
LIVE
JEE MAIN 2024
ATTEMPT – 02 , 04th April 24' , SHIFT - 02
PAPER DISCUSSION

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Mathematics

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(E) If a, b, c are in A.P. and $a+1, b, c+3$ are in G.P., arithmetic mean of a, b, c is 8, then the value of cube of geometric mean of a, b, c is:

(A) 312
(B) 314
(C) 318
(D) 120

$2b = a + c$

$16 = a + c$

$c = 16 - a$

$b^2 = (a+1)(c+3)$

$64 = (a+1)(c+3)$

$64 = (a+1)(19-a)$

$a = 15$

$16 \times 4 = 64$

$a = 15$

$c = 1$

$(a > 10)$

$\frac{a+b+c}{3} = 8$

$\frac{2b+b}{3} = 8$

$b = 8$

$GM = (abc)^{1/3}$

$(GM)^3 = abc$

$(GM)^3 = 15 \cdot 8 \cdot 1$

$= 120$

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(E) to (M)

A parabola $y^2 = 12x$ has a chord PQ with mid-point $(4, 1)$ then equation of PQ passes through:

(A) $\left(\frac{1}{2}, -20\right)$ ✓

(B) $\left(\frac{1}{2}, -10\right)$

(C) $(10, 1/2)$

(D) $\left(-10, -\frac{1}{2}\right)$

$T = S_1$ → Chord with a Given mid pt (x_1, y_1)

$y^2 - 12x = 0$

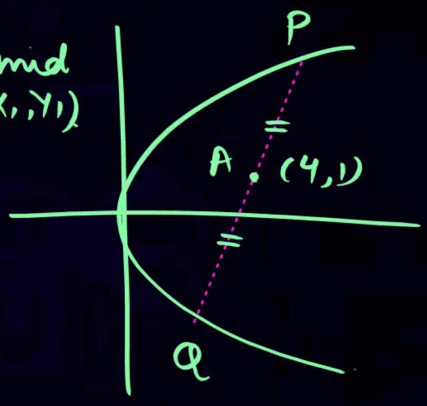
$yy_1 - 6(x + x_1) = y_1^2 - 12x_1$

$yy_1 - 6x = y_1^2 - 6x_1$

$y - 6x = 1 - 24.$

$y - 6x = -23$

$\rightarrow \boxed{y + 23 = 6x}$ ✓



$x \rightarrow \frac{x + x_1}{2}$

(E) If coefficient of x^4, x^5, x^6 of $(1+x)^n$ are in A.P., then find maximum value of n.

A 28
B 21
C 14
D 7

${}^nC_4 \quad {}^nC_5 \quad {}^nC_6$

$2\,{}^nC_5 = {}^nC_4 + {}^nC_6$

$2 = \frac{{}^nC_4}{{}^nC_5} + \frac{{}^nC_6}{{}^nC_5}$

$2 = \frac{5}{n-5+1} + \frac{n-6+1}{6}$

$2 = \frac{5}{n-4} + \frac{n-5}{6}$

${}^nC_5 = \frac{n(n-1)(n-2)(n-3)(n-4)}{5!}$

$\frac{{}^nC_r}{{}^nC_{r-1}} = \frac{n-r+1}{r}$

$2 = \frac{5(6)+(n-5)(n-4)}{6(n-4)}$

$12(n-4) = 30 + n^2 - 9n + 20$

$12n - 48 = n^2 - 9n + 50$

$n^2 - 21n + 98 = 0$

$(n-14)(n-7)$

(E)

If $f(x) = 3\sqrt{x-2} + \sqrt{4-x}$ has maximum value α and minimum value β, then $\alpha^2 + \beta^2$

$f(19/5) = 3\sqrt{\frac{19}{5}-2} + \sqrt{4-\frac{19}{5}} = \frac{3\sqrt{3}}{\sqrt{5}} + \frac{1}{\sqrt{5}} = \frac{10}{\sqrt{5}} = 2\sqrt{5}$

