kjeldahl's method for which of the following compound?



Kjeldahl's method

N_2 - quantitative Estimation

Limitation

— NO_2

A30 — $\text{N}=\text{N}$ —

N in the ring



Question no. 47

For the estimation of nitrogen, 1.4 g of an organic compound was digested by Kjeldahl method and the evolved ammonia was absorbed in 60 mL of $\frac{M}{10}$ sulphuric acid. The unreacted acid required 20 mL of $\frac{M}{10}$ sodium hydroxide for complete neutralization.

The percentage of nitrogen in the compound is

- (1) 5% (2) 6%
(3) 10% (4) 3%

3

$$\frac{1.4}{W} \left(\frac{MV}{HCl} - \frac{MV}{NaOH} \right)$$

$$\frac{1.4}{W} \times \left(\frac{2MV}{H_2SO_4} - \frac{MV}{NaOH} \right) \% N$$

$$\frac{1.4}{W} \times \left(2 \times \frac{1}{10} \times 60 - \frac{1}{10} \times 20 \right)$$

$$\frac{1.4}{1.4} \times (12 - 2)$$

10 %

Match list I with list II.

	List-I (Technique)		List-II (used for separation)
A.	Distillation ✓	I.	glycerol from spent lye
B.	Fractional distillation	II.	Aniline- Water Mixture
C.	Steam distillation	III.	Crude oil fractions
D.	Distillation under reduced pressure	IV.	Chloroform-aniline

A-IV
 B-III
 C-II
 D-I

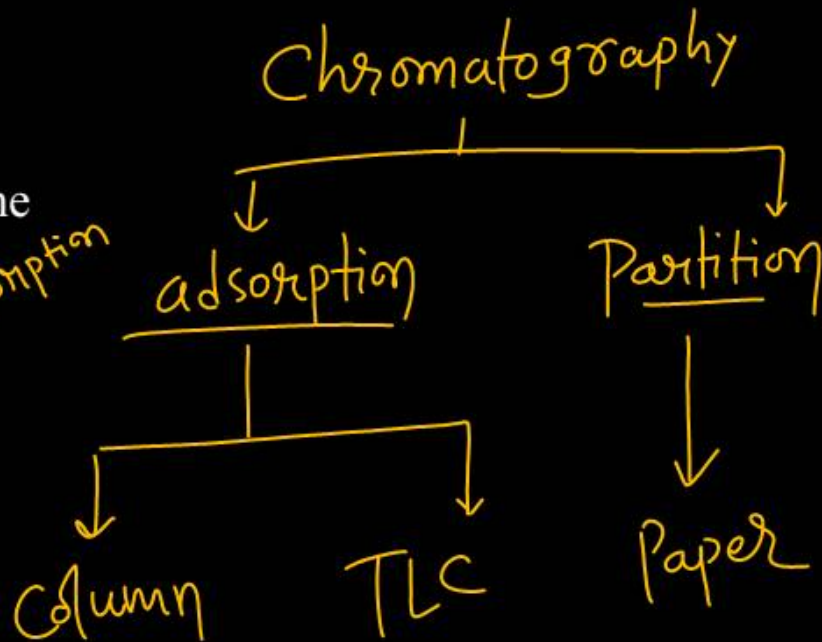
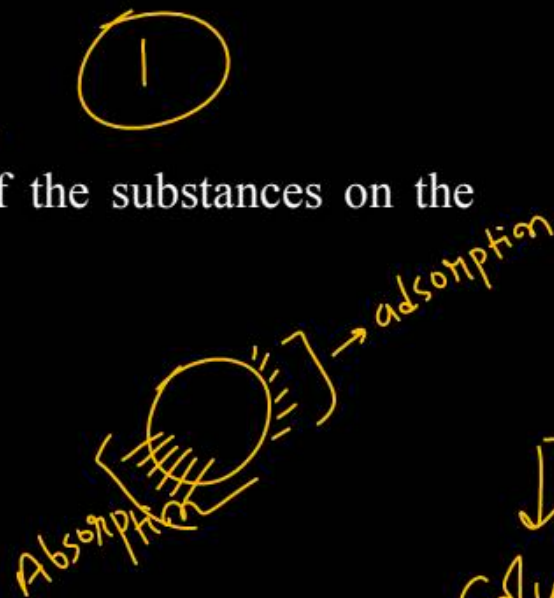
Choose the correct answer from the options given below:

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

3

The principle of column chromatography is

- (1) differential adsorption of the substances on the solid phase.
- (2) capillary action.
- (3) differential absorption of the substances on the solid phase
- (4) gravitation force.



Question no. 50

In Duma's method of estimation of nitrogen, 0.1840 g of an organic compound gave 30 mL of nitrogen collected at 287 K and 758 mm of Hg pressure. The percentage composition of nitrogen in the compound is _____.

2

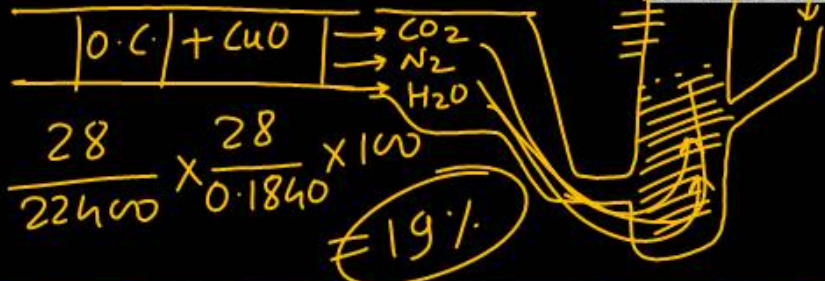
[Given : Aqueous tension at 287 K = 14 mm of Hg]

(1) 9

(2) 19

(3) 36

(4) 40



$$\frac{V_{N_2 \text{ at STP}}}{22400} \times \frac{28}{\text{Wt.}} \times 100 = \% N$$

$$\frac{10.6 \times 21 \times 28 \times 100}{7.6 \times 22400 \times 0.1840} =$$

$$\frac{132.5}{7.6 \times 8 \times 184} =$$

$$\frac{132.5}{1060 \times 3} =$$

$$\frac{132.5}{3180} = 41.7\%$$

$$P_{\text{exp}} - P_{\text{aq. T}} = P_{N_2}$$

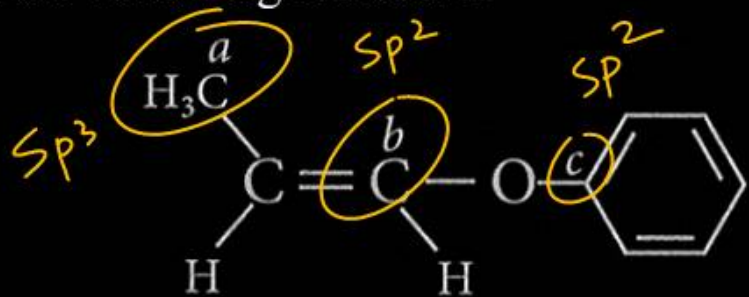
$$758 - 14 = 744 \text{ mmHg}$$

$$\frac{P V}{T} = \frac{P_0 V_0}{T_0}$$

$$\frac{744 \times 30}{287} = \frac{760 \times V_0}{273}$$

$$V_0 = \frac{744 \times 30 \times 273}{40 \times 287 \times 76}$$

In the following molecule.

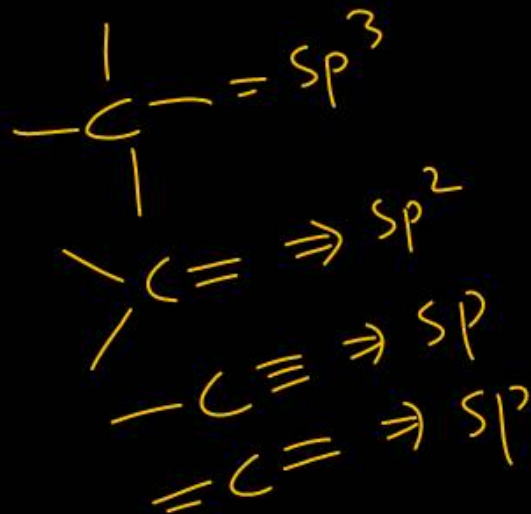


Hybridization of carbon a, b and c respectively are

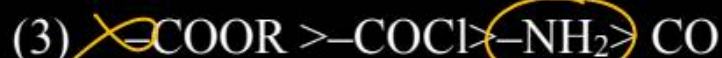
- (1) sp^3, sp^2, sp (2) sp^3, sp, sp^2
 (3) sp^3, sp, sp (4) sp^3, sp^2, sp^2

(4)

Hybridization
No of σ bond + no. of lp



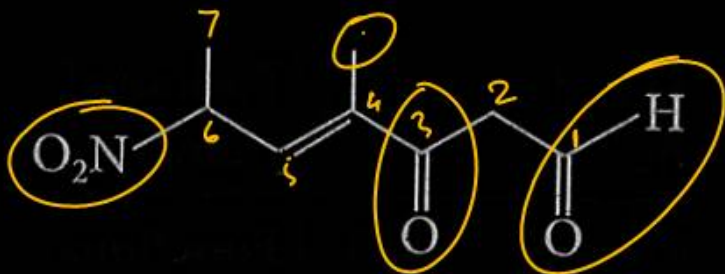
The correct decreasing order of priority of functional groups in naming an organic compound as per IUPAC system of nomenclature is



2



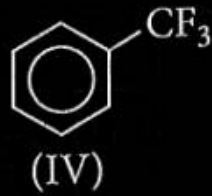
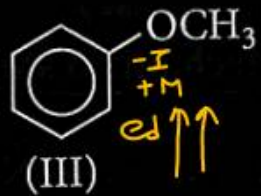
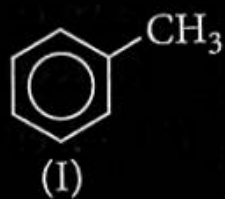
The correct IUPAC name of the following compound is



- (1) ~~4-methyl-2-nitro-5-oxohept-3-enal~~
 (2) ~~4-methyl-5-oxo-5-nitrohept-3-enal~~
 (3) 4-methyl-6-nitro-3-oxohept-4-enal
 (4) ~~6-formyl-4-methyl-2-nitrohex-3-enal~~

3

The correct arrangement for decreasing order of electrophilic substitution for following compounds is



(1) IV > I > II > III

(2) III > IV > II > I

(3) II > IV > III > I

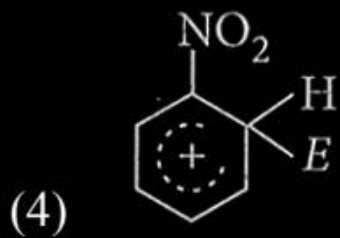
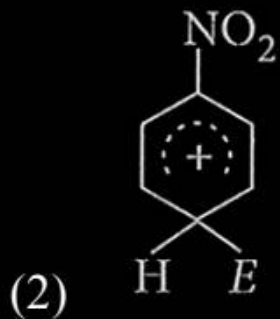
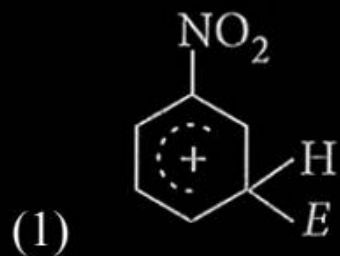
(4) III > I > II > IV

4

ESR

ESR Reactivity \propto ed on Ring

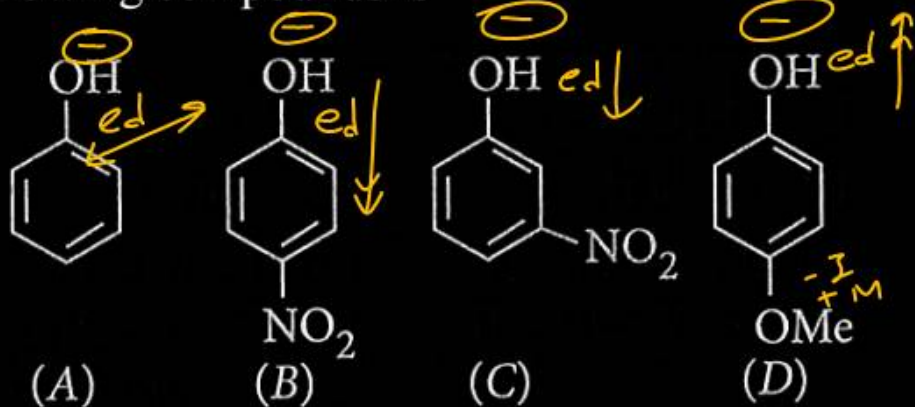
The electrophile, E^+ attacks the benzene ring to generate the intermediate σ -complex. Of the following which σ -complex is of lowest energy?



