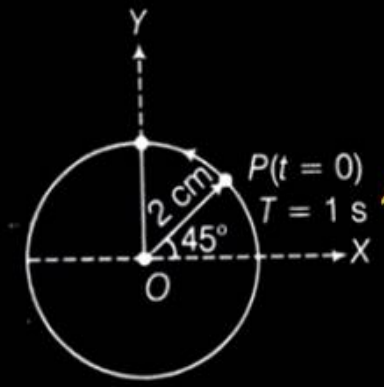
Question no. 1

Figure shows the circular motion of a particle. The radius of the circle, the period, sense of revolution and the initial position are indicated in the figure. The simple harmonic motion of the x-projection of the radius vector of the rotating particle P is



(1) $x = 2\cos\left(2\pi t + \frac{\pi}{4}\right)$ (2) $x = 2\sin\left(2\pi t + \frac{\pi}{4}\right)$

(3) $x = 2\sin\left(2\pi t - \frac{\pi}{4}\right)$ (4) $x = 2\cos\left(2\pi t - \frac{\pi}{4}\right)$

$A = 2cm$

$t = 0$

$y = A\sin(\omega t + 90^\circ + 45^\circ)$

$y = A\cos(\omega t + 45^\circ)$

$y = (2cm)\cos(2\pi t + 45^\circ)$

$\omega = \frac{2\pi}{1}$

$\frac{\pi}{4}$

Question no. 2

A particle executes SHM with amplitude 0.2 m and time period 24 s. The time required for it to move from the mean position to a point 0.1 m from the mean position is

(1) 2 s
(2) 3 s
(3) 8 s
(4) 12 s

$$y = A\sin\left(\frac{2\pi}{24}t\right)$$

$$0.1 = 0.2\sin\left(\frac{2\pi t}{24}\right)$$

$$\frac{2\pi t}{24} = \frac{\pi}{6}$$

$$t = 12/6 = 2\ \text{sec}$$

Question no. 3

x - t

The displacement-time graph for a particle executing SHM is as shown in figure.

Which of the following statements is correct?

(1) The velocity of the particle is maximum at $t = \frac{3}{4}T$.

(2) The velocity of the particle is maximum at $t = \frac{T}{2}$.

(3) The acceleration of the particle is maximum at $t = \frac{T}{4}$.

(4) The acceleration of the particle is maximum at $t = \frac{3}{4}T$.

mean pos $x = 0$ ✓ → V_{max}

$a = 0$

1

Question no. 4

If a simple harmonic motion is represented by $\frac{d^2x}{dt^2} + \beta x = 0$, its time period is

(1) $2\pi\sqrt{\beta}$

(2) $2\pi\beta$

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

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

3

$$\frac{d^2x}{dt^2} + \omega^2 x = 0$$

$$\omega^2 = \beta$$

$$\omega = \sqrt{\beta}$$

$$\frac{2\pi}{T} = \sqrt{\beta}$$

$$T = \frac{2\pi}{\sqrt{\beta}}$$

Question no. 5

The displacement of a particle along the x axis is given by $x = a\sin^2 \omega t$. The motion of the particle corresponds to

(1) Simple harmonic motion of frequency ω/π

(2) Simple harmonic motion of frequency $3\omega/2\pi$

(3) non simple harmonic motion

(4) simple harmonic motion of frequency $\omega/2\pi$

$2\omega = 2\pi f$

$f = \omega/\pi$

$x = a\sin^2 \omega t$

$x = a\left(\frac{1-\cos 2\omega t}{2}\right)$

$x = \frac{a}{2} - \frac{a}{2}\cos(2\omega t)$

SHM

Mean position $x = a/2$

Question no. 6

A physical quantity X is given by $X = \frac{2k^3l^2}{m\sqrt{n}}$. The percentage error in the measurements of k, l, m and n are 1%, 2%, 3% and 4% respectively. The value of X is uncertain by

(1) 8%
(2) 10%
(3) 12%
(4) 14%

% error $= 3(1\%) + 2(2\%) + 1(3\%) + \frac{1}{2}(4\%)$

$= 3\% + 4\% + 3\% + 2\%$

$= 12\%$

3

Question no. 7

Two identical charged spheres are suspended by strings of equal length. The strings make an angle of 30° with each other. When suspended in a liquid of density 0.8 g cm^{-3}, the angle remains the same. What is the dielectric constant of the liquid?

[Density of the material of sphere is 1.6 g cm^{-3}]

(1) 2 (2) 4

(3) 6 (4) 6

$$\varepsilon_r = \frac{\rho_{solid}}{\rho_{solid} - \rho_{liq}}$$

$$\varepsilon_r = \frac{1.6}{1.6 - 0.8} = \frac{1.6}{0.8} = 2$$

Question no. 8

The ratio of the de Broglie wavelength of a proton and an α-particle of same kinetic energy is

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

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

1

$$\lambda = \frac{h}{p} = \frac{h}{\sqrt{2mK}}$$

$$\lambda \propto \frac{1}{\sqrt{m}}$$

$$\frac{\lambda_p}{\lambda_\alpha} = \sqrt{\frac{m_\alpha}{m_p}} = \sqrt{\frac{4m_p}{m_p}} = \frac{2}{1}$$

Question no. 9

An inductance of $(200/\pi)$ mH, a capacitance of $(10^{-3}/\pi)$ F and a resistance of 10Ω are connected in series with an ac source 220v, 50 Hz. The phase angle of the circuit is

(1) $\pi/6$ (2) $\pi/4$

(3) $\pi/2$ (4) $\pi/3$

2

$L = \frac{200}{\pi} \times 10^{-3} H$

$\omega = 100\pi$

$X_L = \omega L$

$= \frac{200}{\pi} \times \frac{1}{1000} \times 100\pi$

$X_L = 20\Omega$

$X_C = \frac{1}{\omega C} = \frac{1}{100\pi \times 10^{-3}} = 10\Omega$

$\tan\phi = \frac{X_L - X_C}{R}$

$= \frac{20 - 10}{10} = 1$

$\phi = 45^\circ$

Question no. 10

Energy obtained when 1 mg mass is completely converted to energy is

(1) 3×10^2 J

(2) 3×10^{10} J

(3) 9×10^{10} J

(4) 9×10^2 J

3

$E = mc^2$

$E = (10^{-3} \times 10^{-3}\ kg) \times 9 \times 10^{16}$

$E = 9 \times 10^{10}$ J

Question no. 11

400 cc volume of a gas having $\gamma = 5/2$ is suddenly compressed to 100 cc. If the initial pressure is P, then the final pressure will be

(1) P/32 (2) 8P

(3) 32P (4) 16P

$$P_1 V_1^{\gamma} = P_2 V_2^{\gamma}$$

$$P(400)^{5/2} = P_2 (100)^{5/2}$$

$$P_2 = P\left(\frac{400}{100}\right)^{5/2}$$

$$P_2 = P\left((4)^{1/2}\right)^5$$

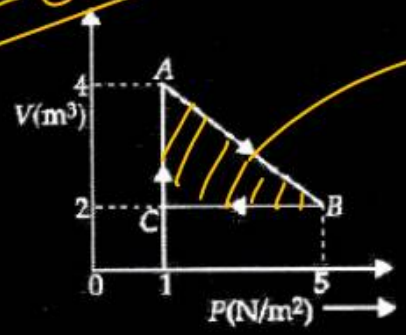
$$= P\,2^5$$

$$= 32P$$

(3)

Question no. 12

An ideal gas is taken through the cycle A → B → C → A, as shown in figure. If the net heat supplied to the gas in the cycle is 5J, the work done by the gas in the process A → B is



(1) 2J
(2) 3J
(3) 4J
(4) 5J

Question no. 13

A system is subjected to a thermodynamic process in which heat transfer, change in internal energy and work done are represented by $Q, \Delta E_{int}$ and W. Which of the following statements is wrong for the process?

(1) In an adiabatic process : $Q=0,\ \Delta E_{int} = -W$

(2) In a constant volume process: $W=0,\ \Delta E_{int} = Q$

(3) In a closed cycle : $\Delta E_{int} = 0, Q=W$

(4) In free expansion : $Q=W=0,\ \Delta E_{int} > 0$

FLOT

$Q = \Delta U + W$

4

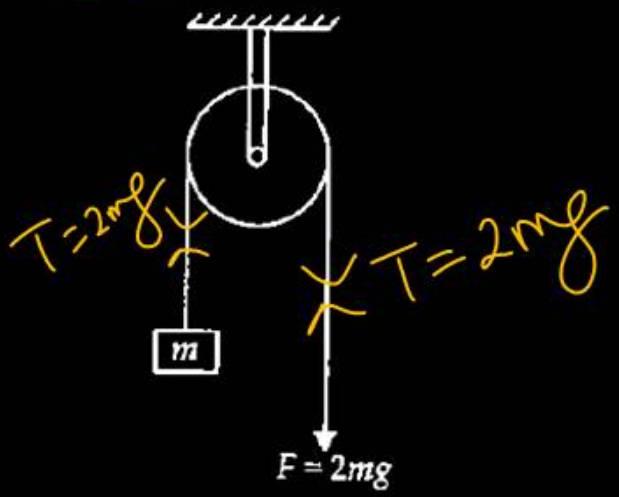
$Q=0$

$W=0$

$\Delta E=0$

Question no. 14

In the arrangement shown in figure, if a force 2mg is applied at the free end of the rope, the mass m will ascend with an acceleration of



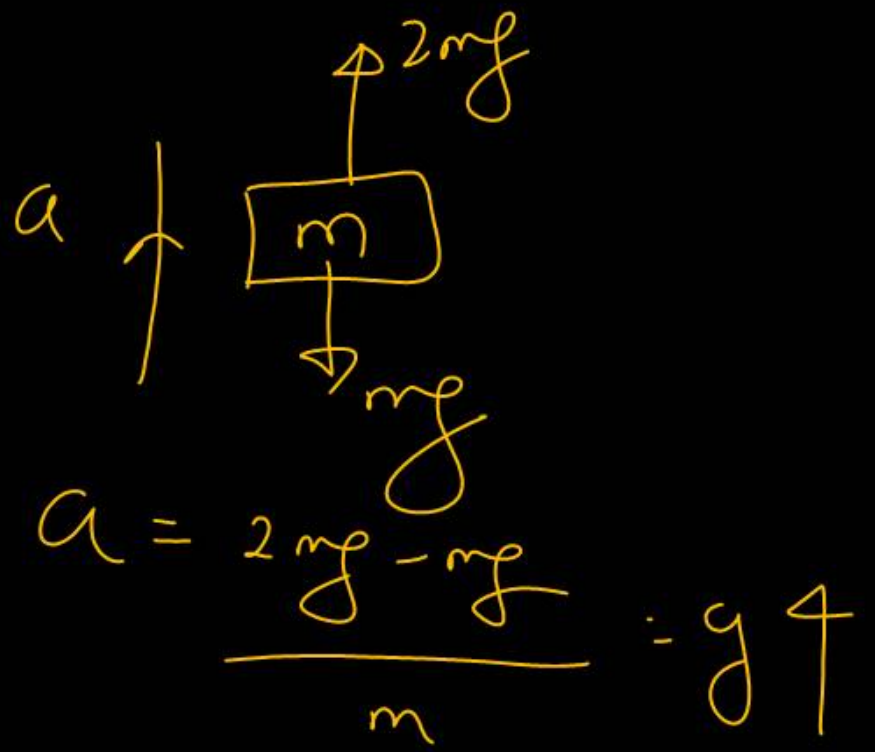
(1) $\frac{g}{3}$

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

(3) g

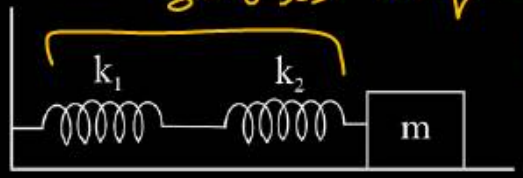
(4) 2g

3



Question no. 15

Two springs of spring constants k_1 and k_2 are joined in series and a mass m is attached to them as shown in figure.



The time period of the oscillation of the mass is

(1) $T = \pi\sqrt{\dfrac{m(k_1+k_2)}{k_1k_2}}$ (2) $T = 2\pi\sqrt{\dfrac{m(k_1+k_2)}{k_1k_2}}$

(3) $T = \dfrac{1}{2\pi}\sqrt{\dfrac{m(k_1+k_2)}{2k_1k_2}}$ (4) $T = 2\pi\sqrt{\dfrac{m(k_1+k_2)}{2k_1k_2}}$

2

Question no. 16

A travelling wave is represented by the equation $y = \frac{1}{10}\sin(60t + 2x)$, where x and y are in metres and t is in seconds. The represents a wave

(A) travelling with a velocity of 30 ms^{-1}

(B) of frequeney $\frac{30}{\pi}$ Hertz

(C) of wavelength π metre

(D) of amplitude 10 cm

(E) moving in the positive x direction

Pick out correct statements from the above

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

(3) A, B, C, D (4) All of these

3

$y = \left(\frac{1}{10}\text{meter}\right)\sin(60t + 2x)$

ω K

$2\pi f = 60$ $K = 2$

$f = \frac{30}{\pi}$ $\frac{2\pi}{\lambda} = 2$

$\lambda = \pi m$

$v = \frac{\omega}{K} = \frac{60}{2} = 30 m/s$

Question no. 17

The equation y=A sink(νt-x) represents wave $\left(k=\frac{2\pi}{\lambda}\right)$

(1) a plane progressive wave travelling along negative x-direction

(2) a plane progressive wave travelling along positive x-direction

(3) a stationary wave

(4) a plane progressive wave travelling along positive

$y = A \sin(kvt - kx)$

$A \sin(\omega t - kx)$

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

PPW

+x

Question no. 18

A 5.5 metre length of string has a mass of 0.035 kg. If the tension in the string is 77N , the velocity of the wave on the string is

(1) 210 ms^{-1} (2) 40 ms^{-1}

(3) 110 ms^{-1} (4) 55 ms^{-1}

$$V = \sqrt{\frac{T}{\mu}} = \sqrt{\frac{T}{m/\ell}}$$

$$V = \sqrt{\frac{T\ell}{m}}$$

$$V = \sqrt{\frac{77 \times 55 \times 100}{35 \quad 10}}$$

$$V = 11 \times 10 = 110\ m/s$$

(3)

Question no. 19

The ratio of speed of sound in helium and hydrogen gases at the same temperature is

(1) $\sqrt{42} : \sqrt{25}$ (2) $\sqrt{25} : \sqrt{42}$

(3) 42 : 25 (4) 25 : 42

(2)

$$V = \sqrt{\frac{\gamma RT}{M}}$$

$$V \propto \sqrt{\frac{\gamma}{M}}$$

$$\frac{V_{He}}{V_{H_2}} = \sqrt{\frac{\gamma_{He}}{m_{He}}} \times \sqrt{\frac{m_{H_2}}{\gamma_{H_2}}}$$

$$= \sqrt{\frac{\gamma_{He}}{\gamma_{H_2}} \times \frac{m_{H_2}}{m_{He}}} = \sqrt{\frac{5/3}{7/5} \times \frac{1}{4}}$$

$$= \sqrt{\frac{25}{42}}$$

Question no. 20

A transformer is used to light a 100 W and 110 V lamp using a 220 V mains supply. If the supply current is 0.5 A, then the efficiency of the transformer is

(1) 100%
(2) 99%
(3) 90.9%
(4) 87.7%

3

$P_{out} = 100 \text{ watt}$

$P_{in} = 220 \times 0.5$

$P_{in} = 22 \times 5$

$$\eta = \frac{100}{22 \times 5} \times 100 = \frac{10}{11} \times 100$$

$$= \frac{1000}{11} \%$$

$$= 90.9 \%$$

Question no. 21

In the figure show below :

(1) In both figure (i) and figure (ii) the didoes are forward biased.

(2) In both figure (i) and figure (ii) the diodes are reverse biased.

(3) In figure (i), the diode is forward biased and in figure (ii), the diodes are reverse biased.

(4) In figure (i), the diode is reverse biased and in figure (ii), the diodes is forward biased.

Question no. 22

The first line the Lyman series has wavelength λ. The first line in the Balmer series has wavelength

(1) $\frac{27}{5}\lambda$

(2) $\frac{5}{27}\lambda$

(3) $\frac{9}{2}\lambda$

(4) $\frac{2}{9}\lambda$

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

$\frac{1}{\lambda} = R \times 3/4$

$R = \frac{4}{3\lambda}$

(1)

$\frac{1}{\lambda'} = R(1)^2\left(\frac{1}{2^2} - \frac{1}{3^2}\right)$

$\frac{1}{\lambda'} = R\left(\frac{1}{4} - \frac{1}{9}\right) = \frac{4}{3\lambda} \times \frac{5}{36} = \frac{5}{27\lambda}$

$\lambda' = \frac{27}{5}\lambda$

Question no. 23

The work function of the nickel is 5 eV. When a light of wavelength 2000 Å falls on it, it emits photoelectrons in the circuit. Then the potential difference necessary to stop the fastest electrons emitted is

(1) 1.0 V (2) 1.7 V

(3) 1.2 V (4) 0.7 V

3

$E - \phi_0 = eV_{st}$

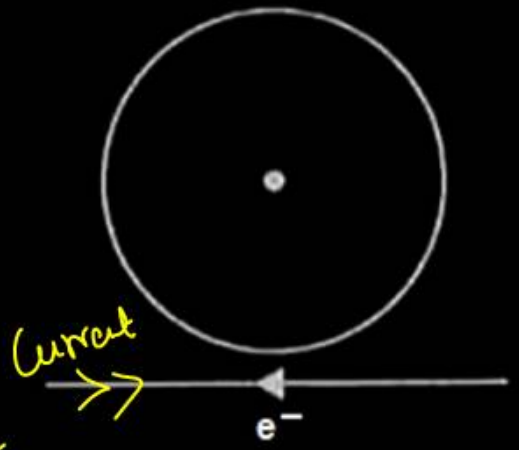
$\frac{12400}{2000} - 5eV = eV_{st}$

$6.2eV - 5eV = eV_{st}$

$V_{st} = 1.2 volt$

Question no. 24

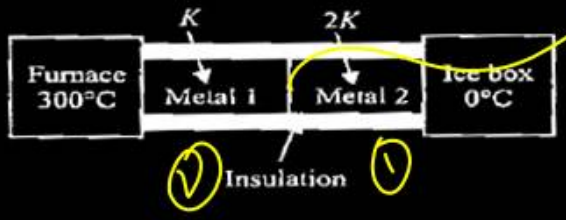
Near a circular loop of conducting wire as shown in the figure, an electron moves along a striaght line. The direction of the induced current if any in the loop is



(1) variable
(2) clockwise
(3) anticlockwise
(4) zero

Question no. 25

In the diagram, a system of two metals of equal lengths and of same cross sectional area are joined together.



The coefficient of thermal conductivities of the metals are K and 2K respectively. If the furnace temperature at one end is 300° C and ice box temperature at the other end is 0°C, then the junction temperature is

(1) 100°C (2) 125°C

(3) 150°C (4) 200°C

$$\theta = \frac{k_1\theta_1 l_2 + k_2\theta_2 l_1}{k_1 l_2 + k_2 l_1}$$

$$= \frac{2k \cdot 0 \cdot l + 300\,k \cdot l}{k \cdot l + 2k \cdot l}$$

$$= \frac{300\,kl}{3kl} = 100^\circ C$$

Question no. 26

Two black bodies at temperatures 327°C and 427°C are kept in an evacuated chamber at 27°C. The ratio of their rates of loss of heat are

(1) $\left(\frac{6}{7}\right)$

(2) $\left(\frac{6}{7}\right)^2$

(3) $\left(\frac{6}{7}\right)^3$

(4) $\frac{243}{464}$

$27^\circ C + 273 = 300K$

$T_1 = 327 + 273 = 600K$

$T_2 = 427 + 273 = 700K$

$$E = e A \sigma (T^4 - T_0^4) \quad (1)$$

$$\frac{E_1}{E_2} = \frac{T_1^4 - T_0^4}{T_2^4 - T_0^4} = \frac{600^4 - 300^4}{700^4 - 300^4} = \frac{108(6^4 - 3^4)}{108(7^4 - 3^4)}$$

Question no. 27

If the coefficient of linear expansion of a metal is $0.00002\ K^{-1}$, then the necessary increase in temperature of the metal rod in order to increase its length by 2% is

(1) 100 K (2) 373 K

(3) 400 K (4) 1000 K

$L' = L + \frac{2}{100}L = \frac{102}{100}L$

$\Delta L = L' - L$

$= \frac{2}{100} \cdot L$

$\Delta L = L \alpha \Delta T$

$\Delta T = \frac{\Delta L}{L \alpha}$

$= \frac{\frac{2}{100} L}{L \alpha} \times 100000$

$= 1000\,K$

Question no. 28

At what temperature the root mean square velocity of a gas is twice of its root mean square velocity at 27°C?

(1) 927°C (2) 827°C

(3) 727°C (4) 627°C

$T = 1200 - 273$

$V_{rms} = \sqrt{\frac{3RT}{M}}$

$2 (V_{rms})_{300} = V_{rms\,(T+273)}$

$2\sqrt{\frac{3 \cdot R \cdot 300}{M}} = \sqrt{\frac{3 \cdot R \cdot (T+273)}{M}}$

$1200 = T + 273$

Question no. 29

If d is the average diameter of the molecule, then the mean free path of the molecules between two successive collisions is proportional to

(1) d (2) d^2

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

$$\ell = \frac{1}{\sqrt{2}\, n \left(\frac{1}{d^2}\right)}$$

Question no. 30

$\alpha = -\omega^2 x$

The displacement, velocity and acceleration in a simple harmonic motion are related as the

(1) displacement, velocity and acceleration all act in the same direction

(2) displacement and velocity act in the same direction, but acceleration in the opposite direction

(3) velocity and acceleration are parallel and both are perpendicular to the displacement

(4) displacement and acceleration are antiparallel and both perpendicular to the velocity

Question no. 31

A particle is executing linear simple harmonic motion of amplitude A. At what displacement is the energy of the particle half potential and half kinetic?