$x \in [2, 4]$

$\sqrt{x-2} = (x-2)^{1/2}$

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

$f'(x) = \frac{1}{2}\left(\frac{3}{\sqrt{x-2}} - \frac{1}{\sqrt{4-x}}\right) = 0$

$\frac{3}{\sqrt{x-2}} = \frac{1}{\sqrt{4-x}} \Rightarrow 9(4-x) = x-2$

$38 = 10x$

$x = 19/5$

$\alpha^2 = 20$ & $\beta^2 = 2$

x	$f(x)$
2	$\sqrt{2}$ → min = β
4	$3\sqrt{2}$
$19/5$	$2\sqrt{5}$ → max = α

(M) & Lengthy.

In a group A there are 4 men and 5 women and in group B there are 5 men and 4 women, if 4 people are selected from each group find number of ways to select 4 men and 4 women.

A: 4M 5W

B: 5M 4W

A	B
4M	4W
3M&1W	1M&3W
2M&2W	2M&2W
1M&3W	3M&1W
4W	4M

$${}^4C_4 \cdot {}^4C_4 + {}^4C_3 \cdot {}^5C_1 \cdot {}^5C_1 \cdot {}^4C_3 + ({}^4C_2 \cdot {}^5C_2)^2 + {}^4C_1 \cdot {}^5C_3 \cdot {}^5C_3 \cdot {}^4C_1 + {}^5C_4 \cdot {}^5C_4$$

$$4m = 1 + (20)^2 + (60)^2 + \dots$$

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V.E

If $\int_{-1}^{1} \frac{\cos \alpha x}{1+3^x} dx = \frac{2}{\pi}$ then α is

A $\frac{\pi}{6}$

B $\frac{\pi}{2}$

C $\frac{\pi}{3}$

D π

$$I = \int_{-1}^{1} \frac{\cos ax}{1+3^x} dx$$

$$I = \int_{-1}^{1} \frac{\cos ax}{1+3^{-x}} dx$$

$$2I = \int_{-1}^{1} \cos ax \, dx$$

$$2I = 2\int_{0}^{1} \cos ax \, dx \qquad a = \pi/2$$

$$I = \frac{\sin ax}{a}\Big|_0^1 = \frac{\sin a}{a} = \frac{2}{\pi}$$

Find value of $\int_0^{\pi/2} \frac{\sin^2 x}{1+\sin x \cos x} dx$.

$\pi/2 - x$

$$I = \int_0^{\pi/2} \frac{\cos^2 x}{1+\sin x \cos x} dx$$

$$2I = \int_0^{\pi/2} \frac{dx}{1+\sin x \cos x}$$

$$2I = \int \frac{2\,dx}{2+2\tan x}$$

(M)

Let $f(x) = \int_0^x \left(t + \sin(1 - e^t)\right) dt$, $f(0) = 0$, then $\lim_{x \to 0} \frac{f(x)}{x^3}$. $= \frac{f'(x)}{3x^2}$

$f'(x) = x + \sin(1 - e^x)$.

$$L = \lim_{x \to 0} \frac{x + \sin(1 - e^x)}{3x^2}$$

$$L = \lim_{x \to 0} \frac{1 + \cos(1 - e^x)(-e^x)}{6x}$$

(0 over $6x$; $\sin(1-e^x) \to 0$, $e^x \to 1$, $\cos(1-e^x) \to 1$, $(-e^x) \to -1$)

$$= \frac{0 - 1}{6} = -\frac{1}{6}$$

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(E)

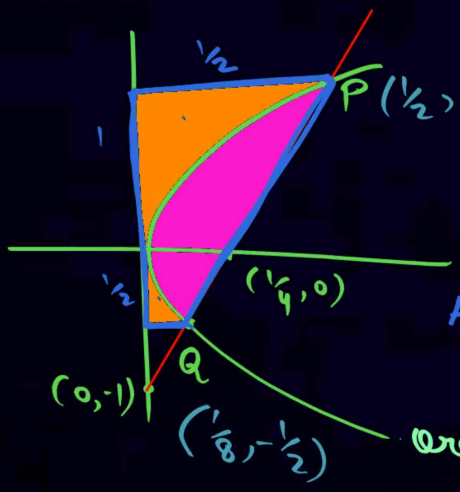
Find area bounded $y^2 \leq 2x$ and $y \geq 4x - 1$.

