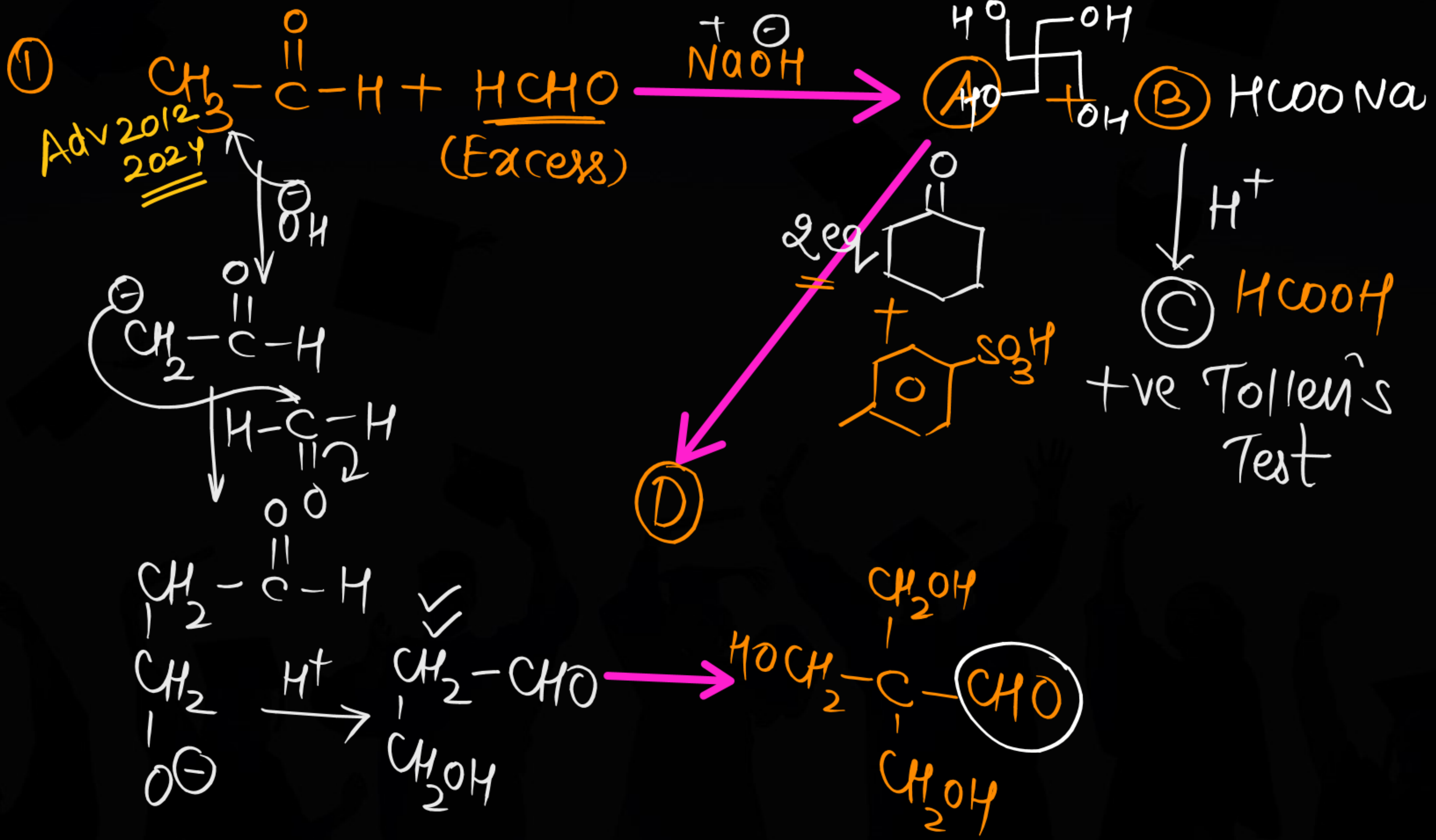
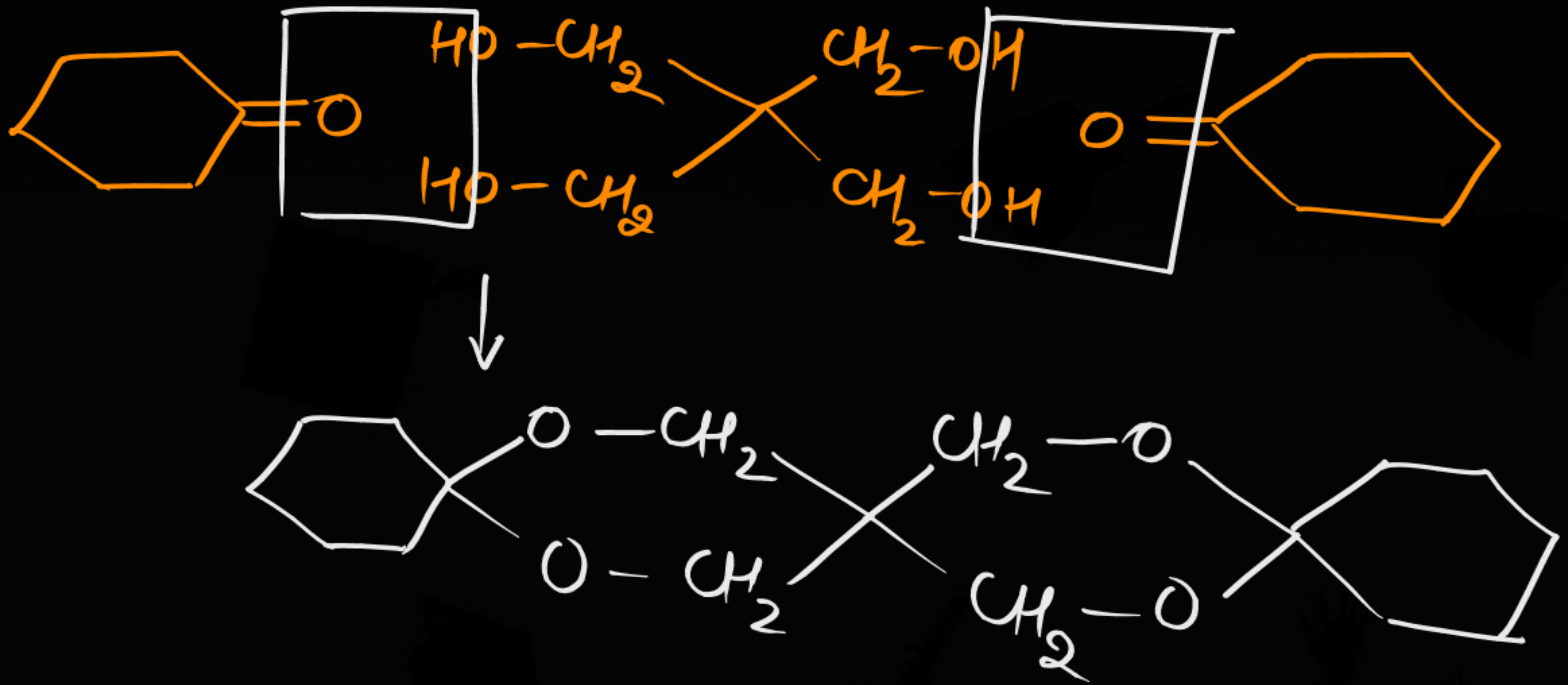
JEE Advanced Paper Discussion

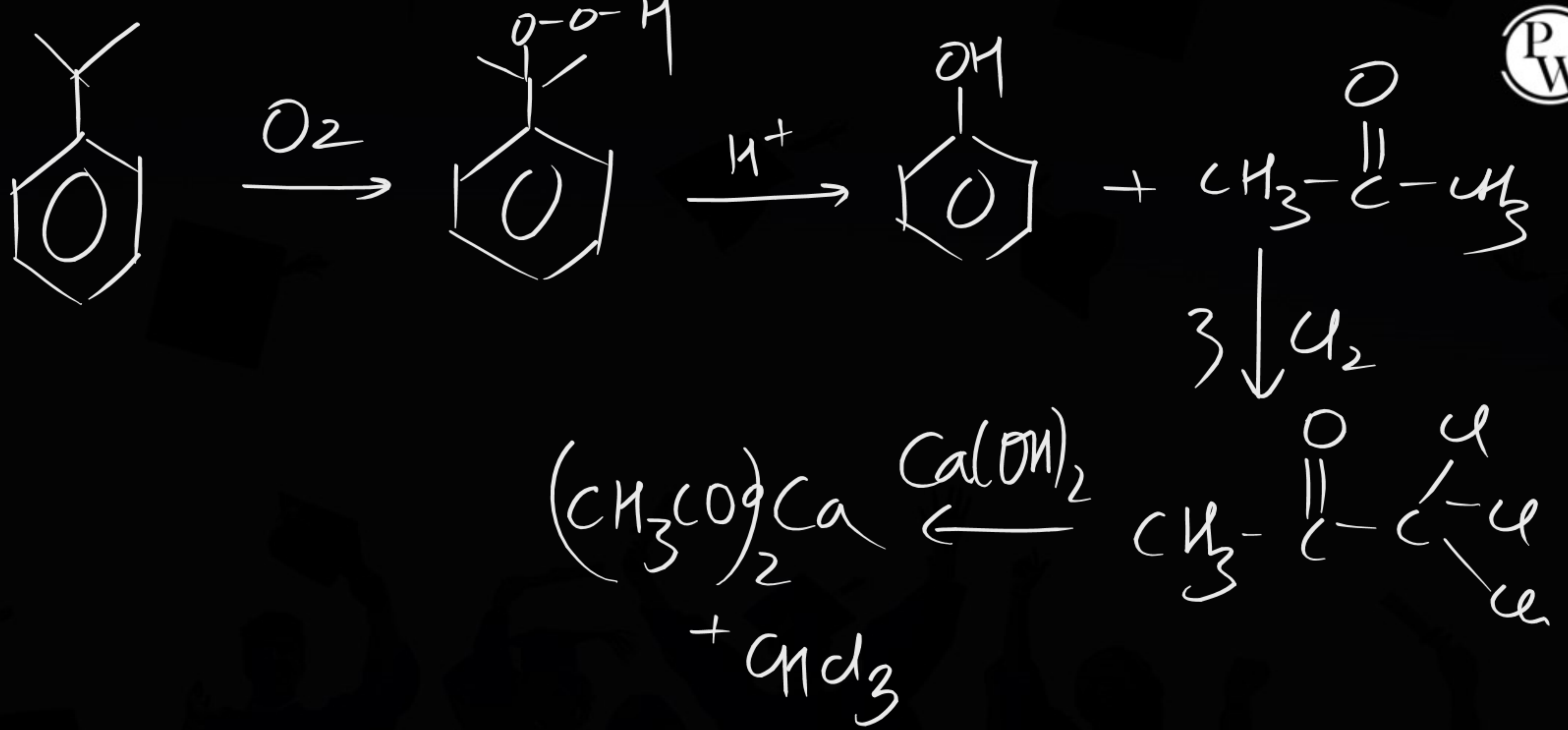
Paper 1 & 2

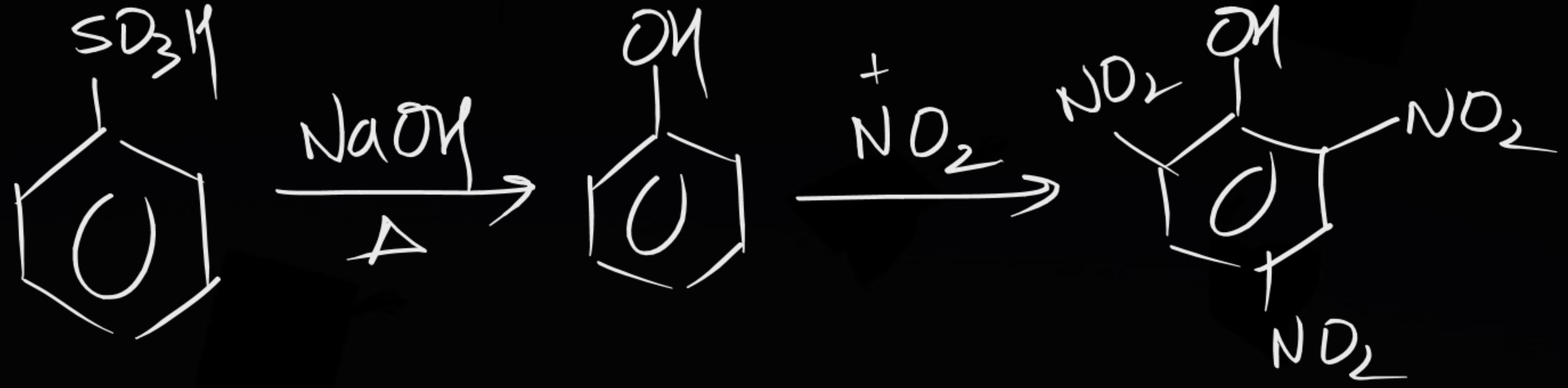
organic chemistry



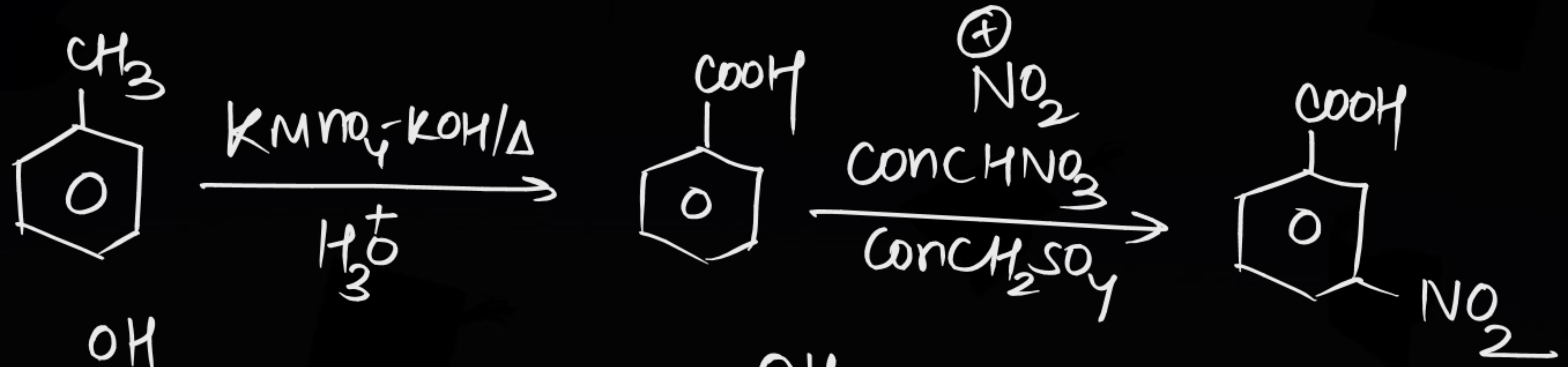
1
Adv 2012
2024
CH3–C(=O)–H + HCHO
(Excess)
NaOH
A
B HCOONa
H+
C HCOOH
+ve Tollen's Test
2eq
SO3H
D
OH
H+
CH2OH
HOCH2–C–CHO
CH2OH