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

(3) $\frac{A}{\sqrt{2}}$ (4) $\frac{A}{\sqrt{3}}$

$E_k = E_p$

$\frac{1}{2}(m\omega^2)(A^2 - x^2) = \frac{1}{2}m\omega^2 x^2$

$A^2 = 2x^2$

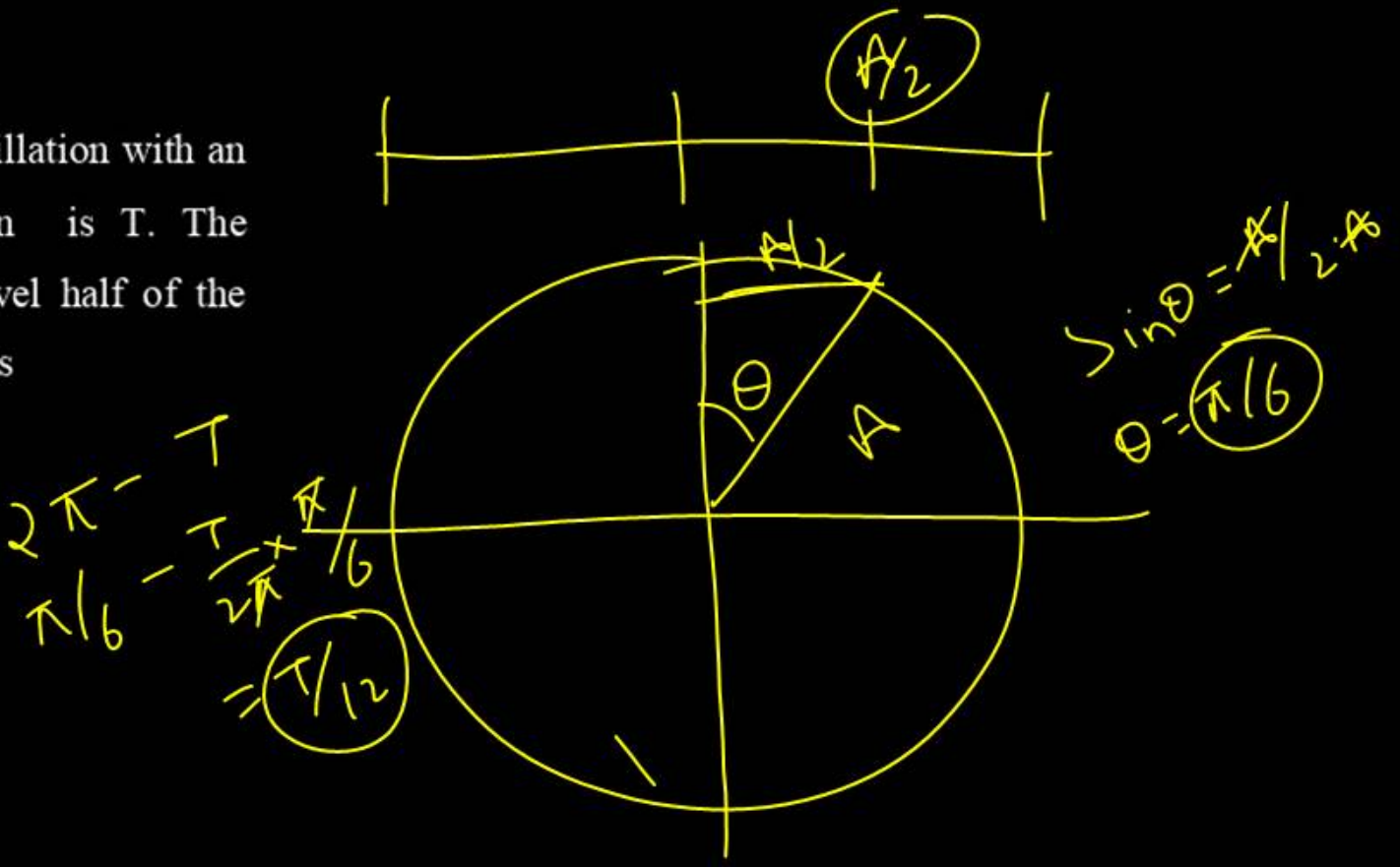
$x = \frac{A}{\sqrt{2}}$

Question no. 32

A particle executes simple harmonic oscillation with an amplitude a. The period of oscillation is T. The minimum time taken by particle to travel half of the amplitude from the equilibrium position is

(1) T/4 (2) T/8

(3) T/12 (4) T/2



Question no. 33

Let T_1 and T_2 be the time periods of springs A and B when mass M is suspended from one end of each spring. If both springs are taken in series and the same mass M is suspended from the series combination, the time period is T, then

(1) $T=T_1+T_2$

(2) $\frac{1}{T}=\frac{1}{T_1}+\frac{1}{T_2}$

(3) $T^2=T_1^2+T_2^2$

(4) $\frac{1}{T^2}=\frac{1}{T_1^2}+\frac{1}{T_2^2}$

$T_1=2\pi\sqrt{\frac{m}{k_1}}$

$T_1^2=4\pi^2\frac{m}{k_1}$

$\Rightarrow \frac{1}{k_1}=\frac{T_1^2}{4\pi^2 m}$

$\frac{1}{k_2}=\frac{T_2^2}{4\pi^2 m}$

key

$\frac{1}{k_{eq}}=\frac{1}{k_1}+\frac{1}{k_2}$

$\frac{T^2}{4\pi^2 m}=\frac{T_1^2}{4\pi^2 m}+\frac{T_2^2}{4\pi^2 m}$

$T^2=T_1^2+T_2^2$

Question no. 34

What is the phase difference between two simple harmonic motions represented by $x_1 = A\sin\left(\omega t + \frac{\pi}{6}\right)$ and $x_2 = A\cos(\omega t)$?

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

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

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

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

$x_1 = A\sin(\omega t + \pi/6)$

$x_2 = A\sin(\omega t + \pi/2)$

$\Delta\phi = \phi_2 - \phi_1$

$= \pi/2 - \pi/6$

$= \frac{3\pi - \pi}{6} = \frac{2\pi}{6} = \pi/3$

Question no. 35

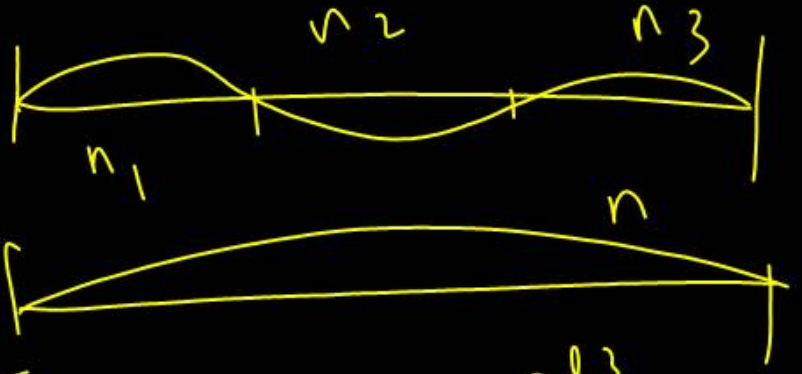
If n_1, n_2 and n_3 are the fundamental frequencies of three segments into which a string is divided, then the original fundamental frequency n of the string is given by

(1) $\frac{1}{n}=\frac{1}{n_1}+\frac{1}{n_2}+\frac{1}{n_3}$

(2) $\frac{1}{\sqrt{n}}=\frac{1}{\sqrt{n_1}}+\frac{1}{\sqrt{n_2}}+\frac{1}{\sqrt{n_3}}$

(3) $\sqrt{n}=\sqrt{n_1}+\sqrt{n_2}+\sqrt{n_3}$

(4) $n=n_1+n_2+n_3$



$$\frac{1}{n}=\frac{2\ell}{\sqrt{T/\mu}}=\frac{2(\ell_1+\ell_2+\ell_3)}{\sqrt{T/\mu}}$$

$$\frac{1}{n}=\frac{2\ell_1}{\sqrt{T/\mu}}+\frac{2\ell_2}{\sqrt{T/\mu}}+\frac{2\ell_3}{\sqrt{T/\mu}}$$

$$\frac{1}{n}=\frac{1}{n_1}+\frac{1}{n_2}+\frac{1}{n_3}$$

$$n=\frac{1}{2\ell}\sqrt{\frac{T}{\mu}}$$

$$\frac{1}{n_1}=\frac{2\ell}{\sqrt{T/\mu}}\qquad \frac{1}{n_2}=\frac{2\ell_2}{\sqrt{T/\mu}}\qquad \frac{1}{n_3}=\frac{2\ell_3}{\sqrt{T/\mu}}$$

Question no. 36

A closed organ pipe and an open organ pipe of same length produce 2 beats sec^{-1} when they are set into vibrations together in fundamental mode. The length of open pipe is now halved and that of closed pipe is doubled. The number of beats produced will be

(1) 7 (2) 4

(3) 8 (4) 2

$f_0 - f_c = 2$

$\frac{V}{2\ell} - \frac{V}{2(4\ell)} = 2$

$\frac{2V - V}{4\ell} = 2$

$V = 8\ell$

$\frac{V}{2(\ell/2)} - \frac{V}{2(4\ell)} =$

$\frac{V}{\ell} - \frac{V}{8\ell} = \frac{8V - V}{8\ell}$

$= \frac{7}{8}\left(\frac{V}{\ell}\right)$

$= \frac{7}{8} \times 8$

Question no. 37

The frequency of the second overtone of the open pipe is equal to the frequency of first overtone of the closed pipe . The ratio of the lengths of the open pipe and the closed pipe is

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

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

$\frac{3v}{2l_o} = \frac{3v}{4l_c}$

$\frac{2}{1} = \frac{l_o}{l_c}$

2nd overtone open / 3rd harmonic

$\nu_o = 3 \cdot \frac{v}{2l_o}$

1st overtone closed / 3rd harmonic.

$\nu_c = 3 \cdot \frac{v}{4l_c}$

Question no. 38

If 10 g of ice is added to 40 g of water at 15°C , then the temperature of the mixture is

(Specific heat of water $=4.2\times10^{3}\ \text{J kg}^{-1}\ \text{k}^{-1}$, Latent heat of fusion of ice $= 3.36\times10^{5}\ \text{J kg}^{-1}$)

(1) 15° C

(2) 12° C

(3) 10° C

(4) 0° C

Water

$m s \Delta T$

$\Rightarrow \frac{40}{1000} \times 4.2\times10^{3} \times 15$

$= 42 \times 60$

$= 2520\ \text{J}$

ice

$Q = mL$

$\frac{10}{1000} \times 3.36\times10^{5} =$

3360 J

Question no. 39

A black body emits radiations of maximum intensity for the wavelength of 5000 Å when the temperature of the body is 1227°C. If the temperature of the body is increased by 1000°C, the maximum intensity would be observed at

(1) 1000 Å (2) 2000 Å

(3) 3000 Å (4) 4000 Å

$\lambda_m \cdot T = b$ Const

$\lambda_{m_1} T_1 = \lambda_{m_2} T_2$

$T_1 = 1227 + 273 = 1500\,k$

$5000\,\text{Å} \times 1500 = \lambda_{m_2} \times 2500$

$\lambda_{m_2} = \frac{5000 \times 1500}{2500} = 3000\,\text{Å}$

$T_2 = 2500\,k$

Question no. 40

A force F acting on a body depends on the distance x as $F \propto x^{-1/3}$. The power delivered by F will depend on distance x as

(1) x^0

(2) $x^{-1/2}$

(3) $x^{-5/3}$

(4) $x^{2/3}$

$P = f \cdot v$

$= x^{-1/3} \cdot x^{1/3}$

$P = 0$

$ma \propto x^{-1/3}$

$\frac{dv}{dt} \propto x^{-1/3}$

$v\frac{dv}{dx} \propto x^{-1/3}$

$\int v\,dv \propto \int x^{-1/3}\,dx$

$v^2 \propto x^{-1/3+1}$

$v^2 \propto x^{2/3}$

$v \propto x^{\frac{1}{3}\times\frac{1}{2}}$

$v \propto x^{1/3}$

Question no. 41

A ball of mass m moving with a speed υ makes a head on collision with an identical ball at rest. The kinetic energy after collision of the balls is three fourth of the original kinetic energy. The coefficient of restitution is

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

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

$m \cdot v = m v_1 + m v_2$ — (I)

$\frac{\frac{1}{2} m v_1^2 + \frac{1}{2} m v_2^2}{\frac{1}{2} m v^2} = \frac{3}{4}$ — (II)

Question no. 42

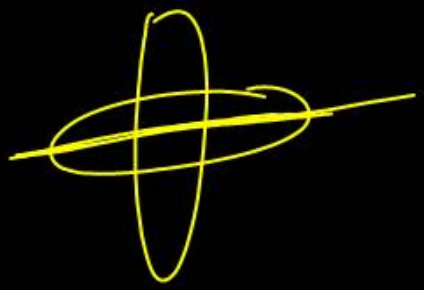
Two identical concentric rings each of mass M and radius R are placed perpendicularly. What is the moment of inertia about axis of one of the rings?

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

(2) $2MR^2$

(3) $3MR^2$

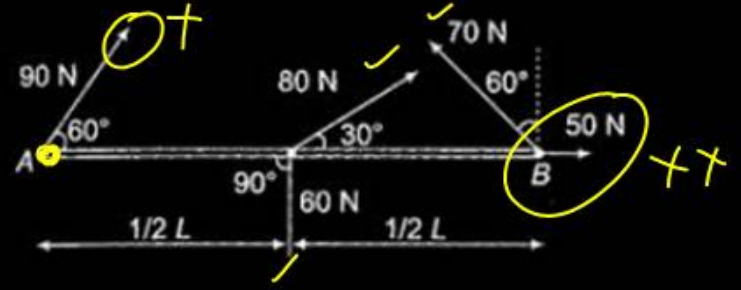
(4) $\frac{1}{4}MR^2$



$$MR^2 + \frac{MR^2}{2} = \frac{3}{2}MR^2$$

Question no. 43

The total torque about pivot A provided by the forces shown in the figure, for L = 3.0 m, is



(1) 210 N m
(2) 140 N m
(3) 95 N m
(4) 75 N m

$(80 \sin 30) \times \frac{3}{2}$

$40 \times \frac{3}{2}$

$+60$ Nm

-90 Nm

$+105$ Nm

-165

-90

$60 \times \frac{3}{2} = 90$

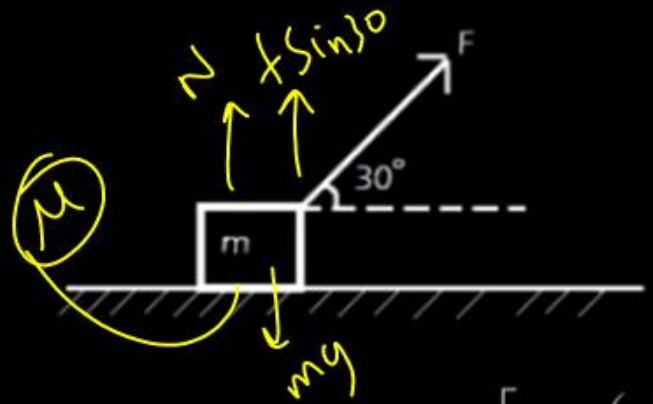
$70 \cos 60 \times 3$

$70 \times \frac{1}{2} \times 3$

$= 105$ Nm

Question no. 44

A mass m rests on horizontal surface. The coefficient of friction between the mass and the surface is μ. If the mass is pulled by a force F as shown in figure, the limiting friction between mass and surface will be



(1) μmg

(2) $\mu\left[mg-\left(\frac{\sqrt{3}}{2}\right)F\right]$

(3) $\mu\left[mg-\frac{F}{2}\right]$

(4) $\mu\left[mg+\frac{F}{2}\right]$

$\Sigma f_y = 0$

$N + f\sin 30 = mg$

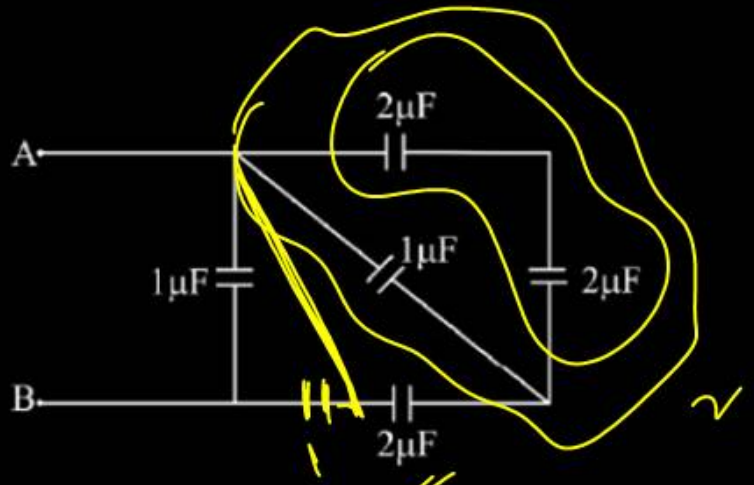
$N = mg - \frac{f}{2}$ (1)

$f_L = \mu N$

$= \mu\left(mg - \frac{f}{2}\right)$

Question no. 45

The equivalent capacitance between the points A and B is



(1) 1 μF (2) 2 μF

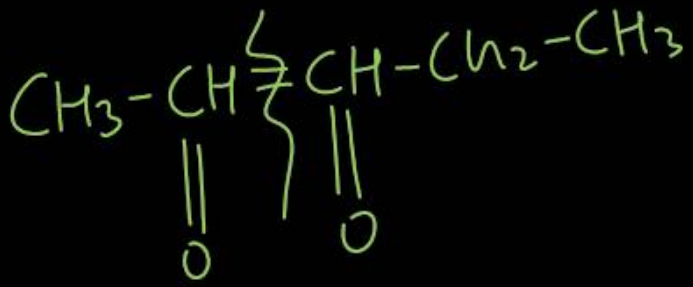
(3) 3 μF (4) 4 μF

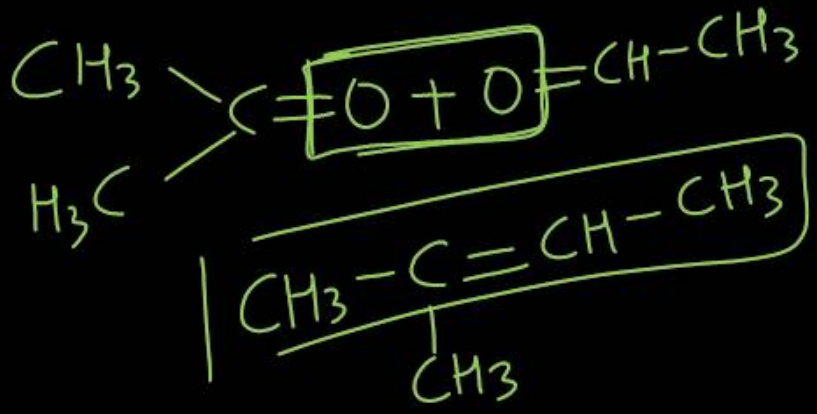
Question no. 46

An alkene having molecular formula C_5H_{10}, on ozonolysis gives two compounds, acetone and an aldehyde. The alkene is

(1) pent–2–ene (2) 2–methylbut–2–ene

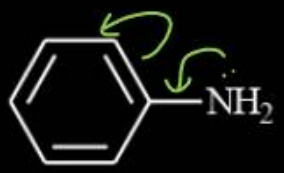
(3) 2–methylbut–1–ene (4) 3–methylbut – 1–ene

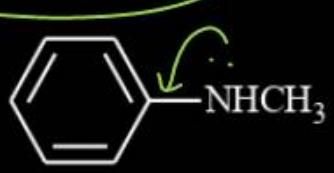


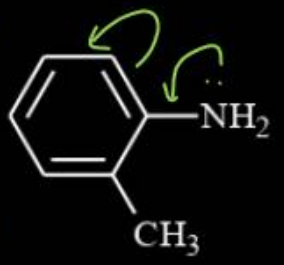


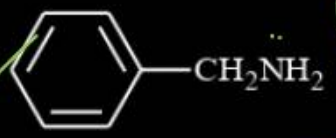
Question no. 47

Which of the following is the strongest base?

(1) 

(2) 

(3) 

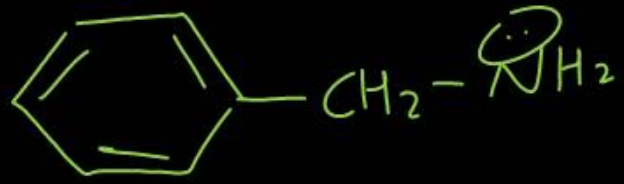
(4) 

localized lp more Basic

Base ⇒ lp donate

ed ↑

lp localized
lp not in R



Question no. 48

Propene, $CH_3\ CH = CH_2$ can be converted into 1–propanol by oxidation. Indicate which set of reagents amongst the following is ideal for the above conversion?