A $\frac{9}{32}$

B $\frac{11}{32}$

C $\frac{11}{8}$

D $\frac{11}{3}$



$\frac{15}{32} - \frac{3}{16} = \frac{15-6}{32} = 9/32$

$y = 4x - 1.$

$y^2 = 2x \Rightarrow (4x-1)^2 = 2x$

$16x^2 - 8x + 1 = 2x$

$16x^2 - 10x + 1 = 0$

$(8x-1)(2x-1) = 0$

$x = 1/2, 1/8.$

Area of trap $= \frac{1}{2} \cdot \frac{3}{2} \left[\frac{1}{2} + \frac{1}{8}\right] = \frac{3.5}{4} = \frac{15}{32}$

orange $= \int_{-1/2}^{1} \frac{y^2}{2} dy = \frac{y^3}{6}\Big|_{-1/2}^{1} = \frac{1}{6}\left[1 + \frac{1}{8}\right] = \frac{9}{8} \cdot \frac{1}{6}$

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If $\cos^{-1}x - \sin^{-1}y = \alpha, x, y \in (-1, 1)$. If $\alpha \in \left[-\frac{\pi}{2}, \pi\right]$ then the minimum value of $x^2 + y^2 + 2xy \sin\alpha$ is:

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

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

(C) -1

(D) 0

(M) θ ϕ

$\theta - \phi = \alpha$

where $\cos\theta = x$

$\sin\phi = y$

(M-2)

$\cos^{-1}x - (\pi/2 - \cos^{-1}y) = \alpha$

$\cos^{-1}x + \cos^{-1}y = \pi/2 + \alpha$

$\cos^2\theta + \sin^2\phi + 2\cos\theta\sin\phi \quad \sin(\theta - \phi)$

$\cos^2\theta + \sin^2\phi + [\sin(\theta+\phi) - \sin(\theta-\phi)]\sin(\theta-\phi)$

$\cos^2\theta + \sin^2\phi + \sin(\theta+\phi)\sin(\theta-\phi) - \sin^2(\theta-\phi)$

$\sin^2\theta - \sin^2\phi$

$1 - \sin^2(\theta-\phi) = \cos^2(\theta-\phi)$.

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M & T

Find the value of $\frac{1\times2^2+2\times3^2+\cdots\cdots\cdots\cdots+100\times(101)^2}{1^2\times2+2^2\times3+\cdots\cdots\cdots\cdots+100^2\times101}$

(A) $\frac{305}{301}$ ✓

(B) $\frac{301}{305}$

(C) $\frac{350}{310}$

(D) $\frac{310}{350}$

M-1

$$\frac{\sum r\cdot(r+1)^2}{\sum r^2(r+1)}$$

$$\frac{\sum r(r^2+1+2r)}{\sum(r^3+r^2)}$$

$$\frac{\sum r^3+\sum r+\sum 2r^2}{\sum r^3+\sum r^2}$$

M-2

$N^r \rightarrow r(r+1)(r+2-1)$

$= r(r+1)(r+2) - r(r+1)$

$N^r = \underbrace{\sum r(r+1)(r+2)}_{\frac{1}{4}n(n+1)(n+2)(n+3)} - \underbrace{\sum r(r+1)}_{\frac{n(n+1)(n+2)}{3}}$

$D^r = r^2(r+1) = r(r+1)[r+2-2]$

$= \underbrace{r(r+1)(r+2)}_{} - 2r(r+1)$

Ans :-

$$\frac{\frac{n(n+1)(n+2)(n+3)}{4} - \frac{n(n+1)(n+2)}{3}}{\frac{n(n+1)(n+2)(n+3)}{4} - \frac{2\,n(n+1)(n+2)}{3}}$$

$$\frac{\frac{n+3}{4} - \frac{1}{3}}{\frac{n+3}{4} - \frac{2}{3}} = \frac{3(n+3)-4}{3(n+3)-8} = \frac{3n+5}{3n+1}$$