more stable
sigma complex / arenium ion
+ve charge

3

The increasing order of the pKa values of the following compounds is



- (1) $D < A < C < B$
 (3) $C < B < A < D$

- (2) $B < C < A < D$
 (4) $B < C < D < A$

2

acidity $\propto \frac{1}{pK_a}$

$B > C > A > D$ (acidity)
 $B < C < A < D$ (pKa)

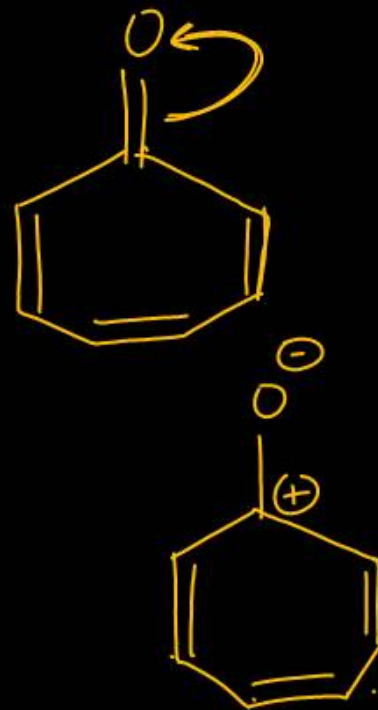
Given below are two statement:

Statement I: Tropolone is an aromatic compound and has 8π electrons.

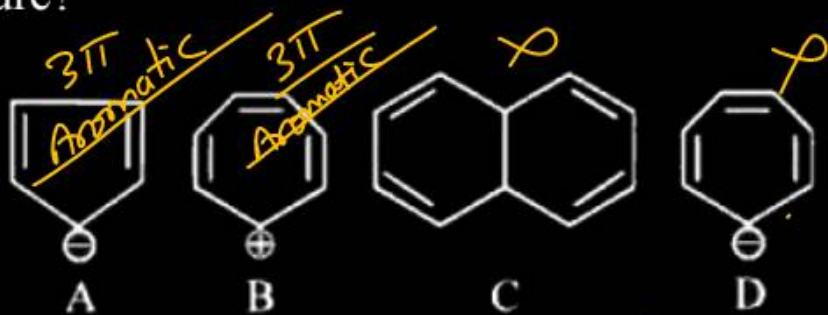
Statement II: π electrons of $>C=O$ group in tropolone is involved in aromaticity.

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

3



Which of the following structures are aromatic in nature?

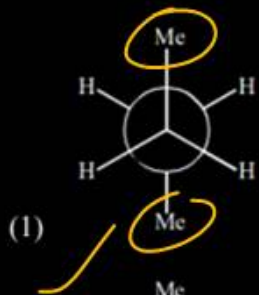


- (1) A, B, C and D (2) Only A and B
- (3) Only A and C (4) Only B, C and D

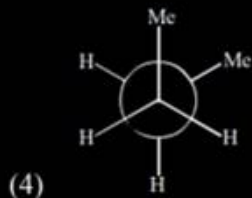
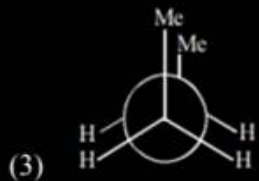
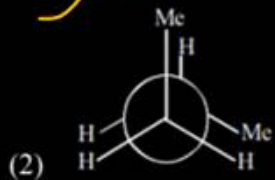
2

Question no. 59

Which of the following conformations will be the most stable?



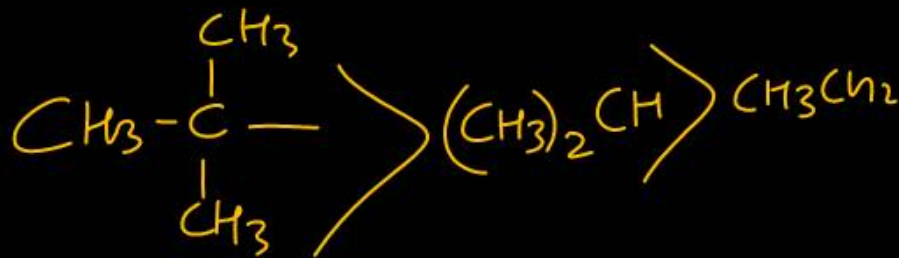
① Anti



Arrangement of $(\text{CH}_3)_3\text{C}-$, $(\text{CH}_3)_2\text{CH}-$, CH_3CH_2- when attached to benzyl or an unsaturated group in increasing order of inductive effect is



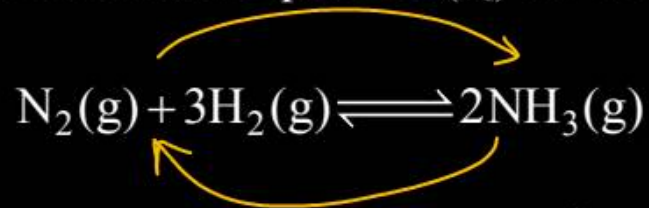
2



$$Q > K_{eq}$$

Question no. 61

The reaction quotient (Q) for the reaction



is given by $Q = \frac{[\text{NH}_3]^2}{[\text{N}_2][\text{H}_2]^3}$. The reaction will

proceed from right to left if

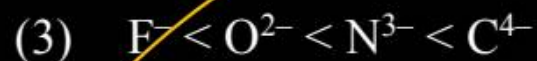
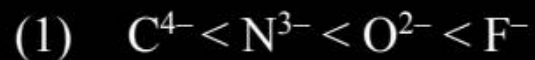
(1) $Q = 0$

(2) $Q = K_c$

(3) $Q < K$

~~(4) $Q > K_c$~~

Arrange the following in increasing order of ionic radii? C^{4-} , N^{3-} , F^{-} , O^{2-}



3

isoelectronic species

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

Question no. 63

At 25°C, the dissociation constant of a base, BOH, is 1.0×10^{-12} . The concentration of hydroxyl ions in 0.01 M aqueous solution of the base would be

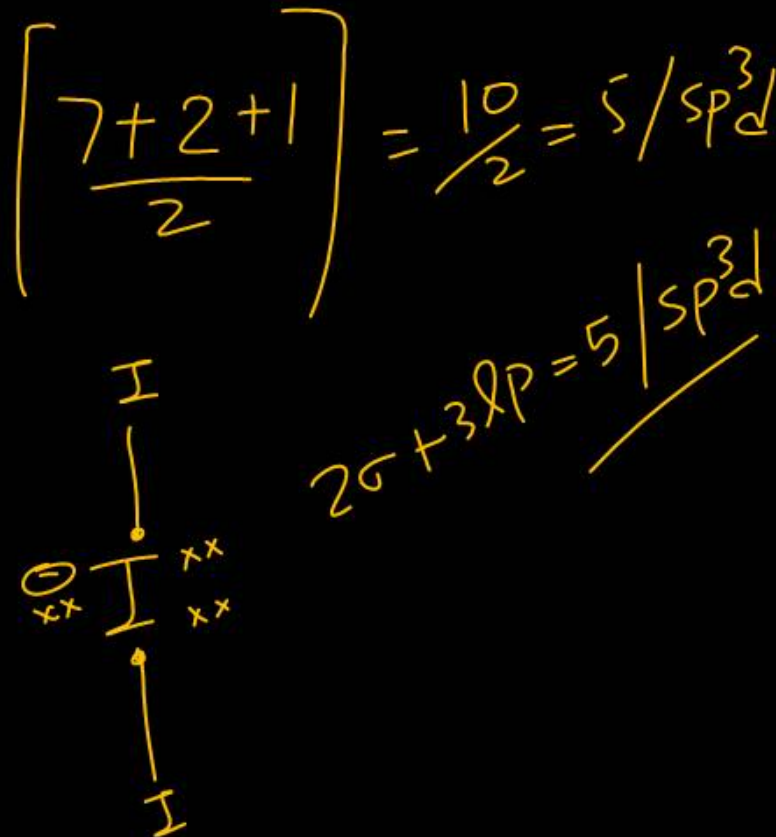
- (1) $1.0 \times 10^{-5} \text{ mol L}^{-1}$ (2) $1.0 \times 10^{-6} \text{ mol L}^{-1}$
 (3) $2.0 \times 10^{-6} \text{ mol L}^{-1}$ (4) $1.0 \times 10^{-7} \text{ mol L}^{-1}$

$$\begin{aligned}
 k_b &= 1.0 \times 10^{-12} \\
 c &= 0.01 = 10^{-2} \\
 [\text{OH}^-] &= \sqrt{k_b \times c} \\
 &= \sqrt{10^{-12} \times 10^{-2}} \\
 &= \sqrt{10^{-14}} \\
 &= 10^{-7}
 \end{aligned}$$

Hybridisation and structure of I_3^- are

- (1) sp^2 and trigonal planar
- (2) sp^3d^2 and linear
- (3) sp^3d and linear
- (4) sp^3 and T-shape

3



Question no. 65

Under isothermal condition for one mole of ideal gas what is the ratio of work done under reversible to irreversible process, initially held at 20 atm undergoes expansion from 1 L to 2 L, at 298 K, under external pressure of 10 atm?

(1) 1.7

(4) 2.0

(3) 1.4

(4) 1.0

$$\begin{aligned}
 W_{\text{reversible}} &= -2.303nRT \log_{10} \frac{V_2}{V_1} \\
 &= -2.303 \times 1 \times 0.0821 \times 298 \log_{10} \frac{2}{1} \\
 &= -2.303 \times 0.082 \times 298 \times 0.3 \\
 &= -0.693 \times 0.0821 \times 298 \\
 &\approx -17 \text{ (Latm)}
 \end{aligned}$$

$$\begin{aligned}
 W_{\text{irreversible}} &= -P_{\text{ext}} \Delta V \\
 &= -10 \times (V_2 - V_1) \\
 &= -10(2 - 1) = -10 \text{ (Latm)}
 \end{aligned}$$

$$\frac{W_{\text{reversible}}}{W_{\text{irreversible}}} = \frac{+17}{-10} = \underline{1.7}$$

Which set of quantum numbers are not possible?

	n	l	m	s	
(1)	3	2	0	+1/2	✓
(2)	2	2	1	+1/2	✗
(3)	1	0	0	-1/2	✓
(4)	3	2	-2	+1/2	✓

$$l \rightarrow (n-1)$$

$$0 \text{ to } (n-1)$$

n & l value equal
 नहीं होती है

The correct decreasing order for metallic character is

(1) $\text{Na} > \text{Mg} > \text{Be} > \text{Si} > \text{P}$

(2) $\text{P} > \text{Si} > \text{Be} > \text{Mg} > \text{Na}$

(3) $\text{Si} > \text{P} > \text{Be} > \text{Na} > \text{Mg}$

(4) $\text{Be} > \text{Na} > \text{Mg} > \text{Si} > \text{P}$

①

Be
Mg ↓

Na | Be |
Mg | Si → P

The most polar bond is

- (1) C-F (2) C-O
(3) C-Br (4) C-S

①

Bond Polarity $\propto \Delta E_n$

① $4 - 2.5 = 1.5$

② $3.5 - 2.5 = 1.0$

③ $2.8 - 2.5 = 0.3$

④ $2.5 - 2.4 = 0.1$

The number of gram molecules of oxygen in 6.02×10^{24} CO molecules is

- (1) 10 g molecules
 (2) ~~5 g molecules~~
 (3) 1 g molecules
 (4) 0.5 molecules

$$\text{mol} = \frac{N}{N_A}$$

$$= \frac{6.02 \times 10^{24}}{6.023 \times 10^{23}} = 10 \text{ mol}$$

No. of molecule CO = $10 \times N_A$
 gm molecule CO = 10 gm molecule

10 gm molecule = CO = 10 gm atom O

1 gm molecule O_2 = 2 gm atom O

= 5 gm molecule of oxygen

Question no. 70

Oxidation number of nitrogen in $(\text{NH}_4)_2\text{SO}_4$ is

(1) $-1/3$

(2) -1

(3) $+1$

~~(4) -3~~

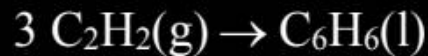


$$x + (+1) \times 4 = +1$$

$$x = -3$$

Question no. 71

At 25°C and 1 atm pressure, the enthalpy of combustion of benzene (l) and acetylene (g) are $-3268 \text{ kJ mol}^{-1}$ and $-1300 \text{ kJ mol}^{-1}$, respectively. The change in enthalpy for the following reaction will be