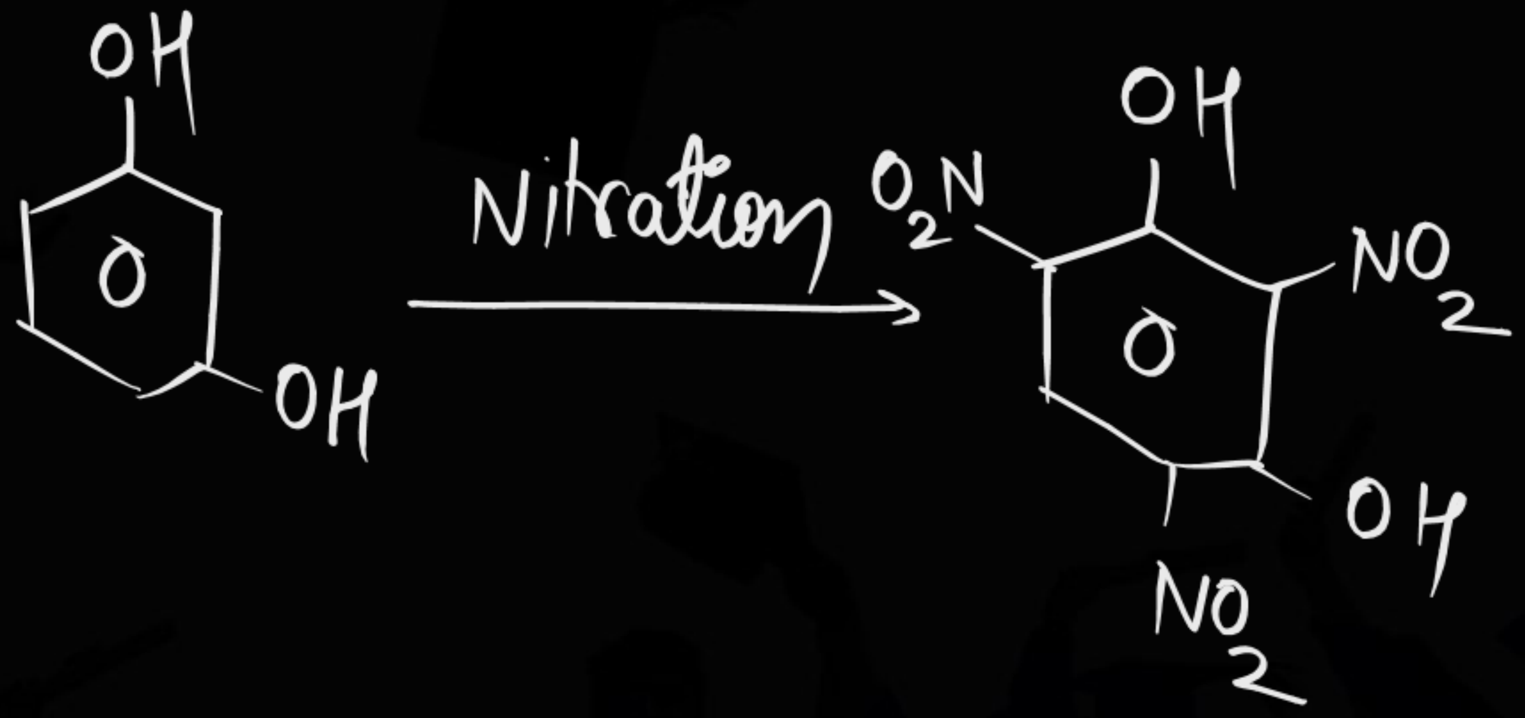

HO–CH2
HO–CH2
CH2–OH
CH2–OH
O
O–CH2
O–CH2
CH2–O
CH2–O


O-O-H
O_2
H^+
OH
O
$+ CH_3-C-CH_3$
$3\ Cl_2$
O
Cl
$CH_3-C-C-Cl$
Cl
$Ca(OH)_2$
$(CH_3COO)_2Ca$
$+ CHCl_3$



SO3H
NaOH
Δ
OH
NO2
OH
NO2
NO2
NO2


CH_3
$KMnO_4$-KOH/Δ
H_3O^+
COOH
$\overset{\oplus}{NO_2}$
Conc HNO_3
Conc H_2SO_4
COOH
NO_2


OH
OH
Nitration
OH
O_2N
NO_2
OH
NO_2

Q/ $H-C\equiv C-(CH_2)_{15}-\overset{O}{\overset{\|}{C}}-OH$

$$\downarrow Hg^{2+} / H_2O$$

$$H-\underset{H}{C}=\overset{OH}{C}-(CH_2)_{15}-COOH$$

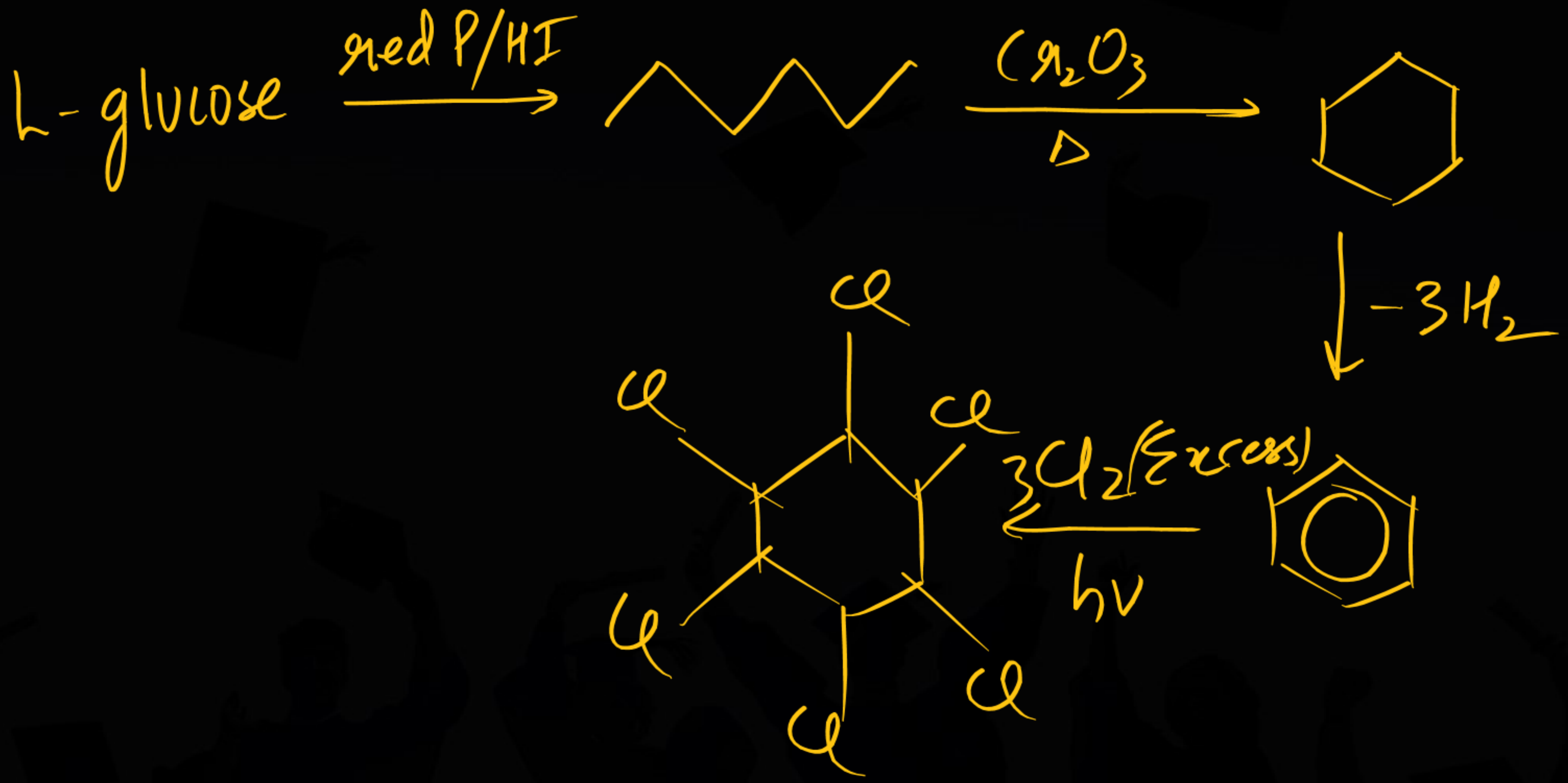
$$\updownarrow$$

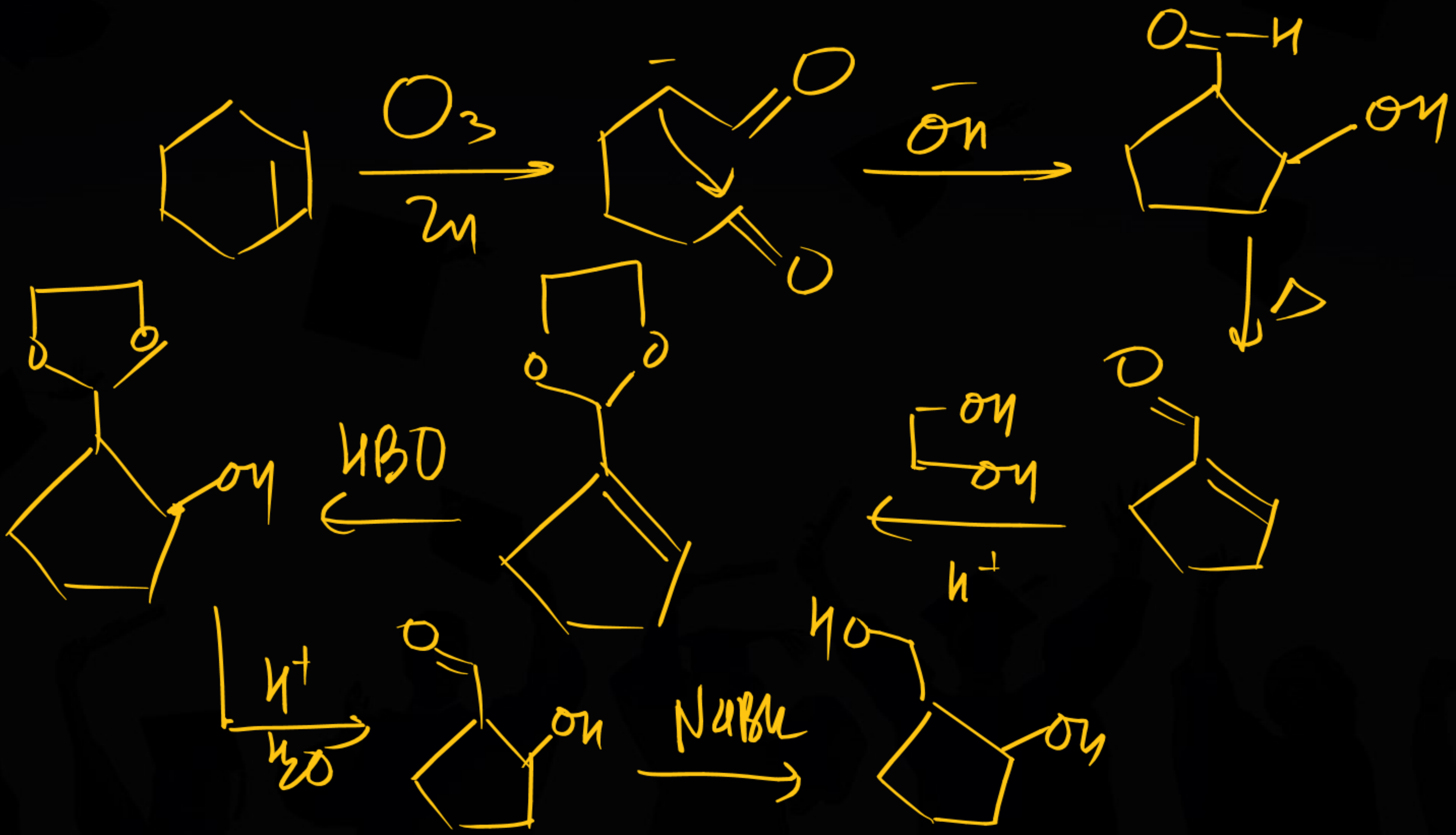
$$CH_3-\overset{O}{\overset{\|}{C}}-(CH_2)_{15}-COOH \xrightarrow[\text{Conc HCl}]{Zn(Hg)} CH_3-CH_2-(CH_2)_{15}-COOH$$

3 eq

$$\boxed{C_{17}H_{35}-COOH}$$

$$C_{17}H_{35}-COOH + \begin{array}{l} HO-CH_2 \\ HO-CH \\ HO-CH_2 \end{array} \longrightarrow \begin{array}{l} C_{17}H_{35}COO-CH_2 \\ C_{17}H_{35}COO-CH \\ C_{17}H_{35}COO-CH_2 \end{array}$$


L-glucose
red P/HI
Cr2O3
Δ
-3H2
3Cl2(Excess)
hν
Cl
Cl
Cl
Cl
Cl
Cl



O3
Zn
OH
O=H
OH
OH
OH
H+
HBO
OH
H+
H2O
OH
NaBH
HO
OH

Aspartame is a methyl ester of the dipeptide of Natural amino acid ?

(L-Aspartic Acid + L-Phenyl Alanine)

JEE ADVANCED 2024 LIVE PAPER DISCUSSION

What is the disproportionation product of HNO_2 ?

(A) NO

(B) H_2O

(C) $HNO_3 + NO + H_2O$ ✓

(D) None of these

$$\overset{+3}{2HNO_2} \longrightarrow \overset{+2}{NO} + \overset{+5}{HNO_3} + H_2O$$


PW
LIVE STREAMING
JEE ADVANCED 2024
SHIFT 01
QUESTION PAPER
DISCUSSION

Chemistry

In which of the following option first compound shows Geometrical isomerism and the second one shows ionisation isomerism -

MA_3B_3

(A) $[Co(NH_3)_3Cl_3]$ and $[Co(H_2O)_5SO_4]Cl$

(B) $[Co(en)_3]$ and $[Co(NH_3)_3Cl_3]$

(C) $[Co(NH_3)_6][CoCl_6]$ and $[Co(NH_3)_6]Cl$

(D) $[Co(NH_3)_2Cl_2]$ and $[Co(NH_3)_6][CoCl_6]$

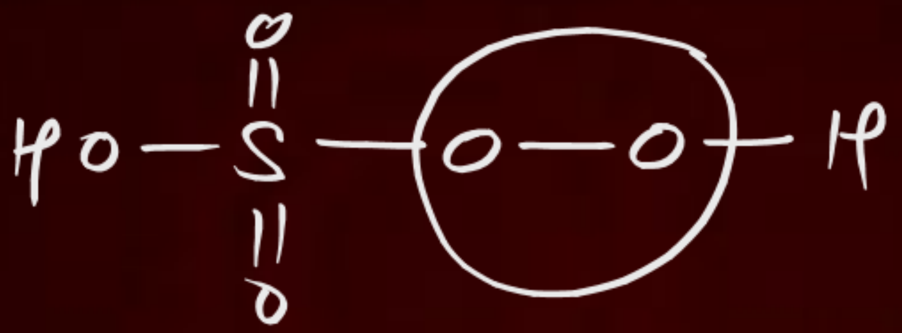
Which of the following has peroxy linkage?