$n = 100$

$$\frac{305}{301}$$

① $\sum r(r+1)(r+2)$

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

② $\sum r(r+1)(r+2)(r+3)$

$= \frac{n(n+1)(n+2)(n+3)(n+4)}{5}$

✓

(E)

$A = \begin{bmatrix} 1 & 2 \\ 0 & 1 \end{bmatrix}$ and $X = I + \text{adj}(A) + (\text{adj}(A))^2 + \ldots\ldots\ldots + (\text{adj}(A))^{10}$, then the sum of elements of X is:

$\frac{10\times11}{2}\times 2$

$\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} + \begin{bmatrix} 1 & -2 \\ 0 & 1 \end{bmatrix} + \begin{bmatrix} 1 & -4 \\ 0 & 1 \end{bmatrix} + \ldots \begin{bmatrix} 1 & -20 \\ 0 & 1 \end{bmatrix}$

$= \begin{bmatrix} 11 & -2(1+2+\ldots 10) \\ 0 & 11 \end{bmatrix}$

$\begin{bmatrix} 11 & -110 \\ 0 & 11 \end{bmatrix}$

$22 - 110$.

$\text{Adj}A = \begin{bmatrix} 1 & -2 \\ 0 & 1 \end{bmatrix}$

$(\text{Adj}A)^2 = \begin{bmatrix} 1 & -2 \\ 0 & 1 \end{bmatrix}\begin{bmatrix} 1 & -2 \\ 0 & 1 \end{bmatrix} = \begin{bmatrix} 1 & -4 \\ 0 & 1 \end{bmatrix}$

$(\text{Adj}A)^3 = \begin{bmatrix} 1 & -4 \\ 0 & 1 \end{bmatrix}\begin{bmatrix} 1 & -2 \\ 0 & 1 \end{bmatrix} = \begin{bmatrix} 1 & -6 \\ 0 & 1 \end{bmatrix}$

A) 88

B) -88 ✓

C) 124

D) 0

(E)

Let $\bar{a} = \hat{i} + \hat{j} + \hat{k}$, $\bar{b} = 2\hat{i} + 4\hat{j} - 5\hat{k}$ and $\bar{c} = x\hat{i} + 2\hat{j} + 3\hat{k}, x \in R$, If $\bar{d}$ is unit vector in the direction of $\bar{b} + \bar{c}$ such that $\bar{a} \cdot \bar{d} = 1$, then $(\bar{a} \times \bar{b}) \cdot \bar{c}$ is equal to

$$\vec{d} = \frac{\vec{b}+\vec{c}}{|\vec{b}+\vec{c}|}$$

$$\vec{a}\cdot\vec{d} = \frac{\vec{a}\cdot\vec{b} + \vec{a}\cdot\vec{c}}{|\vec{b}+\vec{c}|} = 1$$

$$\vec{a}\cdot\vec{b} + \vec{a}\cdot\vec{c} = |\vec{b}+\vec{c}|$$

$$1 + x + 5 = \sqrt{(x+2)^2 + 6^2 + 2^2}$$

$$(x+6)^2 = (x+2)^2 + 40$$

$$x^2 + 36 + 12x = x^2 + 4x + 44$$

$$8x = 8$$

$$\boxed{x = 1}$$

$$[a\ b\ c] = \begin{vmatrix} 1 & 1 & 1 \\ 2 & 4 & -5 \\ 1 & 2 & 3 \end{vmatrix} = \checkmark$$

(E)

A relation defined as $(x_1, y_1)R(x_2, y_2): x_1 \leq x_2$ & $y_1 \leq y_2$ and given that