- (1) $+ 324 \text{ kJ mol}^{-1}$
 (2) $+ 632 \text{ kJ mol}^{-1}$
 (3) -632 kJ mol^{-1}
 (4) $- 732 \text{ kJ mol}^{-1}$

$$\begin{aligned}
 3 \text{ C}_2\text{H}_2(\text{g}) &\longrightarrow \text{C}_6\text{H}_6(\text{l}) \\
 \Delta H_r &= H_R - H_P \\
 &= [3 \times (-1300) - (-3268)] \\
 &= -3900 + 3268 \\
 &= \underline{\underline{-632 \text{ kJ/mol}}}
 \end{aligned}$$

Question no. 72

Identify the correct statements with respect to cis/trans 2-butene from the following

- (A) cis-2-Butene is more polar than trans-2 Butene
- (B) ~~Melting point of cis 2 Butene is greater than that of trans-2-Butene~~
- (C) boiling point of cis-2- Butene is greater than that of trans-2-Butene
- (D) ~~trans-2-Butene is more polar than cis 2 Butene~~
- (E) ~~boiling point of trans-2-Butene is greater than that of cis-2-Butene~~

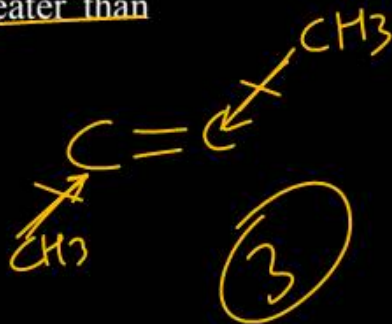
Correct answer is

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

Polarity cis > trans
 $\mu = 0$

m.p.t \propto symmetry cis < trans

B.p.t \propto Polarity cis > trans



Dalton's theory failed to explain

- (1) law of conservation of mass ✓
- (2) laws of chemical combination ✓✓
- (3) laws of gaseous volumes ✗
- (4) both (1) and (2)

Question no. 74

Acid

100 mL of 0.04 N HCl aqueous solution is mixed with 100 mL of 0.02 N NaOH solution. The pH of the resulting solution is:

- (1) 1.0 (2) 1.7
 (3) ~~2.0~~ (4) 2.3

Acid $N_1V_1 = 100 \times 0.04 = 4$

Base $N_2V_2 = 100 \times 0.02 = 2$

Acid > Base soln is Acidic

$$[H^+] = \frac{(N_1V_1)_{\text{Acid}} - (N_2V_2)_{\text{Base}}}{V_1 + V_2}$$

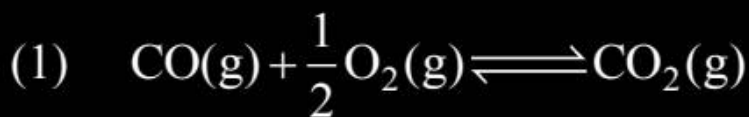
$$= \frac{4 - 2}{100 + 100} = \frac{2}{200} = 10^{-2}$$

$$[H^+] = 10^{-2}$$

$$\boxed{\text{pH} = 2}$$

Question no. 75

The K_p/K_c ratio will be highest in case of



$\Delta n_g = 1 - 1.5 = -0.5$

$K_p/K_c \rightarrow$ Ratio highest
 $\Delta n_g =$ highest



$\Delta n_g = 2 - 2 = 0$



$\Delta n_g = 2 - 1 = 1$

(Highest) $\rightarrow K_p/K_c$



$\Delta n_g = 6 - 9 = -3$

Highest

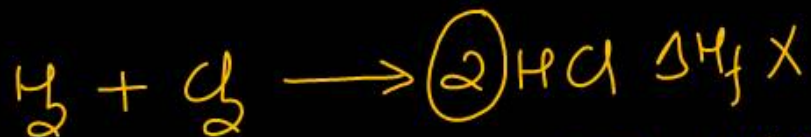
\rightarrow lowest

$K_p/K_c \rightarrow$ lowest

Question no. 76

Given that bond energies of H – H and Cl – Cl are 430 kJ mol⁻¹ and 240 kJ mol⁻¹ respectively and ΔH_f for HCl is -90 kJ mol⁻¹, bond enthalpy of HCl is

- (1) 380 kJ mol⁻¹ ~~(2) 425 kJ mol⁻¹~~
 (3) 245 kJ mol⁻¹ (4) 290 kJ mol⁻¹



→ अगर B.E. दी हों तो $\Delta H = H_p - H_r$

$$\Delta H_f = \left[\frac{1}{2} \times 430 + \frac{1}{2} \times 240 \right] - [\text{HCl}]$$

$$-90 = [215 + 120] - [\text{HCl}]$$

$$[\text{HCl}] = 335 + 90$$

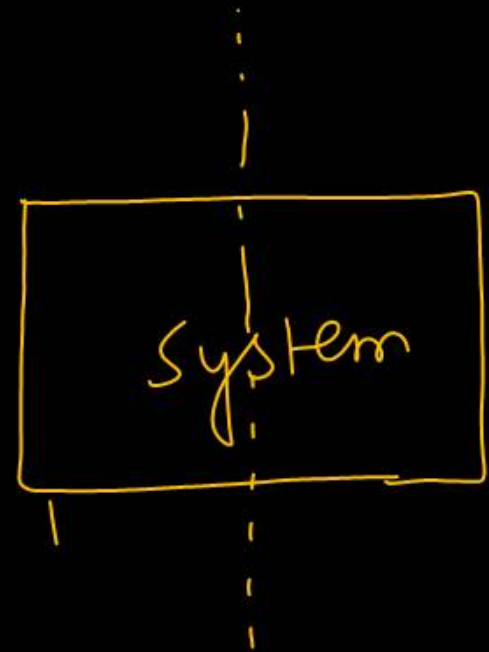
$$[\text{HCl}] = 425 \text{ kJ/mol}$$

Question no. 77

Among the following, identify the extensive properties:

- | | |
|---------------------------------|----------------------|
| (A) Density ✗ | (B) Mass ✓ |
| (C) Volume ✓ | (D) Pressure ✗ |
| (E) Enthalpy ✓ | |
| (1) (B), (C) and (E) | (2) (B), (C) and (D) |
| (3) (A) and (D) | (4) (A), (B) and (C) |

with property change
 External → change



Statement I: Magnetic quantum number determines the size of the orbital. ✗

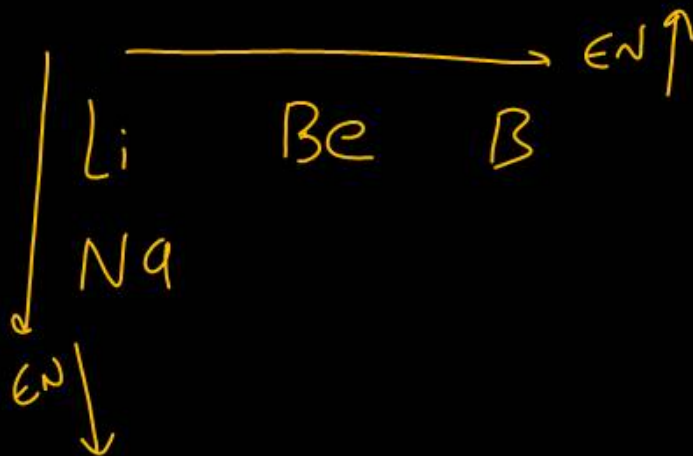
Statement II: Spin quantum number of an electron determines the orientation of the spin of electron relative to the chosen axis. ✓

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

The correct order of electronegativity is:

- (1) $\text{Na} < \text{Be} < \text{B} < \text{Li}$
- (2) $\text{B} < \text{Be} < \text{Li} < \text{Na}$
- (3) $\text{Li} < \text{B} < \text{Na} < \text{B}$
- (4) $\text{Na} < \text{Li} < \text{Be} < \text{B}$

4



In the following equilibrium reaction



The equilibrium concentration of A, B and C are 1×10^{-3} M, 2×10^{-3} M and 3×10^{-3} M respectively at 300. K The value of K_c for this equilibrium at the same temperature is

(1) $\frac{1}{6}$

(3) $\frac{1}{36}$

(2) 6

(4) 36

$$K_{eq} = \frac{[B][C]}{[A]^2}$$

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

$$= \frac{2 \times 3 \times 10^{-6}}{10^{-6}}$$

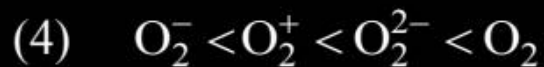
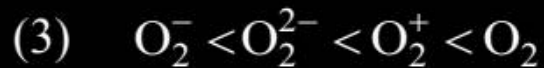
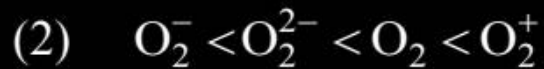
$$K_{eq} = 6$$

Question no. 81

2.5 2 1.5 1

 Consider the ions/molecule O_2^+ , O_2 , O_2^- , O_2^{2-} For

increasing bond order the correct option is:



1

Question no. 82

Which of the following Statement are NOT true about the periodic table?

- (A) ~~The properties of elements are function of atomic weight.~~ ✗
- (B) The properties of elements are function of atomic number. ✓
- (C) Elements having similar outer electronic configuration are arranged in same period. ✗
- (D) An element's location reflects the quantum number of the last filled orbital. ✓
- (E) The number of elements in a period is same as the number of ^{e-}atomic orbitals available in energy level that is being filled. ✗



Choose the correct answer from the options given below:

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

①

Question no. 83

Match List-I with List-II.

	List-I		List-II
(A)	$\Delta H = -ve$; $\Delta S = -ve$ $\Delta G = -ve$	(i)	Reaction will be <u>non-spontaneous</u> at <u>high</u> temperature
(B)	$\Delta H = -ve$; $\Delta S = -ve$ $\Delta G = +ve$	(ii)	Reaction will be non-spontaneous at low temperature
(C)	$\Delta H = +ve$; $\Delta S = +ve$ $\Delta G = +ve$	(iii)	<u>Reaction will be spontaneous</u> at <u>low</u> temperature
(D)	$\Delta H = +ve$; $\Delta S = +ve$ $\Delta G = -ve$	(iv)	Reaction will be spontaneous at high temperature

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

$$\Delta G = \Delta H - T\Delta S$$

-ve -ve -ve
 +ve +ve +ve
 -ve +ve +ve

A → iii
 B → i
 C → ii
 D → iv

Question no. 84

The equilibrium constant for the reversible reaction

$\text{N}_2 + 3\text{H}_2 \rightleftharpoons 2\text{NH}_3$ is K and for reaction

$\frac{1}{2}\text{N}_2 + \frac{3}{2}\text{H}_2 \rightleftharpoons \text{NH}_3$, the equilibrium constant is

K' The K and K' will be related as:

(1) $K \times K' = 1$

(2) $K = K'$

(3) $K' = \sqrt{K}$

(4) $K = \sqrt{K'}$

$$K_{eq} = (K)^{1/n}$$

$$K_{eq} = (K)^{1/2}$$

$$K' = \sqrt{K}$$

Which of the following statements about benzene are correct?