(1) $KMnO_4$ (alkaline)

(2) Osmium tetroxide (OsO_4/CH_2Cl_2)

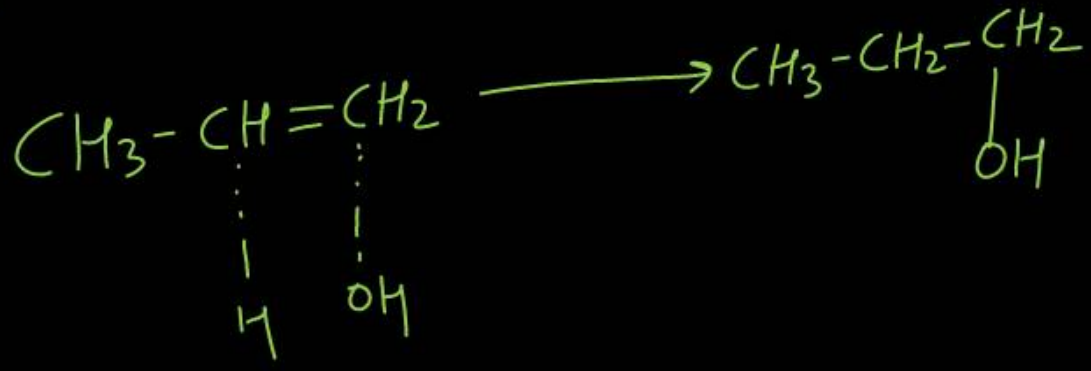
(3) B_2H_6 and alk. H_2O_2

(4) O_3/Zn

Hydroxylation

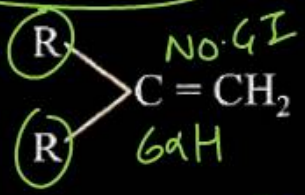
(Hydroboration – oxidation)

3

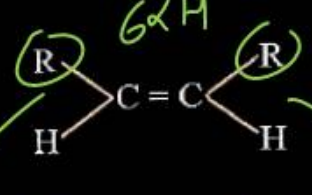


Question no. 49

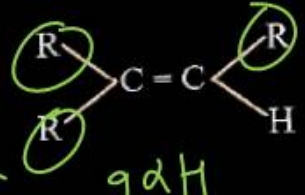
The catalytic hydrogenation is more easier in case of which alkene?

(1) 

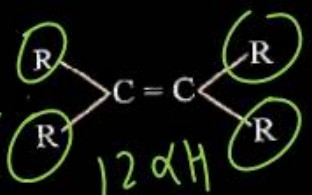
No. of α-H

(2) 

6 α-H

(3) 

9 α-H

(4) 

12 α-H

R = CH3

Stability of alkene $\propto \frac{1}{\text{Reactivity}}$

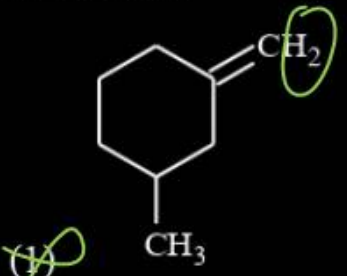
Reactivity ↓
Hydrogenation ↓

least stable (2)

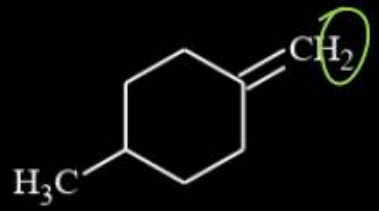
Easy Hydrogenation
Reactive Alkene
less stable alkene
less substituted
less no. of α-H

Question no. 50

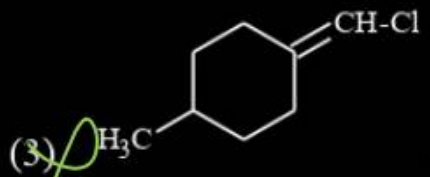
Which of the following compound show geometrical isomerism?



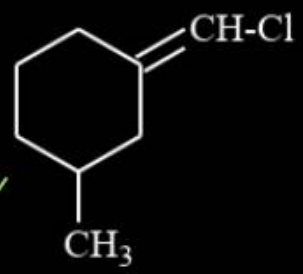
(1)



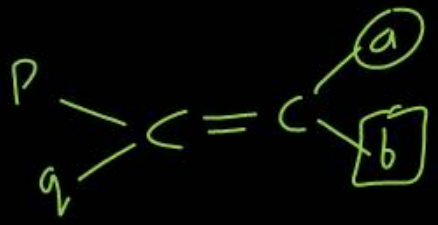
(2)

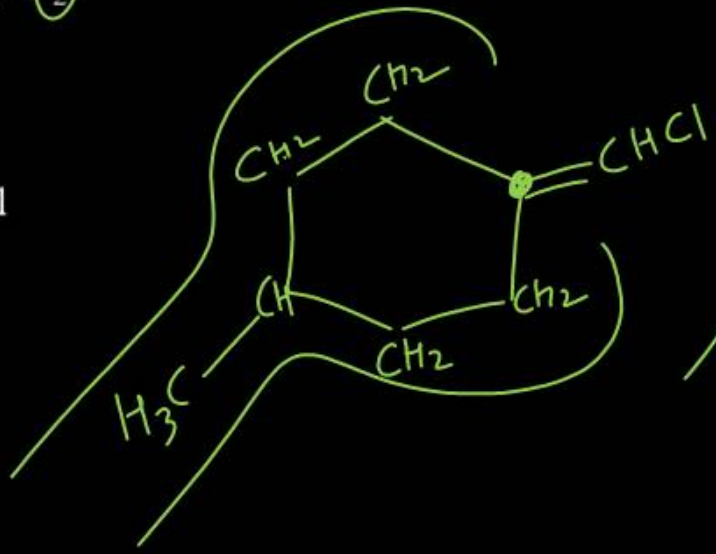


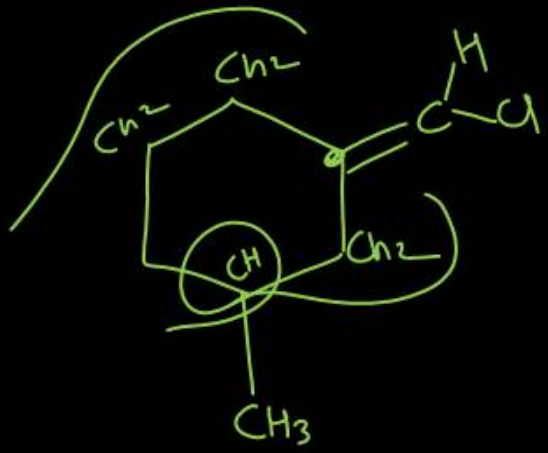
(3)



(4)







Question no. 51

Consider the following compounds.

I. NH_3 II. $C_2H_5NH_2$

III. $(C_2H_5)_2NH$ IV. $(C_2H_5)_3N$

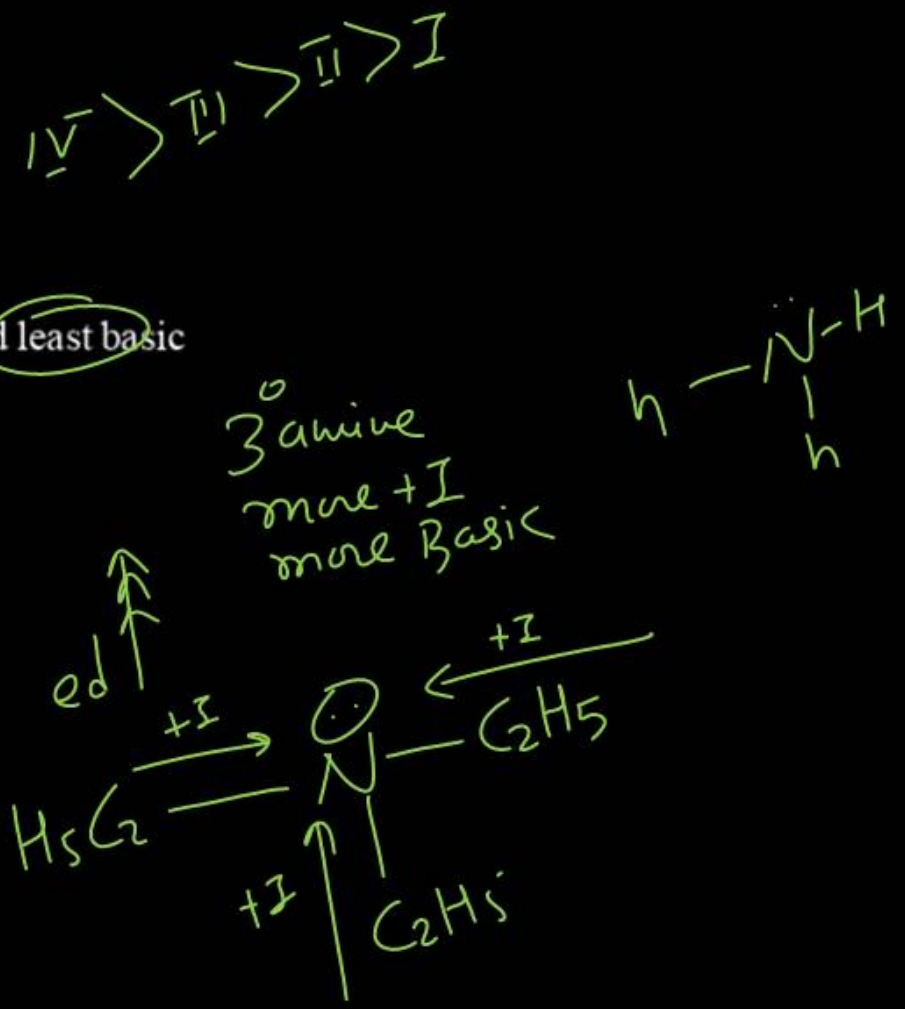
Among the given compound, highly basic and least basic respectively are

(1) $(C_2H_5)_2NH$ and NH_3

(2) $(C_2H_5)_3N$ and NH_3

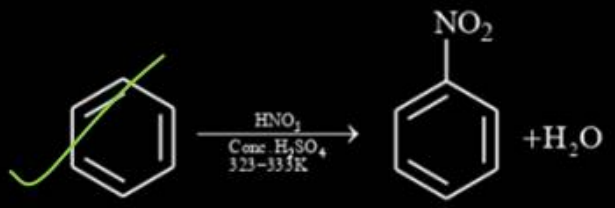
(3) NH_3 and $C_2H_5NH_2$

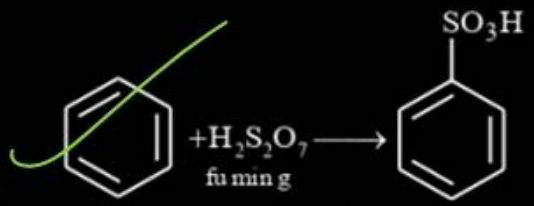
(4) $C_2H_5NH_2$ and $(C_2H_5)_3N$

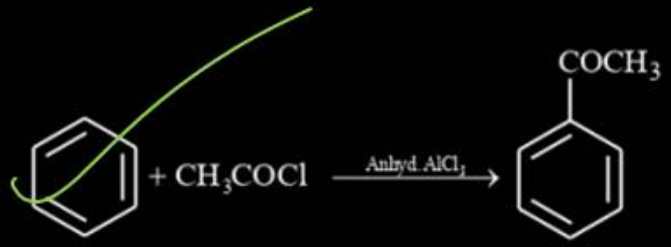


Question no. 52

Which of the following reaction is/are the example of electrophilic substitution reaction?

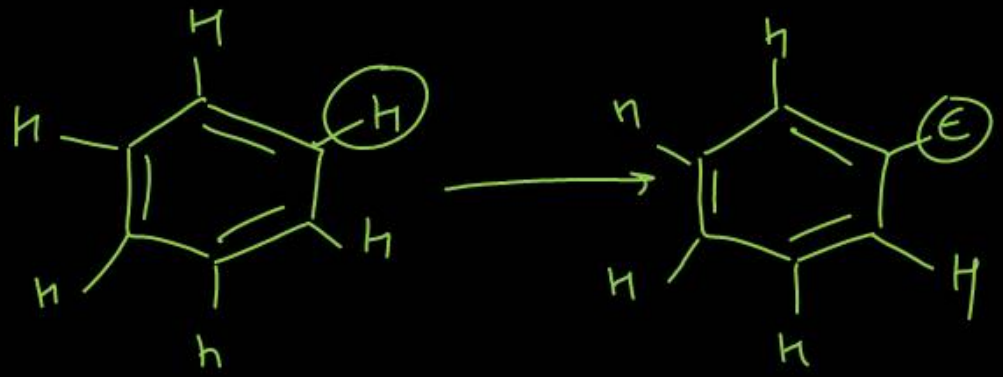
I. 

II. 

III. 

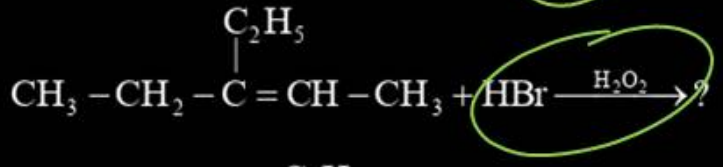
Choose the correct option.

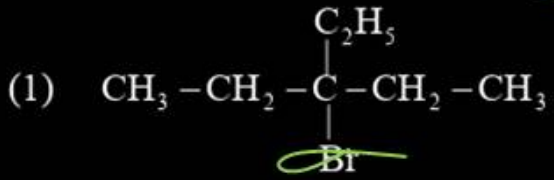
(1) Only III
(2) I and II
(3) I and III
(4) I, II and III

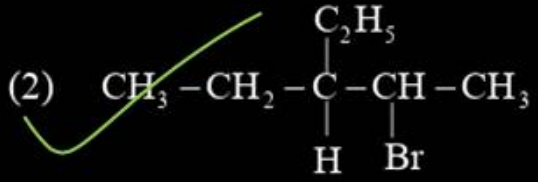


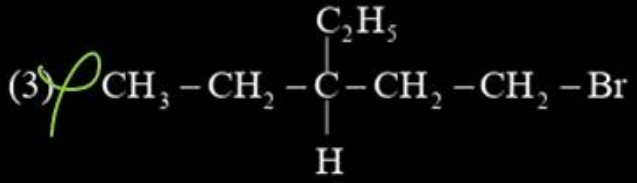
Question no. 53

Product of the following reaction is

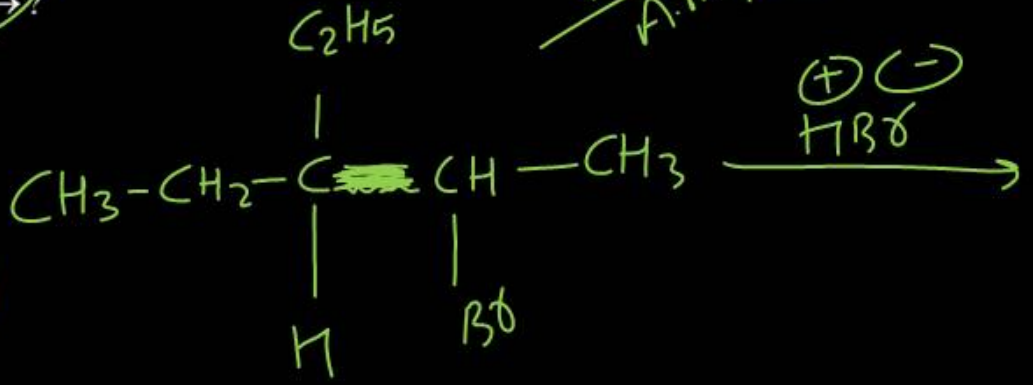


(1) 

(2) 

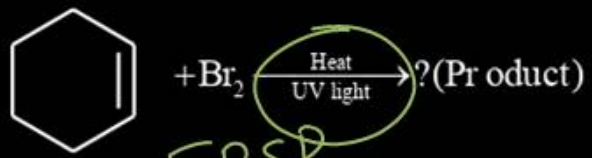
(3) 

(4) Reaction uneffected



Question no. 54

Identify the product formed in the following reaction.

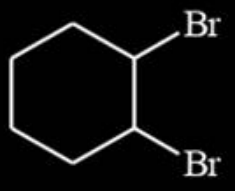


FRSR

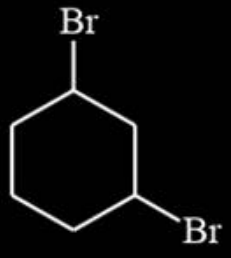
(1)

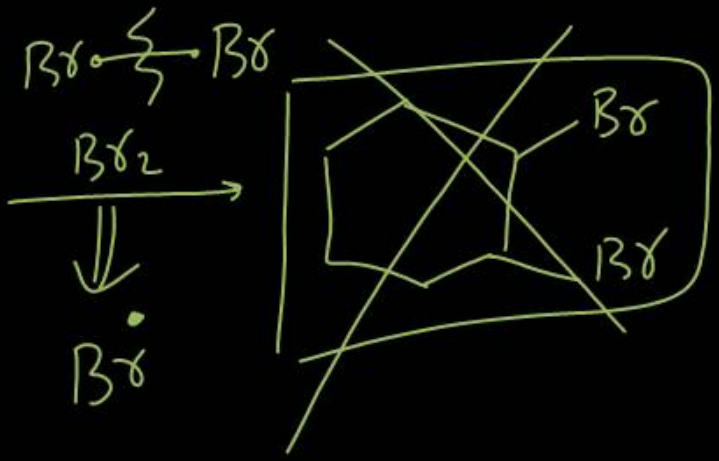
(2)

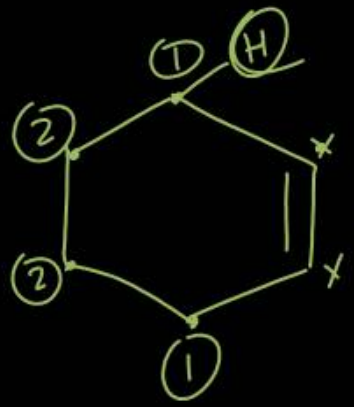
(3)

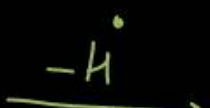


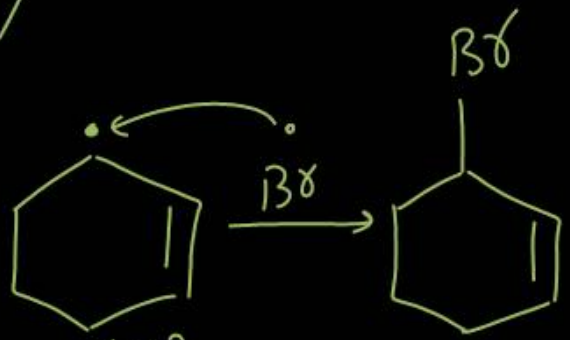
(4)







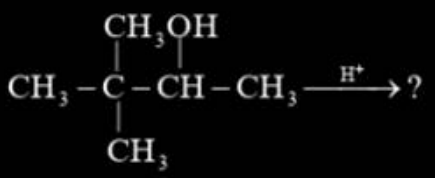


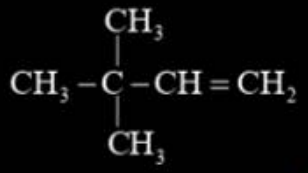


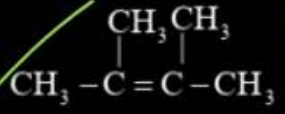
Stable by R

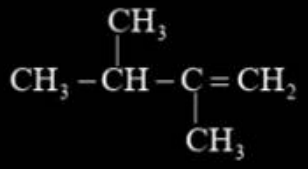
Question no. 55

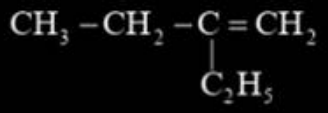
What will be the major product of the following reaction :

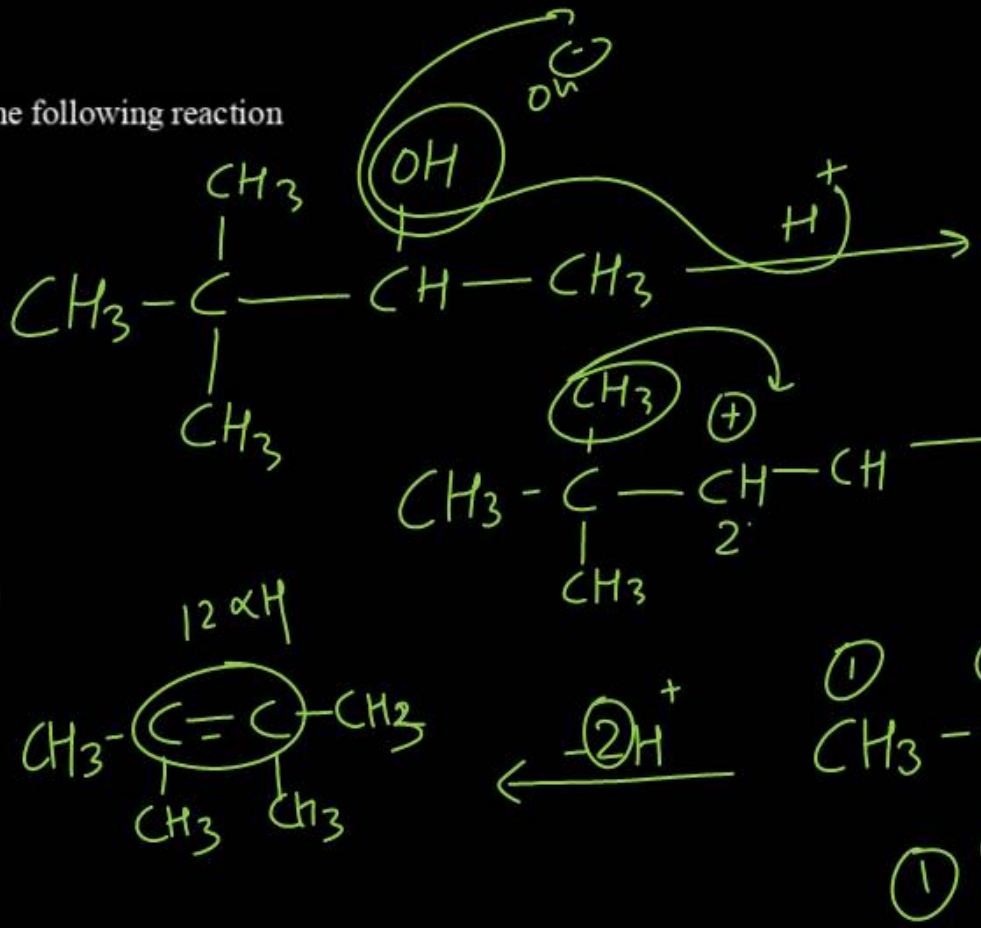


(1) 

(2) 

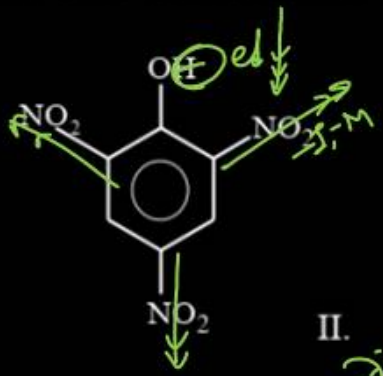
(3) 

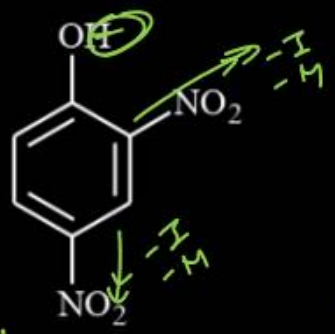
(4) 

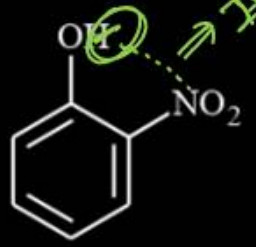


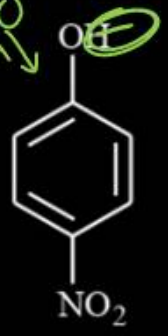
Question no. 56

Correct order of acidic nature of following compounds :

I. 