(a) R is reflexive but not symmetric

(b) R is transitive

Then,

A (a) Is true and (b) is false

B (b) Is false and (b) is true

C Both (a) and (b) are true

D Both (a) and (b) are false

$x_1 \leq x_2 \leq x_3$

$(2,5) \rightarrow (3,6)$

$(2,3) \rightarrow (2,3)$

Ref ✓

$(2,5) \rightarrow (3,6)$

$(3,6) \not\rightarrow (2,5)$

Symm (X)

(E)

$$f(x)=\begin{cases}\dfrac{(72)^x-9^x-8^x+1}{\sqrt{2}-\sqrt{1+\cos x}}, & x\neq 0\\ a\log 2\log 3; & x=0\end{cases}$$, is continuous at $x=0$, then a^2 equals to:

A 1152

B 572

C 1225

D 1005

$a = 24\sqrt{2}$

$a^2 = 24^2 \times 2 = 576 \cdot 2$

$$\lim_{x\to 0}\frac{(9^x-1)(8^x-1)}{\sqrt{2}-\sqrt{1+\cos x}}\cdot\frac{\sqrt{2}+\sqrt{1+\cos x}}{1}$$

$$\frac{(9^x-1)(8^x-1)}{\frac{1-\cos x}{x^2}\cdot x^2}\cdot 2\sqrt{2}$$

$\frac{1}{2} \leftarrow \frac{1-\cos x}{x^2}$

$$= 4\sqrt{2}\left(\frac{9^x-1}{x}\right)\left(\frac{8^x-1}{x}\right)$$

$$= 4\sqrt{2}\ln 9 \cdot \ln 8$$

$$= 4\sqrt{2}\cdot 2\ln 3 \cdot 3\ln 2$$

$$= 24\sqrt{2}\ln^2 \ln 3$$

(E)

Let $y = y(x)$ be the solution of differential equation

$(x^2 + 4)^2 dy + (2x^3 y + 8xy - 2)dx = 0$

If $y(0) = 0$, then $y(2)$ is equal to.

$$(x^2+4)^2 \frac{dy}{dx} + y(2x^3+8x) = 2$$

$$\frac{dy}{dx} + y\frac{2x(x^2+4)}{(x^2+4)^2} = \frac{2}{(x^2+4)^2}$$

$$\boxed{\frac{dy}{dx} + y\frac{(2x)}{x^2+4} = \frac{2}{(x^2+4)^2}}$$

$$IF = e^{\ln(x^2+4)} = x^2+4$$

$$y(x^2+4) = \int \frac{2}{x^2+4}\,dx$$

$$y(x^2+4) = 2\cdot\frac{1}{2}\tan^{-1}x/2 + C$$

$$y(x^2+4) = \tan^{-1}(x/2)$$

$$y(8) = \tan^{-1}1$$

$$y(8) = \pi/4$$

$$y = \pi/32$$

(E)

For $\lambda > 0$, Let θ be the angle between the vectors $\vec{a} = \hat{i} + \lambda\hat{j} - 3\hat{k}$ and $\vec{b} = 3\hat{i} - \hat{j} + 2\hat{k}$.

If the vector $\vec{a} + \vec{b}$ and $\vec{a} - \vec{b}$ are mutually perpendicular, then the value of $(14\cos\theta)^2$ is equal to -

$(\vec{a}+\vec{b}).(\vec{a}-\vec{b}) = 0$

$\vec{a}\cdot\vec{a} - b\cdot b = 0$

$|a|^2 = |b|^2$

$1 + \lambda^2 + 9 = 9 + 1 + 4$

$\lambda^2 = 4 \Rightarrow \boxed{\lambda = 2}$

$\cos\theta = \frac{3 - \lambda - 6}{14}$

$14\cos\theta = -5$

$(14\cos\theta)^2 = 25$

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T & Lengthy

$P(W) = 1/3 \quad P(L) = 2/3$

In a Tournament, a team plays 10 matches with probabilities of winning and losing each match as $\frac{1}{3}$ and $\frac{2}{3}$ respectively. Let x be the number of matches that the team wins, and y be the number of matches that team loses. If the probability $P(|x-y| \leq 2)$ is p, then $3^9 p$ equals

(A) 8288

(B) 8381

(C) 8461

(D) 8911

Win	Loss
0	10
1	9
4	6
5	5
6	4

$${}^{10}C_4 (1/3)^4 (2/3)^6 + {}^{10}C_5 (1/3)^5 (2/3)^5 + {}^{10}C_6 (1/3)^6 (2/3)^4$$

$$\frac{{}^{10}C_4 [2^6 + 2^4] + {}^{10}C_5 \cdot 2^5}{3^{10}} = p$$

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Tough & lengthy.