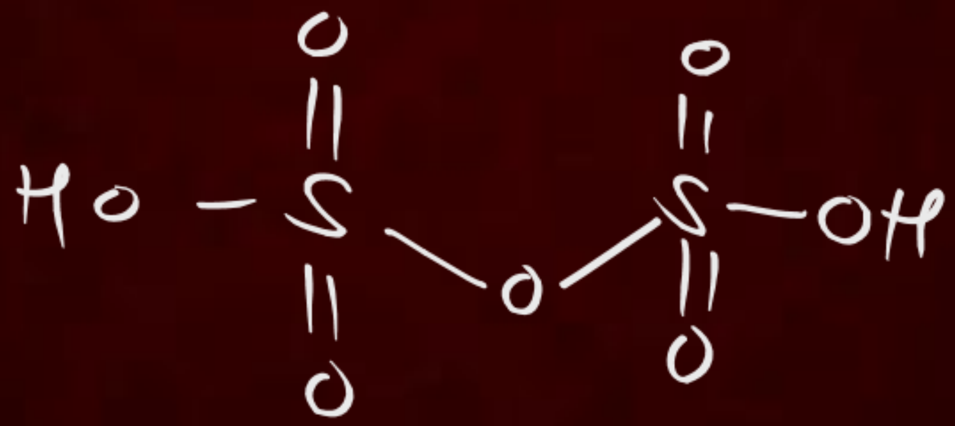
(A) H_2SO_5

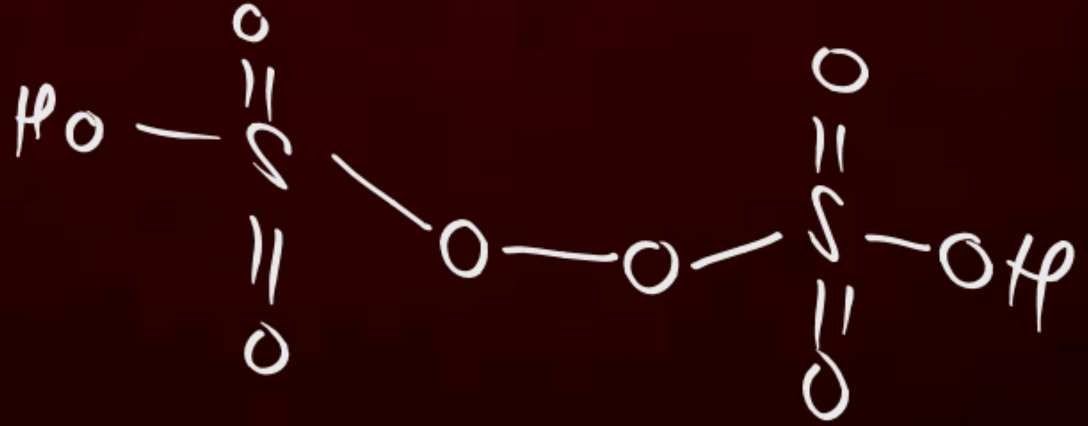
(B) $H_2S_2O_7$

(C) $H_2S_2O_5$

(D) $H_2S_2O_8$







Total number of compound among the following which are tetrahedral-

(A) $Ni(CO)_4$ $\longrightarrow$ $4s^2\, 3d^8$ $\longrightarrow$ d^{10} sp^3

(B) $[\overset{+2}{Ni}(CN)_4]^{2-}$ $\longrightarrow$ $3d^8$ $\longrightarrow$ dsp^2

(C) P_4 $\longrightarrow$

(D) $[\overset{+2}{Pd}Cl_4]^{2-}$ $\longrightarrow$ $4d^8$, $5d^8$ $\Big\}$ $\rightarrow dsp^2$

(E) $[PtCl_4]^{2-}$ $\longrightarrow$ $5d^8$

$Ni(CO)_4$

$Ni(CN)_4^{2-}$

$[NiCl_4]^{2-}$

Match the following:

Column-I	Column-II
(A) XeF_4	(p) Linear
(B) XeO_3F_2	(q) Trigonal Pyramidal
(C) XeO_3	(r) Square Planar
(D) XeF_2	(s) TBP

$\rightarrow bp=4\ lp=2$ sq. Planar

follow EAN Rule?

5

How many complexes ~~are isoelectronic?~~

$V(CO)_6$, $Cr(CO)_6$, $[Mn(CO)_5]^-$ $Fe(CO)_5$, $[Co(CO)_3]^{3-}$, $[Cr(CO)_4]^{4-}$, $Ir(CO)_3$, $[Cu(CO)_3]^+$

36 36 36 36 36 x

34

$23 + 6 \times 2 = 35$

$[Ni(CO)_4]$

36

Which of the following complexes are diamagnetic?

$[Mn(NH_3)_6]^{+3}$; $[Fe(H_2O)_6]^{+3}$; $[CoCl_6]^{3-}$; $[Co(NH_3)_6]^{3+}$; $[Ni(CO)_4]$

+3 +3 +3 +3

$2+5=d^4$ $2+6-3$ d^6 d^6 d^{10}

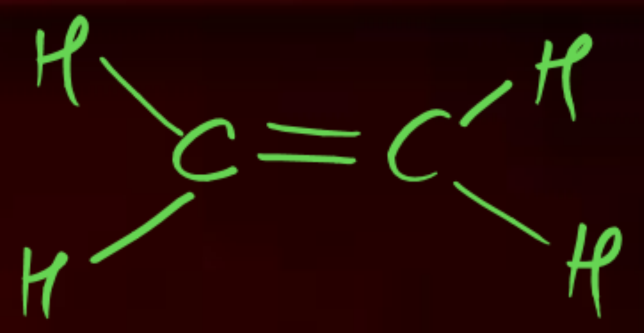
P d^5 Para Diamag Dia

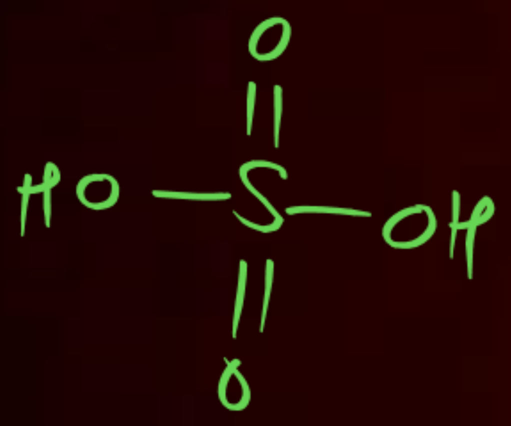
e_g Para

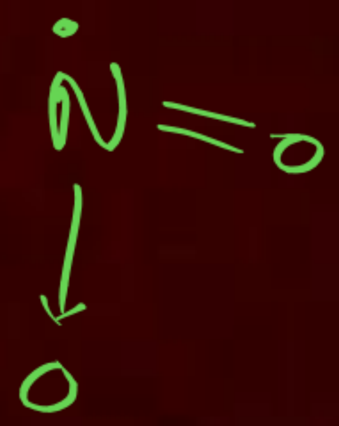
t_{2g}

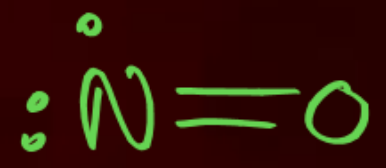
Which of the following follow octet rule:

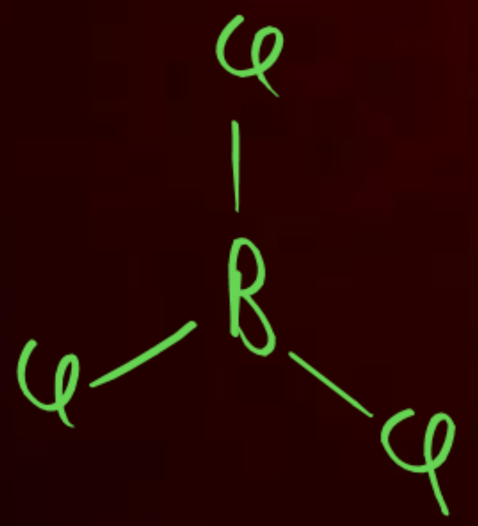
H_2SO_4, HCl, NO_2, NO, O_3, C_2H_4, BCl_3











Product of disproportion of HNO_2

(A) NO

(B) HNO_3

(C) N_2O_5

(D) N_2O

PHYSICS

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If $\underbrace{e^{\alpha}.\varepsilon_0^{\beta}}.\underbrace{h^{\gamma}.c^{\delta}}$ is dimensionless quantity, then find a relation between $\alpha, \beta, \gamma, \delta$ where e, ε_0, h, c respectively charge, permittivity of free space, planck constant and speed of light

$U = \frac{e^2}{4\pi\epsilon_0 r}$ $\quad \frac{e^2}{\epsilon_0} = Ur \quad [ML^3T^{-2}]$

$E = \frac{hc}{\lambda} \Rightarrow hc = E\lambda = [ML^3T^{-2}]$

$\frac{hc\epsilon_0}{e^2} = [M^0L^0T^0A^0]$

$e^{-2}\epsilon_0^1 h^1 c^1 \Rightarrow$

$\boxed{-2n; n, n, n}$

Ans

$e = [AT]$

$\epsilon_0 = [M^{-1}L^{-3}T^{4}A^{2}]$

$h = [ML^{2}T^{-1}]$

$c = [LT^{-1}]$

$$[e^{\alpha}\epsilon_0^{\beta}h^{\gamma}c^{\delta}] = [M^0L^0T^0A^0]$$

$$[AT]^{\alpha}[M^{-1}L^{-3}T^{4}A^{2}]^{\beta}[ML^{2}T^{-1}]^{\gamma}$$

$$[LT^{-1}]^{\delta} = M^0L^0T^0A^0$$

$$A^{\alpha+2\beta}\ T^{\alpha+4\beta-\gamma-\delta}\ M^{-\beta+\gamma}\ L^{-3\beta+2\gamma+\delta}$$

$$= M^0L^0T^0A^0$$

$\alpha + 2\beta = 0$

$\alpha + 4\beta - \gamma - \delta = 0$

$-\beta + \gamma = 0$

$-3\beta + 2\gamma + \delta = 0$

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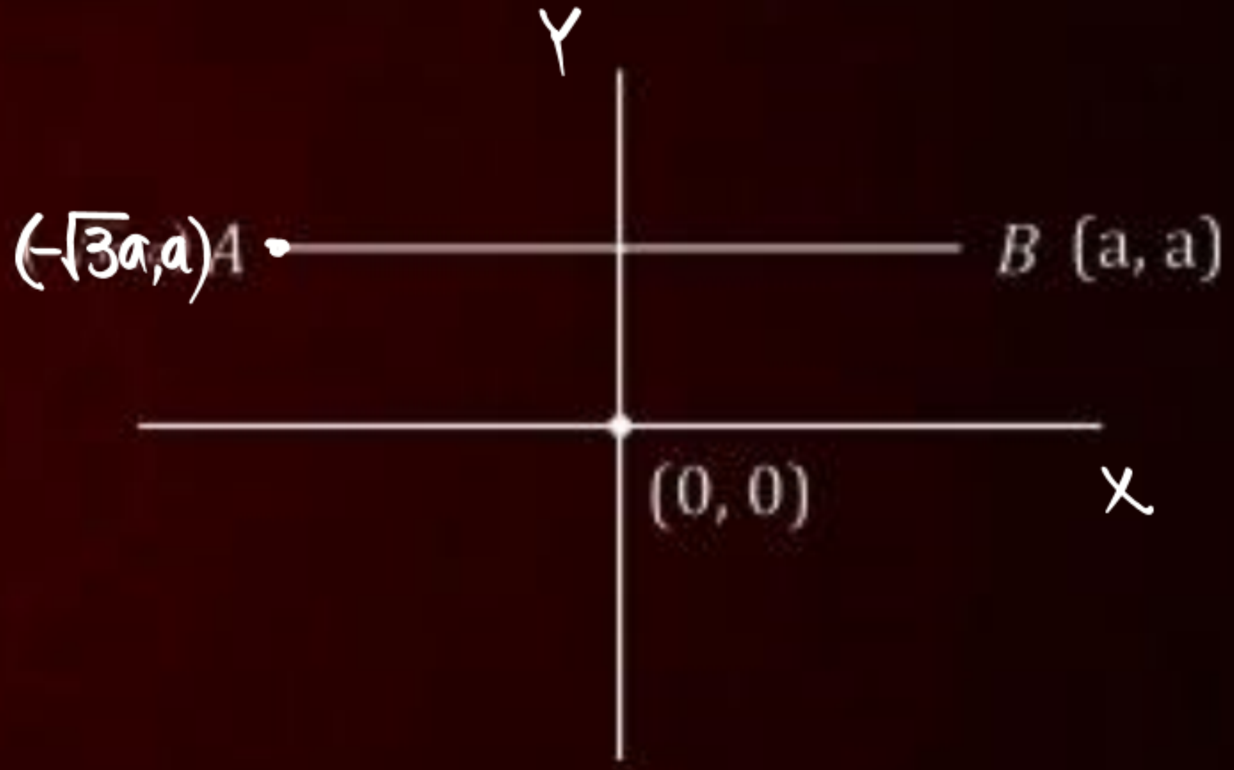
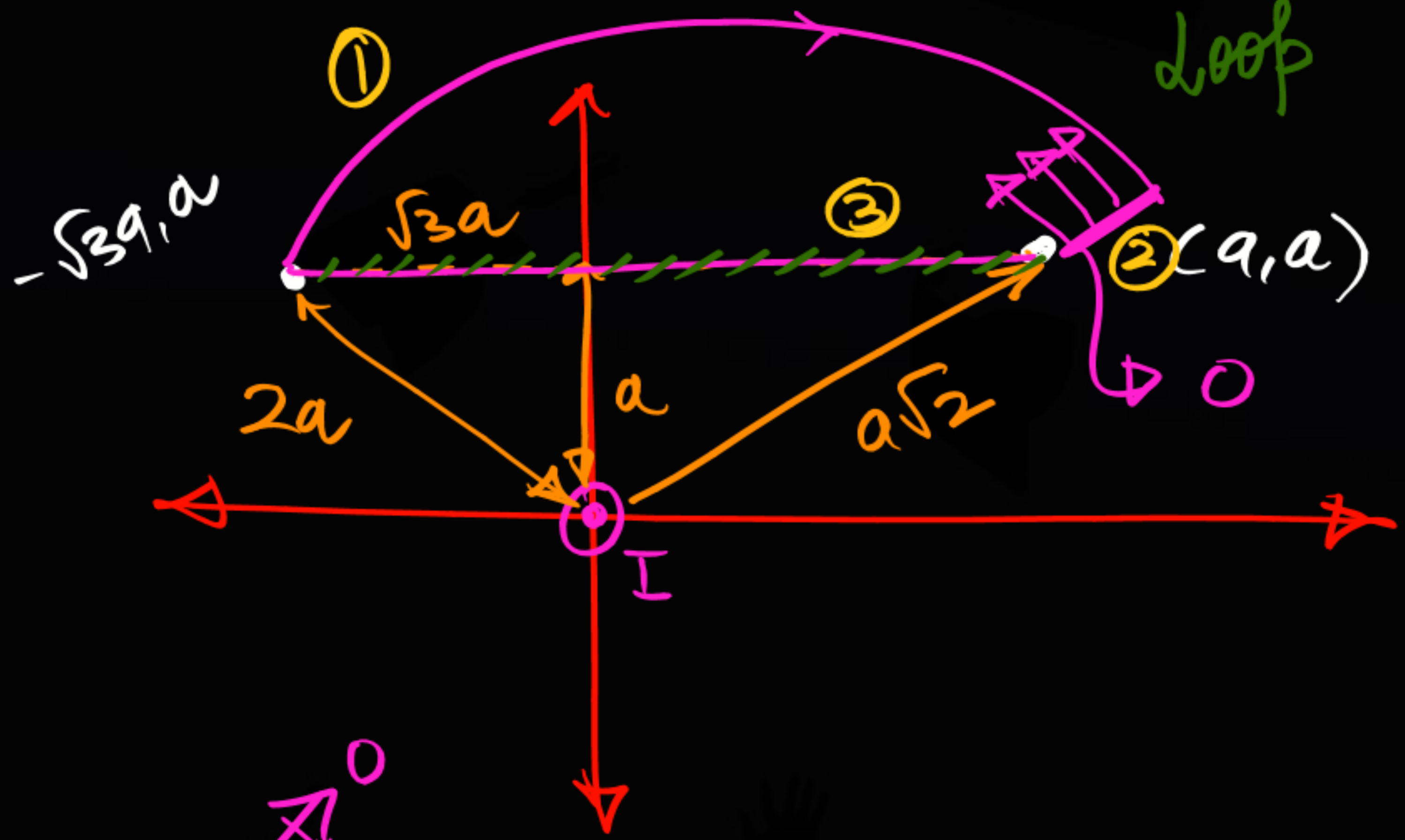
A infinite wire is placed along +z direction and a straight line has its end point at $A(-\sqrt{3}a, a)$ and $(a, a, 0)$ then the value of line integral of $\int \vec{B}.d\vec{l}$ is