II. 

III. 

IV. 

Choose the correct option.

(1) I > II > III > IV (2) I > II > IV > III

(3) I > IV > II > III (4) IV > I > II > III

Question no. 57

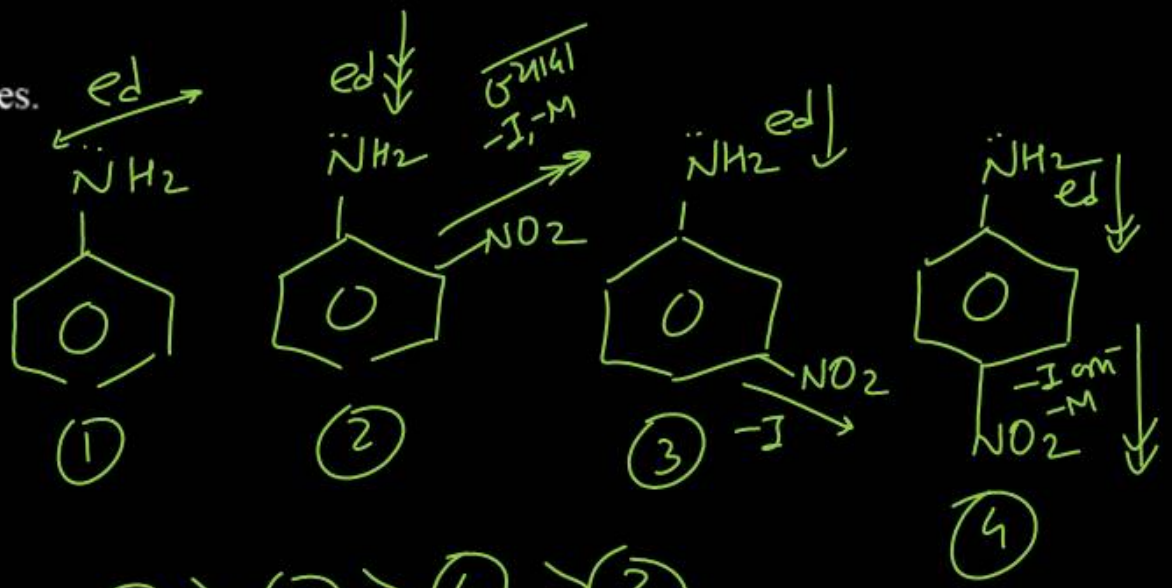
Choose correct order of basic nature of aromatic amines.

(1) Aniline > m-nitroaniline > p-nitroaniline > o-nitroaniline

(2) Aniline > p-nitroaniline > m-nitroaniline > o-nitroaniline

(3) p-nitroaniline > Aniline > m-nitroaniline > o-nitroaniline

(4) Aniline > o-nitroaniline > m-nitroaniline > p-nitroaniline



Question no. 58

Boiling point of a 2% (w/w) aqueous solution of a non– volatile solute A is equal to the boiling point of 8% (w/w) aqueous solution of a non–volatile solute B. The relation between molecular weights of A and B is

(1) $M_A = 4M_B$ (2) $M_B = 4M_A$

(3) $M_A = 8M_B$ (4) $M_B = 8M_A$

$\Delta T_b = K_b m$

$\Delta T_{bA} = \Delta T_{bB}$

$K_b m_A = K_b m_B$

$$\frac{2}{M_A} \times \frac{1000}{98} = \frac{8}{M_B} \times \frac{1000}{92}$$

$$\frac{M_B}{M_A} = \frac{4}{1}$$

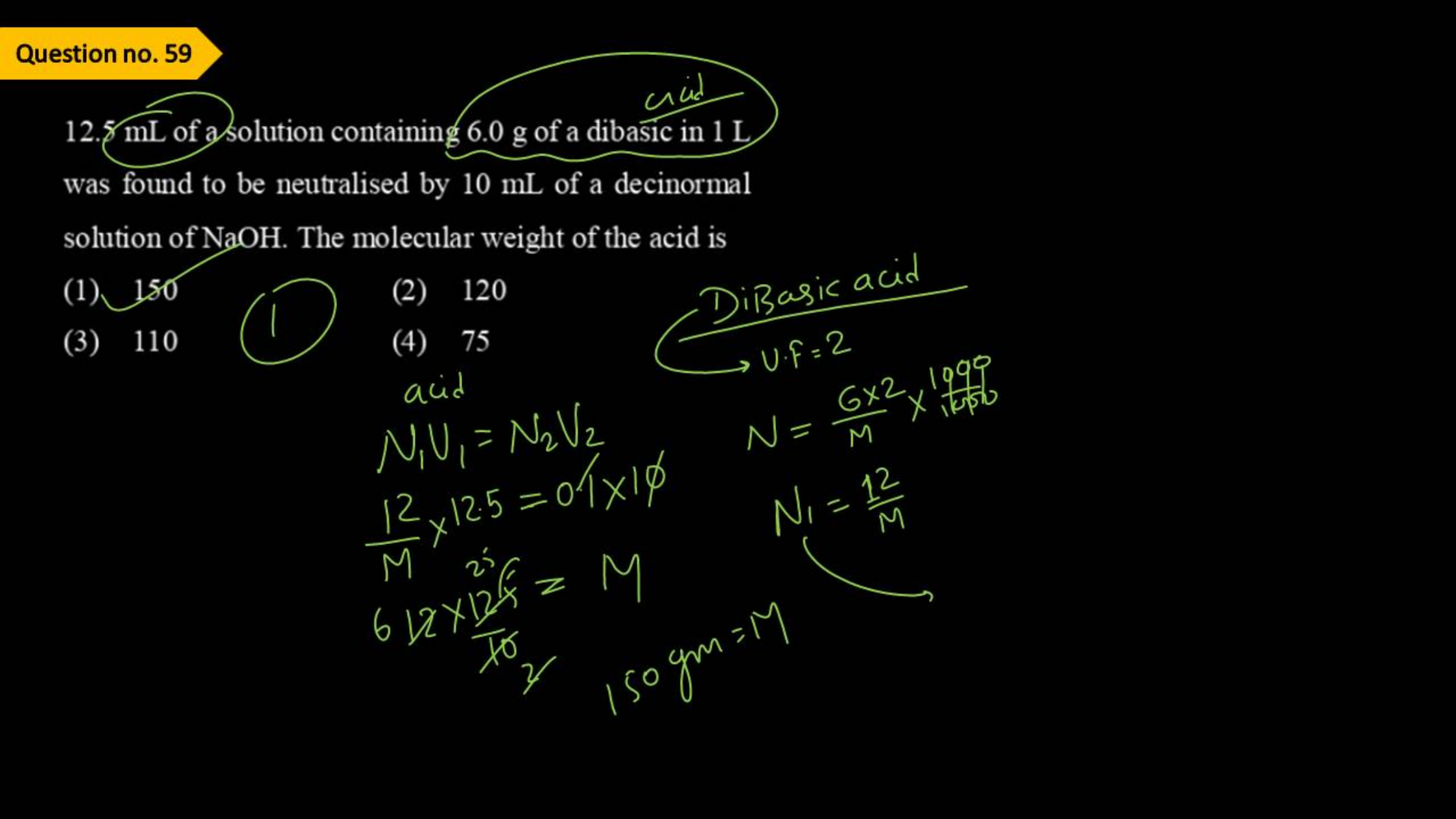
$$M_B = 4M_A$$

$$\frac{M_B}{M_A} = \frac{1}{4} \times \frac{98}{92} \quad (4.26)$$

Question no. 59

12.5 mL of a solution containing 6.0 g of a dibasic in 1 L was found to be neutralised by 10 mL of a decinormal solution of NaOH. The molecular weight of the acid is

(1) 150
(2) 120
(3) 110
(4) 75



Question no. 60

Which of the following statements is incorrect?

I. According to Pauli's exclusion principle, no two electrons in an atom can have the same value of quantum numbers n, l and m.

II. The total energy of an electron in an orbit is half of its potential energy.

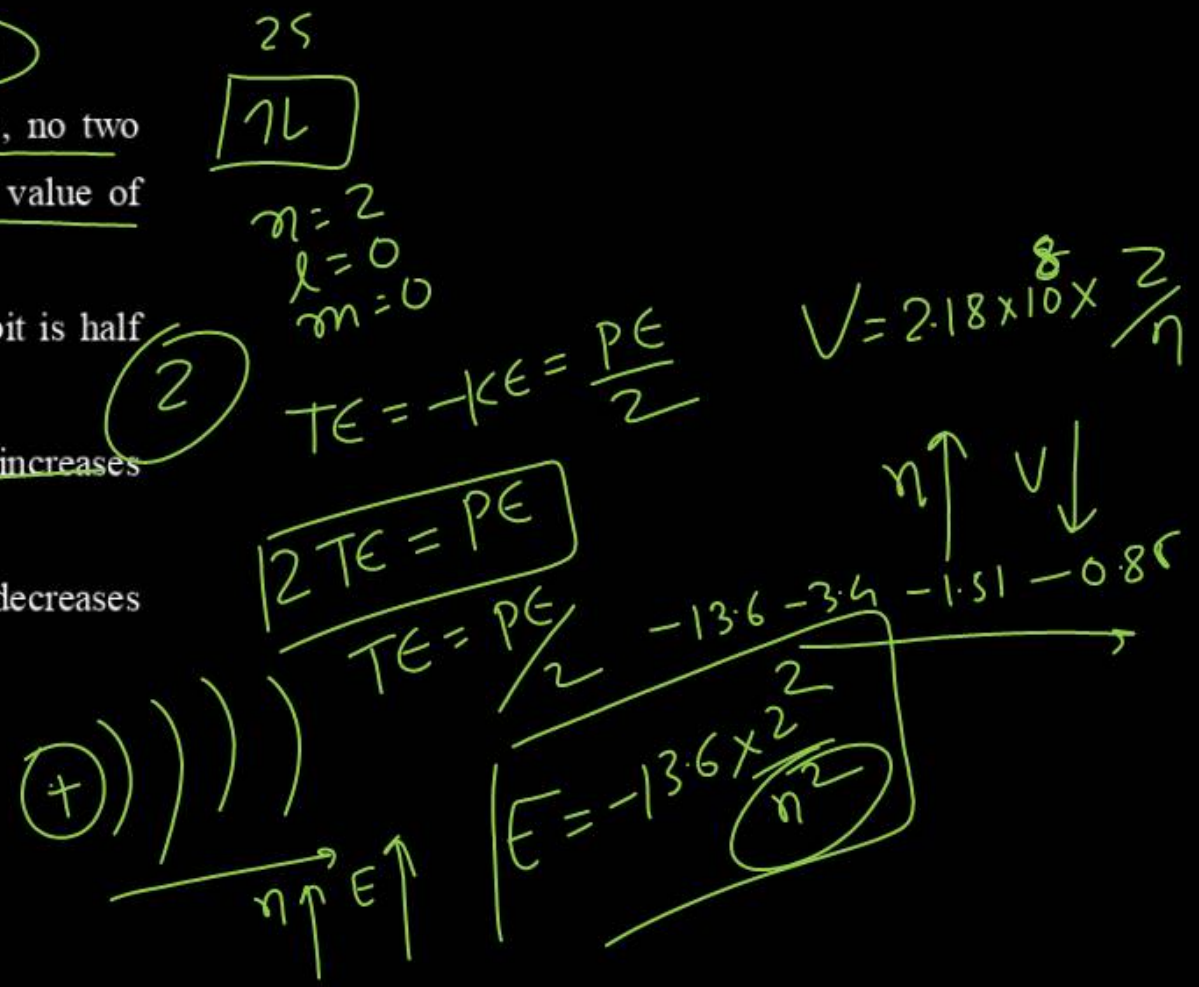
III. The speed of an electron in an orbit increases with increase its quantum number n.

IV. The energy of an electron in an orbit decreases with increase of its quantum number n.

Choose the correct option.

(1) I, III (2) I, III, IV

(3) I, II, III (4) I, II, III, IV

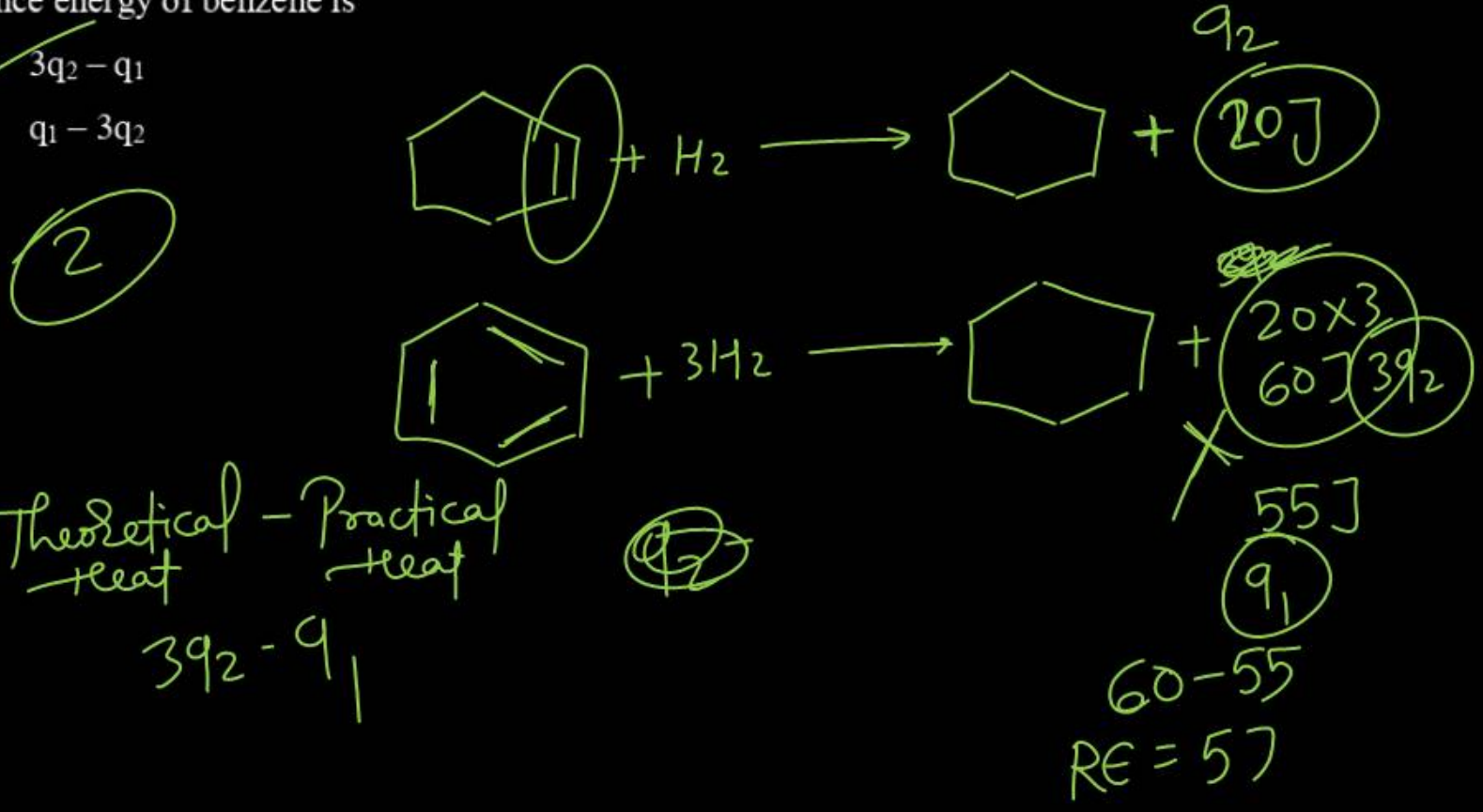


Question no. 61

Enthalpy of hydrogenation of benzene is q_1 and for cyclohexene is q_2, then resonance energy of benzene is

(1) $3q_1 - q_2$ (2) $3q_2 - q_1$

(3) $3q_1 + q_2$ (4) $q_1 - 3q_2$



Question no. 62

Consider the following reaction,

$$SO_2(g) + \frac{1}{2}O_2(g) \underset{}{\overset{K_1}{\rightleftharpoons}} SO_3(g) \quad \text{— } K_1$$

$$2SO_3(g) \overset{K_2}{\rightleftharpoons} 2SO_2(g) + O_2(g) \quad \text{— } K_2 =$$

What is the relation between K_1 and K_2?

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

(2) $K_1 = \frac{1}{\sqrt{K_2}}$ (2)

(3) $K_1 = K_2$

(4) $K_1 = \frac{1}{K_2^2}$

$$K_2 = \frac{1}{K_1^2}$$

$$\boxed{K_2 = \frac{1}{K_1^2}} \Rightarrow K_1^2 = \frac{1}{K_2}$$

$$\Rightarrow \boxed{K_1 = \sqrt{\frac{1}{K_2}}}$$

Question no. 63

Calculate pH of solution which contains 100 mL of 0.01 M HCl + 100 mL of 0.2 MH_2SO_4 + 100 mL of 0.1 M HNO_3 and 700 mL of H_2O.

(1) 3.2 (2) 1.29

(3) 7.0 (4) 6.84

2

$M \times V(lit)$

moles of $H^+ \Rightarrow 0.01 \times 0.1$ (HCl) $\Rightarrow 10^{-3}\ H^+$

$\Rightarrow 2 \times 0.2 \times 0.1$ (H_2SO_4) $\Rightarrow 4 \times 10^{-2}\ H^+$

$\Rightarrow 0.1 \times 0.1$ (HNO3) $\Rightarrow 1 \times 10^{-2}$

$\Rightarrow 40 \times 10^{-3}\ H^+$

$\Rightarrow 10 \times 10^{-3}$

$\frac{51 \times 10^{-3}}{1000} \Rightarrow 50 \times 10^{-3} \Rightarrow 5 \times 10^{-2}$

$pH = -\log[H^+]$ (molarity)

$= -\log[5 \times 10^{-2}]$

$= -[\log 5 + 2\log 10]$

$= -[0.70 - 2]$

$= +1.3$

$\frac{\text{moles}}{V} = M$

Question no. 64

Among the following rules, the one which is applied in the given reaction is

$$CH_3CHBrCH_2CH_3 \xrightarrow{\text{Alc. KOH}}$$

I. $CH_3CH = CHCH_3$ (major product)

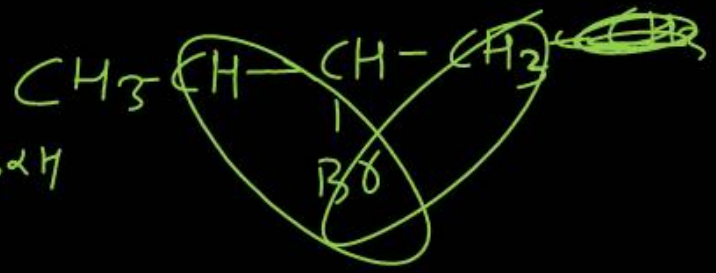
II. $CH_2 = CHCH_2CH_3$ (minor product)

(1) Saytzeff's rule

(2) Hofmann's rule

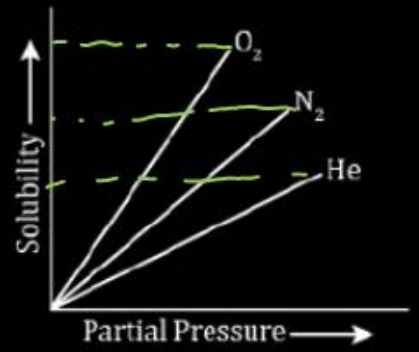
(3) Markownikoff's rule

(4) Kharasch effect



Question no. 65

Molar solubility of He, N_2 and O_2 are plotted against partial pressure of the gas at constant temperature.



Solubility order $O_2 > N_2 > He$

K_H $O_2 < N_2 < He$

Henry's law constant for these gases will lie in the sequence as

(1) $O_2 > N_2 > He$ (2) $O_2 < N_2 < He$

(3) $O_2 = N_2 = He$ (4) $O_2 > N_2 < He$

$K_H \propto \frac{1}{\text{Solubility}}$

Question no. 66

Match the List-I with List-II.