If $\int \text{cosec}^5 x\,dx = \alpha \cot x \,\text{cosec}x \left(\text{cosec}^2 x + \frac{3}{2}\right) + \beta \log_e \left|\tan\frac{x}{2}\right| + c$

where $\alpha, \beta \in R$ and C is the constant of Integration, then the value of $8(\alpha + \beta)$ equals

M-2

$\text{cosec}\,x + \cot x = t$

$(-\text{cosec}\,x\cot x - \text{cosec}^2 x)\,dx = dt$

$-\text{cosec}\,x\,(\text{cosec}\,x + \cot x)\,dx = dt$

$\text{cosec}\,x\,dx = -dt/t$

$\text{cosec}\,x - \cot x = 1/t$

$\Rightarrow \text{cosec}\,x = t + \frac{1}{2}$

$\int \text{cosec}^4 x\,(\text{cosec}\,x\,dx)$

$= \int \frac{(t+1/t)^4}{2^4}\cdot\left(-\frac{dt}{t}\right)$

$= \int -\frac{1}{16}\,\frac{(t^2+1)^4}{t^5}$

M-1

$I_n = \int (\operatorname{cosec} x)^n \, dx$

$I_5 \longrightarrow I_3$.

$I_3 \longrightarrow I_1$

$I_1 = \ln(\tan x/2)$

$I_n = \int \underbrace{(\operatorname{cosec} x)^{n-2}}_{I} \underbrace{\operatorname{cosec}^2 x}_{II} \, dx$

$(\operatorname{cosec} x)^{n-2} \cdot (-\cot x) - \int (n-2)(\operatorname{cosec})^{n-3} (\operatorname{cosec} x \cot x) \cot x \, dx$

$= (\operatorname{cosec} x)^{n-2} (-\cot x) - (n-2) \int (\operatorname{cosec} x)^{n-2} \cdot (\operatorname{cosec}^2 x - 1) \, dx$

$I_n = (\operatorname{cosec} x)^{n-2} (-\cot x) - (n-2) I_n + (n-2) I_{n-2}$

$\boxed{(n-1) I_n = (\operatorname{cosec} x)^{n-2} (-\cot x) + (n-2) I_{n-2}}$

$n = 5$ & ~~$n = 3$~~

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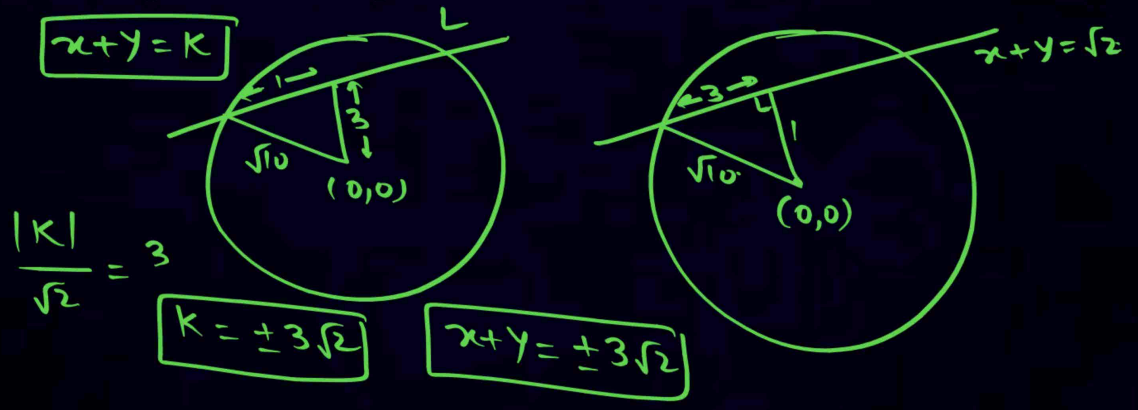
E to M

Centre of circle is (0, 0) & radius = $\sqrt{10}$, $x + y = \sqrt{2}$ is its chord.