$$\int \vec{B}\cdot\vec{dl} = \int B\,dl\cos\theta.$$



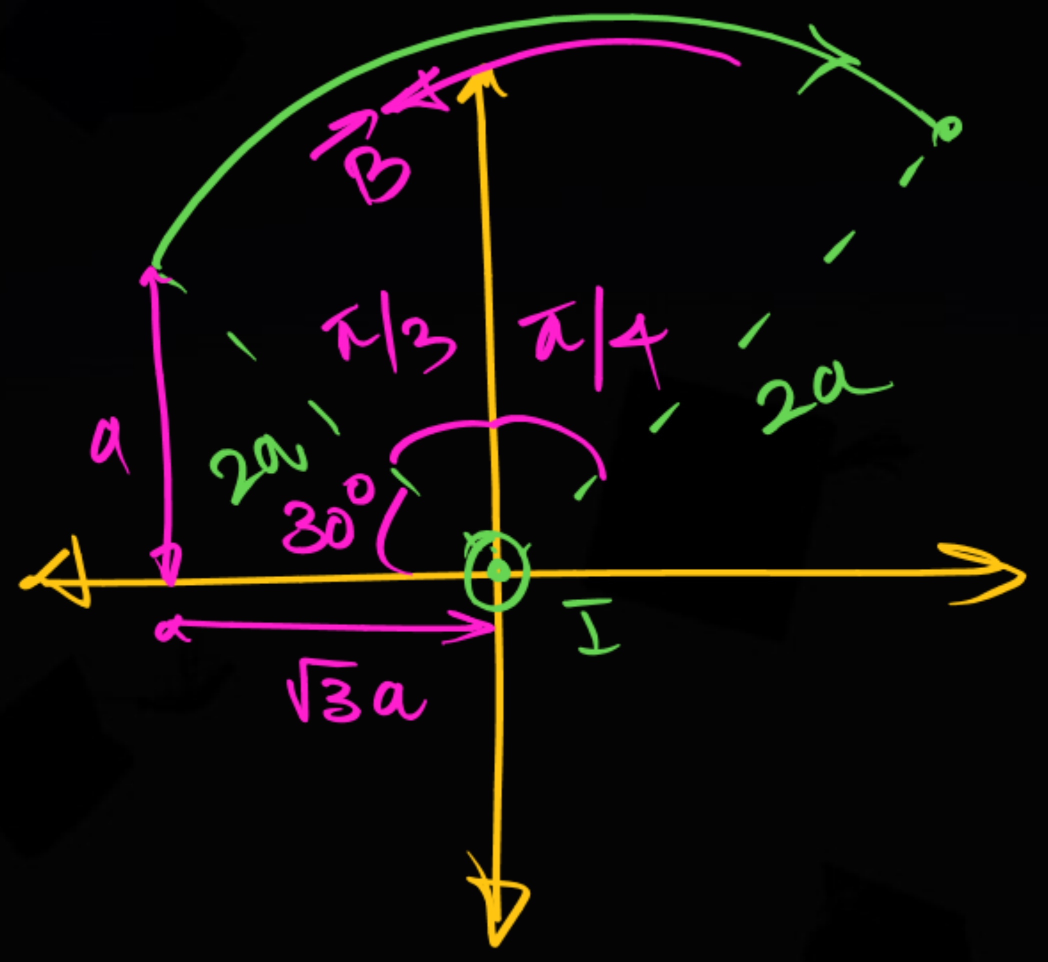


Loop $I_i = 0$

$$\oint \vec{B}\cdot d\vec{l} = 0$$

$$\int \vec{B}\cdot d\vec{l}_1 + \underbrace{\int \vec{B}\cdot d\vec{l}_2}_{0} + \int \vec{B}\cdot d\vec{l}_3 = 0$$

$$\boxed{\left|\int \vec{B}\cdot d\vec{l}\right|_1 = -\left|\vec{B}\cdot d\vec{l}\right|_2}$$



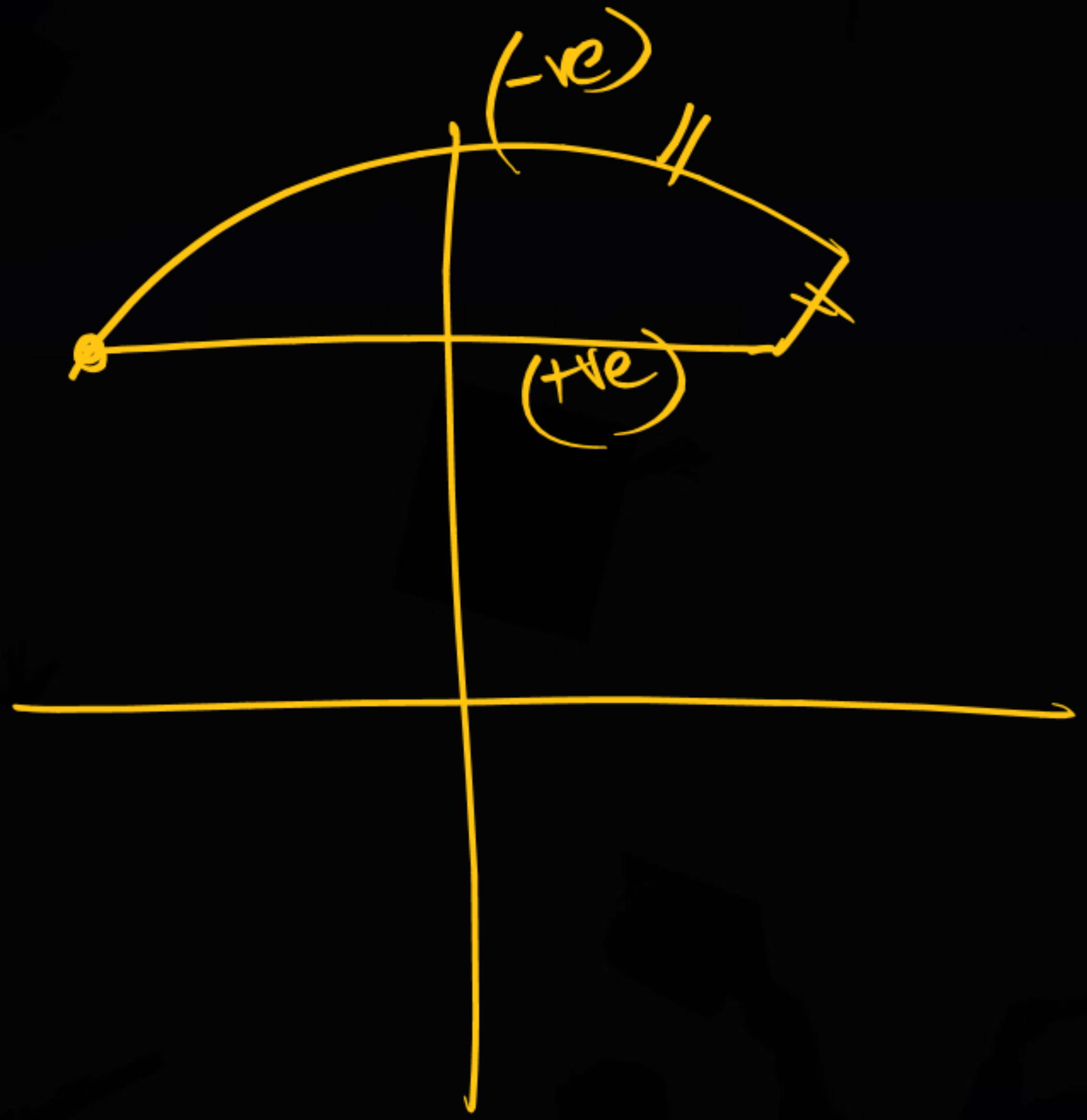
$$B = \frac{\mu_0 I}{2\pi(2a)}$$

$R(\theta)$

$$\int \bar{B}\, d\bar{l} = \frac{\mu_0 I}{2\pi(2\cancel{a})} \cdot 2\cancel{a}\left(\frac{\pi}{3} + \frac{\pi}{4}\right)\cos\pi$$

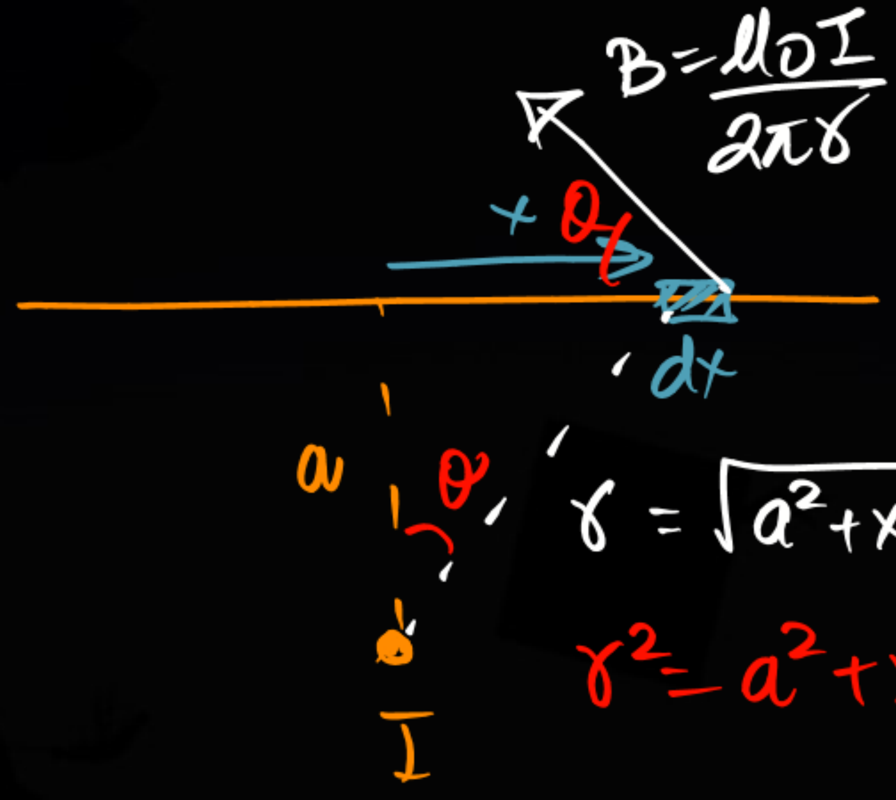
$$= -\frac{\mu_0 I}{2}\left[\frac{7}{12}\right]$$

$$= \frac{-7\mu_0 I}{24}$$



$$\text{Ans} = \frac{7\mu_0 I}{24} \quad \underline{\text{Ans}}$$

#



$r = \sqrt{a^2 + x^2}$

$r^2 = a^2 + x^2$

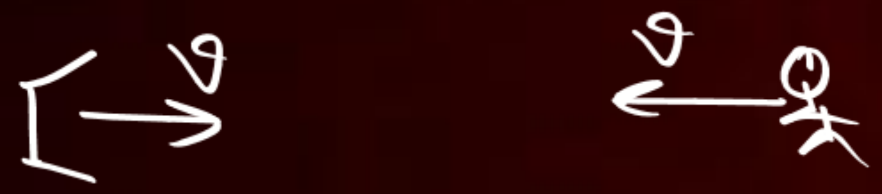
$$\int B\,dl = \int \frac{\mu_0 I}{2\pi r} \cdot dx \cdot \cos\theta$$

$$\int \frac{\mu_0 I \, a \, dx}{2\pi r^2}$$

$$= \int_{-\sqrt{3}a}^{+a} \frac{\mu_0 I a \, dx}{2\pi (a^2 + x^2)}$$

When a source and observer are moving towards each other with same speed than the observed frequency is 288 Hz. if source and observer move away from each other with same speed then find the observed frequency. Given frequency of source $n_0 = 240$ Hz and speed of sound in air = $\boxed{330\ m/s}$

$$\frac{330+u}{330-u} = \frac{12}{10}$$



$$f = f_0\left[\frac{c+v_0}{c-v_s}\right]$$

$$\cancel{288}^{\,48,\ 12} = \cancel{240}^{\,24,\ 10}\left[\frac{330+v}{330-v}\right]$$

$$f' = f_0\left[\frac{c-v_0}{c+v_s}\right] \Rightarrow f' = \cancel{240}^{\,20}\left[\frac{330-v}{330+v}\right] \quad \frac{10}{\cancel{12}}$$

$$f' = 200$$

A substance is heated at constant volume from temperature $T_1 = 200$ K to $T_2 = 300$ K and specific heat is $C = KT$. The mass of the substance is $\boxed{1g}$. If heat given to the substance is $\boxed{\Delta Q = nK}$ then, Find the value of n

1kg

$$\Delta Q = \int m s\, dT$$

$$= \int_{200}^{300} 1 \times KT\, dT$$

$$= \left[\frac{KT^2}{2}\right]_{200}^{300} = \frac{K}{2}\left(300^2 - 200^2\right)$$

$$= \frac{K}{2} \times 10^4 \times 5$$

$$= \frac{5}{2} \times 10000 \times K$$

$$= 25000K$$

(SHM)

A block of mass 5 kg moves along the x-direction subject to the force $F = (-20x + 10)$N with the value of x in meter. At time $t = 0$ s. it is at rest at position $x = 1$ m. The position and momentum of the block at $\left(t = \frac{\pi}{4}\right)$ sec.