(A) Benzene has localized π -electrons. ~~✗~~



(B) Benzene undergoes electrophilic substitution reaction. ✓

(C) Benzene follows Huckel's rule

$[(4n + 2)\pi \text{ electrons, where } n = 1]$ ✓

$4(1) + 2 = 6\pi e^-$
 $= 3\pi \text{ Bonds}$

(D) Benzene is highly reactive towards addition reactions. ~~✗~~

(1) (A) and (B)

~~(2) (B) and (C)~~

2

(3) (C) and (D)

(4) (B) and (D)

Question no. 86

Considering entropy (S) as a thermodynamic parameter, the criteria for the spontaneity of any process is

- (1) $\Delta S_{\text{system}} + \Delta S_{\text{surroundings}} > 0$
- (2) $\Delta S_{\text{system}} - \Delta S_{\text{surroundings}} > 0$
- (3) $\Delta S_{\text{system}} > 0$ only
- (4) $\Delta S_{\text{surroundings}} > 0$ only

~~$\Delta G = -ve$~~

System + Surroundings
 $\Delta S = +ve$

The correct orders among the following are

(A) Atomic radius : $B < \overbrace{Al < Ga} < In < Tl$ ✗

(B) Electronegativity : $Al < Ga < In < Tl < B$ ✓

(C) Density : $Tl < In < Ga < Al < B$ ✗

(D) 1st Ionisation Energy : $In < Al < Ga < Tl < B$ ✓

B $Al < Ga < In < Tl < B$

Choose the correct answer from the options given below:

(1) (B) and (D) Only (2) (A) and (C) Only

(3) (C) and (D) Only (4) (A) and (B) Only

जे से Ga Al In
Be Tl Ga आल इंडिया

Question no. 88

Based upon VSEPR theory, match the shape (geometry) of the molecules in List-I with molecules in List-II and select the most appropriate option

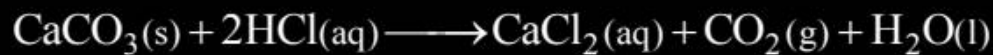
	List-I (Shape)		List-II (Molecules)
(A)	T-shaped	(i)	XeF ₄
(B)	Trigonal planar	(ii)	SF ₄ / sp ³ d
(C)	Square planar	(iii)	ClF ₃ / sp ³ d
(D)	See-saw	(iv)	BF ₃ / sp ²

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

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

Question no. 89

What mass of 95% pure CaCO_3 will be required to neutralize 50 mL of 0.5 M HCl solution according to the following reaction?



(1) 1.32 g

(2) 3.65 g

(3) 9.50 g

(4) 1.25 g



$$\begin{aligned} \text{mili } n &= M \times V_{\text{ml}} \\ &= 0.5 \times 50 \text{ millimol} \\ &= 0.025 \text{ mol} \end{aligned}$$

$$0.0125 \text{ mol} \leftarrow 0.025 \text{ mol}$$

$$\begin{aligned} \text{Wt} &= \text{mol} \times \text{Mw} \\ &= 0.0125 \times 100 = 1.25 \text{ gm} \end{aligned}$$

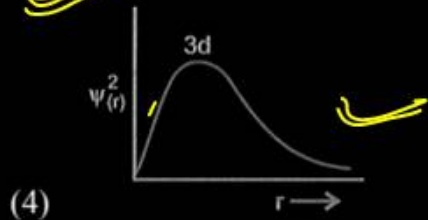
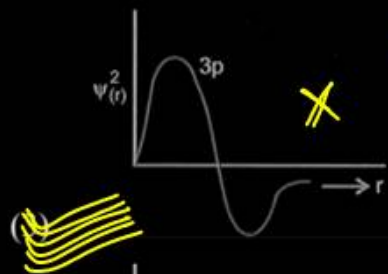
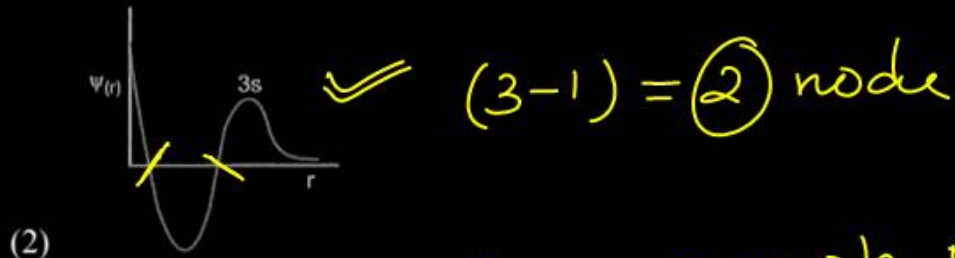
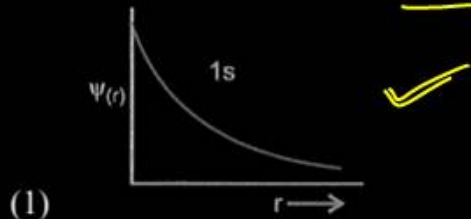
$$\text{When } 100\% \text{ pure} = 1.25 \text{ gm}$$

$$100 \times 1.25 = 95\% \times x \text{ gm}$$

$$x = \frac{100 \times 1.25}{95} = 1.32 \text{ gm}$$

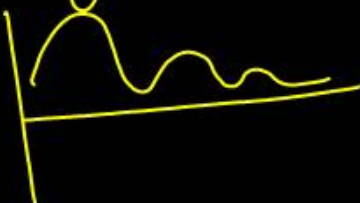
$$95\% \text{ pure} = 1.32 \text{ gm}$$

Which of the following graph is incorrectly labelled?



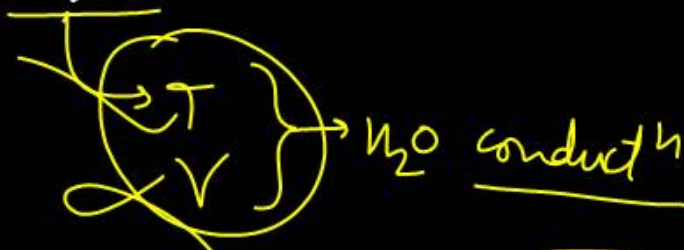
Ans. = 3

$\psi^2 \rightarrow$ graph Negative नहीं आता



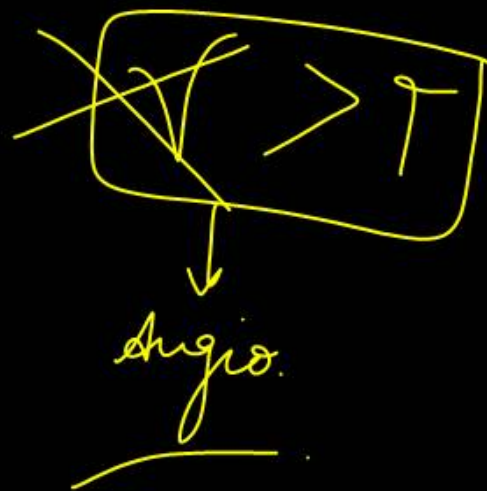
The chief water conducting elements of xylem in gymnosperms are :

- (1) vessels
- (2) fibres
- (3) Both (1) and (2)
- (4) tracheids



X.f.

X.p



Which one is the example of gramineae family?

(1) Cucurbita maxima

(2) Pisum sativum

(3) Solanum nigrum

(4) Zea mays

धान

Some glands produce hormones that stimulate other endocrine glands. Which of the following hormones specifically acts to trigger secretion of hormones by another endocrine gland?

- (1) thyroxine ϕ
- (2) progesterone ϕ
- (3) adrenocorticotrophic hormone (ACTH) ✓
- (4) antidiuretic hormone (ADH)

Tropic hormones

3

Cortisol

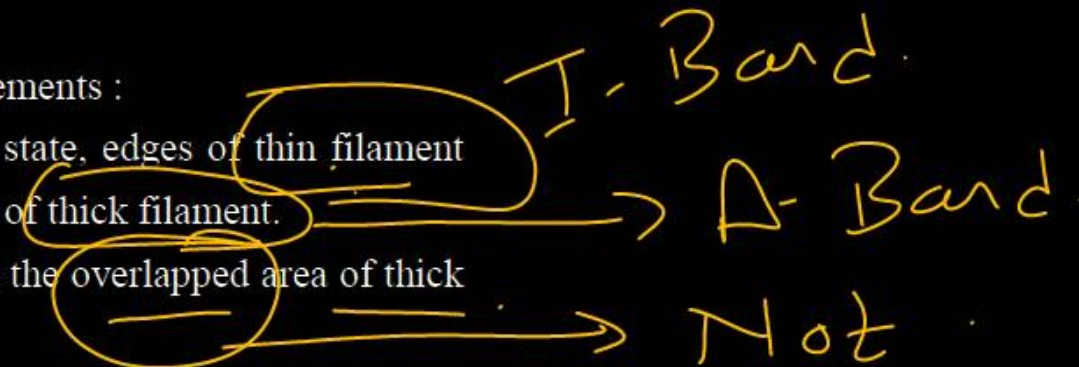
Given below are two statements :

Statement I : In resting state, edges of thin filament partially overlap the ends of thick filament.

Statement II : H-zone is the overlapped area of thick and thin filaments.

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

- (1) Both statement I and statement II are correct.
- (2) Both statement I and statement II are incorrect.
- (3) Statement I is correct but statement II is incorrect.
- (4) Statement I is incorrect but statement II is correct.



3

Development

Intrinsic heterophylly is found in all except.

(1) cotton ✓

(2) buttercup

(3) coriander ✓

(4) larkspur

2

Differentiation of shoot is controlled by

- (1) high ~~gibberellin~~ : cytokinin ratio
- (2) high auxin : cytokinin ratio — *Root*
- (3) high cytokinin : auxin ratio ✓
- (4) high ~~gibberellin~~ : auxin ratio

3

Auxin & cytokinin

High A/C — Root

High C/A = shoot

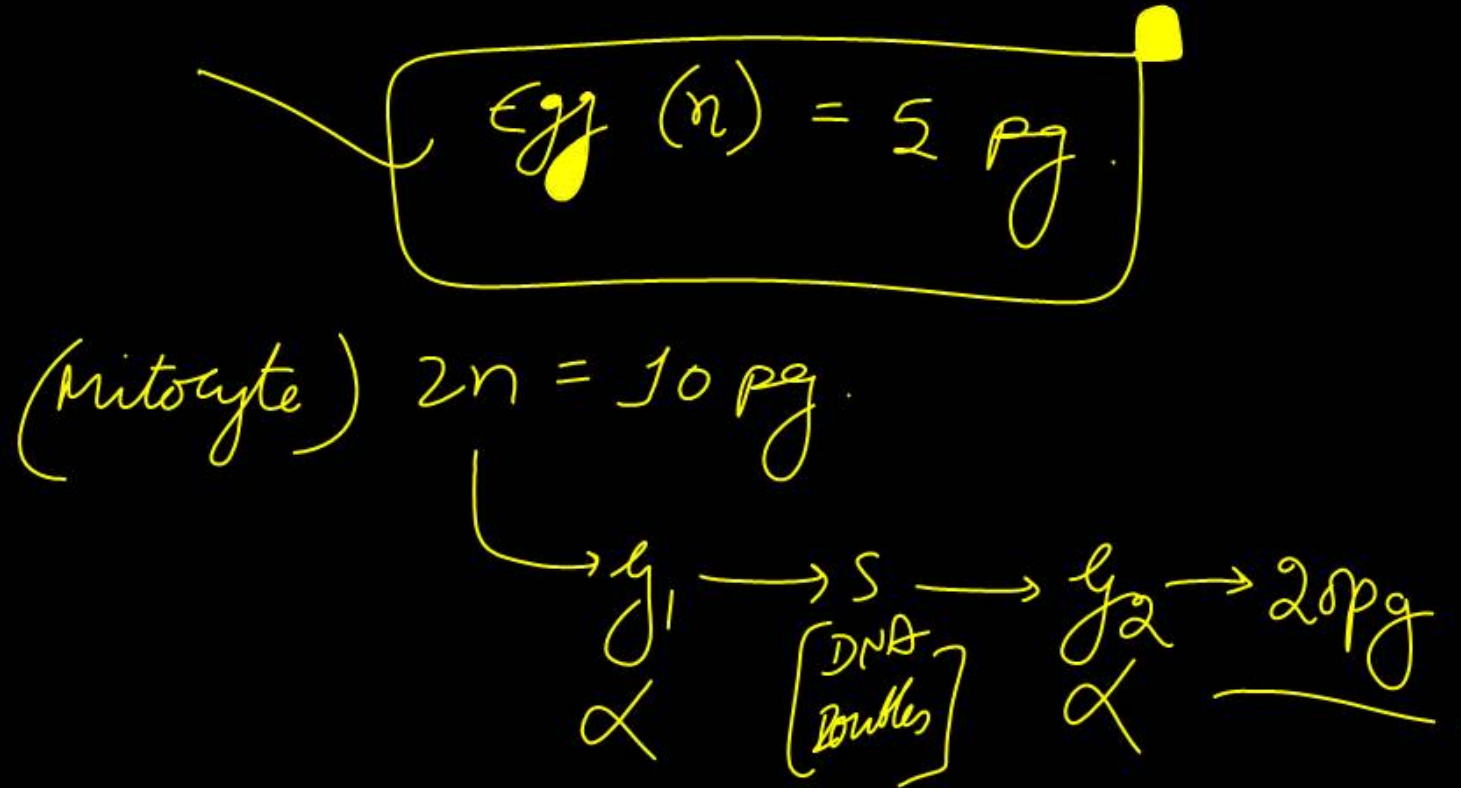
Intermediate = Callus

Question no. 98

An egg cell has 5 pico gram of DNA in its nucleus.