$\left|\frac{c_2 - c_1}{\sqrt{a^2+b^2}}\right|$

Another chord of slope –1 has length 2 units. Find distance between this chord & line.



$\frac{|K|}{\sqrt{2}} = 3$

$K = \pm 3\sqrt{2}$

$x + y = \pm 3\sqrt{2}$

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(F)

$b^2 = a^2(e^2-1)$

A circle (C_1) centred at $(0, 0)$ touches hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ at vertex. Another circle (C_2) centred at focus of hyperbola touches circle C_1. Area of C_1 and C_2 are 36π and 4π respectively then find latus rectum of hyperbola.

$r_1 = a$

$r_2 = ae - a$

$36\pi = \pi r_1^2$

$a^2 = 36$

$\pi r_2^2 = 4\pi$

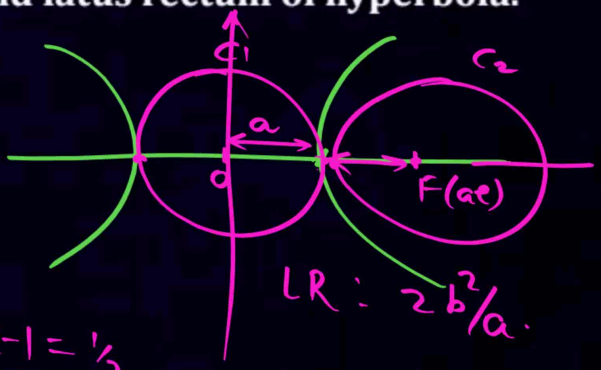
$r_2 = 2$

$ae - a = 2$

$6(e-1) = 2$

$e - 1 = 1/3$

$e = 4/3$



LR : $2b^2/a$.

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(E)

If $\frac{dy}{dx} = \frac{1}{(x+y+2)^2}$ and $f(0) = 0$. Then $f(x) = \tan^{-1}\left(\frac{x+y}{2x+2y+\lambda}\right)$ then find λ.

$\lambda = 5$ ✓

$x + y + 2 = t$

$1 + dy/dx = dt/dx$

$dy/dx = dt/dx - 1$

$\frac{dt}{dx} - 1 = \frac{1}{t^2}$

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

$\int \frac{t^2+1-1}{1+t^2}\,dt = \int dx$

$t - \tan^{-1}t = x + c$

$x + y + 2 - \tan^{-1}(x+y+2) = x + c$

$2 - \tan^{-1}2 = c$

$y + x - \tan^{-1}(x+y+2) = x - \tan^{-1}2$

$y = \tan^{-1}(x+y+2) - \tan^{-1}2$

$y = \tan^{-1}\left(\frac{x+y}{1+2(x+y+2)}\right)$

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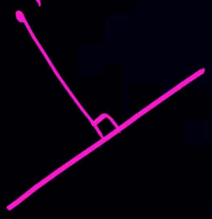
E & L

Two lines L_1 and L_2 are given and they intersect at point P.

$$L_1: \frac{x}{1} = \frac{y}{2} = \frac{z}{3} = \lambda \;\&\; L_2: \frac{x-3}{1} = \frac{y+2}{-2} = \frac{z-7}{2} = \mu$$

$A(8, 7, -1)$ and $B(5, 1, 17)$ are two points. Find minimum distance of point P from the line joining A and B.