$F = -20x + 10$

$F = -kx$

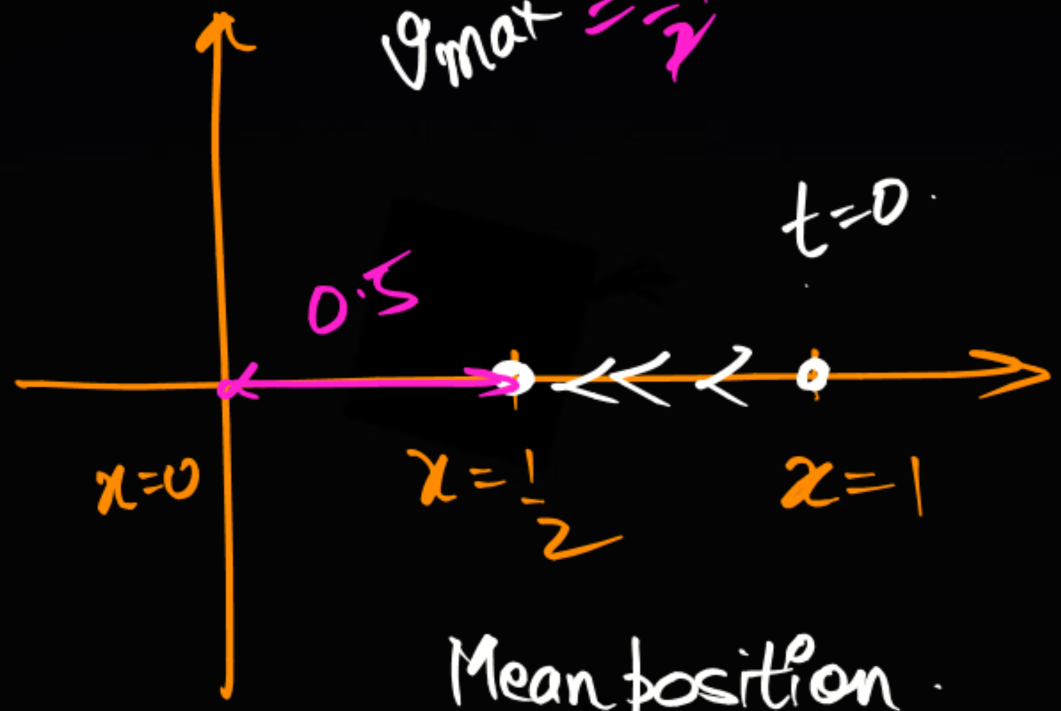
$F = -20\left(x - \frac{1}{2}\right)$

Mean position $x = +\frac{1}{2}$

$k = 20 = m\omega^2$

$\cancel{20} = \cancel{5}\omega^2$

$4 = \omega^2$, $\omega = 2$



$v_{max} = A\omega = \frac{1}{2} \times 2 = 1$

Mean position

$\vec{r} = -\frac{1}{2}\hat{i}$

$\omega = 2$

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

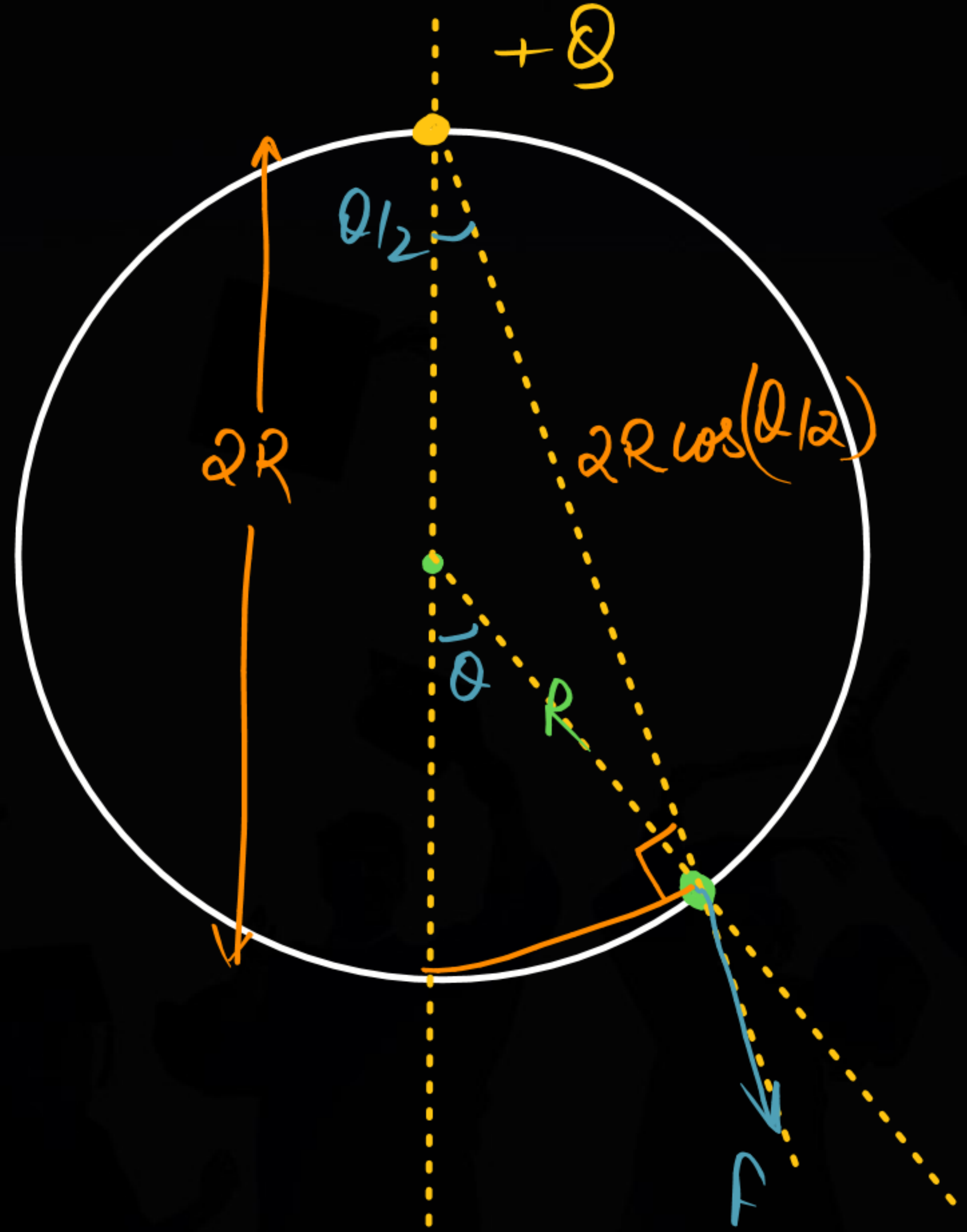
$T = \pi$ Seconds

$t = \frac{\pi}{4} = \frac{T}{4}$

$\vec{P} = mv = -5 \times 1$ m/s

$\boxed{\vec{P} = -5\hat{i}}$

Point charge Q is fixed at loop at any point. another charge Q is placed at diametrically opposite point. Find angular SHM of charge.



+Q
θ/2
2R
2R cos(θ/2)
θ
R
F

$$E = \frac{Kq^2}{2R\cos(\theta/2)} + \frac{1}{2}\times mR^2 \times \omega^2 = \text{Const.}$$

$$\Rightarrow \frac{dE}{dt} = 0$$

$$\frac{Kq^2}{2R}\left[\sec\frac{\theta}{2}\tan\frac{\theta}{2}\times\frac{1}{2}\frac{d\theta}{dt}\right] + \frac{1}{\cancel{2}} mR^2 \times \cancel{2}\omega\frac{d\omega}{dt} = 0$$

$$\frac{Kq^2}{4R}\frac{\sin\theta/2}{\cos^2\theta/2}\times\cancel{\omega} = -mR^2\cancel{\omega}\,\alpha$$

$$\alpha = -\frac{KQ^2}{4mR^3}\frac{\sin\theta/2}{\cos^2\theta/2}$$

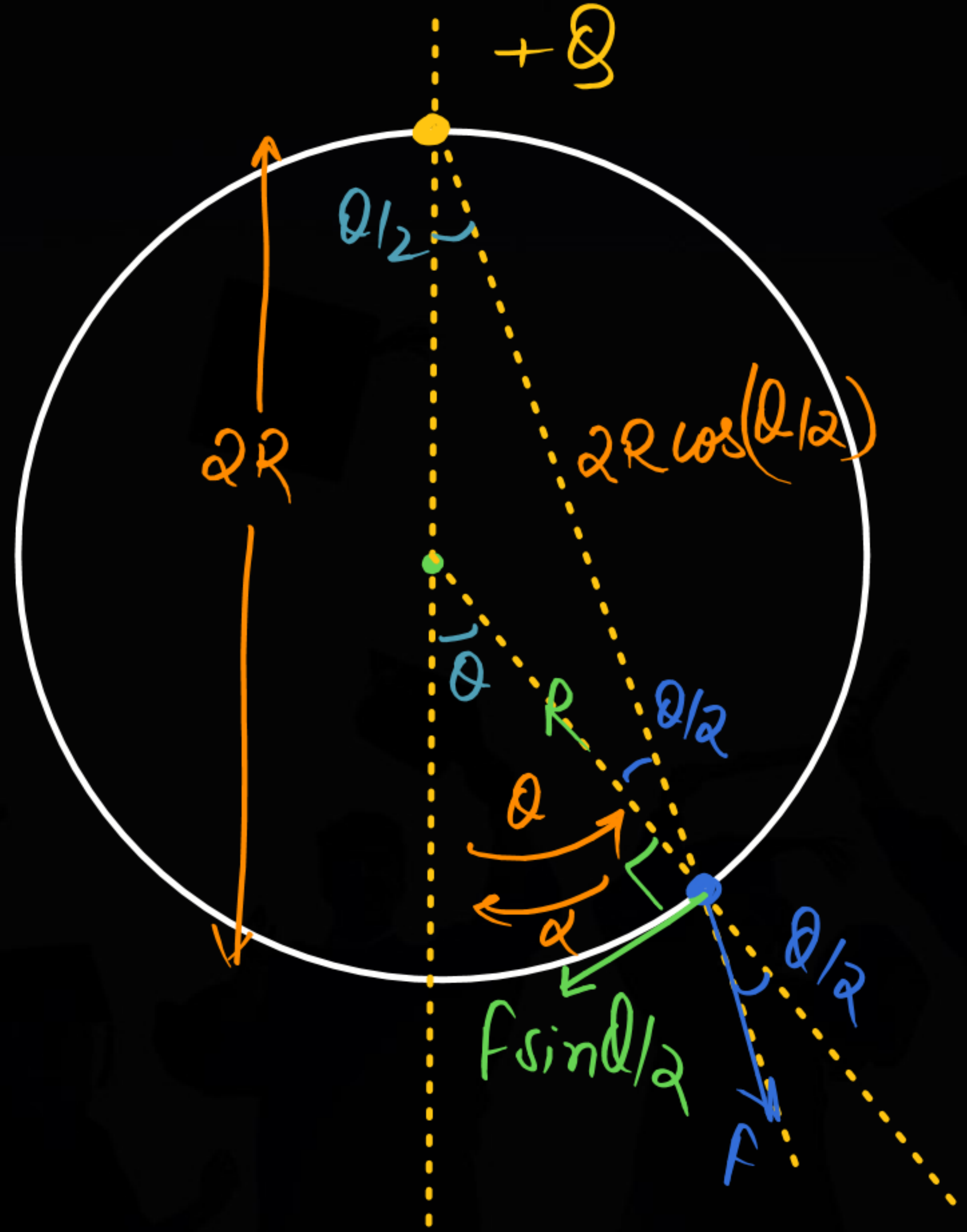
if θ is very small $\Rightarrow$

$$\sin(\theta/2) \approx \frac{\theta}{2}$$

$$\cos(\theta/2) \approx 1$$

$$\alpha = -\boxed{\frac{KQ^2}{8mR^3}} \times \theta$$

$$\boxed{\alpha = -\omega^2\theta}$$



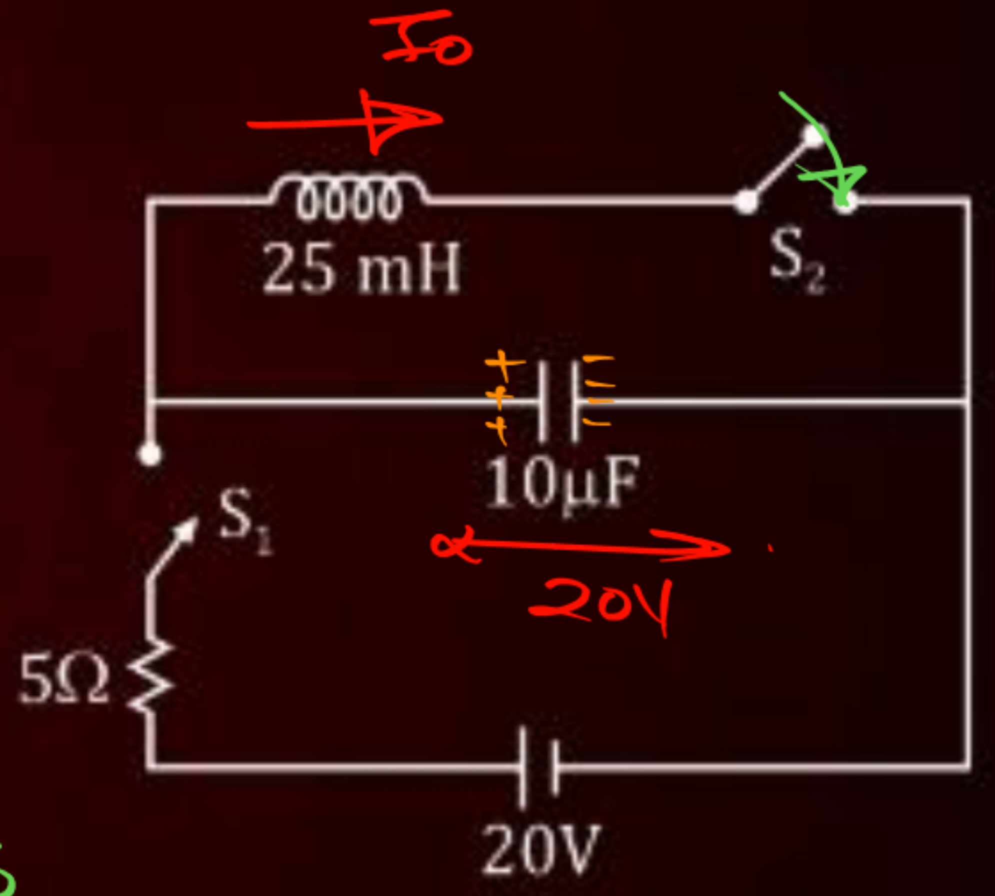
$$\tau = F_{\perp} r$$

$$I\alpha = \frac{KQ^2}{(2R\cos\theta/2)^2} \times \sin(\theta/2) \times R$$

$$mR^2\alpha = \frac{KQ^2}{4R\cos^2\theta/2}\sin(\theta/2)$$

$$\boxed{\alpha = -\left(\frac{KQ^2}{8R^3m}\right)\theta}$$

In given circuit S_1 closed for long time after S_1 opened and S_2 closed for LC oscillator. find angular frequency ω and V_{max} across capacitor.