How much amount of DNA will be at the end of G_2 -phase of mitosis?

- (1) 2.5 pico gram
- (2) 5 pico gram
- (3) 5 g
- (4) 20 pico gram



Question no. 99

Bacteria and yeast are similar in all the following features except that

- (1) both are unicellular
- (2) both are prokaryotes
- (3) both are capable of causing fermentation
- (4) both produce spores



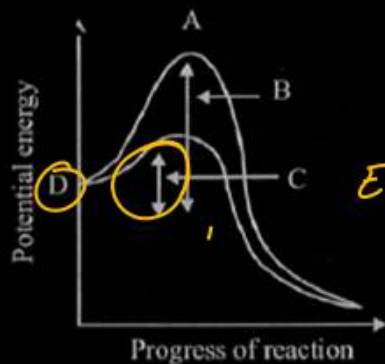
diff. b/w B/Y

Refer the botanical name of wheat "Triticum aestivum" and identify the statement which correctly describes it.

- (1) The second word belongs to genus and starts with a small letter. *g s*
- (2) Both the words "Triticum aestivum" denote the specific epithet.
- (3) The first word Triticum denotes the genus which starts with a capital letter.
- (4) The first word Triticum denotes the specific epithet while the second word denotes the genus.

3

Consider the graph given below w.r.t the concept of activation energy.



- (1) 'A' indicates the transient and stable state. ϕ
- (2) 'B' indicates the difference in average energy content of substrate from that of transition state if the enzyme is absent. \checkmark
- (3) 'C' indicates the state of activation energy in the absence of enzyme. ϕ
- (4) 'D' indicates the product formed in unit time. ϕ

All of the following features are true for monocot stem except.

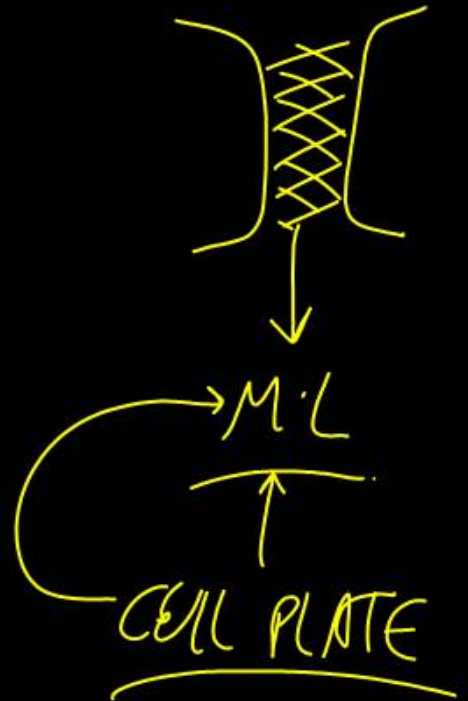
- (1) Phloem parenchyma is absent
- (2) Metaxylem are present towards the periphery
- (3) Presence of collenchyma in pith
- (4) Scattered vascular bundles

(endarch)



Which of the following is responsible for the formation of the new cell wall and also represents the middle lamella between the walls of two adjacent cells?

- (1) Cell plate (2) Cell furrow
(3) Cell membrane (4) Plasmodesmata



Which of the following features are correct w.r.t

China rose?

- A. Superior ovary
- B. Monoadelphous condition of stamens
- C. Axile placentation
- D. Actinomorphic flowers
- E. Opposite phyllotaxy

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

M.S.C
Alternate

Which of the following statements with respect to gymnosperms is/are correct?

- A. The process of double fertilisation is present in gymnosperms. ✗
- B. Gymnosperms range in size from microscopic Wolffia to tall trees of Sequoia. ✗
- C. In gymnosperms, the seeds are not covered. ✗
- D. In gymnosperms, the male and female gametophytes have an independent free living existence. ✗

Angio

Of the above statements.

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

Receptres for protein hormones are found.

- (1) inside nucleus (2) inside cytoplasm
(3) on surface of ER (4) on cell surface

(4)

Thyroxine
Steroid = Nucleus.

Protein = P.M.

The floral formula of Poaceae can be represented as :



P

B
S

Choose the correct answer :

(1) A only

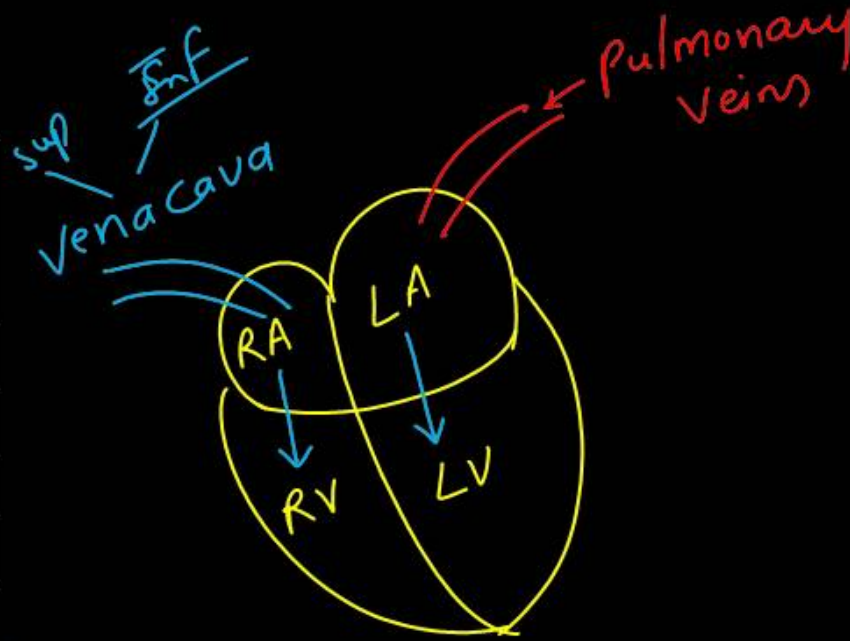
(2) B and C only

(3) A and D only

(4) C only

Match List-I with List-II.

	List-I (Chambers of heart)		List-II (Receives blood from)
A.	Right atrium	I.	Left atrium
B.	Right ventricle	II.	Vena cavae
C.	Left atrium	III.	Right atrium
D.	Left ventricle	IV.	Pulmonary veins



Choose the correct answer from options given below:

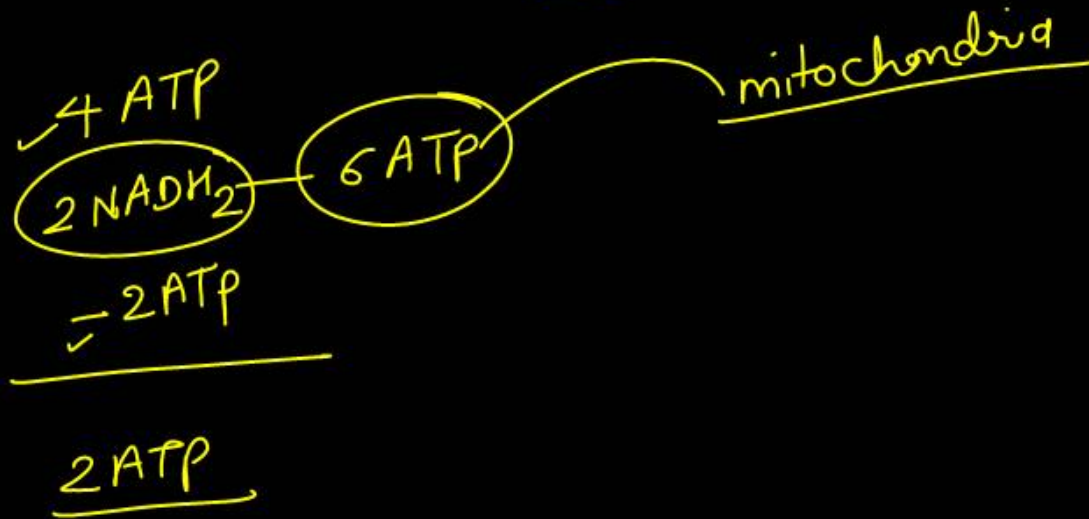
- (1) A - II, B - III, C - IV, D - I ✓
- (2) ~~A - I, B - II, C - III, D - IV~~
- (3) ~~A - IV, B - I, C - II, D - III~~
- (4) ~~A - III, B - IV, C - I, D - II~~



How many net molecules of ATP are produced during glycolysis?

- (1) 2 ✓ (2) 4
(3) 6 (4) 8

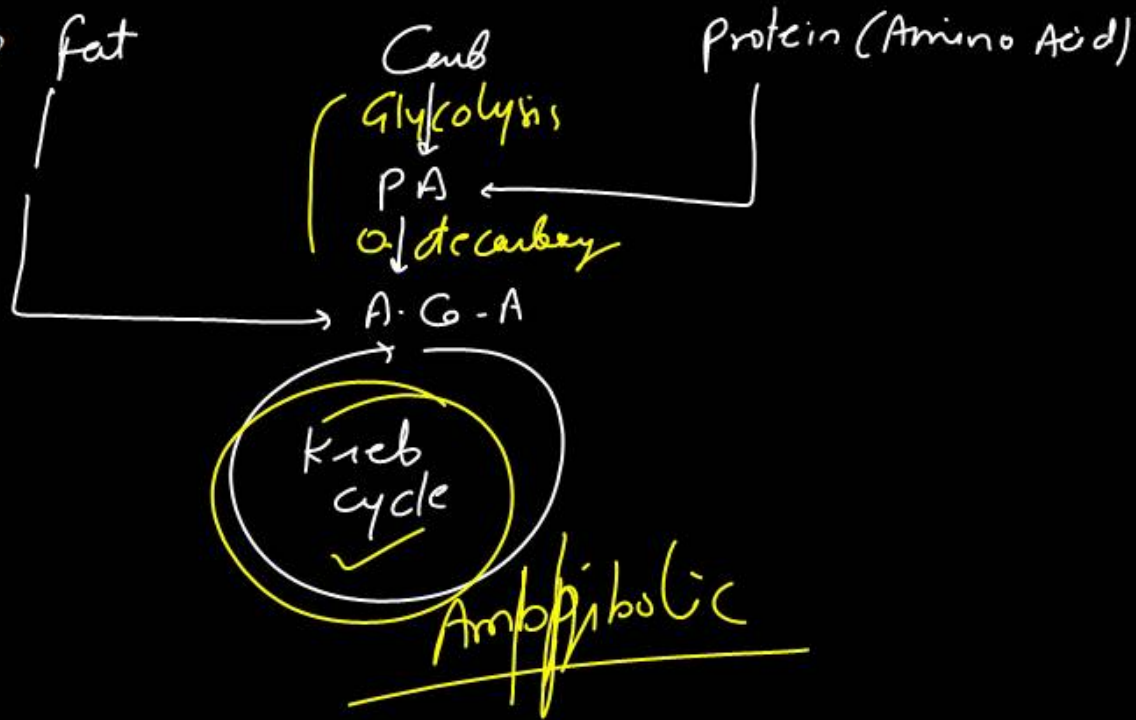
1



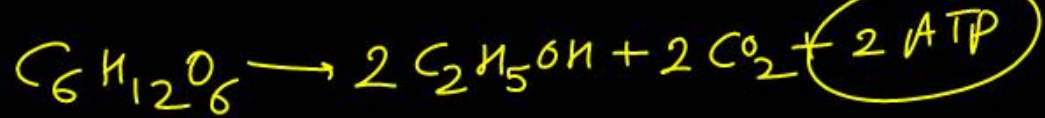
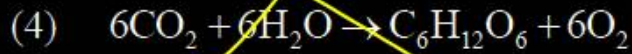
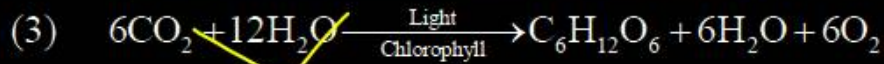
Which of the following is amphibolic in nature?