	List-I		List-II
A.	Cell constant	I.	Ω^{-1} cm^2 eq^{-1}
B.	Molar conductance	II	cm^{-1} or m^{-1}
C.	Equivalent conductance	III.	S cm^2 mol^{-1}
D.	Specific conductance	IV.	mho cm^{-1}

Choose the correct answer from options given below :

(1) A–II, B–III, C–I, D–IV

(2) A–I, B–II, C–III, D–IV

(3) A–I, B–III, C–II, D–IV

(4) A–IV, B–II, C–III, D–I

Cell constant $\frac{l}{a} = \frac{cm}{cm^2} = cm^{-1}$

K_G (sp. cond) $= \frac{1}{R} \times \frac{l}{a}$

$= \Omega^{-1} \cdot m^{-1}$ | $\Omega^{-1} cm^{-1}$

mho m^{-1}

S m^{-1}

(A)

$\lambda_{eq} = K_G \times V'$

$= \Omega^{-1} cm^{-1} \times \frac{cm^3}{Eq}$

$= \Omega^{-1} cm^2 Eq^{-1}$

Ω^{-1}, mho, S

A – II | C – I

B – III | D – IV

$\lambda_M = K_G \times V'$

$= \Omega^{-1} cm^{-1} \times \frac{cm^3}{mol}$

$= \Omega^{-1} cm^2 mol^{-1}$

$= S\, cm^2 mol^{-1}$

Question no. 67

In passing 3F of electricity through three electrolytic cells connected in series containing Ag^{+}, Ca^{2+} and Al^{3+} ions respectively. The molar ratio in which the three metal ions are liberated at the electrode is

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

(3) 6 : 3 : 2 (4) 3 : 4 : 2

3

$m \propto zQ$

$m = \frac{E}{F}Q$

Ag Eq. wt $= \frac{108}{1}$

Ca Eq. wt $= \frac{40}{2} = 20$

Al Eq. wt $= \frac{27}{3} = 9$

$\frac{m_1}{m_2} = \frac{E_1}{E_2}$

$m_1 : m_2 : m_3$

$Eq_1 : Eq_2 : Eq_3$

m. $\frac{1}{108} : \frac{1}{20} : \frac{1}{9}$

mole $\frac{1}{108} : \frac{1}{40} : \frac{1}{27}$ 3

$1 : \frac{1}{2} : \frac{1}{3}$

$6 : 3 : 2$

Question no. 68

For a reaction 3 A → product, the rate of reaction doubles. If the concentration of A is increased four times. What will be the order of reaction?

(1) 1 (2) 2

(3) 0.5 (4) 2.5

3

$3A \longrightarrow P$

$Rate = k[A]^n$

$2 = [4]^n$

$2 = [2^2]^n$

$2^1 = 2^{2n}$

$1 = 2n$

$\frac{1}{2} = n$

$0.5 = n$

$Rate \propto (conc.)^n$

Question no. 69

Given below are two statements.

Statement-I : The half-life of zero order reaction is $t_{1/2} = \frac{[A_0]}{2k}$.

Statement-II : The half-life of ~~zero~~ first order reaction is directly proportional to initial concentration.

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

(1) Both Statement I and Statement II are incorrect.

(2) Statement I is correct but Statement II is incorrect.

(3) Statement I is incorrect but Statement II is correct.

(4) Both Statement I and Statement II are correct.

$t_{1/2} = \frac{[A_0]}{2K}$ zero

$t_{1/2}$ 1st order $= \frac{0.693}{K} = \frac{\ln 2}{K}$

2

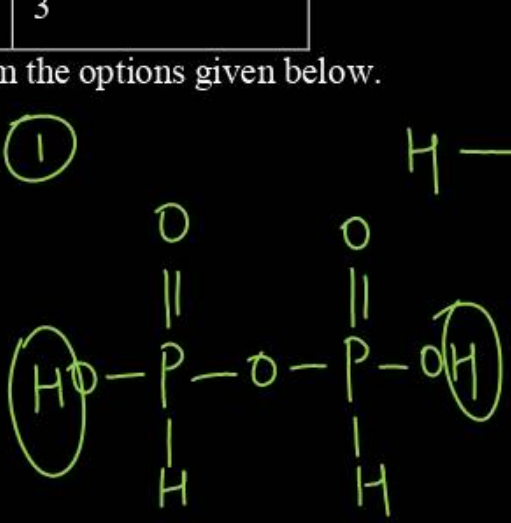
Question no. 70

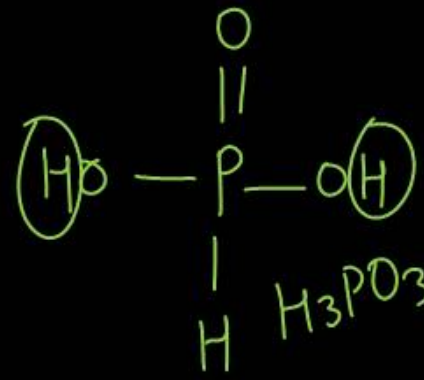
Match List-I with List-II.

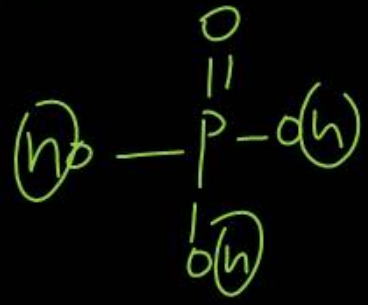
	List-I (Compound)		List-II (Basicity)
A.	H_3PO_2 (1)	I.	2
B.	H_3PO_3 (2)	II.	1
C.	H_3PO_4 (3)	III.	2
D.	$H_4P_2O_5$ (2)	IV.	3

Basicity of an acid = no. of H^+ donated by acid

only those H^+ donated in which H is attached to more EN atom







Choose the correct answer from the options given below.

(1) A–II, B–I, C–IV, D–III

(2) A–I, B–III, C–II, D–IV

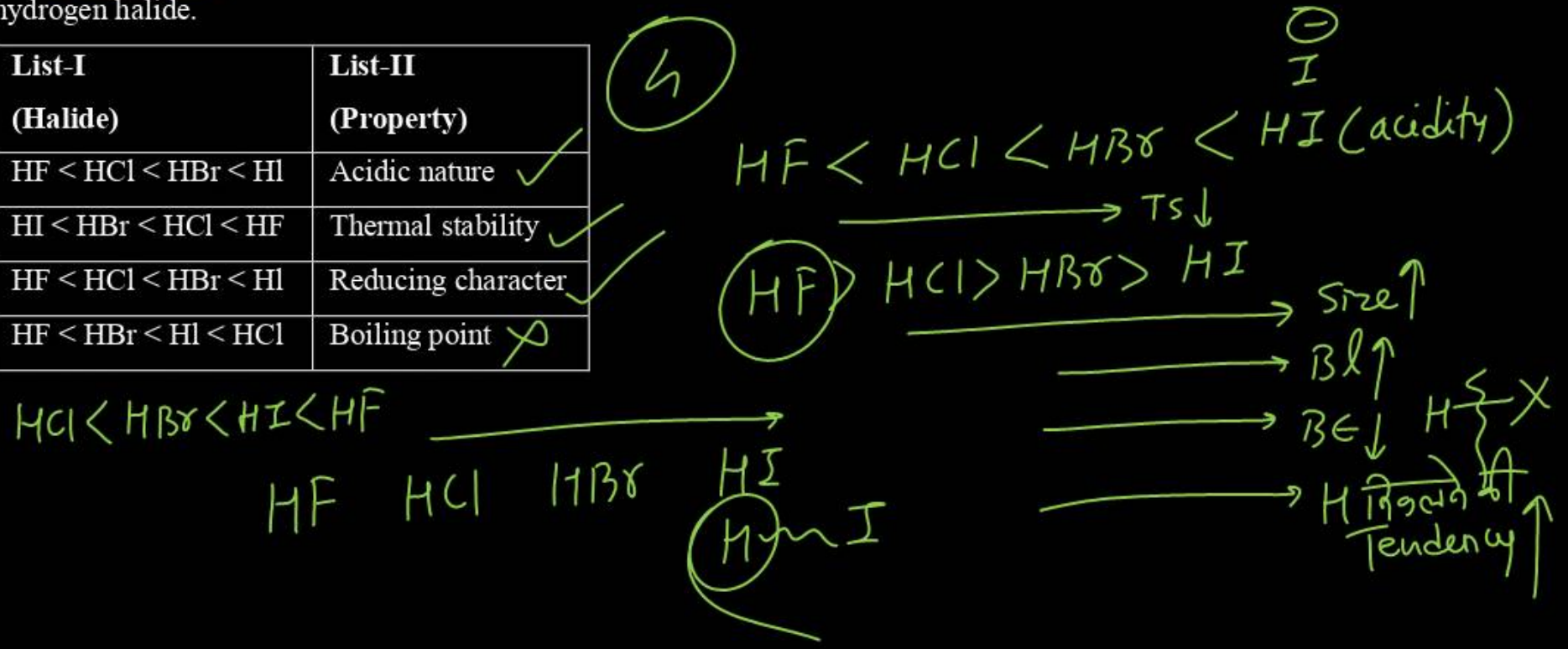
(3) A–IV, B–III, C–II, D–I

(4) A–III, B–IV, C–II, D–I

Question no. 71

Choose the incorrect matching from List-I and List-II about hydrogen halide.

	List-I (Halide)	List-II (Property)
(1)	HF < HCl < HBr < Hl	Acidic nature
(2)	HI < HBr < HCl < HF	Thermal stability
(3)	HF < HCl < HBr < Hl	Reducing character
(4)	HF < HBr < Hl < HCl	Boiling point



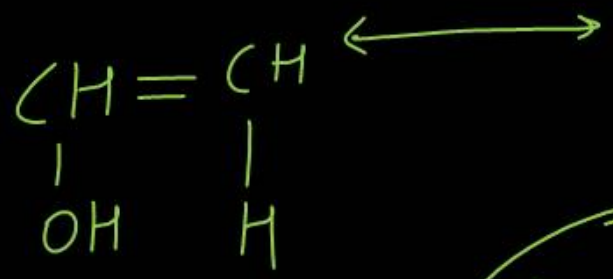
Question no. 72

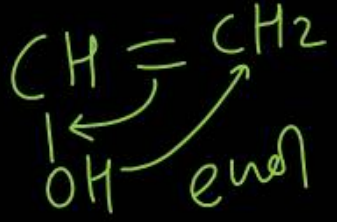
$CH \equiv CH + H_2O \xrightarrow{H_2SO_4 + HgSO_4} X$, X is identified as

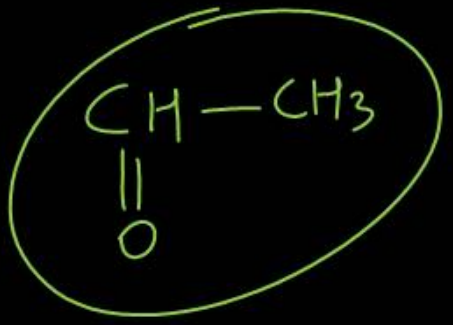
(1) ketone
(2) ethanol
(3) acetaldehyde
(4) propionaldehyde

Addition of H_2O
Kucherov Rxn

3

$CH \equiv CH \xrightarrow{H_2O}$ 





Question no. 73

Given below are two statements.

Statement-I : MnO_4^{2-} and MnO_4^- ions are tetrahedral in shape.

Statement-II : MnO_4^{2-} ion is diamagentic but the MnO_4^- is paramagnetic.

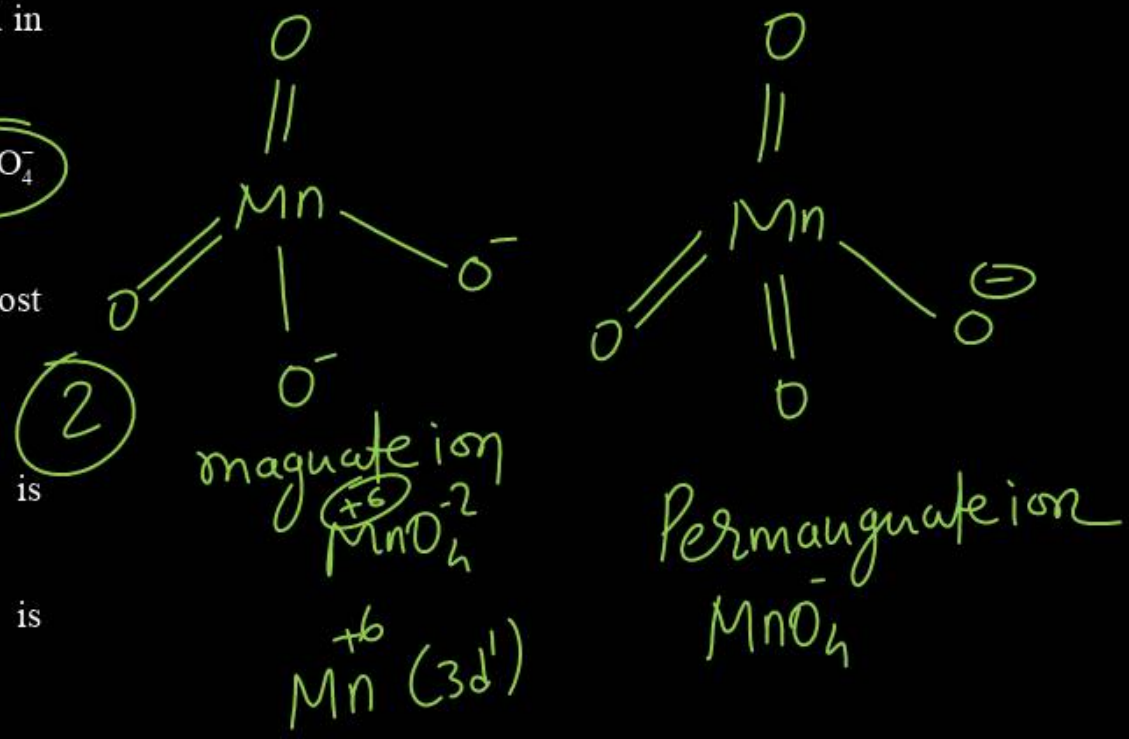
In the light of above statements, choose the most appropriate answer from the options given below.

(1) Both Statement I and Statement II are incorrect.

(2) Statement I is correct but Statement II is incorrect.

(3) Statement I is incorrect but Statement II is correct.

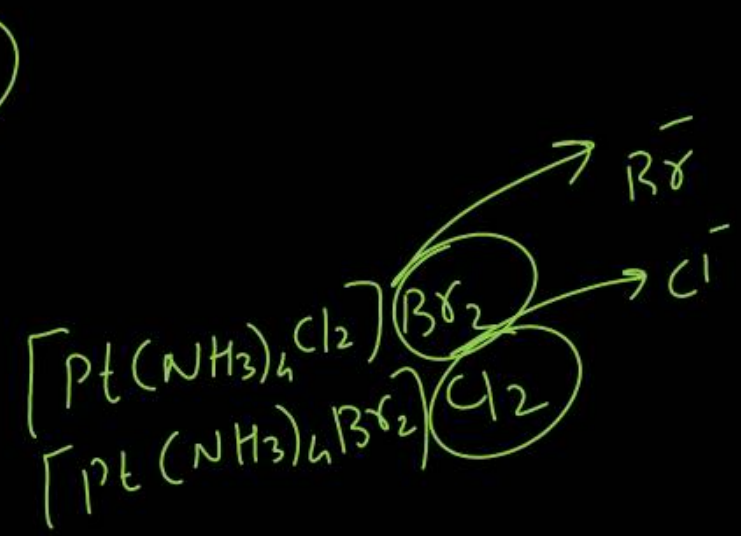
(4) Both Statement I and Statement II are correct.



Question no. 74

Which of the following set is not correctly matched about isomersim in given list?

	List-I	List-II
(1)	$[Cr(H_2O)_6]Cl_3$ $[Cr(H_2O)_5Cl]\ Cl.\ H_2O$	Hydrate isomerism
(2)	$[Cr(H_2O)_5SCN]^{2+}$ $[Cr(H_2O)_5NCS]^{2+}$	Linkage isomer
(3)	$[Pt(NH_3)_4]Br_2$ $[Pt(NH_3)_4Br_2]\ Cl_2$	Ionisation isomerism
(4)	$[Co(NH_3)_6]\ [Cr(CN)_6]$ $[Cr(NH_3)_6]\ [Co(CN)_6]$	Ionisation isomer



Question no. 75

Which of the following metal ions show paramagentism?

(1) La^{3+} (2) Ce^{4+}

(3) Lu^{3+} (4) Yb^{3+}

4

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

$4f^{14}$

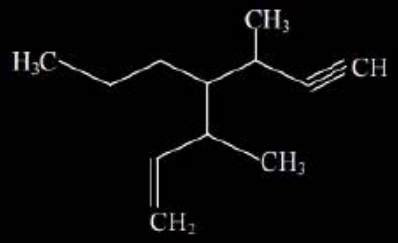
La^{+3}_{57} $[Xe]_{54} 6s^2 4f^0 5d^1 = 4f^0$

$Ce^{+4}_{58} = [Xe]_{54} 6s^2 4f^0 5d^1 = 4f^0$

$Yb^{+3}_{Z=70} = [Xe]_{54} 6s^2 4f^{13}$

Question no. 76

The IUPAC name for the following compound is:

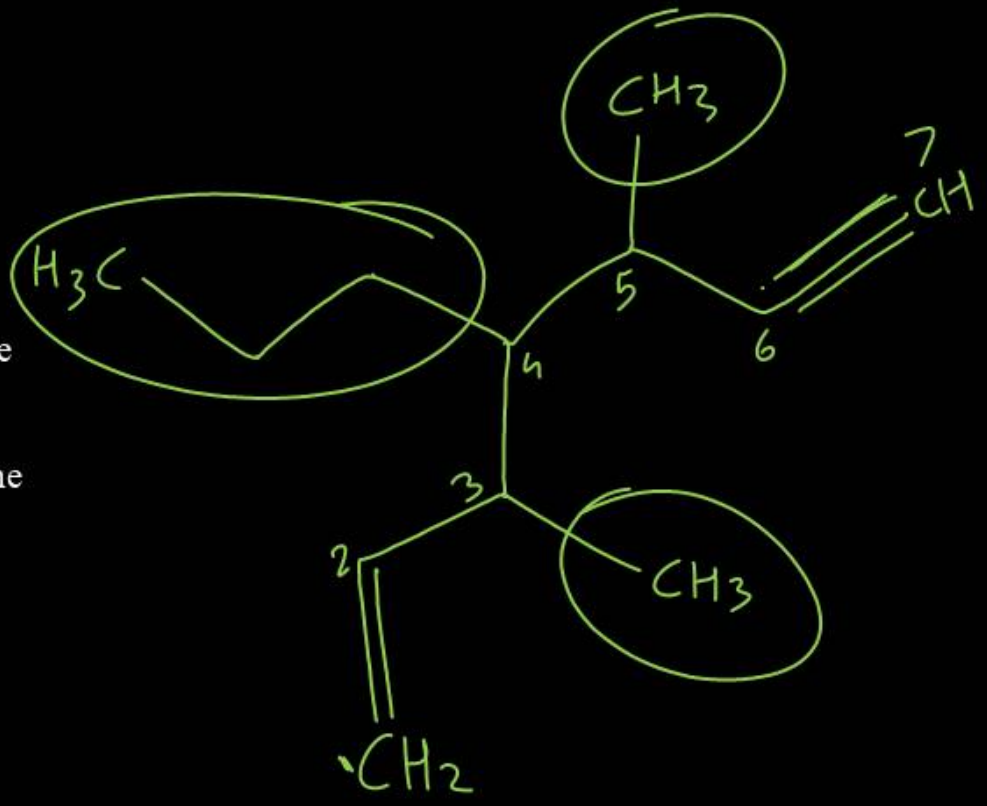


(1) 3–methyl–4–(3–methylprop–1–enyl)–l–heptyne

(2) 3, 5–dimethyl–4–propylhept–6–en–l–yne

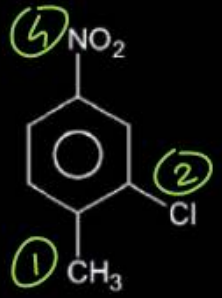
(3) 3–methyl–4–(1–methylprop–2–ynyl)–l– heptene

(4) 3, 5–dimethyl–4–propylhept–l–en–6yne



Question no. 77

The correct IUPAC name of the following compound is:

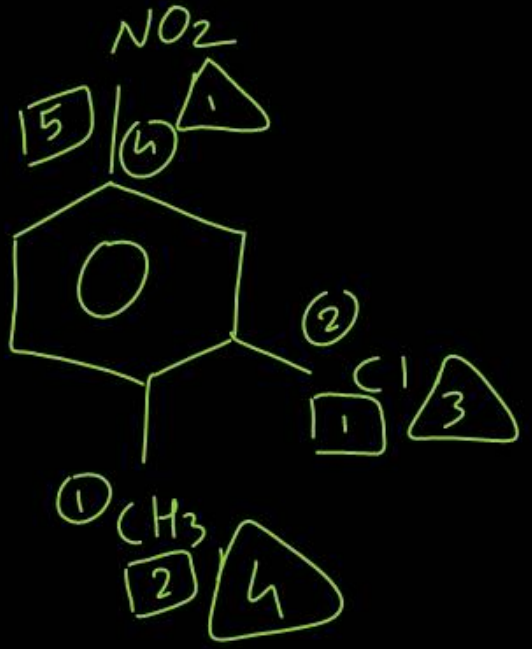


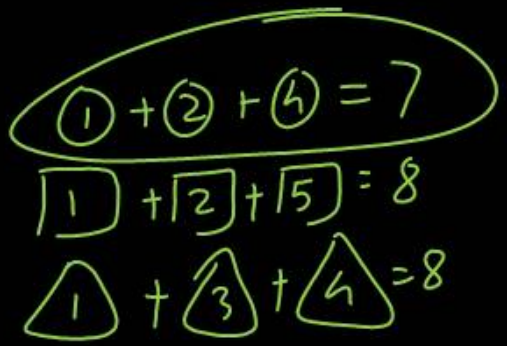
(1) 5–chloro–4–methyl–1–nitrobenzene

(2) 2–chloro–1–methyl–4–nitrobenzene

(3) 3–chloro–4–methyl–1–nitrobenzene

(4) 2–methyl–5–nitro–1–nitrobenzene





Question no. 78

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

(1) —COOH> —$CONH_2$ >—COCl> —CHO

(2) —SO_3H> —COCl>—$CONH_2$> —CN

(3) —COOH> —COCl>—NH_2>—CHO

(4) —COOH> —COOR>—$CONH_2$> —COCl

2

Priority order

-COOH > $-SO_3H$ > anhydride > Ester > acid Halide > amide > -CN > -NC > -CHO > $-\overset{\overset{O}{\|}}{C}-$ > $-NH_2$

Question no. 79

Relative stability of the contributing structures is:

(1) (I) > (III) > (II) (2) (I) > (II) > (III)

(3) (II) > (I) > (III) (4) (III) > (II) > (I)

2

Non-Polar

incomplete octet.