S_2 open
S_1 close.

$t=0 \quad I = \frac{20}{5} = 4A$

$t=\infty \quad I = 0.$

$Q = CV = 10\times10^{-6}\times 20 = 200\,\mu C$

S_1 LC Oscillations = $\omega = \frac{1}{\sqrt{LC}} = \frac{1}{\sqrt{25\times10^{-3}\times10\times10^{-6}}}$

$= \frac{1}{\sqrt{25\times10^{-8}}} = \frac{1}{5\times10^{-4}} = \frac{10000}{5} = 2000$

SHM

$$\boxed{\frac{Q^2}{2C} = \frac{1}{2} L I_0^2}$$

I_0 Inductor = ______

Metal Target ($z = 46$) bombarded with High energy e^- beam. The emission of X – rays from target is analysed. The ratio 'r' of λ of k_α line and cut off is found to be $r = 2$. If same e^- beam bombard another metal target with $z = 41$, then 'r' will be :

Class

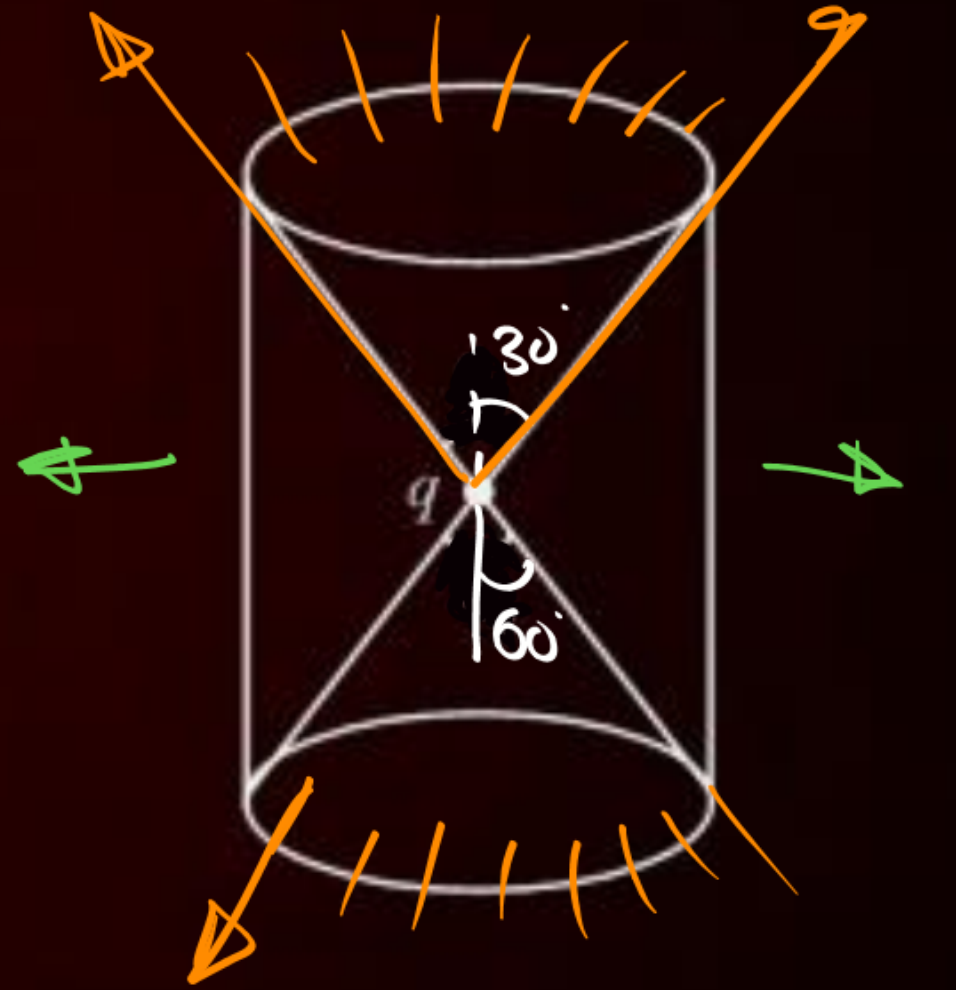
A q charged is placed inside the closed cylinder as shown in figure. find the ratio of flux through upper base and lower base of cylinder

$$\phi = \frac{q}{2\varepsilon_0}(1-\cos\theta)$$

$$\phi_u = \frac{q}{2\varepsilon_0}(1-\cos 30)$$

$$\phi_L = \frac{q}{2\varepsilon_0}(1-\cos 60)$$

$$\frac{\phi_u}{\phi_L} = \frac{1-\cos 30}{1-\cos 60} = \frac{1-\frac{\sqrt{3}}{2}}{1-\frac{1}{2}} = 2-\sqrt{3}$$

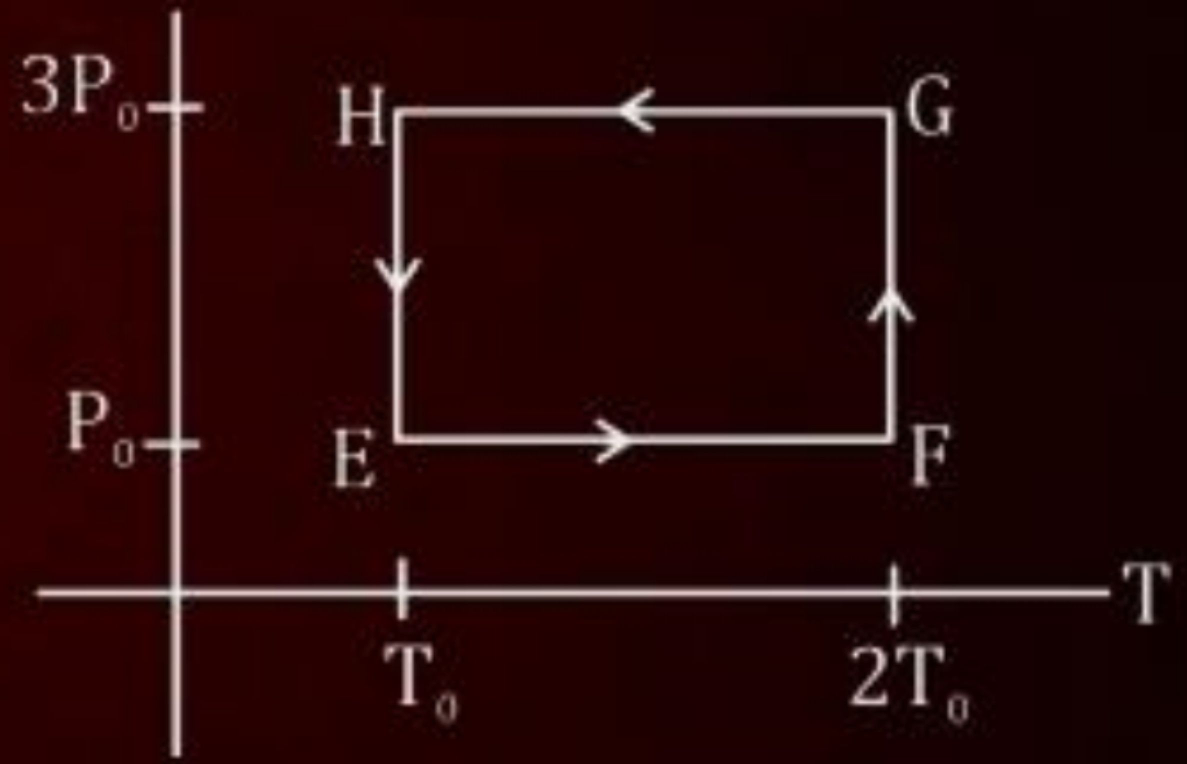


A gas goes through cyclic process EFGH. Pressure and Temperature graph shown below. Find

(a) Total Done in cycle EFGH

(b) ΔU_{FE}

(c) Q_{Total} in cycle EFGH



If F= -kr in hypothetical atom, how velocity depends on n.

(dakshya)

$$F = -Kr = \frac{mv^2}{r}$$

$$mvr = \frac{nh}{2\pi}$$

$$Kr = \frac{mv^2}{r}$$

$$\boxed{Kr^2 = mv^2}$$

$$r = \frac{nh}{2\pi m v}$$

$$\frac{Kr^2}{2} = \frac{mv^2}{2} = KE$$

$$\frac{K n^2 h^2}{4\pi^2 m^2 v^2} = mv^2$$

$$\frac{K n^2 h^2}{4\pi^2 m^3} = v^4 \Rightarrow \boxed{v \propto n^{1/2}}$$ Ans.

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Chemistry

PHYSICAL CHEMISTRY

A radioactive sample of U^{238} decays to Pb^{207} through a process for which half-life is 4.5×10^9 years. Find time-period when mass ratio of Pb to U is 7.

$$\boxed{\ln\left(1+\frac{n_{Pb}}{n_U}\right) = \lambda t}$$

$$\ln\left(1+\frac{238\times 7}{207}\right) = \frac{\ln 2}{t_{1/2}}\times t$$

$$\ln\left(\frac{207+1666}{207}\right) = \frac{\ln 2}{t_{1/2}}\times t$$

$$\ln(9) = \frac{\ln 2}{t_{1/2}}\times t$$

$$t_{1/2} = \frac{\ln 2}{\lambda}$$

$$\lambda = \frac{\ln 2}{t_{1/2}}$$

Mass $\Rightarrow n \times MM$

$$\frac{Mass_{Pb}}{Mass_U} = \frac{n_{Pb}\times 207}{n_U \times 238} = \frac{7}{1}$$

$$\boxed{\frac{n_{Pb}}{n_U} \Rightarrow \frac{238\times 7}{207}}$$

$$\begin{array}{r} 238 \\ \times 7 \\ \hline 1666 \end{array}$$

$$t \Rightarrow \frac{\ln 9}{\ln 2} \times t_{1/2}$$

$$\Rightarrow \frac{\cancel{2.303} \times 2\log 3}{\cancel{2.303} \times \log 2} \times 4.5 \times 10^9$$

$$\Rightarrow \frac{2 \times 0.48}{\cancel{0.3}} \times \overset{15}{\cancel{4.5}} \times 10^9$$

$$\Rightarrow 3\cancel{0} \times 0.48 \times 10^9$$

$$= 4.8 \times 3 \times 10^9$$

$$= 14.4 \times 10^9$$

$$144 \times 10^8$$

Atomic

Max Kinetic Energy out of following as per Bohr's Model?

$$\boxed{E = +13.6 \times \frac{Z^2}{n^2} eV}$$

① 1st orbit of H. → $E = +13.6 \times 1 \ eV$

② 1st orbit of He^+ (Z=2) → $E \Rightarrow +13.6 \times \frac{4}{1} eV$

③ 2nd orbit of He^+ → $E \Rightarrow +13.6 \times \frac{\cancel{2^2}}{\cancel{2^2}} eV$

④ 2nd orbit of Li^{+2} → $E \Rightarrow +13.6 \times \frac{9}{4} eV$

JEE ADVANCED 2024 LIVE PAPER DISCUSSION

$\frac{M_y}{M_x} = \frac{100}{80}$

W_1 gm of a non volatile solute X is dissolved in a W_2 gm of water and another W_1 gm of non volatile solute Y is dissolved in W_2 gm H_2O. The molecular mass of x is 80 % of Y and the vant Hoff factor of X is 1.2 times of Y then the elevation in boiling point of X is .....% of Y.

$M_x = \frac{80}{100} M_y$

$i_x = 1.2\, i_y$

X → w_1
Water → w_2

Y → w_1
Water → w_2

$$\frac{\Delta T_{b.x}}{\Delta T_{by}} = \frac{i_x \cancel{K_b}\, m_x}{i_y \cancel{K_b}\, m_y}$$

$$\Rightarrow \frac{1.2 \cancel{i_y}}{\cancel{i_y}} \times \frac{\left(\frac{\cancel{Mass_x}}{MM_x} \times \frac{\cancel{1000}}{\cancel{M_{H_2O}}}\right)}{\left(\frac{\cancel{Mass_y}}{MM_y} \times \frac{\cancel{1000}}{\cancel{M_{H_2O}}}\right)}$$

$$\Rightarrow 1.2 \times \frac{MM_y}{MM_x}$$

$$\Rightarrow 1.2 \times \frac{100}{80}$$

$$\Rightarrow \frac{12}{8} = \frac{3}{2}$$

$\Rightarrow$

In a container, 10 gm X is added which creates 2 atm pressure at constant temperature. In the same container, 80 gm y is added which creates a final pressure of 6 atm at same temperature. Find $\frac{V_{RMS}x}{V_{RMS}y}$?