- (1) Glycolysis ~~✗~~
- (2) Oxidative decarboxylation of pyruvate ~~✗~~
- (3) TCA cycle ✓
- (4) Oxidative phosphorylation

3



Fermentation is represented by the equation :

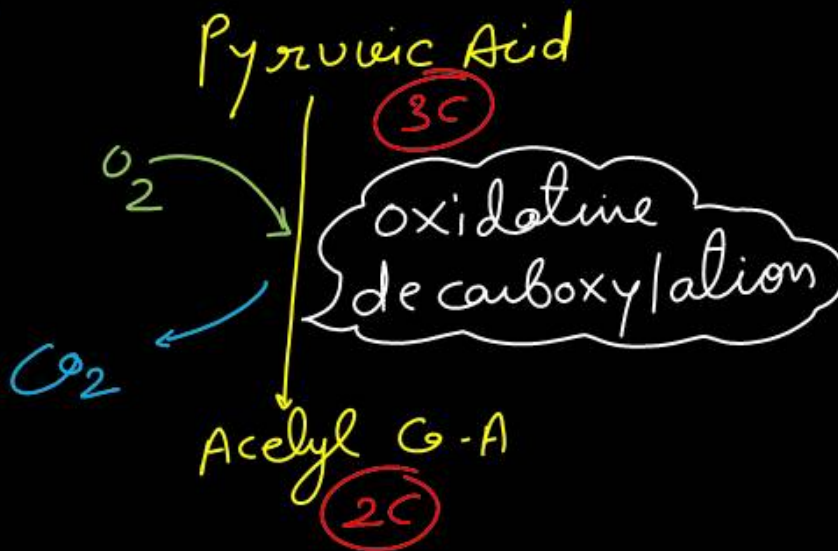


2

Which one of the following reactions is an example of oxidative decarboxylation?

- (1) Conversion of succinate ~~to~~ fumarate.
- (2) Conversion of fumarate ~~to~~ malate.
- (3) Conversion of pyruvate to acetyl CoA.
- (4) conversion of citrate to isocitrate.

3



Which type of plant tissue is being described by the given statements?

- A. It consists of living cells.
- B. They may possess intercellular space. → **P**
- C. Found in cortex of dicot roots.
- D. It usually helps in storage.

- (1) Parenchyma
- (2) Sclerenchyma
- (3) Collenchyma
- (4) Chlorenchyma

Find out the wrongly matched pair of the stage of prophase I with their feature -

- (1) Zygotene – Synaptonemal complex
- (2) Pachytene - Mutation
- (3) Diplotene - Chiasmata
- (4) Diakinesis – Terminalization of chiasmata

Given below are two statements:

Statement I :Main plant body of bryophytes is sporophytic.

Statement II:Main plant body of pteridophytes is gametophytic.

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

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

g
s

Match List-I with List-II.

	List-I (Phylum)		List-II (Examples)
A.	Echinodermata	I.	Ascidia, Doliolum
B.	Hemichordata	II.	Asterias, Ophiura
C.	Urochordata	III.	Branchiostoma
D.	Cephalochordata	IV.	Balanoglossus, Saccoglossus

Choose the correct answer from options given below:

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

2

If Henle's loop were absent from mammalian nephron, which one of the following is to be expected?

- (1) There will be no urine formation.
- (2) There will be hardly any change in the quality and quantity of urine formed.
- (3) The urine will be more concentrated.
- (4) The urine will be more dilute



Which of the following sets of animals give birth to young ones?

- (1) Platypus, Penguin, Bat, Hippopotamus.
- (2) Shrew, Bat, Cat, Kiwi
- (3) Kangaroo, Flying fox, Dolphin, Lion ✓
- (4) Lion, Bat, Whale, Ostrich

3

Identify the statement that is not correct.

- (1) The pituitary gland is located in a bony cavity called sella turcica and is attached to hypothalamus by a stalk. ✓
- (2) Adenohypophysis consists of two portions, pars distalis and pars intermedia. → P.A.S.H.
- (3) Pars intermedia secretes only one hormone called melanocyte stimulating hormone (MSH). ✓
- (4) Prolactin regulates the growth of the salivary glands and formations of saliva in them. ✗

4

Given below are some events which occur during muscle contraction.

- A. ATP is hydrolyzed. ✓
- B. Myosin heads bind to actin. ✓
- C. Hemoglobin concentration in muscle fibers increases. ~~✓~~ Myoglobin
- D. Calcium concentration in the sarcomere increase. ✓
- E. I bands shorten and H zones disappear. ✓

Select the correct events which occur during muscle contraction.

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

3

Identify the statement that is NOT correct

- (1) Somatic nervous system – Conducts impulses from CNS to skeletal muscles
- (2) Autonomic nervous system – Conduct impulses from CNS to internal organ muscles
- (3) Central nervous system – Consists of brain and spinal cord
- (4) Visceral nervous system – Consists of nerves carrying impulses to brain and spinal cord only

4

inner organs

Find the statement that is **NOT** correct.

- (1) Reabsorption of water occurs passively in the renal tubules ✓
- (2) Nitrogenous wastes are absorbed by passive transport. ✓ *use*
- (3) Conditional reabsorption of Na^+ and water takes place in DCT. ✓
- (4) DCT reabsorbs glucose. ✓

Handwritten notes:
Aldo → ADH
PCT

4

Question no. 123

Match List - I with List II.

List - I		List - II	
A.	Inspiratory Capacity (IC)	I.	Total air, a person can inspire after normal expiration
B.	Expiratory Capacity (EC)	II.	Maximal volume of the air, a person can breathe in after a forced expiration
C.	Functional Residual Capacity	III.	Volume of the air that will remain in lungs after a normal expiration
D.	Vital Capacity (VC)	IV.	Total volume of air, a person can expire after a normal inspiration

Choose the correct answer from options given below :

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

TV ✓
 IRV ✓
 ERV ✓
 RV ✓

$$IC = TV + IRV$$

$$EC = TV + ERV$$

$$RV + ERV = FRC$$

$$VC = TV + IRV + ERV$$

2

Which of the following are characteristic features of Asteraceae flowers ?

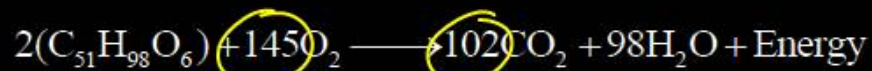
- A. Inflorescence is a capitulum (head) subtended by bracts
- B. Flowers may be ray florets or disc florets
- C. ~~Ovary superior, bicarpellate~~
- D. Fruit is cypsela

Choose the correct answer :

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



Refer the given equation and answer the question



The RQ of above reaction is

(1) ~~1~~

(2) 0.7 ✓

(3) ~~1.45~~

(4) ~~1.62~~

$$R.Q = \frac{\text{CO}_2}{\text{O}_2}$$

$$0.7$$

$$= \frac{102}{145}$$

2

In cockroach, the testes are present in

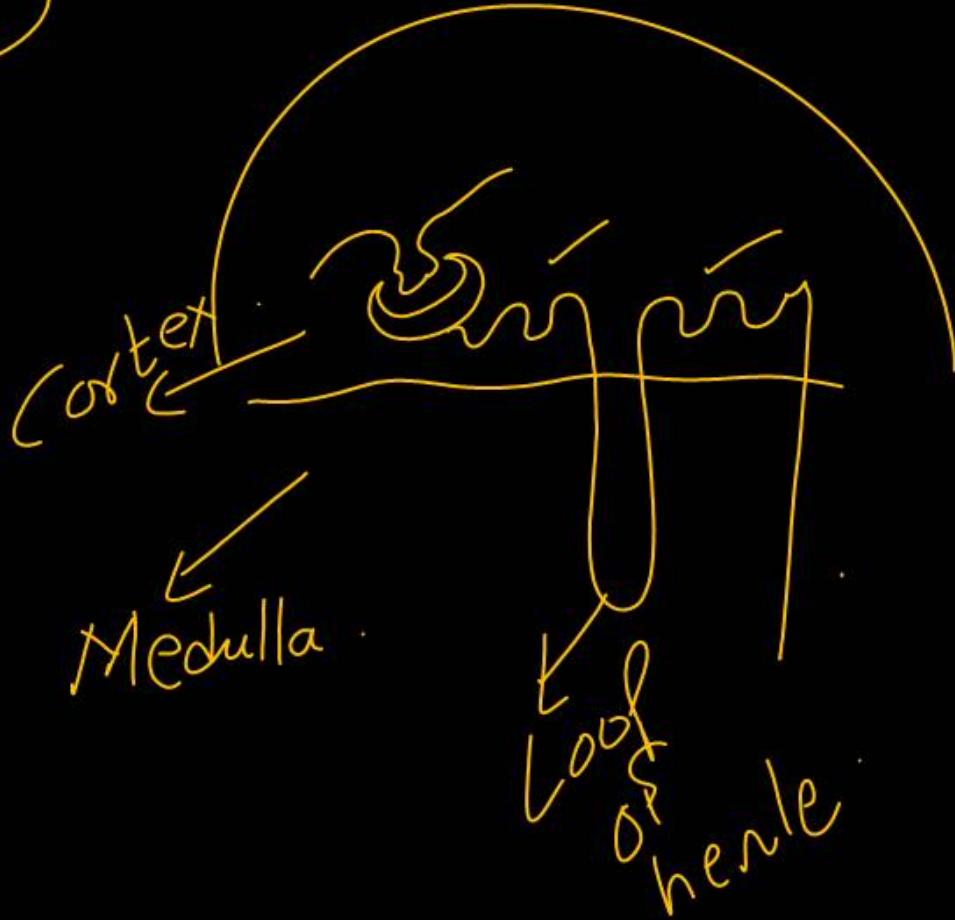
- (1) 3, 4, 5 abdominal segments
- (2) 4, 5, 6 abdominal segments
- (3) 5, 6, 7 abdominal segments
- (4) 6, 7, 8 abdominal segments

2

The cortical region of the kidney has except

- (1) malpighian corpuscle only
- (2) PCT only
- (3) DCT only
- (4) Henle's loop

✓
4



Cartilaginous rings in respiratory passage are present in

- (1) ~~Trachea only~~
- (2) Trachea and initial part of bronchi only
- (3) Trachea, bronchi and initial bronchioles only
- (4) Trachea, bronchi and all bronchioles