Polar

octet incomplete

Polar

$CH_2 = CH - C - H$ (1)

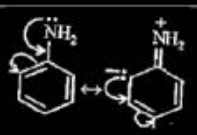
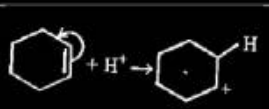
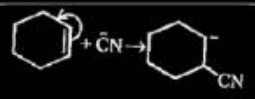
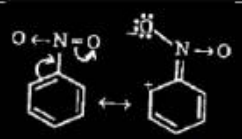
$CH_2 - CH = C - H$ (2)

$CH_2 - CH = C - H$ (3)

1 > 2 > 3

Question no. 80

. Match List–I with List–II:

A.		(I)	–E effect
B.		(II)	– R effect
C.		(III)	+ E effect
D.		(IV)	+ R effect

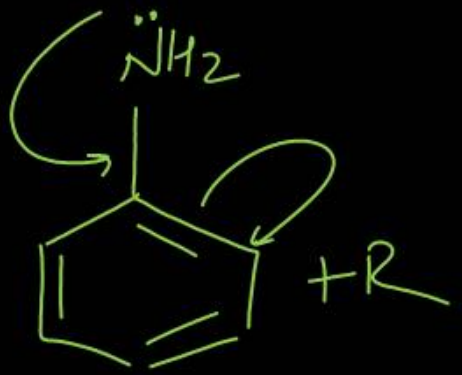
Choose the correct answer from the options givens below:

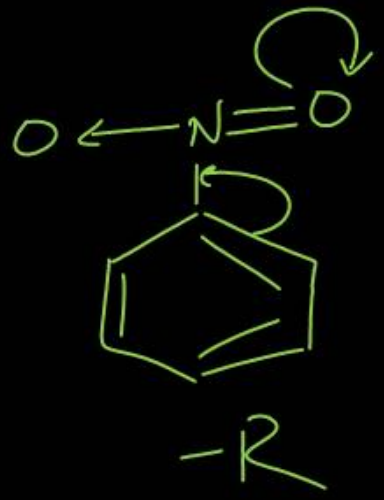
(1) A–(IV), B–(III), C–(I), D– (II)

(2) A–(III), B–(I), C–(II), D– (IV)

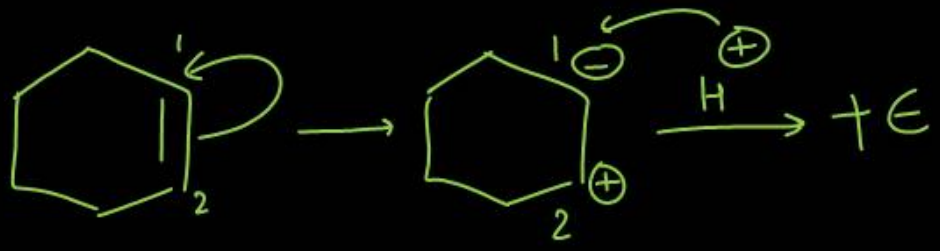
(3) A–(II), B–(IV), C–(III), D– (I)

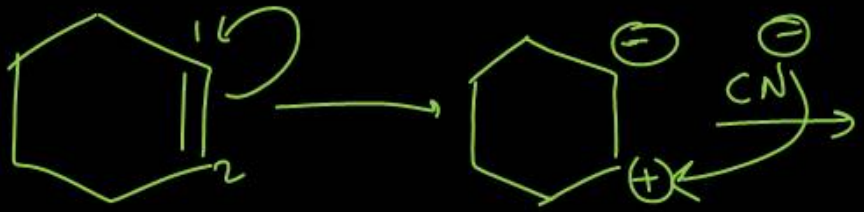
(4) A–(I), B–(II), C–(IV), D– (III)





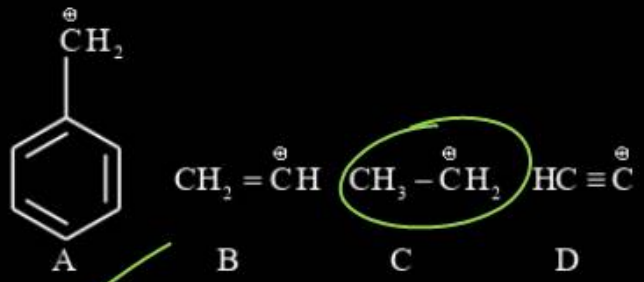
A IV
B - III
C - I
D - II





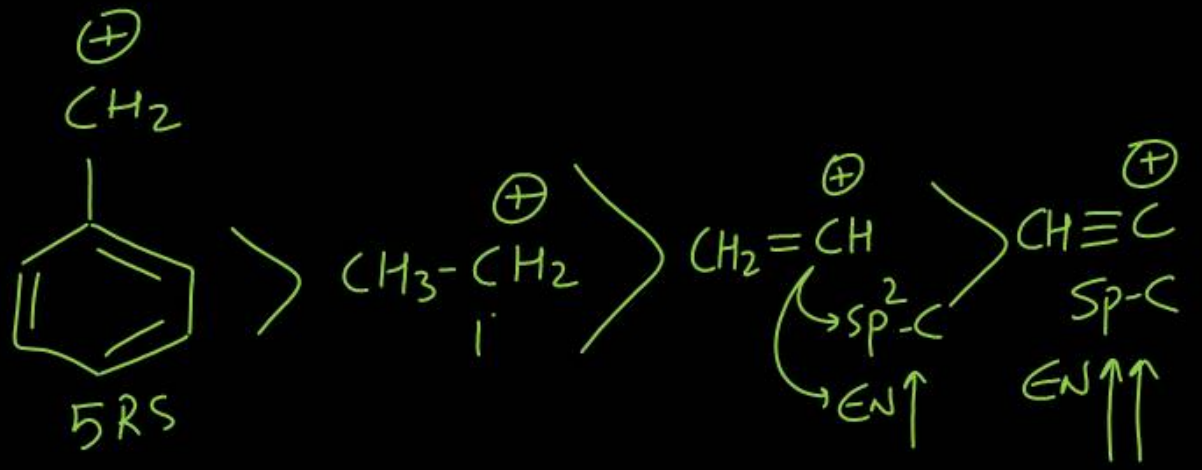
Question no. 81

The correct order of stability of given carbocation is:



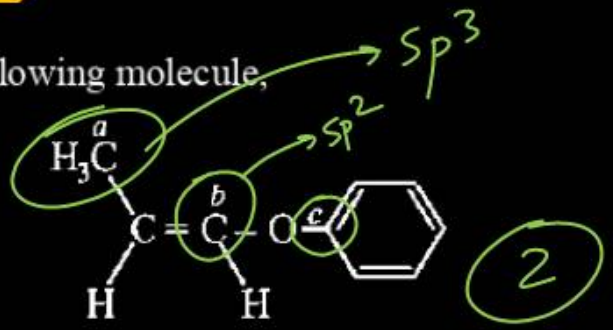
(1) A > C > B > D (2) D > B > C > A

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



Question no. 82

In the following molecule,



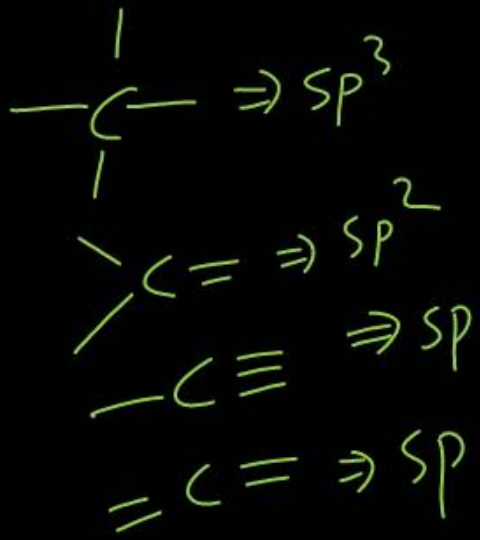
Hybridisation of carbon a,b and c respectively are :

(1) sp^3, sp,sp

(2) sp^3, sp^2, sp^2

(3) sp^3, sp, sp^2

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



Question no. 83

Which of the following does not give a white precipitate with $AgNO_3$ solution?

(1) Propyne (2) 1-butyne

(3) 2-butyne (4) 1-pentyne

Tollen's Reagent

$CH_3-C\equiv C-CH_3$

3

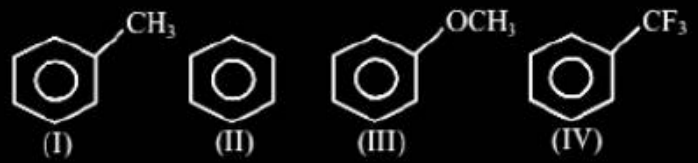
acidic-H $\xrightarrow{\text{metal}}$

$CH\equiv CH \xrightarrow{Ag^+} CH\equiv C^{\ominus}Ag^{\oplus}$ white ppt

1- Alkyne acidic in Nature

Question no. 84

The correct arrangement for decreasing order of electrophilic substitution for below compounds

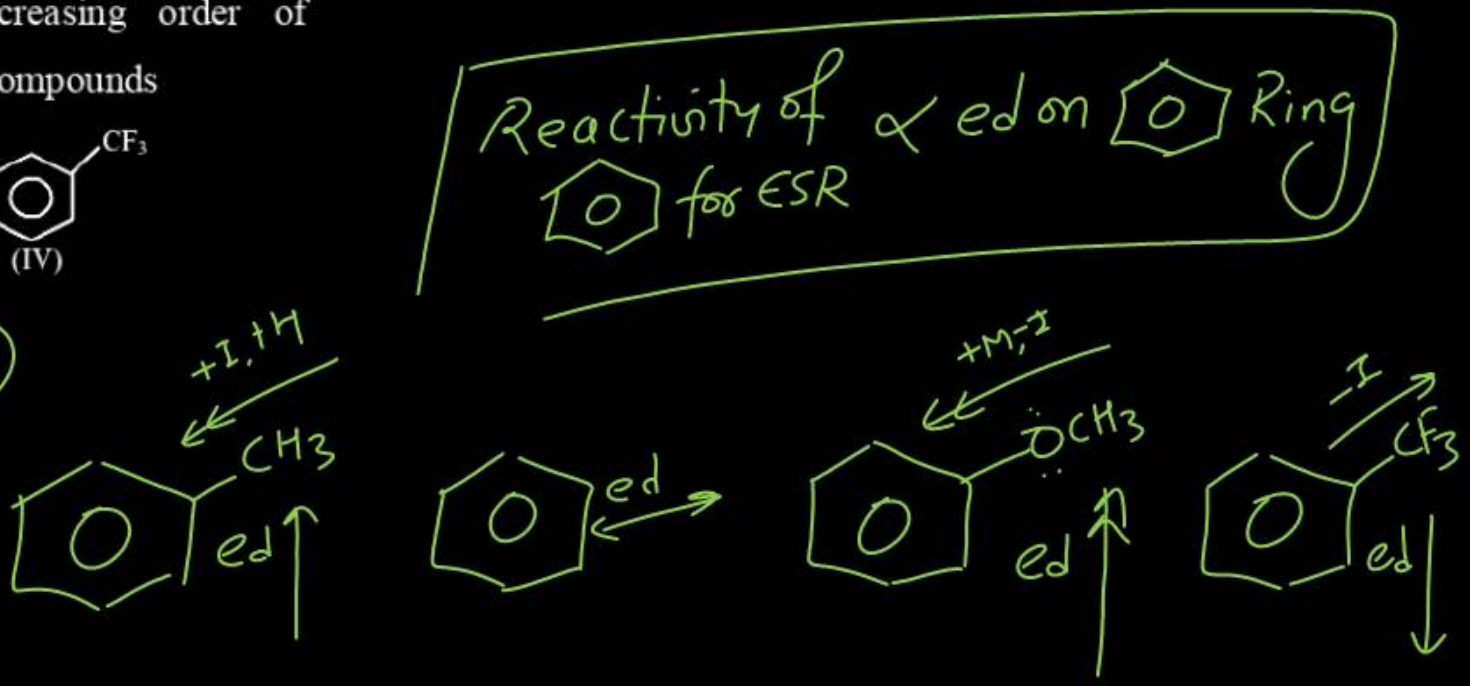


(1) (IV) > (I) > (II) > (III)

(2) (III) > (I) > (II) > (IV)

(3) (II) > (IV) > (III) > (I)

(4) (III) > (IV) > (II) > (I)

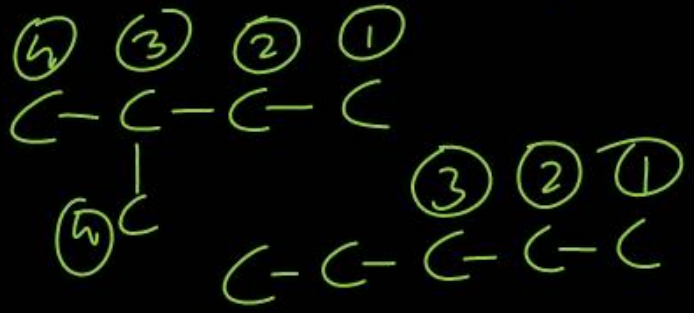


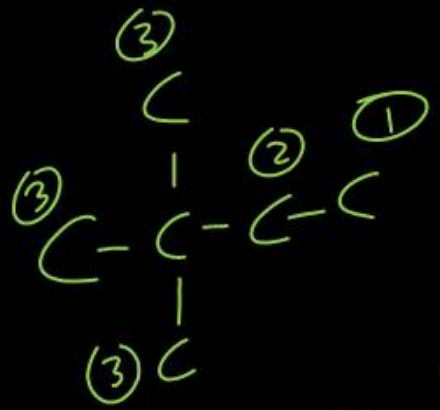
Question no. 85

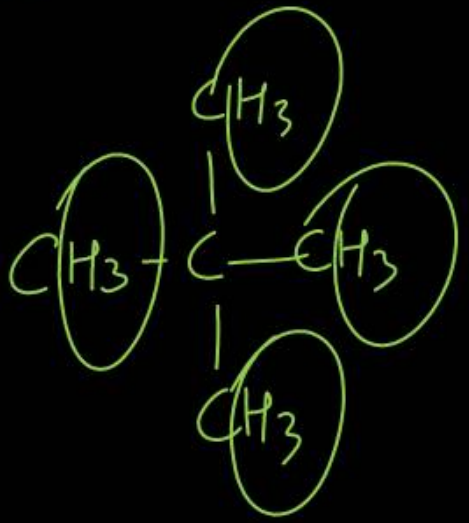
The alkane that gives only one mono-chloro product on chlorination with Cl_2 in presence of diffused sunlight is

(1) 2, 2-dimethylbutane (2) neopentane

(3) n-pentane (4) isopentane







Question no. 86

Which compound cannot be formed from Wurtz reaction?

(1) Propane
(2) Butane
(3) Ethane
(4) Methane

$$2R\text{-}X \xrightarrow[\text{Dry-Ether}]{Na} R\text{-}R$$

Question no. 87

Match the items of List-I with the List-II and choose the correct option from the codes given below:

	List-I (Structure of compounds)		List-II (Type of isomerism)
A.	$CH_3CH_2CH_2CH_2CH_3$ and $CH_3-\underset{\displaystyle CH_3}{\underset{|}{CH}}-CH_2CH_3$	I.	Chain isomers
B.	$CH_3CH_2CH_2OH$ and $CH_3-\underset{\displaystyle OH}{\underset{|}{CH}}-CH_3$	II.	Position isomers
C.	CH_3-CH_2-CHO and $CH_3-\overset{\displaystyle O}{\overset{\|\|}{C}}-CH_3$	III.	Metamers
D.	$C_2H_5OC_2H_5$ and $CH_3OC_3H_7$	IV.	Functional isomers

Codes :

(1) A – I, B – II, C – III, D – IV

(2) A – II, B – III, C – I, D – IV

(3) A – IV, B – I, C – II, D – III

(4) A – I, B – II, C – IV, D – III

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

$CH_3-CH_2-O-CH_2-CH_3$

$CH_3-O-CH_2-CH_2-CH_3$

Question no. 88

Match the items of List-I with the List-II and choose the correct option from the codes given below:

	List-I		List-II
A.	Meso compound	I.	An equimolar mixture of enantiomers
B.	Enantiomers	II.	Stereosiomers that are not mirror images
C.	Diastereosimers	III.	Non-superimposable mirror images
D.	Racemates	IV.	An optically inactive compound whose molecules are achiral even though they contain chiral centres

d & l-isomer

A - IV

B - III

C - II

D - I

Codes :

(1) A – II, B – IV, C – I, D – III

(2) A – I, B – II, C – III, D – IV

(3) A – III, B – II, C – I, D – IV

(4) A – IV, B – III, C – II, D – I

4

Question no. 89

The correct decreasing order of stability of butane conformation.

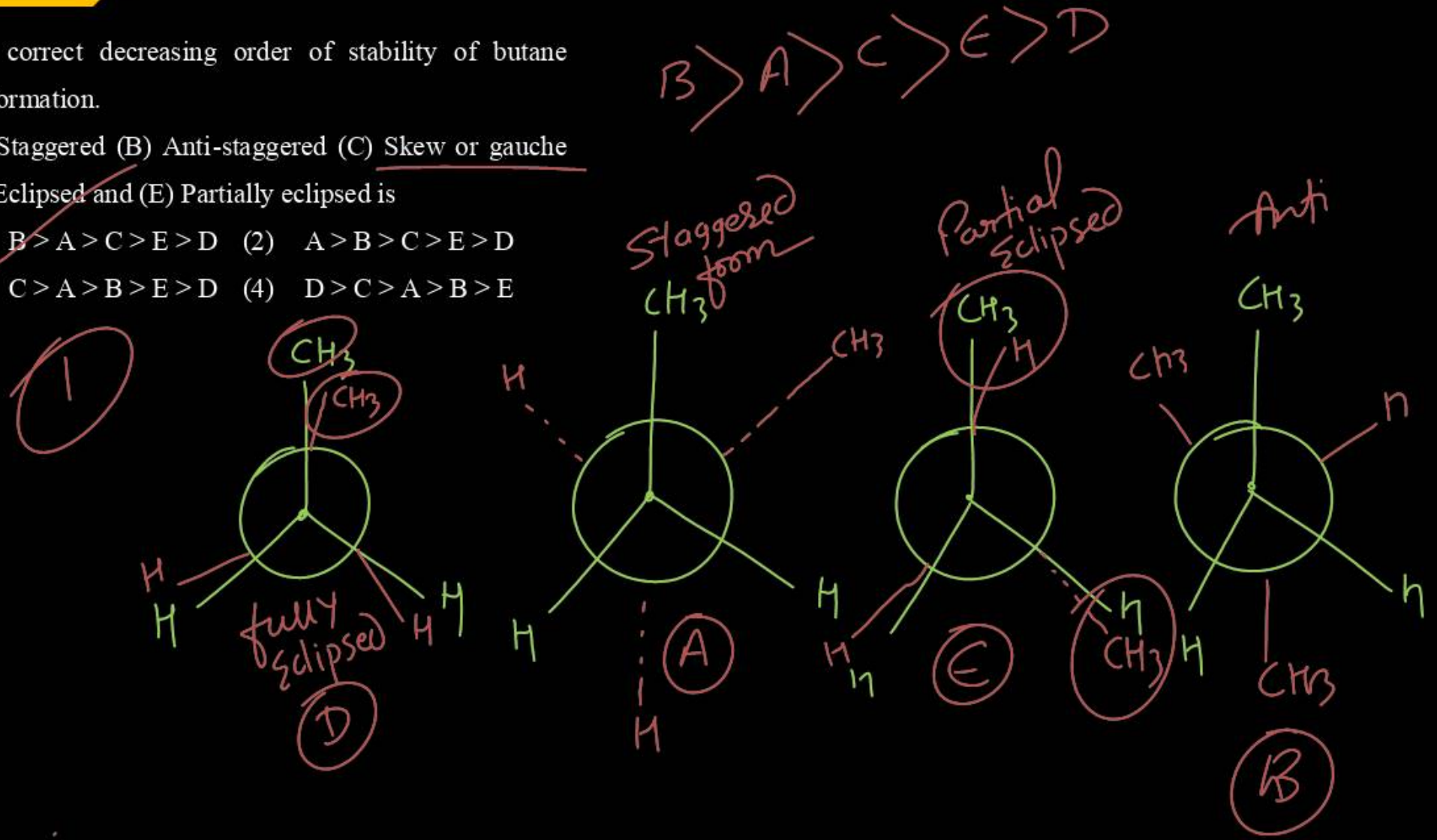
(A) Staggered (B) Anti-staggered (C) Skew or gauche

(D) Eclipsed and (E) Partially eclipsed is

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

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

B > A > C > E > D



Question no. 90

The most suitable reagent for the following conversion,

is

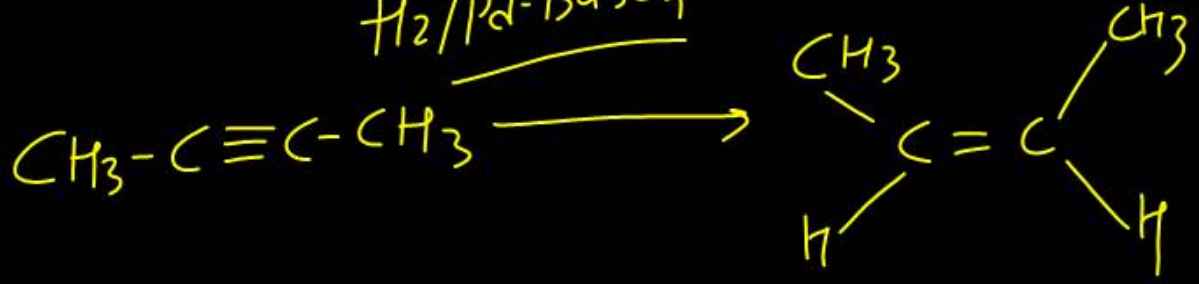
(1) H_2, Pd/C, quinoline (2) Zn/HCl

(3) Hg^{2+}/H^+, H_2O (4) Na/liquid NH_3

1

H_2 Pd/C-quinoline

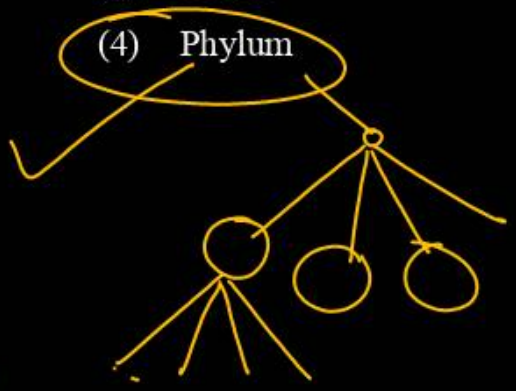
H_2/Pd-$BaSO_4$



Question no. 91

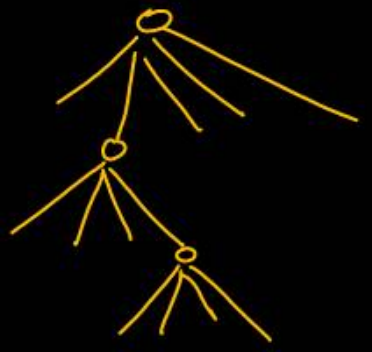
Which of the following definitions convers a greater number of organisms?