T X

$X \to 10gm$

$P_x = 2atm$

T Y

$Y \to 80gm$

$P_y \Rightarrow 4atm$

$X \to 10gm.$

$Y \to 80gm.$

$P_f \Rightarrow 6atm.$

$PV = nRT$

$PV = \frac{m}{M}RT$

$M = \frac{mRT}{PV}$

$M \propto \frac{m}{P}$

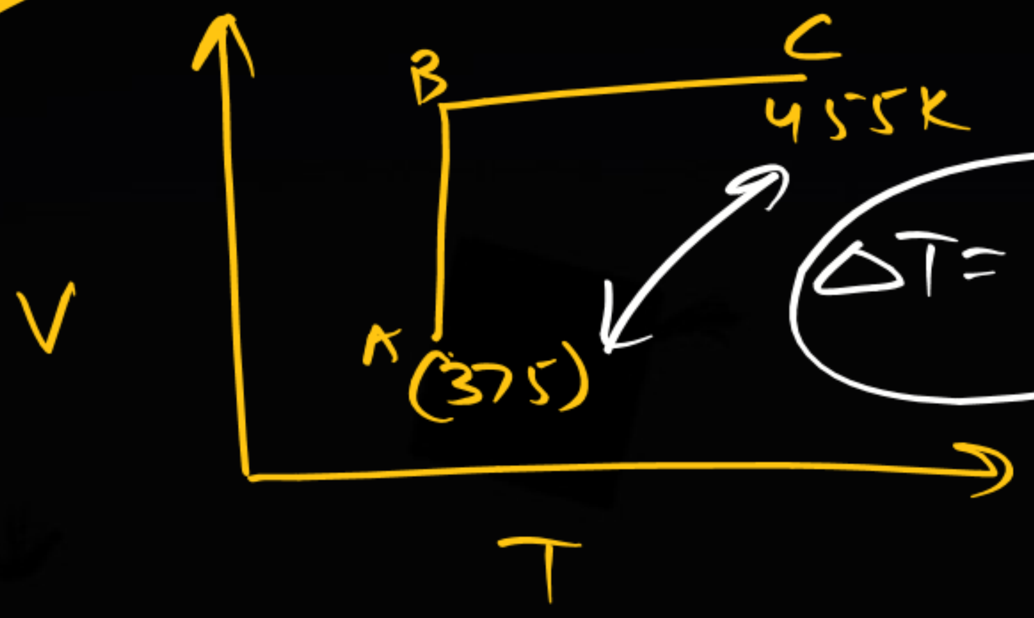
$V_{RMS} \propto \frac{1}{\sqrt{M}}$

$$\boxed{\frac{V_x}{V_y} = \sqrt{\frac{M_y}{M_x}}}$$

$$\frac{V_x}{V_y} = \sqrt{\frac{m_y}{P_y} \times \frac{P_x}{m_x}}$$

$$\Rightarrow \sqrt{\frac{\cancel{80}}{\cancel{4}2} \times \frac{2}{\cancel{10}}} = 2:1$$

Thermo



$\Delta T = 80K$

$\bar{C}_v = 12$

$R = 8.3$

$n = 5$ moles

$\bar{C}_p = \bar{C}_v + R$

$= 12 + 8.3$

$\Rightarrow 20.3$

$\Delta \bar{H}_{(A \to C)} \Rightarrow n \bar{C}_p \Delta T$

$\Rightarrow 5 \times 20.3 \times 80$

$\Rightarrow 8120$

Hydrazine is reacting electrochemically with oxygen which produces N_2 gas which help in converting chemical energy to electrical energy?

$$O_2 + \overset{-2}{N_2}H_4 \longrightarrow \overset{0}{N_2}$$

oxid^n → Anode

(A) At ~~cathode~~, N_2 is produced

(B) At anode, N_2 is produced where 4 moles of electrons is involved

(C) Major product of this reaction are oxides of nitrogen

(D) At cathode, O_2, is converted to OH^-

$N \Rightarrow -2$ to 0

$2e^{\ominus}$

$4e$

$M_xY_2O_4$ is a compound in which M exists as +2 and +3 oxidation state and Y exists as +3 oxidation state. The fraction of +2 oxidation state of M is $1/3^{rd}$ of total M. Find the value of x?

M_x: +2, +3 $\quad Y_2$: +3 $\quad O_4$: −2

$$+2(a) + 3(x-a) + 6 - 8 = 0$$

$$2a + 3x - 3a - 2 = 0$$

$$\boxed{3x = a + 2}$$

$$\boxed{a = \frac{1}{3}x}$$

$$3x = \frac{x}{3} + 2$$

$$3x - \frac{x}{3} = 2$$

$$\frac{8x}{3} = 2$$

$$x = \frac{3}{4} = 0.75$$

$\lim_{t \to x} \frac{t^{10} f(x) - x^{10} f(t)}{t^9 - x^9} = 1$ if $f(1) = 2$, find $f(x)$.

0T

0T

L-H Rule

$\lim_{t\to x} \frac{10t^9 \cdot f(x) - x^{10} \cdot f'(t)}{9t^8} = 1$

$10x^{\cancel{9}} f(x) - x^{\cancel{10}\,2} f'(x) = 9\cancel{x^8}$

$10x \cdot f(x) - x^2 f'(x) = 9$

DE

$x^2 \frac{dy}{dx} - 10xy = -9$

$\div x^2$

$$\boxed{\frac{dy}{dx} - \frac{10}{x} y = -\frac{9}{x^2}}$$

$\text{IF} = e^{-\int \frac{10}{x} dx} = e^{-10 \ln x} = x^{-10}$

$y \cdot x^{-10} = \int -\frac{9}{x^2} \cdot \frac{1}{x^{10}} dx = -\int 9x^{-12}$

$= \frac{+9x^{-11}}{+11} + C$

$$y \cdot x^{-10} = \frac{9}{11x^{11}} + c \longrightarrow \boxed{y = \frac{9\cancel{x^{10}}}{11x^{\cancel{11}}} + \frac{13}{11}x^{10}}$$

$x = 1,\ y = 2.$

$$2 = \frac{9}{11} + c$$

$$\frac{22-9}{11} = c = \frac{13}{11}$$

The value of $\tan\left[\underbrace{\sin^{-1}\left(\frac{3}{5}\right)}_{A} - \underbrace{2\cos^{-1}\left(\frac{2}{\sqrt{5}}\right)}_{B}\right]$ is

Easy

(A) $-7/24$

(B) $5/24$

(C) $-5/24$

(D) $7/24$

$$\tan(A-B) = \frac{\tan A - \tan B}{1+\tan A \tan B}$$

$$\frac{\frac{3}{4} - \frac{4}{3}}{1+1} = \frac{-7}{24}$$

I

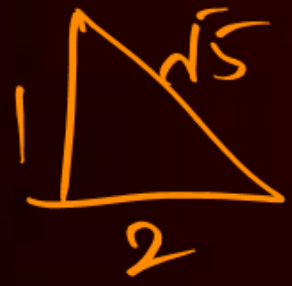
$$\sin^{-1}\left(\frac{3}{5}\right) = A$$

$$\frac{3}{5} = \sin A$$

$$\frac{3}{4} = \tan A$$

$$2\cos^{-1}\left(\frac{2}{\sqrt{5}}\right) = B$$

$$\frac{2}{\sqrt{5}} = \cos\frac{B}{2} \qquad \left(0, \frac{\pi}{4}\right)$$



$$\frac{1}{2} = \tan\left(\frac{B}{2}\right)$$

$$\tan B = \frac{2\tan B/2}{1-\tan^2 B/2} = \frac{2\left(\frac{1}{2}\right)}{1-\frac{1}{4}} = \frac{1}{3/4} = \frac{4}{3}$$

JEE ADVANCED 2024 LIVE PAPER DISCUSSION

Let, $S = \{a + b\sqrt{2} : a, b \in \mathbb{Z}\}$, $T_1 = \{(-1+\sqrt{2})^n : n \in \mathbb{Z}\}$ and $T_2 = \{(1+\sqrt{2})^n : n \in \mathbb{Z}\}$.

<1

0

Then which of the following are true:

(A) $Z \cup T_1 \cup T_2 \subset S$

(B) $T_2 \cap (2024, \infty) \neq \phi$

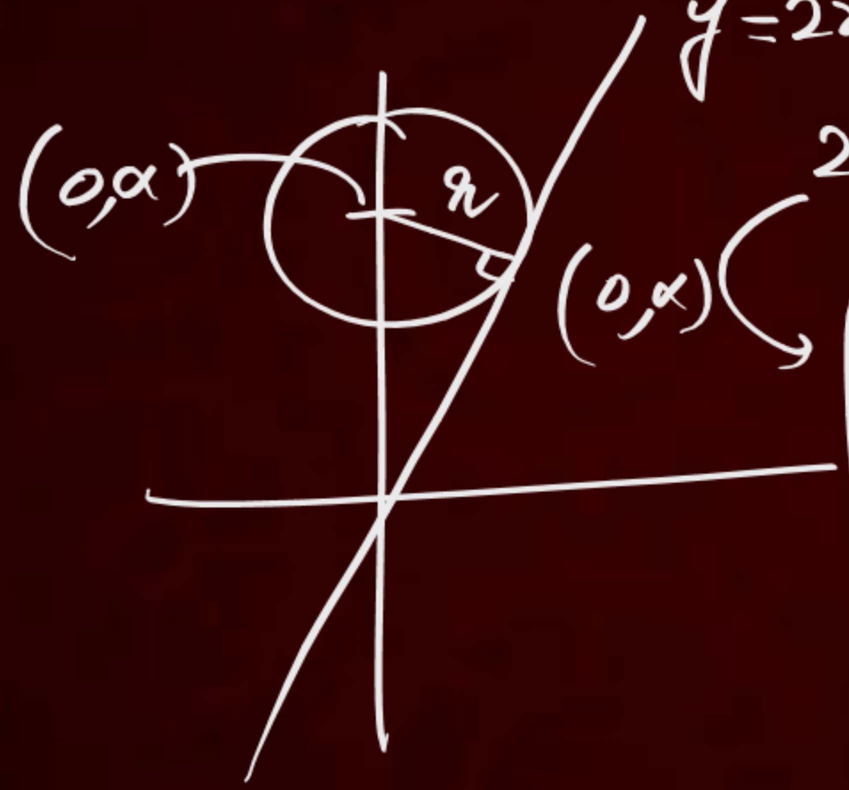
(C) $T_1 \cap \left(0, \frac{1}{2024}\right) = \phi$

(D) ?

$1+\sqrt{2}$
$3+2\sqrt{2}$
$\vdots$

$-1+\sqrt{2}$
$3-2\sqrt{2}$
$\vdots$

Circle with centre $(0, \propto)$ & with radius r touches $y = 2x$ if $\propto + r = \underline{5 + \sqrt{5}}$ then find $\propto$ & r.



$2x - y = 0$

$(0,\alpha) \rightarrow \left|\frac{-\alpha}{\sqrt{5}}\right| = r$

$|-\alpha| = \sqrt{5}\, r$

$\sqrt{5}\, \underline{r} + \underline{r} = \sqrt{5}(\sqrt{5}+1)$

$\cancel{(\sqrt{5}+1)}\, r = \sqrt{5}\,\cancel{(\sqrt{5}+1)}$

$r = \sqrt{5}$

$\alpha = 5$

JEE ADVANCED 2024 LIVE PAPER DISCUSSION

1^{∞}

If $\lim_{x\to 0}(\sin(\sin kx) + \cos x + x)^{2/x} = e^6$

Find the value of k.

$$\left(\sin(\sin kx) + \cos x + x - 1\right)\cdot\frac{2}{x} = \overset{3}{\cancel{6}}$$

$$\lim_{x\to 0}\frac{\sin(\sin kx) + \cos x + x - 1}{x}$$

$$\underbrace{\frac{\sin(\sin kx)}{x}}_{k} + \underbrace{\frac{\cos x - 1}{x}}_{0} + \underbrace{\frac{x}{x}}_{1} = 3$$

$$k + 1 = 3$$

$$k = 2$$

JEE ADVANCED 2024 LIVE PAPER DISCUSSION

Let $\mathbb{R}^2$ denote $\mathbb{R} \times \mathbb{R}$.

Let $S = \{(a, b, c) : a, b, c \in \mathbb{R}\ \&\ ax^2 + 2bxy + cy^2 > 0\ \forall (x, y) \in \mathbb{R}^2 - \{(0, 0)\}\}$ then which are true

(a) × $\left(2, \frac{7}{2}, 6\right) \in S$ $\quad ac = 12 \quad b^2 = \frac{49}{4}$

divide by x^2

$a + 2b(y/x) + c(y/x)^2 > 0$

(b) ✓ $\left(3, b, \frac{1}{12}\right) \in S$ then $|2b| < 1$

$ac = 3/12 = 1/4$

$b^2 < 1/4.$

$4b^2 < 1$

$|2b| < 1$

$cm^2 + 2bm + a > 0 \quad \forall m \in R$

$c > 0\ \&\ D < 0.$

$4b^2 - 4ac < 0$

$c > 0\ \&\ \boxed{b^2 < ac}$

$\boxed{a = 3\sqrt{2}}$ $\boxed{b = \frac{1}{5^{1/6}\ 6^{1/2}}}$

$3x + 2y = \log_a(18)^{5/4}$ & $2x + y = \boxed{\log_b(1080)^{1/2}}$

Find value of $4x + 5y$.