3

ABA acts antagonistic to

- (1) ethylene (2) cytokinin
(3) gibberellic acid (4) IAA

→ विरुद्धी

3

Mustard belong to family _____

- (1) Brassicaceae (2) Compositae
(3) Malvaceae (4) Graminae

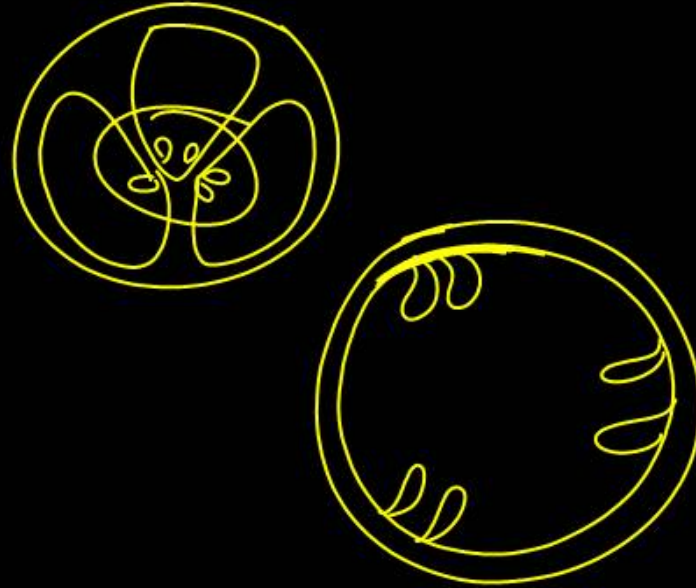
Given below are two statements :

Statement I : When ovules are born on central axis, it is called axile placentation

Statement II : In parietal placentation, the ovules develop on the outer wall of the ovary

Appropriate answer from the options given below :

- (1) Both statement I and statement II are correct
- (2) Both statement I and statement II are incorrect
- (3) Statement I is correct but statement II is incorrect
- (4) Statement I is incorrect but statement II is correct



Which of the following statement is/are the correct about the events in aerobic respiration?

- A. ~~The complete oxidation of pyruvate by the stepwise removal of all the hydrogen atoms, leaving three molecules of O_2 .~~ CO_2
- B. The reactions catalysed by pyruvate dehydrogenase require participation of several coenzymes.
- C. The passing on of the electrons removed as part of the hydrogen atoms to molecular O_2 with simultaneous synthesis of ATP
- D. Kreb's cycle is also called as Tricarboxylic acid cycle
- E. Pyruvate must enter in matrix of mitochondria
- (1) A and C only (2) A and D only
 (3) B, C, D and E only (4) B, D and E only

NAD⁺
 Mg²⁺
 CoA
 Lipoic Acid
 TPP

3

Chemotaxonomy is connected with

- (1) classification of chemicals found in plants
- (2) uses the chemical constituent of plant for classification
- (3) application of chemicals on herbarium sheets
- (4) use of statistical methods in chemicals yielding plants

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

Assertion (A) : Meiosis II is known as equational or homotypic division

Reason (R) : Meiosis II produces same number of chromosome in cell

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

- (1) Both A and R are true and R is the correct explanation of A
- (2) Both A and R are true but R is NOT the correct explanation of A
- (3) A is true but R is false
- (4) A is false but R is true

Binomial nomenclature means

- (1) one name given by two scientists.
- (2) one scientific name consisting of a generic and specific epithet.
- (3) two names, one latinised, other of a person.
- (4) two names of same plant.

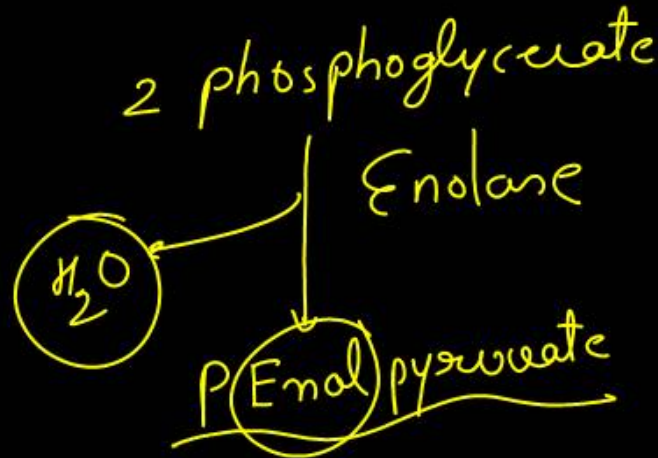
genus
species ✓

2

In which of the following reaction of glycolysis, a molecule of water is removed from the substrate ?

- (1) Fructose - 6 - phosphate \rightarrow Fructose, 1, 6 - bisphosphate
- (2) 3 - phosphate glyceraldehyde \rightarrow 1, 3 biphosphoglyceric acid
- (3) PEP \rightarrow Pyruvic acid
- (4) 2 - phosphoglycerate \rightarrow PEP

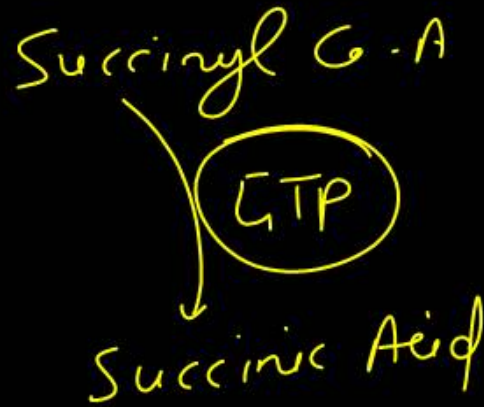
4



In citric acid cycle, energy bond (GTP) is produced as a result of conversion of :

- (1) citric acid to α - keto glutaric acid
- (2) succinic acid to malic acid
- (3) succinyl - CoA to succinic acid
- (4) succinic acid to succinyl - CoA

3



From the statement given below choose the correct option

- A. Genus comprises a group of related species
- B. Taxon represents a taxonomic group of individual organisms
- C. Family comprises a group of related genera
- D. Taxonomic category class include related orders

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

3

Which of the following statement sequences is correct to initiate inspiration?

- A. The contraction of external intercostal muscles raises the ribs and sternum (1)
- B. Volume of thorax increases in the dorso - ventral axis (2)
- C. Increase in pulmonary volume (5)
- D. Diaphragm contraction (3)
- E. Volume of thorax increases in the anterior - posterior axis (4)

(1) A, B, D, E, C ✓

(2) A, B, C, D, E ✗

(3) D, E A, B, C

(4) E, A, B, C, D ✗

(1)

Terminal cytochrome of respiratory chain which donates electrons to oxygen is :

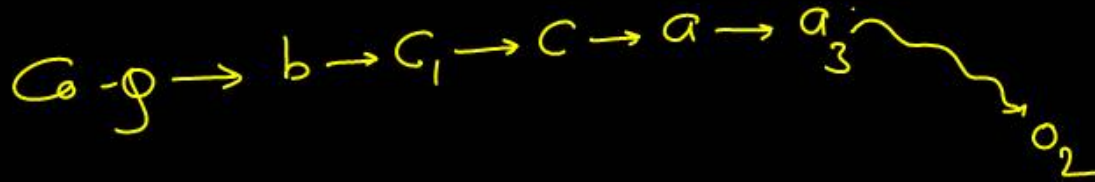
(1) cyt. b

(2) cyt. c

(3) cyt. a

(4) cyt. a₃

4



A process that creates an important difference between C_3 and C_4 plants is called _____

(1) Calvin cycle ✗

(2) photosynthesis ✗

(3) photorespiration

— only in C_3

(4) transpiration

✗/4

3

Find the correct statements :

- A. In Equisetum, the female gametophyte is retained on the parent sporophyte
- B. In Ginkgo, male gametophyte is not independent
- C. The sporophyte in Riccia is more developed than that in Polytrichum
- D. Sexual reproduction in Volvox is isogamous

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

isogamous

M D L

Given below are two statements :

Statement I : Human ribs are bicephalic as they possess two articulation surfaces

Statement II : Floating ribs are not connected to sternum ventrally

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

- (1) Both statement I and statement II are correct
- (2) Both statement I and statement II are correct
- (3) Statement I is correct but statement II is incorrect
- (4) Statement I is incorrect but statement II is correct

✓
- 11th & 12th

1

Match List – I with List – II

List – I (Function)		List – II (Types of enzymes)	
A.	Enzymes catalyse <u>removal of groups</u> from substrates	I.	Isomerases
B.	Enzyme catalysing inter – conversion of optical or positional isomers	II.	Oxidoreductase
C.	Enzymes which catalyse <u>oxidoreduction</u>	III.	Ligases
D.	Enzyme catalysing the linking together of 2 compounds	IV.	Lyases

Dehydro —

3

Choose the correct answer from options given below

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

Capitulum inflorescence surrounded by bracts is characteristic of :

Sunflower

- (1) Asteraceae (2) Malvaceae
(3) Poaceae (4) Brassicaceae



Match List – I with List - II

List – I (Type of synovial joint)		List – II (Bone involved)	
A.	Ball and Socket joint	I.	Carpal and metacarpal of thumb
B.	Hinge joint	II.	Humerus and pectoral girdle
C.	Pivot joint	III.	Knee
D.	Saddle joint	IV.	Atlas and axis

Choose the correct answer from options given below :

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

Match List – I with List - II

List – I		List – II	
			
A.	<u>4C compound</u>	I.	Acetyl CoA 2C
B.	2C compound	II.	Pyruvate 3C
C.	5C compound	III.	α -ketoglutaric acid 5C
D.	3C compound	IV.	Malic acid 4C

Choose the correct answer from options given below :

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



Which of the following statements related to G_0 stage of the cell cycle are correct?

- A. It is a quiescent stage
- B. In this phase, cell cycle is stopped
- C. G_0 cells do not grow or proliferate but metabolically active
- D. G_0 cells cannot divide in response to some stimulus

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

Taxonomic hierarchy refers to:

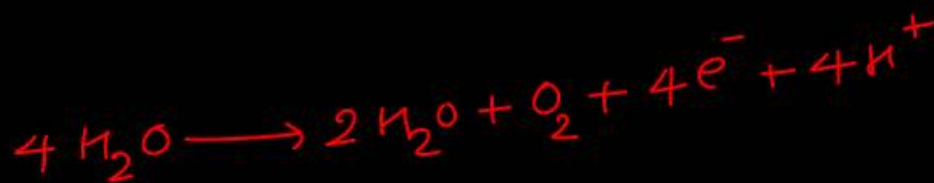
- (1) step-wise arrangement of all categories for classification of plants and animals.
- (2) a group of senior taxonomists who decide the nomenclature of plants and animals.
- (3) a list of botanists or zoologists who have worked on taxonomy of a species or group.
- (4) classification of a species based on fossil record.



Which among the following sentence is not correct about light reaction?

- (1) ~~It is also known as 'photochemical' phase.~~
- (2) ~~It includes light absorption, water splitting, oxygen release, and the formation of high-energy chemical intermediates.~~
- (3) ~~Reaction centre consist of one molecule of chl a and two molecules of chl b.~~
- (4) The pigments are organized into two discrete ~~photochemical~~ light harvesting complexes (LHC) with in PS-I and PS-II.