(1) Class
(2) Genus
(3) Family
(4) Phylum



4

Kingdom
↓
phylum
↓
class
↓
order
↓
family
↓
Genus
↓
sp.



Question no. 92

The species, through insignificant in number, determine the existence of many other species in a given ecosystem. Such species is known as

(1) endemic species
(2) sacred species
(3) extinct species
(4) keystone species

4

Question no. 93

The number of abdominal segments in male and female cockroach is

(1) 10, 10
(2) 9, 10
(3) 10, 11
(4) 8, 10

Head = 1
Thorax = 3
Abdomen = 10

Question no. 94

Which of the following forests is known as the 'lungs of the planet Earth'?

(1) Tiaga forest

(2) Tundra forest

(3) Amazon rain forest

(4) Rain forests of North East India.

Question no. 95

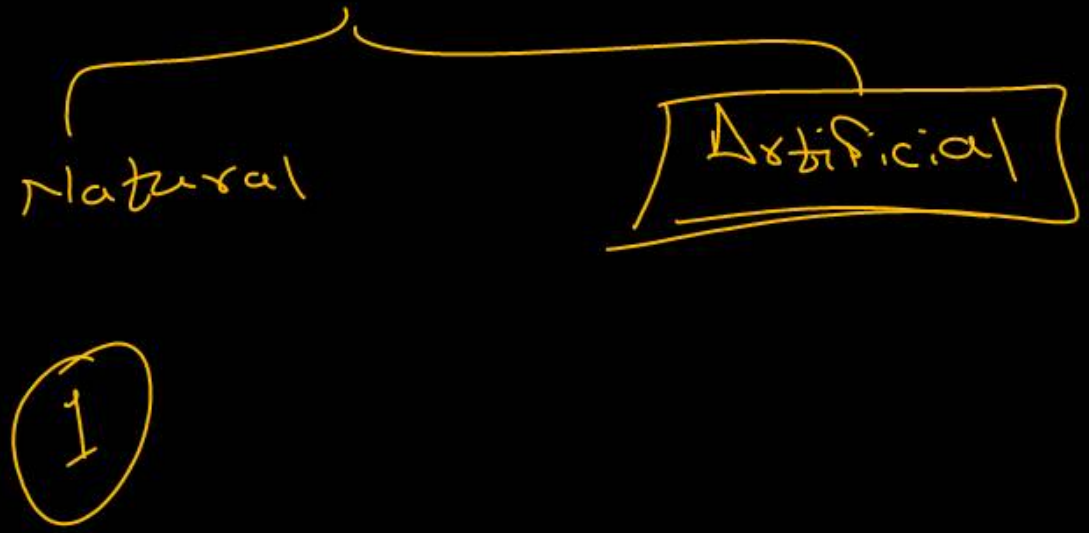
Artificial system of classifications given by Linnaeus is based on

(1) The number and structure of stamen and carpel

(2) Evolutionary as well as genetic affinities

(3) Gross morphology

(4) Natural affinities among the organism



Question no. 96

Bryophytes are called amphibians of plant kingdom because

(1) They are mostly found in aquatic habitat.

(2) Water is essential for square dispersal.

(3) Water is necessary for their sexual reproduction.

(4) Fertilization occurs outside the body in water.

Question no. 97

In gymnosperms, the seed that develop after fertilization are naked. It mean

(1) Seeds are very small and not visible with naked eyes

(2) Seeds are not covered any ovule wall

(3) Seeds are not covered by any ovary wall

(4) Seeds are enclosed in pericarp

Question no. 98

Read the following statements A To E for pteridophytes and select the option with correct statements.

A. Pteridophytes are the first terrestrial plants to possess vascular tissues.

B. They are found in cool, damp and shady localities.

C. Dominant phase in the life cycle is gametophyte.

D. Main plant body is differentiated into root–like, stem like, and leaf–like structure.

E. Gametophyte and sporophyte both are free living independent stage.

(1) A, B, and E (2) B, C, and D

(3) A, D, and E (4) A, B, C, D, and E

Question no. 99

How many of the following features are associated with family solanaceae?

(i) Marginal placentaion ×

(ii) Nonendospermous seeds ×

(iii) Leaf tendrils ×

(iv) Monadelphous stamens ×

(v) Vexillary aestivation ×

(vi) Actinomorphic bisexual flowers ✓

Axile

Endospermous

5 : Epipetalous

Valvate

2

(1) Six

(2) One

(3) Five

(4) Three

Question no. 100

Choose the incorrect option w.r.t. placentation.

(1) Marginal –Pea (2) Axile – Lemon

(3) Parietal – China rose (4) Basal – Marigold

Arrangement of ovules

Axile.

3

Question no. 101

Depolarization of a neuron occurs when

(1) Both Na^+ and K^+ move into the neuron

(2) Both Na^+ and K^+ move outside the neuron

(3) Only Na^+ move into the neuron

(4) Only K^+ moves into the neuron

3

∴ Impulse = Depolarization.

Influx of Na+

Question no. 102

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

	Column I		**Column II**
a.	Multipolar neuron	i.	Embryonic stage
b.	Bipolar neuron	ii.	Retina of eye
c.	Unipolar neuron	iii.	Cerebral cortex

(1) a–(i), b–(ii), c–(iii)

(2) a–(ii), b–(i), c–(iii)

(3) a–(iii), b–(i), c–(ii)

(4) a–(iii), b–(ii), c–(i)

Question no. 103

Nissl bodies are mainly composed of

(1) Proteins and lipids

(2) DNA and RNA

(3) Nucleic acids and SER

(4) Free ribosomes and RER

Ans: Protein Synthesis

4

Question no. 104

Which structure of pollen grains help in their fossilization?

(1) Intine

(2) Exine — Sporopollenin

(3) Germ pores

(4) Cell membrane

2

Question no. 105

Assured seed set even in absence of pollinators may occur in

(1) Ficus
(2) Vallisneria
(3) Commelina
(4) Zostera

Cleistogamous

3

Question no. 106

Select the incorrect match for post–fertilization development in flowering plants.

(1) Ovule– Seed

(2) Entire embryo sac – Endosperm

(3) Ovary wall – Pericarp

(4) Zygote – Embryo

Question no. 107

In some members of which of the following pairs of families, pollen grains retain their viability for months after release?

(1) Poaceae ; Rosaceae

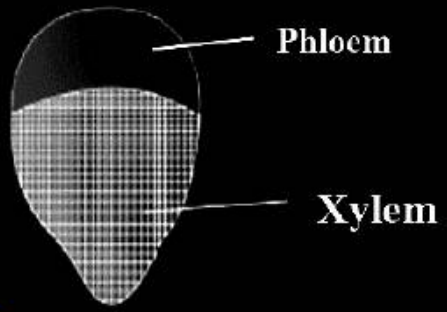
(2) Poaceae ; Leguminosae

(3) Poaceae; Solanaceae

(4) Rosaceae; Leguminosae

Question no. 108

The given vascular bundle is present in



(1) Monocot stem
(2) Dicot stem
(3) Monocot root
(4) Dorsiventral leaf

Conjoint
Collateral
Closed

(1)

Question no. 109

Bulliform cells are generally seen in

(1) Abaxial epidermis of monocot leaf

(2) Adaxial epidermis of dicot leaf

(3) Abaxial epidermis of dicot leaf

(4) Adaxial epidermis of monocot leaf

large
colorless

4

Question no. 110

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

	Column I		Column II
a.	Radial vascular bundles	i.	Dicot stem
b.	Conjoint and open vascular stem	ii.	Dicot root
c.	Conjoint and closed vascular bundles	iii.	Monocot root
d.	Conjunctive tissue	iv.	Monocot stem

(1) a–(iii), b–(i), c–(iv), d–(ii)

(2) a–(iv), b–(i), c–(ii), d–(iii)

(3) a–(iv), b–(i), c–(iii), d–(ii)

(4) a–(ii), b–(iv), c–(iii), d–(i)

Question no. 111

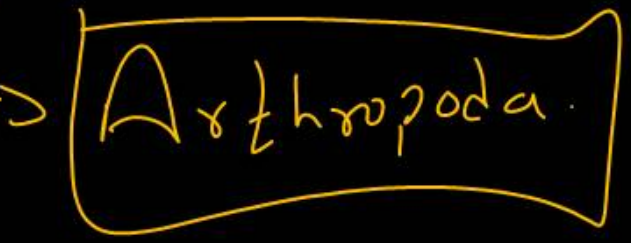
Which group of animals belong to the same phylum?

(1) Earthworm, Pinworm, Tapeworm

(2) Prawn, Scorpion, Locusta

(3) Sponge, Sea anemone, Starfish

(4) Malarial parasite, Amoeba, Mosquito



(2)

Question no. 112

When the margins of sepals or petals overlap one another without any particular direction, the condition is termed as:

(1) Vexillary
(2) Imbricate
(3) Twisted
(4) Valvate

2

Question no. 113

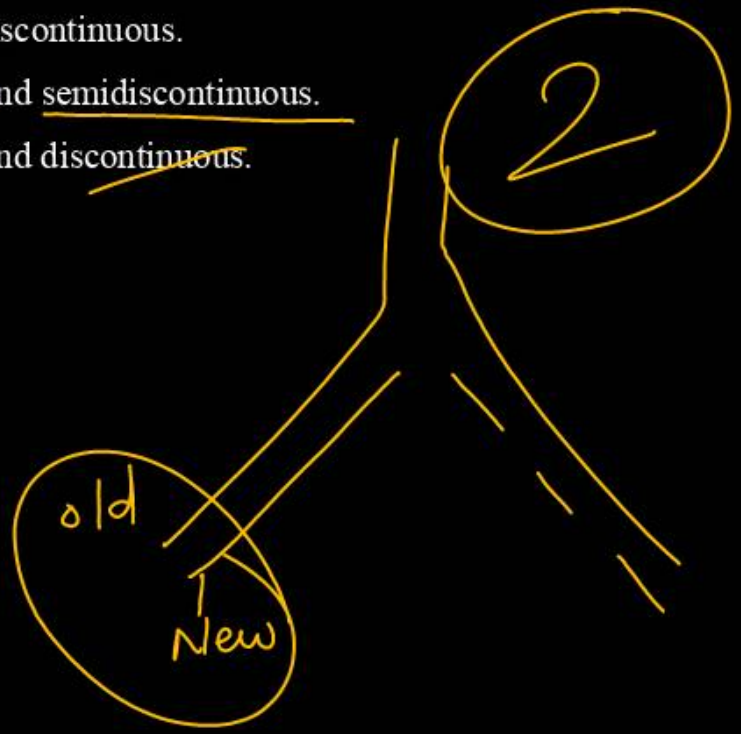
DNA replication is

(1) conservative and discontinuous.

(2) semiconservative and semidiscontinuous.

(3) semiconservative and discontinuous.

(4) conservative.



Question no. 114

In which of the following would you place the plants having vascular tissue lacking seeds?

(1) Pteridophytes

(2) Gymnosperms

(3) Algae

(4) Bryophytes

Question no. 115

If we completely remove the decomposers from an ecosystem, its functioning will be adversely affected, because

(1) mineral movement will be blocked

(2) the rate of decomposition will be very high

(3) energy flow will be blocked

(4) herbivores will not receive solar energy

Question no. 116

A cricket player in fast chasing a ball in the field. Which one of the following groups of bones are directly contributing in this movement?

(1) Femur, malleus, tibia, metatarsals

(2) Pelvis, ulna, patella, tarsals

(3) Sternum, femur, tibia, fibula

(4) Tarsals, femur, metatarsals, tibia

Question no. 117

Read the statements regarding muscle proteins.

(i) Actin is a thin filament and is made up of two F–actins.

(ii) The complex protein, tropomyosin is distributed at regular intervals on the troponin.

(iii) Myosin is a thick filament which is also a polymerized protein.

(iv) The globular head of meromyosin consists of light meromyosin (LMM).

Of the above statements,

(1) (i), (ii) and (iii) are correct

(2) (i), (ii) and (iv) are correct

(3) (i) and (iii) are correct

(4) (ii) and (iv) are correct

Question no. 118

Which of the following branch of taxonomy considers more than hundred characters at the same time giving equal weightage to each of them?

(1) Numerical taxonomy

(2) Chemotaxonomy

(3) Biochemical taxonomy

(4) Cytotaxonomy

Question no. 119

In bryophytes,

(1) Gametophytes are dependent upon sporophytes

(2) Sporophytes are dependent upon gametophytes

(3) Sporophyte and gametophyte generations are independent.

(4) Sporophyte itself completes the life cycle.

2

Question no. 120

Haplontic life cycle is present in all the given organisms, except

(1) Volvox
(2) Spirogyra
(3) Kelps
(4) Chlamydomonas

Haplodiplontic life cycle.

3

Question no. 121

Select the plants having actinomorphic symmetry in flower.

A. Mustard
B. Datura
C. Bean
D. Chili

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

3

Question no. 122

The given floral formula belongs to family

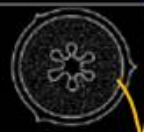
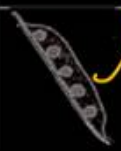
Br $\oplus$ ⚥ $Epi_{3-7}\ K_{(5)}\ \overset{\frown}{C_5\ A_{(\infty)}}\ \underline{G}_{(5-\infty)}$

(1) Liliaceae (2) Fabaceae

(3) malvaceae (4) Brassicaceae

Question no. 123

Match column I and column II and select the correct option.

	Column I		Column II
a.		i.	Marginal
b.		ii.	Parietal
c.		iii.	Axile
d.		iv.	Free central
e.		v.	Basal

(1) a–(ii), b–(iv), c–(i), d–(v), e–(iii)

(2) a–(iii), b–(iv), c–(i), d–(ii), e–(v)

(3) a–(ii), b–(i), c–(iv), d–(iii), e–(v)

(4) a–(iv), b–(iii), c–(v), d–(ii), e–(i)

Question no. 124

In the axonal membrane, $Na^+ - K^+$ pumps

(1) Operate during repolarization and transport $3Na^+$ outwards and $2K^+$ inwards.

(2) Operate during repolarization and transport $2Na^+$ outwards and $3K^+$ inwards.

(3) Operate during resting state and transport $3Na^+$ outwards and $2K^+$ inwards.

(4) Operate during resting state and transport $2Na^+$ outwards and $3K^+$ inwards.

3 Na+ - outside

2 K+ - inside

(3)

Question no. 125

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

	Column I (Part of the brain)		**Column II (Function)**
a.	Cerebral hemisphere	i.	Sensory and motor signaling
b.	Thalamus	ii.	Posture and balance
c.	Cerebellum	iii.	Movement of heart, stomach, lungs, etc.
d.	Medulla oblongata	iv.	Reflex action
		v.	Voluntary control, intelligence, hearing. speech, etc.

(1) a–(v), b–(ii), c–(i), d–(iv)

(2) a–(v), b–(i), c–(ii), d–(iv)

(3) a–(iii), b–(iv), c–(ii), d–(v)

(4) a–(iii), b–(ii), c–(i), d–(iv)

Question no. 126

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

(1) Medulla oblongata : Controls respiration and cardiovascular reflexes.

(2) Limbic system : Consists of fibre tracts that interconnect different regions of brain; controls movement.

(3) Hypothalamus : Production of releasing hormones and regulation of temperature, hunger and thirst.

(4) Corpus callosum : Band of fibers connecting left and right cerebral hemispheres.

Question no. 127

How many divisions are required for formation of 3–celled mature male gametophyte from pollen mother cell?

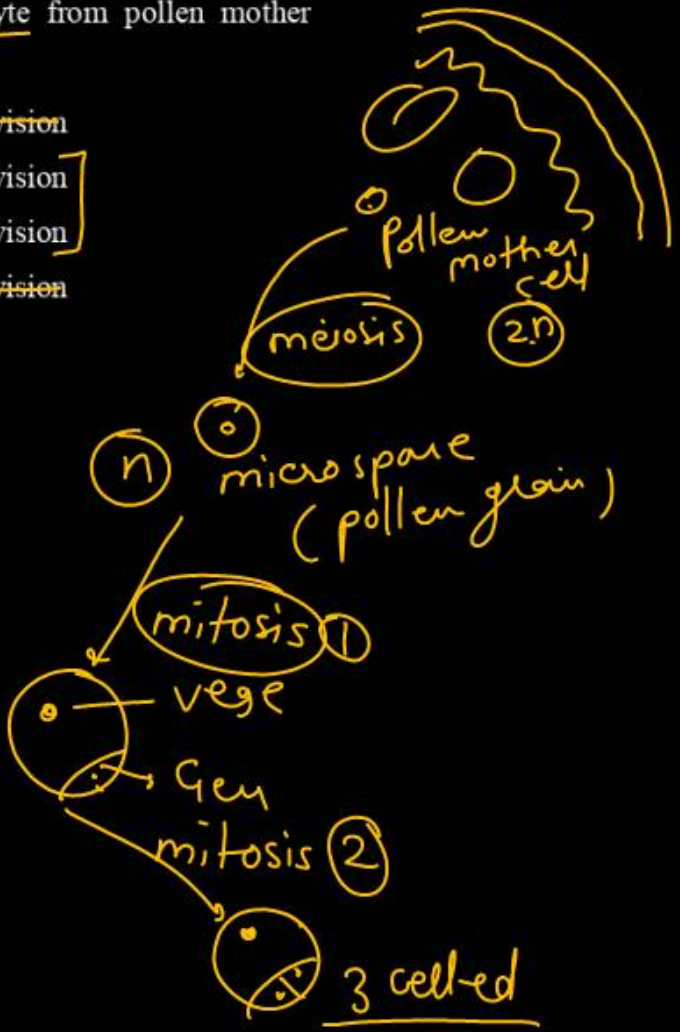
(1) 2 meiotic and 2 mitotic division

(2) 1 meiotic and 2 mitotic division

(3) 1 meiotic and 3 mitotic division

(4) 1 meiotic and 1 mitotic division

2



Question no. 128

Majority of insect pollinated flowers are

(1) Colourful, fragrant and nectarless

(2) Small, colourless and rich in nectar

(3) Large, fragrant and with full of nectar

(4) Brightly coloured, odourless and nectarless

Question no. 129

Which of the following option represents the correct sequence of embryogenesis in dicots?

(1) Zygote → Globular embryo → Heart shaped embryo → Mature embryo

(2) Zygote → Heart shaped embryo → Globular embryo → Mature embryo

(3) Zygote → Heart shaped embryo → Mature embryo → globular embryo

(4) Zygote → Globular embryo → Proembryo → Heat shaped embryo

Question no. 130

Given below are two statements:

Statement I: Cleistogamous flowers are invariably autogamous.

Statement II: Cleistogamy is disadvantageous as there is no change for cross–pollination.

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

(1) Statement I is correct, but statement II is incorrect.

(2) Statement I is incorrect, but statement II is correct.

(3) Both statement I and statement II are correct.

(4) Both statement I and statement II are incorrect.