216×5

$a = 3\sqrt{2} = \sqrt{18} = (18)^{1/2}$

$b = 5^{-1/6} \times 6^{-1/2} = 5^{-1/6} \cdot 6^{-3/6} = (5 \cdot 6^3)^{-1/6} = (1080)^{-1/6}$

$\boxed{3x + 2y = 5/2} \rightarrow (1)$

$\log_{(1080)^{-1/6}} (1080)^{1/2} = \frac{1/2}{-1/6} \times 1 = -3$

$\frac{5}{4} \log_a (18)$

$\frac{5}{4} \frac{\log_{10}(18)}{1/2} = 5/2$

$2x \quad \boxed{2x + y = -3} \rightarrow (2)$

$4x + 2y = -6 \rightarrow (3)$

$-x = 5/2 + 6$

$-x = 17/2$

$x = -17/2$

$-17 + y = -3$

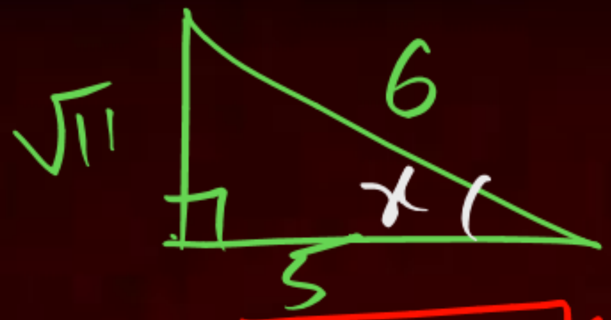
$\boxed{y = 14}$

$-34 + 70$

36

If $\cot x = \frac{-5}{\sqrt{11}}$, $\frac{\pi}{2} < x < \pi$

Then $\sin\frac{11x}{2}(\sin 6x - \cos 6x) + \cos\frac{11x}{2}(\sin 6x + \cos 6x) =$



$\sin x = +\frac{\sqrt{11}}{6}$

$\boxed{t > 0}$

$\cos\left(6x - \frac{11x}{2}\right) + \sin\left(6x - \frac{11x}{2}\right)$

$\cos x/2 + \sin x/2 = t$

$1 + \sin x = t^2$

$1 + \frac{\sqrt{11}}{6} = t^2$

$t^2 = \frac{6+\sqrt{11}}{6}$

$t^2 = \frac{12+2\sqrt{11}}{12}$

$t^2 = \frac{(\sqrt{11}+1)^2}{12}$

$\boxed{t = \frac{\sqrt{11}+1}{2\sqrt{3}}}$ ✓

Area bounded

$Y \geq 0, x \geq 0, \boxed{Y^2 \geq 12 - 2x}$

$Y^2 \geq 4x, 3y + \sqrt{8}x \leq 5\sqrt{8}$

$\hookrightarrow y^2 = 4x$

$y^2 = 12 - 2x$

$y^2 = -2(x - 6)$

$4x = -2x + 12$

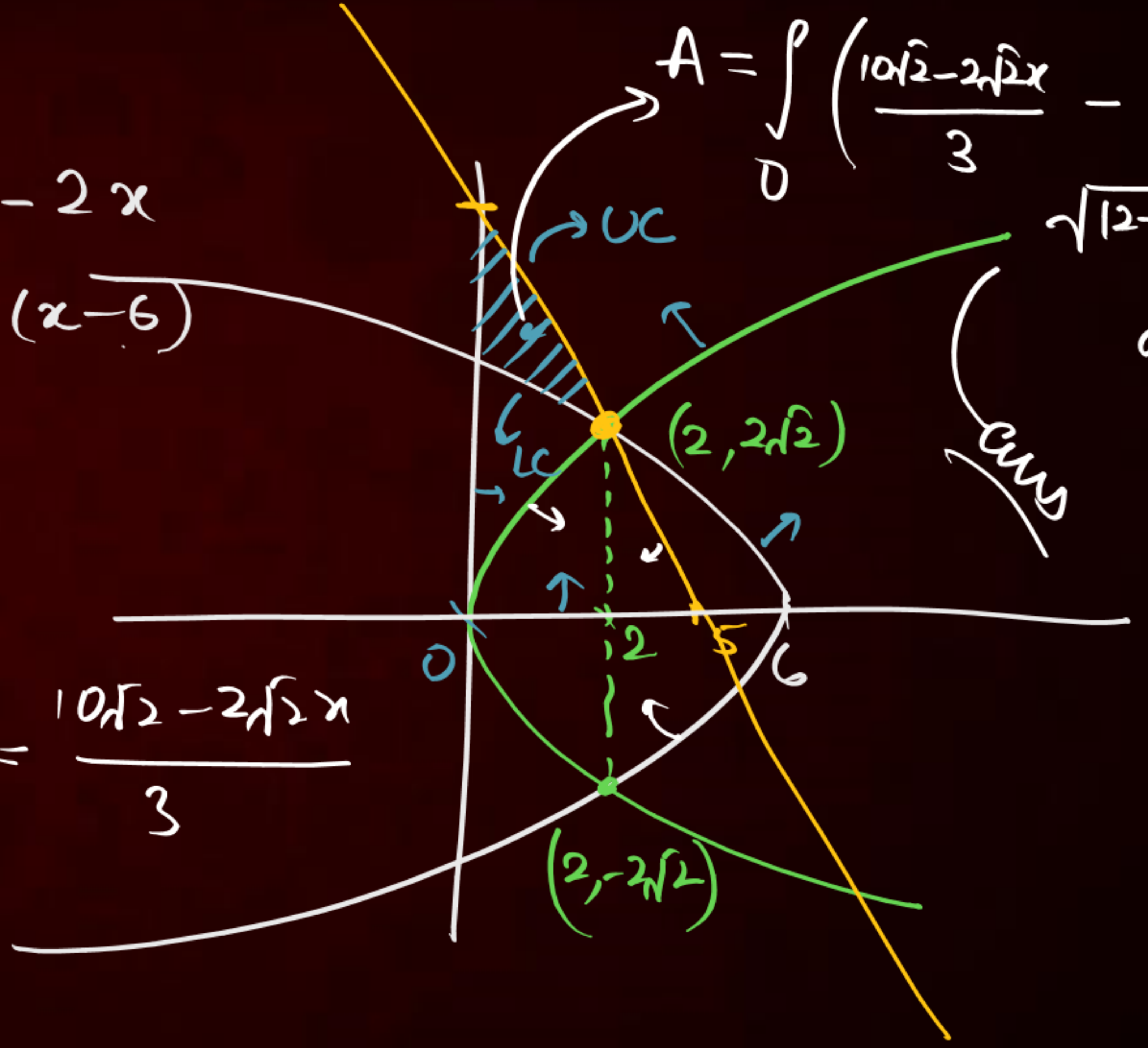
$6x = 12$

$3y + 2\sqrt{2}x = 5 \times 2\sqrt{2} \rightarrow y = \dfrac{10\sqrt{2} - 2\sqrt{2}x}{3}$

$\hookrightarrow y = 0 \rightarrow x = 5$

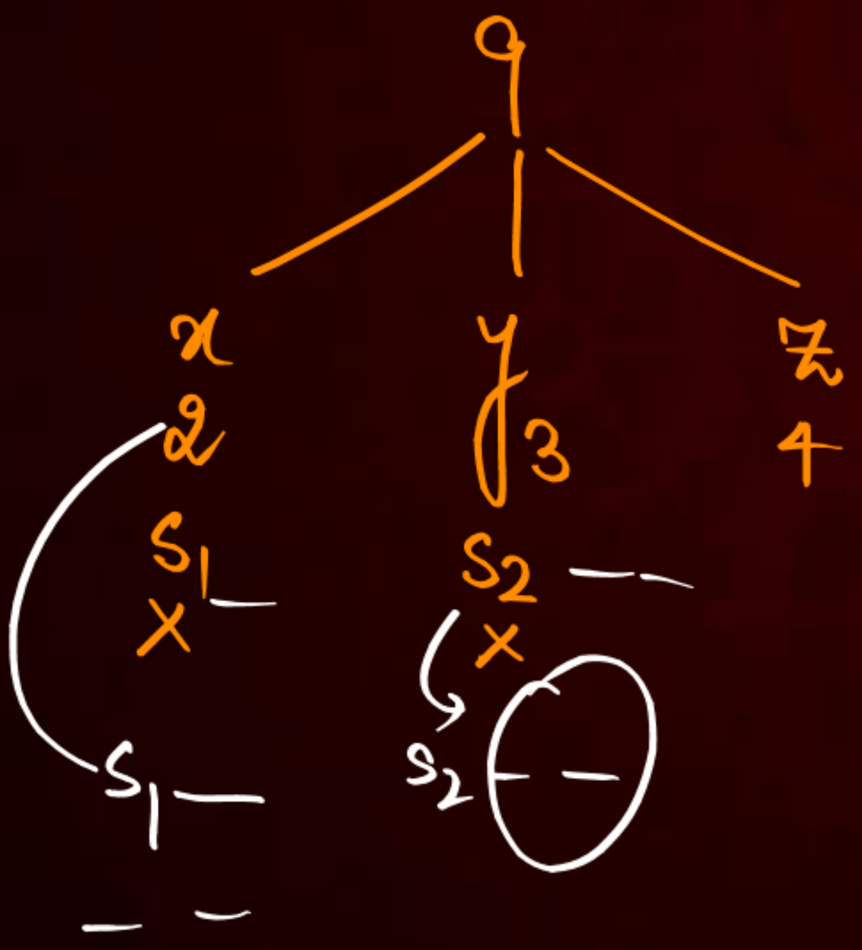
$\hookrightarrow x = 0 \rightarrow y = \dfrac{10\sqrt{2}}{3}$

$A = \int_0^2 \left(\dfrac{10\sqrt{2} - 2\sqrt{2}x}{3} - \sqrt{12 - 2x} \right) dx.$



JEE ADVANCED 2024 LIVE PAPER DISCUSSION

A group of 9 students, $s_1, s_2, \ldots S_9$ is to be divided to form three teams x, y and z of sizes 2, 3 & 4 suppose that s_1 cannot be selected for the team X, and S_2 cannot be selected for team Y. Then the no. of ways to form such teams.



$$\text{Total} - \left(\begin{matrix} s_1 \\ \downarrow \\ X \end{matrix} + \begin{matrix} s_2 \\ \downarrow \\ Y \end{matrix} - \left(\begin{matrix} s_1 & s_2 \\ | & | \\ X & Y \end{matrix} \right) \right)$$

$$\frac{9!}{2!\,3!\,4!} - \left(\frac{8!}{4!\,3!\,1!} + \frac{8!}{2!\,2!\,4!} - \left(\frac{7!}{4!\,2!\,1!} \right) \right) = 665$$

$f(x) = \sin^2 x$

$g(x) = \sqrt{\frac{\pi}{2}x - x^2}$

1. $\frac{16}{\pi^3}\int_0^{\pi/2} f(x)\cdot g(x)\,dx = 0.25$

2. $2\int_0^{\pi/2} f(x)\cdot g(x)\,dx - \int_0^{\pi/2} g(x)\cdot dx$

$$I = \frac{16}{\pi^3}\int_0^{\pi/2} \sin^2 x \sqrt{x\left(\frac{\pi}{2} - x\right)}\,dx$$

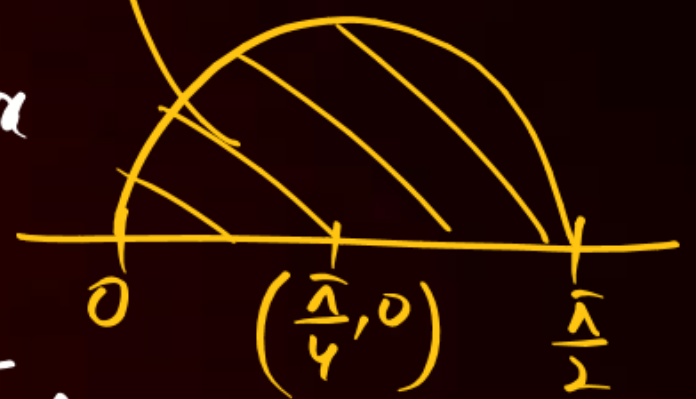
$$I = \frac{16}{\pi^3}\int_0^{\pi/2} \cos^2 x \sqrt{x\left(\frac{\pi}{2} - x\right)}\,dx$$

$$2I = \frac{16}{\pi^3}\int_0^{\pi/2} \sqrt{\frac{\pi}{2}x - x^2}\,dx$$

$y = \sqrt{\frac{\pi}{2}x - x^2}$

$x^2 + y^2 - \frac{\pi}{2}x = 0$

$\pi \cdot \frac{\pi^2}{16} / 2 = \frac{\pi^3}{32}$



$\left(\frac{\pi}{4}, 0\right)$

$$2I = \frac{16}{\cancel{\pi^3}} \cdot \frac{\cancel{\pi^3}}{32} = \frac{1}{2}$$

$I = \frac{1}{4}$

$\underbrace{3\alpha+3\beta}-2+l=0 \Rightarrow 3(-1)-2+l=0$

$l=5$

Let $\overrightarrow{OP}=\frac{\alpha-1}{\alpha}\hat{\imath}+\hat{\jmath}+\hat{k}, \overrightarrow{OQ}=\hat{\imath}+\frac{\beta-1}{\beta}\hat{\jmath}+\hat{k}$ and $\overrightarrow{OR}=\hat{\imath}+\hat{\jmath}+\frac{1}{2}\hat{k}$ be three vectors, where $\alpha,\beta\in R-\{O\}$ and O denotes origin.

$\left(\underbrace{\overrightarrow{OP}\times\overrightarrow{OQ}}\right)\cdot\underbrace{\overrightarrow{OR}}=0$

The point $\underbrace{(\alpha,\beta,2)}$ lies on the plane $3x+3y-z+l=0$, $l=?$

$$\begin{vmatrix} 1-\frac{1}{\alpha} & 1 & 1 \\ 1 & 1-\frac{1}{\beta} & 1 \\ 1 & 1 & \frac{1}{2} \end{vmatrix}=0$$

$\left(1-\frac{1}{\alpha}\right)\left[\left(1-\frac{1}{\beta}\right)\frac{1}{2}-1\right]-1\left[-\frac{1}{2}\right]+1\left[1-1+\frac{1}{\beta}\right]=0$

$\left(1-\frac{1}{\alpha}\right)\left(1-\frac{1}{\beta}\right)\frac{1}{2}-1+\frac{1}{\alpha}+\frac{1}{2}+\frac{1}{\beta}=0$

$\frac{1}{2}\left(1-\frac{1}{\alpha}-\frac{1}{\beta}+\frac{1}{\alpha\beta}\right)-\frac{1}{2}+\frac{1}{\alpha}+\frac{1}{\beta}=0$

$\cancel{-\frac{1}{2\alpha}}-\cancel{\frac{1}{2\beta}}+\frac{1}{2\alpha\beta}+\frac{2}{2\alpha}+\frac{2}{2\beta}=0$

$\frac{1}{2\alpha\beta}+\frac{1}{2\alpha}+\frac{1}{2\beta}=0$

$\boxed{\alpha+\beta+1=0}$ ✓

$\alpha+\beta=-1$

$1+a+b+c=-9 \Rightarrow \boxed{a+b+c=-10}$

Let $\boxed{f(x) = x^4 + ax^3 + bx^2 + c}$ be a poly. with real coeff, such that $\boxed{f(1) = -9.}$ Suppose $i\sqrt{3}$ is a root of equation $4x^3 + 3ax^2 + 2bx = 0$, where $i = \sqrt{-1}$.

If $\alpha_1, \alpha_2, \alpha_3$ and α_4 are the roots of equation $f(x) = 0$, then $|\alpha_1|^2 + |\alpha_2|^2 + |\alpha_3|^2 + |\alpha_4|^2$ is equal to 20.

$[4x^2+3ax+2b]=0$ → $\sqrt{3}i$, $-\sqrt{3}i$

$-\frac{3a}{4}=0 \Rightarrow \boxed{a=0}$

$\frac{2b}{4}=3$

$\Rightarrow \boxed{b=\frac{12}{2}=6}$

$0+6+c=-10$

$\boxed{c=-16}$

$x^4+6x^2-16=0$

$x^4+8x^2-2x-16=0$

$(x^2-2)(x^2+8)=0$

$x^2=2,-8$

$\alpha_1^2=2 \quad \alpha_3^2=-8$

$\alpha_2^2=2 \quad \alpha_4^2=-8$

THANK YOU