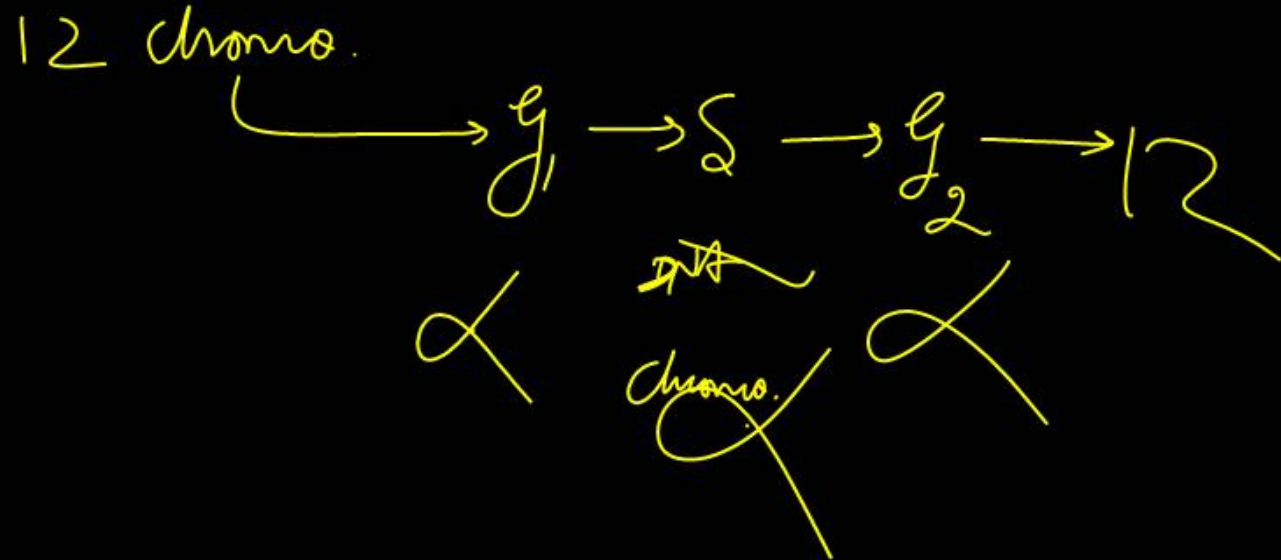
light Energy \rightarrow Chemical Energy
 (ATP + NADPH₂)



3

A plant cell has 12 chromosomes at the end of mitosis.
How many chromosomes would it have in the G_2 -
phase of its next cell cycle?

- (1) 6
- (2) 8
- (3) 12
- (4) 24



Which of the following is the result when karyokinesis is not followed by Cytokinesis?

- (1) Synaptonemal complex
- (2) Syncytium (multinucleate condition)
- (3) Recombination nodules
- (4) Terminalisation.



From the statements given below choose the correct option:

- A. The endomembrane system includes mitochondria, chloroplast and peroxisomes.
- B. Smooth endoplasmic reticulum is the major site for synthesis of lipid.
- C. Rough endoplasmic reticulum is actively involved in protein synthesis.
- D. Mitochondrial matrix possesses single, circular DNA, a few RNA and 80S ribosomes.
- (1) A and C only
- (2) B and D only
- (3) C and D only
- (4) B and C only

Atrial natriuretic factor (ANF) is released in response to the increase in blood volume and blood pressure.

Which of the following is not the function of ANF?

- (1) stimulates aldosterone secretion.
- (2) inhibits the release of renin from JGA.
- (3) stimulates salt loss in urine.
- (4) inhibits sodium reabsorption from collecting duct.

ANF X Aldosterone

1

which of the following statement about the hormone action in humans is correct?

- (1) Binding of a hormone to its receptor leads to the formation of a hormone-receptor complex. ✓
- (2) FSH stimulates the secretion of estrogen and progesterone. φ
- (3) Glucagon is secreted by β-cells of Islets of Langerhans and stimulates glycogenolysis. α-cell.
- (4) Secretion of thymosin is stimulated with ageing. ✗

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

Assertion (A) : Animals belonging to phylum chordate are fundamentally characterised by presence of notochord.

Reason (R) : They possess a post-anal tail.

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

- (1) Both A and R are true and R is the correct explanation of A.
- (2) Both A and R are true but R is **NOT** the correct explanation of A.
- (3) A is true but R is false.
- (4) A is false but R is true.

✓

2

A fall in glomerular filtration rate (GFR) activates

- (1) adrenal cortex to release aldosterone.
- (2) adrenal medulla to release adrenaline.
- (3) juxta - glomerular cells to release renin.
- (4) posterior pituitary to release vasopressin.

Baroreceptor

J. G. cell

3

Match List-I with List-II.

	List-I (Type of secondary metabolite)		List-II (Example)
A.	Alkaloid	I	Abrin
B.	Toxin	II	Morphine
C.	Lectin	III	Vinblastine
D.	Drug	IV	Concanavaline A

Choose the **correct** answer from options given below:

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

2

Acromegaly is caused by

- (1) excess of growth hormone
- (2) excess of thyroxine
- (3) deficiency of thyroxine
- (4) excess of adrenaline

→ Adult
↑ G.H ↑

①

Read the following statements

- A. Metagenesis is observed in Helminths. ✗
- B. Echinoderms are triploblastic and coelomate animals. ✓
- C. Round worms have organ-system level of body organisation. ✓
- D. Comb plates present in ctenophores help in digestion. ✗
- E. Water vascular system is characteristic of Echinoderms. ✓

1

Choose the correct answer from options given below.

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

The steps in catalytic cycle of an enzyme action are given in random order.

- A. The enzyme releases the products. Now enzyme is free to bind another substrate.
- B. The active sites, now in close proximity of substrate breaks the bond of substrate and forms E-P complex.
- C. Binding of substrate induces the enzyme to alter its shape fitting more tightly around the substrate.
- D. The substrate binds to the active site of enzyme (i.e., fitting into the active site).

The correct order is

- (1) A, B, C, D ✗ (2) D, C, B, A ✓
- (3) A, C, B, D ✗ (4) A, B, D, C ✗

Last step

2

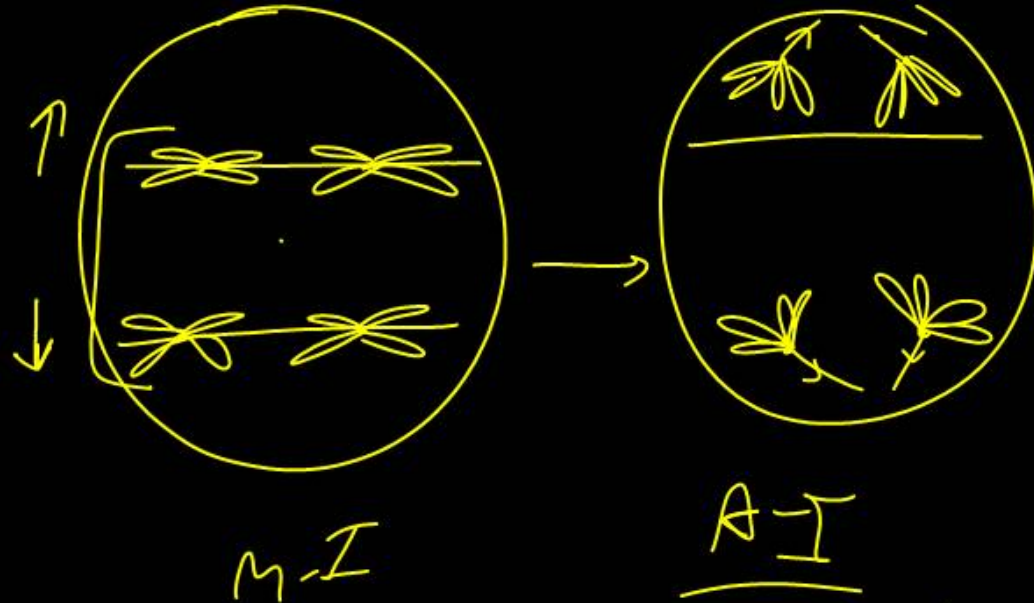
The total requirement of ATP & NADPH for each molecule of CO_2 fixed & reduced in photosynthesis in the Calvin cycle is — 3

- (1) 2 ATP & NADPH (2) 2 ATP & 3 NADPH
(3) 3 ATP & 2 NADPH (4) 4 ATP & 3 NADPH

3

Identify the meiotic stage in which the homologous chromosomes separate while the sister chromatids remain associated at their centromeres

- (1) Metaphase I (2) Metaphase II
(3) Anaphase I (4) Anaphase II



The presence of mononucleated, striated and involuntary muscle fibers is characteristic of :

- (1) Skeletal muscle
- (2) Smooth muscle
- (3) Cardiac muscle ✓
- (4) Connective tissue

3

Thymus in mammals is mainly concerned with

- (1) regulation of body growth
- (2) secretion of thyrotropin
- (3) regulation of body temperature
- (4) immunological functions

4

The part of the nephron impermeable to water is

- (1) proximal tubule
- (2) distal tubule
- (3) ascending limb of Henle's loop
- (4) collecting duct

permeable for electrolytes.
impermeable for water. (3)

Which of the following hormone/enzyme is/are correctly paired with its function ?

- A. Renin - it catalyses the formation of angiotensin I
- B. Aldosterone - Regulates water reabsorption at the distal convoluted tubule.
- C. Anti - diuretic hormone (ADH) - It is a powerful vasoconstrictor that stimulates the secretion of aldosterone
- D. Aldosterone - Promotes reabsorption of sodium at distal convoluted tubule

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

Angiotensinogen → A-I

Priority - 1st

1

Match List – I with List II

	List – I (Cell type)		List – II (Size)
A.	Viruses	I	1 – 2 mm
B.	PPLO	II	10-20 mm
C.	Eukaryotic cell	III	About 0.1 mm
D.	Bacterium	IV	<u>0.02-0.2 mm</u>

Choose the correct answer from options given below :

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

Given below are two statements :

Statement I : "Foolish Seeding or Bakanae" disease of rice led to the discovery of GA ✓

Statement II : GA₃ was one of the first gibberellins to be discovered ✓

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

- (1) Both statement I and statement II are correct
- (2) Both statement I and statement II are incorrect
- (3) Statement I is correct but statement II is incorrect
- (4) Statement I is incorrect but statement II is correct

1

Accumulation of uric acid crystals in the synovial joint causes

- (1) rheumatoid arthritis
- (2) gout
- (3) osteoarthritis
- (4) muscular dystrophy

2

Given below are two statement : one is labelled as

Assertion (A) and the other is labelled as Reason (R)

Assertion (A) : In lymphatic system, lymph is known as tissue fluid ✓

Reason (R) : It comprises of plasma proteins, RBCs and WBCs ✗

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

- (1) Both A and R are true and R is the correct explanation of A
- (2) Both A and R are true but R is NOT the correct explanation of A.
- (3) A is true but R is false ✓
- (4) A is false but R is true

3

Match List – I with List - II

	List – I		List – II
A.	Pineal	I.	Epinephrine
B.	Thyroid	II.	Melatonin
C.	Ovary	III.	Estrogen
D.	Adrenal medulla	IV.	Tetraiodothyronine

Choose the correct answer from options given below :

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

4

Which of the following are the characters of dinoflagellates?

- A. These organisms are mostly marine and photosynthetic. ✓
- B. Cell wall has stiff cellulose plates. ✓
- C. They appear yellow, green, brown, blue and red in colour. ✓
- D. Most of them have two flagella. ✓
- E. Their toxin can kill other organism. ✓

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

3

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

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

3

Aux Cyt
GA = ABA

Auxin

Match List-I with List-II.

	List-I		List-II
A	Leeuwenhoek	I.	First saw and described <u>a living cell</u>
B	Robert <u>Brown</u>	II.	Presence of cell wall is <u>unique to plant cells</u>
C	Schleiden	III.	Discovered the nucleus
D	Schwann	IV.	All plants are composed <u>of different kind of cells</u>

Choose the correct answer from options given below:

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

Which of the following is wrongly matched?

(1)	Ribozyme	Proteinaceous in nature. <i>X</i>
(2)	Apoenzyme	The protein part of enzyme.
(3)	Co-enzyme	Loosely attached organic cofactor of holoenzyme
(4)	Co-factors	Non-protein part of holoenzyme.

Nucleic Acid .

1

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

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

increase in blood urea level.

3

Identify the correct characteristics of porifera.

- A Commonly known as sea walnuts. ~~X~~
- B Presence of ostia and collar cells. ✓
- C Exhibit tissue level of characteristics. ~~X~~
- D It is the largest phylum of animal kingdom. ~~X~~
- E The body is supported by spicules and sponging fibers. ✓

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

1

Male cockroach can be identified from the female by the presence of

- (1) long antennae
- (2) wingless body
- (3) elongated abdomen
- (4) anal styles



4

Cerebellum of brain is

- (1) concerned with the maintenance of posture/equilibrium
- (2) responsible for olfactory functions
- (3) controls optic functions
- (4) controls voluntary actions.

1