3

Question no. 131

A characteristic of monocot root is the presence of

(1) Diarch to hexarch radial vascular bundles

(2) Large and well–develoed pith

(3) Protoxylem towards center and metaxylem towards periphery

(4) Formation of cambium at the time secondary growth

Question no. 132

The meristematic tissue which develops between vascular bundles is called

(1) Interfascicular cambium

(2) Intrafascicular cambium

(3) Intercalary meristem

(4) Cork cambium

Question no. 133

The feature which is not associated with internal structure of an isobilateral leaf is

(1) Undifferentiated leaf mesophyll

(2) Conjoint and closed vascular bundles

(3) Presences of more stomata on the abaxial epidermis

(4) Presence of similar size of vascular bundles

3

Question no. 134

Which of the following statement (i–v) are incorrect?

(i) Parapodia are lateral appendages in arthropods used for swimming.

(ii) Radula in molluscs are structures involved in excretion.

(iii) Aschelminthes are dioecious.

(vi) Echinoderm adults show radial symmetry.

(1) (i) and (ii) (2) (i) and (iii)

(3) (i) and (iv) (4) (iii) and (iv)

Question no. 135

Identify the inflorescence shown by the given figure A and B.

A B

Racemose Cymose

(1) A–Cymose, B–Racemose

(2) A–Racemose, B–Cymose

(3) A–Racemose, B–Racemose

(4) A–Cymose, B–Cymose

2

Question no. 136

Whose experiments cracked the DNA and discovered unequivocally that a genetic code is a 'triplet'

(1) Hershey and Chase

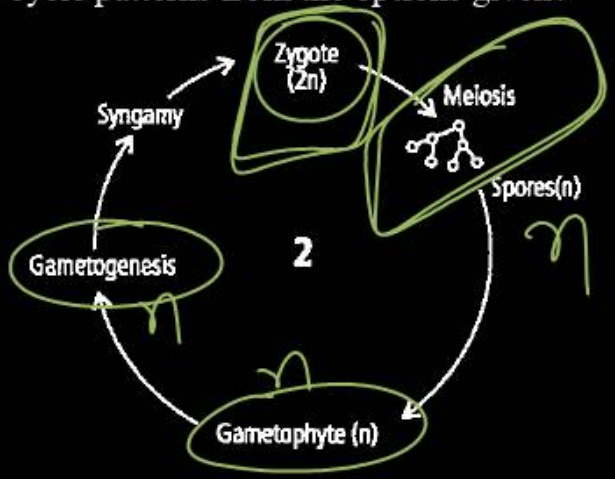
(2) Morgan and Sturtevant

(3) Beadle and Tantum

(4) Nirenberg and Mathaei

Question no. 137

Which of the following correctly represents the type of life cycle patterns from the options given?



(1) Diplontic

(2) Haplodiplontic

(3) Haplontic

(4) Diplontic

Question no. 138

The cranial capacity was largest among the

(1) Peking man

(2) Java ape man

(3) Africa man

(4) Neanderthal man

1450 cc

4

Question no. 139

Which of the following would necessarily decrease the density of a population in a given habitat?

(1) Natality and mortality

(2) Immigration and emigration

(3) Mortality and emigration

(4) Natality and immigration

Question no. 140

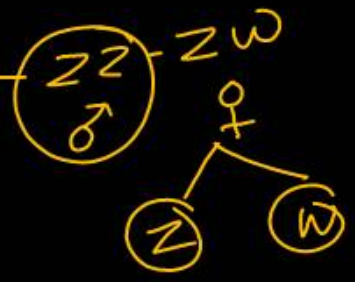
Identify the wrong statement.

(1) In male grasshoppers, 50% of the sperms have no sex chromosome.

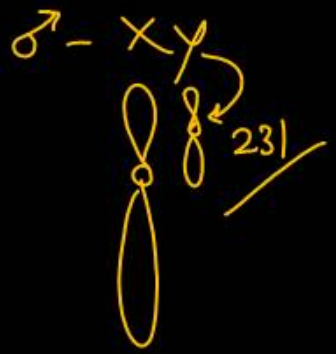
(2) Usually female birds produce two types of gametes based on sex chromosomes.

(3) The human male have one of their sex chromosome much shorter than the other.

(4) In domesticated fowls, the sex of the progeny depends on the type of sperm that fertilizes the egg.



4



Question no. 141

Select the mismatched pair:

(1) Unicellular flagellated– Chlamydomonas

(2) Unicellular flagellated –Chlorella

(3) Flagellated colonial – Volvox

(4) Kelps– Chara

2 4

Question no. 142

A feature (s) common between bryophytes and pteridophytes is /are

A. Presence of indepdendent and photosynthetic gametophyte.

B. Sporic meiosis and haplo–diplontic life cycle.

C. Formation of motile male and non–motile female gamete.

D. Requirement of water for sexual reproduction.

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

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

4

Question no. 143

Which of these algae shows haplo–diplontic and diplontic life cycle, respectively.

(1) Ulothrix, Fucus

(2) Polysiphonia, Fucus

(3) Fucus, Polysiphonia

(4) Polysiphonia, Ectocarpus

H.D diplo.

2

Question no. 144

Select the wrongly matched pair.

(1) Epiphyllous condition – Lily

(2) Monadelphous stamen – Pea → Diadelphe

(3) Ovary inferior – Ray florets of sunflower

(4) Apocarpous condition – Rose

2

Question no. 145

Match column I with column I and choose the correct combination from the options given below.

	Column I (Aestivation)		**Column II (Example)**
a.	Valvate	i.	Bean
b.	Twisted	ii.	Gulmohur
c.	Imbricate	iii.	Mustard
d.	Vexillary	iv.	China rose

(1) a–(iv), b–(i), c–(ii), d–(iii)

(2) a–(iv), b–(ii), c–(i), d–(iii)

(3) a–(ii), b–(iv), c–(i), d–(iii)

(4) a–(iii), b–(iv), c–(ii), d–(i)

Question no. 146

Which one of the following plants shows vexillary aestivation and diadelphous stamens?

(1) Allium cepa

(2) Solanumnigrum

(3) Colchicum autumnale

(4) Pisumsativum

(Pea)

Pisum sativum

4

Question no. 147

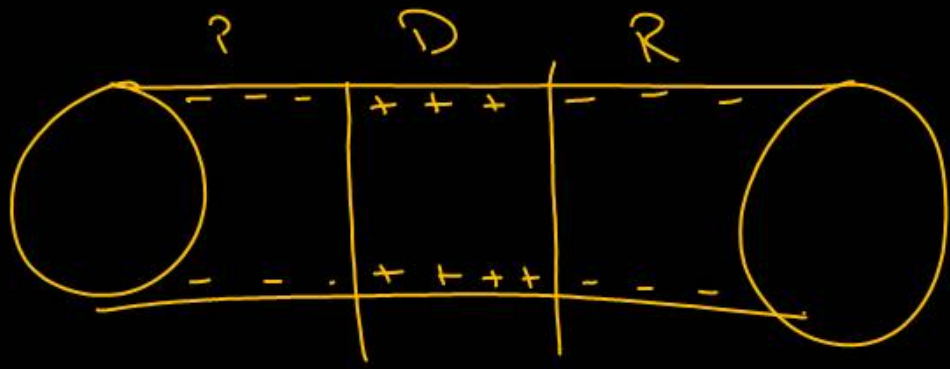
During the conduction of impulse through a neuron, the electrical potential on the inner side of the axonal membrane is

(1) First positive, then negative, and then positive

(2) First negative, then positive, and then negative

(3) First negative, then positive, and continues to be positive.

(4) Frist positive, then negative, and continues to be negative.



2

Question no. 148

Which of the following is not a function of parasympathetic nervous system?

(1) Increases production of gastric juice

(2) Increase secretin of sweat glands

(3) Decrease heart rate

(4) Constricts pupil

Normal condition

2

Question no. 149

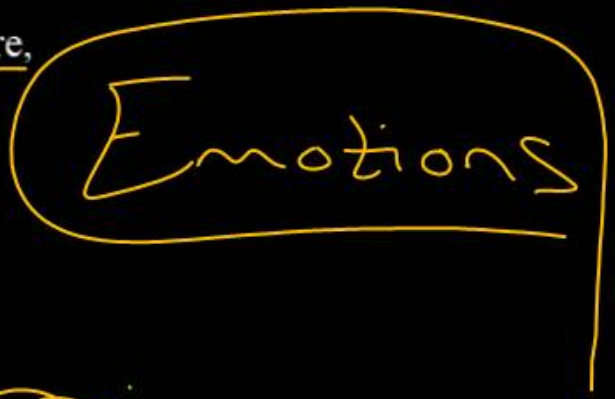
The parts of human brain that helps in regulation of sexual behavior, expression of excitement, pleasure, rage, fear, etc., are

(1) Corpora quadrigemina and hippocampus

(2) Brain stem and epithalamus

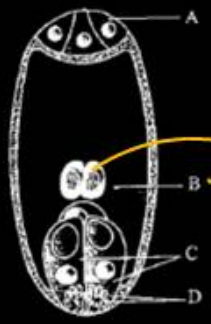
(3) Corpus callosum and thalamus

(4) Limbic system and hypothalamus



Question no. 150

. Given below is the diagrammatic representation of embryo sac. Identify the parts labelled A, B, C, and D and select the correct option.



Antipodas
– central cell
synergids
filiform app
3

	A	B	C	D
(1)	Antipodals	Central cell	Synergids	Egg cell
(2)	Antipodals	Polar nuclei	Synergids	Filiform apparatus
(3)	Antipodals	Central cell	Synergids	Filiform apparatus
(4)	Synergids	Polar nuclei	Antipodals	Egg cell

Question no. 151

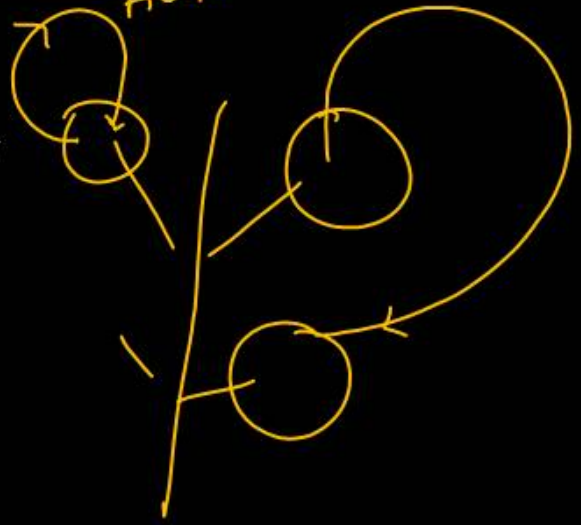
In plants like papaya and date palm, the type(s) of pollination which would be prevented is/are

(1) Only autogamy

(2) Only geitonogamy

(3) Both autogamy and geitonogamy

(4) Both autogamy and xenogamy



Question no. 152

How many of the following have albuminous seeds?

Wheat, Maize, Barley, Castor, Orchid, Pea, Groundnut

(1) 2

(2) 3

(3) 4

(4) 6

Question no. 153

Locations or sites in the human DNA where single base DNA differences occur are called

(1) repetivie DNA
(2) VNTR
(3) SNP
(4) SSCP

Question no. 154

Barrel–shaped cells with suberisedCasparian strips are seen in

(1) Endodermis of dicot stem

(2) Epidermis of dicot stem

(3) Endodermis of dicot root

(4) Epidermis of monocot root

Single layer of barrel shaped cells.

3

Question no. 155

Cork cambium and intrafascicular cambium are the examples of

(1) Primary meristems (2) Secondary meristems

(3) Lateral meristems (4) Marginal meristems

Bark
wood

2

Question no. 156

Read the following statements with respect to dicot stem.

A. Vascular bundles are arranged in a ring.

B. Epidermis is converd by a thin layer of cuticle.

C. The cells of the endodermis have a deposition of water impermeable waxy material.

D. Pericycle contains both parenchyma and sclerenchyma.

E. Well–developed pith is present in centre.

How many of the above given statements are correct?

(1) Two (2) Three

(3) One (4) Four

Question no. 157

Choose the correct combinations.

I. Hypogynous flower

II. Perigynous flower

III. Epigynous flower

(1) A–I, B–II, C–III (2) A–I, B–III, C–II

(3) A–III, B–II, C–I (4) A–III, B–I, C–II

Position of ovary

1

Question no. 158

The number of glycosidic bonds associated with DNA of diploid human cell are

(1) 6.6×10^{9}

(2) $2\times6.6\times10^{9}$

(3) 3.3×10^{9}

(4) $3.3\times10^{9}-2$

∴ 2

Question no. 159

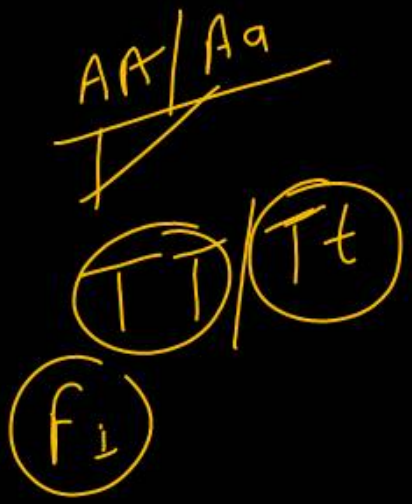
Test cross is used to

(1) check heterozygosity in F_1 generation

(2) check heterozygosity in F_2 generation

(3) check independent assortment

(4) check segregation.



Question no. 160

One of the ex situ conservation methods for endangered species is

(1) wildlife sanctuaries (2) biosphere reserves

(3) cryopreservation (4) National parks

3

Question no. 161

Which of the following controls the function of Sertoli cells?

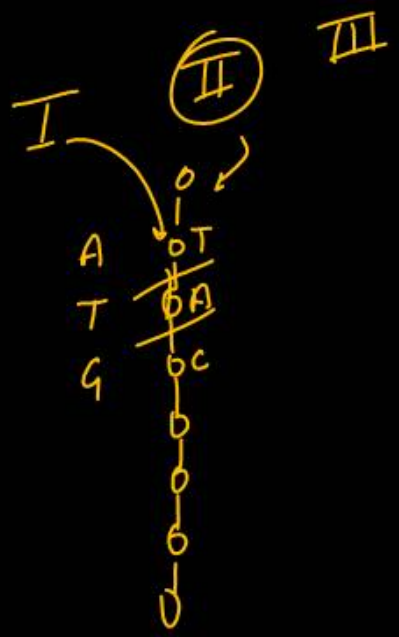
(1) FSH
(2) Estrogen
(3) ACTH
(4) Testosterone

Question no. 162

The prokaryotic enzymes with 5'→ 3' exonuclease property is/are

(1) DNA polymerase I (2) DNA polymerase II

(3) DNA polymerase III (4) both (1) and (3)



Question no. 163

Agar, one of the commercial products, is obtained from

(1) Porphyra and Polysiphonia

(2) Laminaria and Fucus

(3) Sargassum and Prophyra

(4) Gelidium and Gracilaria

Culture medium.

(4)

Question no. 164

How many statements are/is correct?

a. Selaginella and Salvinia are heterosporous.

b. Majority of pteridophytes are homosporous.

c. In Equisetum, sporophylls are aggerated to form strobilus or cone.

d. Antherozoids require water for their transfer towards the mouth of archegonia.

(1) Two (2) Four

(3) Five (4) three

2

Question no. 165

Match the column I and column II and select the correct option:

	Column I		Column II
a.	Psilopsida	i.	Dryopteris
b.	Lycopsida	ii.	Psilotum
c.	Sphenopsida	iii.	Lycopodium
d.	Pteropsida	iv.	Equisetum

(1) a–(ii), b–(iii), c–(iv), d–(i)

(2) a–(i), b–(iii), c–(iv), d–(ii)

(3) a–(ii), b–(iv), c–(iii), d–(i)

(4) a–(ii), b–(i), c–(iv), d–(iii)

Question no. 166

Which of the following options has correctly matched algal class with its major pigments and stored food?

	Classes of alae	Major pigments	Stored food
(1)	Chlorophyceae	Chl a, b	Cellulose
(2)	Phaeophyceae	Chl a, c; Fucoxanthin	Mannitol, laminarin
(3)	Rhodophyceae	Chl a, d; xanthophyll	Starch, align
(4)	Cyanophyceae	Phycocyanin&phycoerythrin	Floridean starch, glycogen.

2

Question no. 167

Which one of the following pairs correctly matches a hormone with a disease resulting its deficiency?

(1) Insulin – Diabetes insipidus

(2) Thyroxine – Osteoporosis

(3) Parathormone – Tetany

(4) Oxytocin – Gigantism

3

Question no. 168

The anatomy of springwood shows some peculiar features. Identify the correct set of statements about springwood.

A. It is also called as the earlywood.

B. In spring season, cambium produces xylem elements with narrow vessls.

C. It is lighter in colour.

D. The springwood along with autumn wood shows alternate concentric rings forming annual ring.

E. It has lower density.

Choose the correct answer from the options given below:

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

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

Question no. 169

The forebrain consists of

(1) Thalamus, cerebellum, and pons

(2) Cerebrum, cerebellum, and pons

(3) Cerebrum, thalamus, and hypothalamus

(4) Cerebrum, hypothalamus, and cerebellum

Question no. 170

Which of the following is not a part of hindbrain?

(1) Pons
(2) Cerebrum
(3) Cerebellum
(4) Medulla oblongata

Cerebellum
Pons
medul

2

Question no. 171

In which of the following layer of anther wall, cells possess dense cytoplasm and generally have more than one nucleus?

(1) Endothecium
(2) Tapetum
(3) Middle layer
(4) Exothecium

Question no. 172

What will be the ploidy of synergids, megaspore, MMC and nucellus respectively in a flowering plant?

(1) n, n, 2n, 2n

(2) n, n, 2n, n

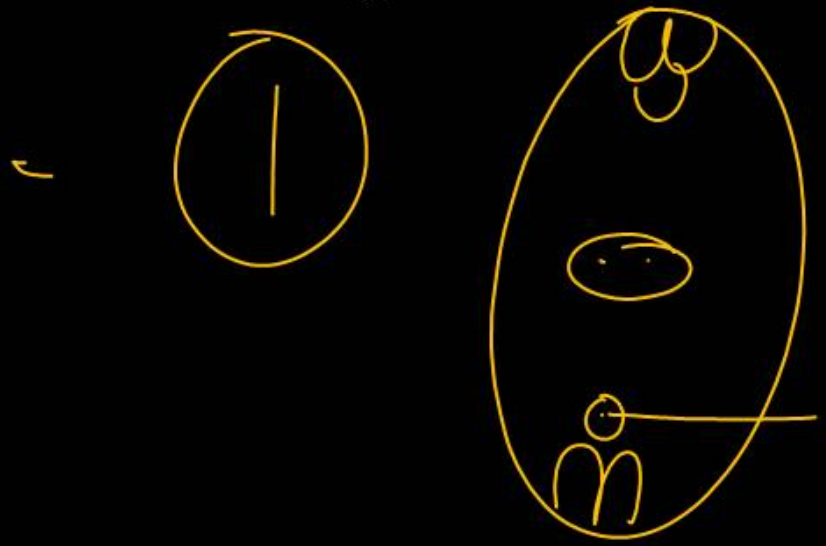
(3) n, 2n, 2n, n

(4) 2n, 2n, n, 2n

Question no. 173

How many female gamete (s) are involved in double fertilization?

(1) 1
(2) 2
(3) 3
(4) 0



Question no. 174

What would be the number of chromosomes of aleuronic cells of a plant with 42 chromosome in its root tip cells?

(1) 42
(2) 63
(3) 84
(4) 21

Endosperm
3n
3 × 21 = 63

2n = 42
n = 21

Question no. 175

Pith is well developed in

A. Monocot root
B. Dicot root
C. Monocot stem
D. Dicot stem

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

Parenchyma cell.

2

Question no. 176

Anatomy of dorsiventral leaves is similar to that of isobilateral leaves in many ways but the former shows some characteristic differences with latter. These are

A: Presence of bulliform cells

B: Differentiated leaf mesophyll

C: More stomata on lower epidermis

D: Conjoint and closed vascular bundles

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

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

Question no. 177

Which of the following sequence is correct from outside to inner side in the internal structure of a soody dicotyledonous stem?

(1) Cork→ Secondary cortex →Secondary phloem →Phellogen Wood

(2) Phellem→Phellogen→Phelloderm →Secondary phloem →Wood

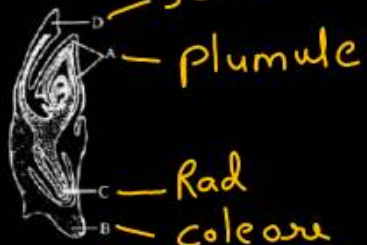
(3) Cork→ Secondary cortex →Cork cambium →Secondary phloem → Secondary xylem

(4) Phellem→Phelloderm→Phellogen→Secondary phloem →Secondary xylem

Question no. 178

Identify the parts labelled A, B, C and D in the given diagram from the list (i–vii) and select the correct option.

Components:



Scutellum
Plumule
Rad
Coleorhiza

(i) Scutellum
(ii) Coleoptile
(iii) Shoot apex
(iv) Epiblast
(v) Radicle
(vi) Root cap
(vii) Coeorrhiza

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

2

Question no. 179

Cup shaped choloroplast is present in–

(1) Spirogyra

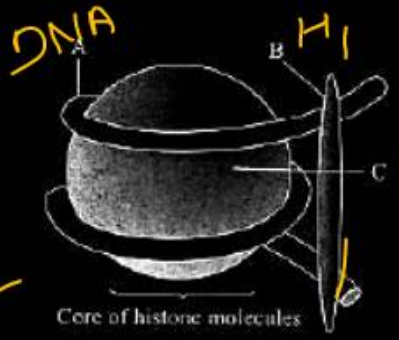
(2) Chlamydomonas

(3) Ulothrix

(4) Chara

Question no. 180

Identify A, B and C of a nucleosome.



(1) A – DNA; B – H1 histone; C – Histone octamer

(2) A – H1 histone ; B – DNA; C – Histone octamer

(3) A – Histone octamer ; B – RNA ; C– H1 histone

(4) A – RNA; B – H1 histone ; C –Histone octamer