$P(\lambda, 2\lambda, 3\lambda)$ $\quad P[\mu+3, -2\mu-2, 2\mu+7]$

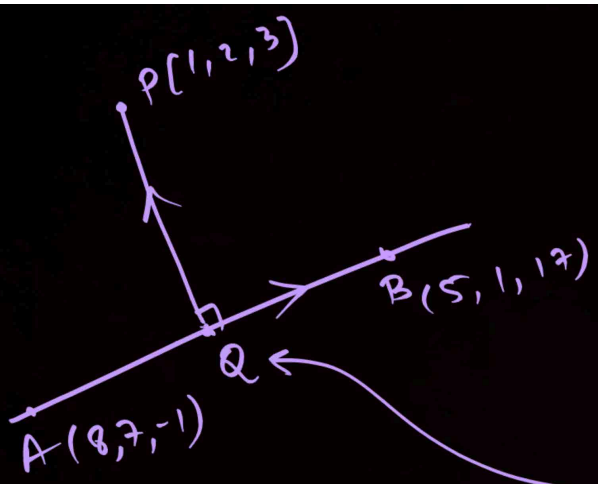
$\lambda = \mu+3$ $\quad 2\lambda = -2\mu-2$ $\quad 3\lambda = 2\mu+7$ ✓

$\lambda = 1$

$\lambda + \mu = -1$

$\mu + 3 + \mu = -1 \Rightarrow 2\mu = -4$

$\mu = -2$



eq^n of AB

$$\frac{x-5}{3} = \frac{y-1}{-6} = \frac{z-17}{-18} = K$$

$$\frac{x-5}{1} = \frac{y-1}{2} = \frac{z-17}{-6} = K$$

$$\begin{cases} x = K+5 \\ y = 2K+1 \\ z = 17-6K \end{cases}$$

Easy → 16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PHYSICS

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A bulb rating 50 W – 200 V connected across 100 then what is the power consumed in this case ?

$P_{rated} = 50\ W$

$V_{rated} = 200\ V$

$R_{bulb} = Const.$

$P = \frac{V^2}{R}$

Concept :-

$$R_{bulb} = \frac{V_{rat}^2}{P_{rat}}$$

In ckt

$$P_{ckt} = \frac{V_{ckt}^2}{R_{bulb}}$$

$$P_{ckt} = \left(\frac{V_{ckt}}{V_{rated}}\right)^2 P_{rated}$$

$$= \left(\frac{100}{200}\right)^2 \times 50 = \frac{50}{4} = 12.5\ W$$

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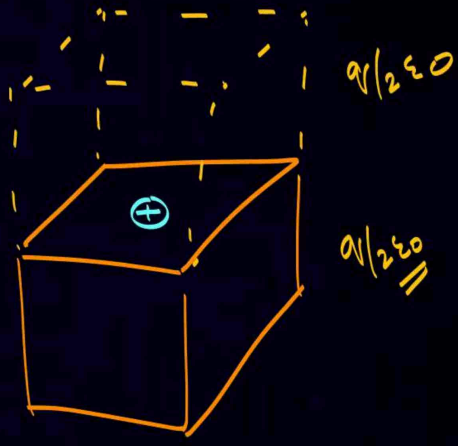
A charge +Q is placed at center of the surface of cube then find flux through the cube.



A $Q/8\epsilon_0$

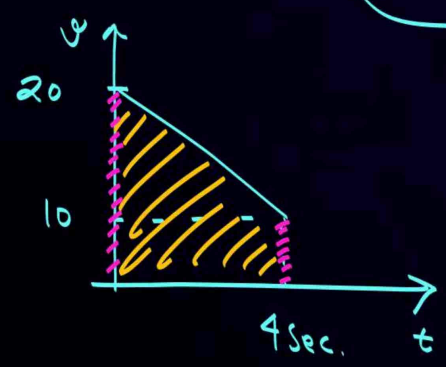
B $Q/24\epsilon_0$

C $Q/6\epsilon_0$

D $Q/2\epsilon_0$

A car running at 72 Km/h reduces its velocity to half in 4 seconds considering uniform retardation, then find distance travel for this interval.

→ 20 m/s



→ Slope of v/t = Const (-ve)

Concept :- Area = distance = $\frac{1}{2}(30) \times 4 = 60\,m$.

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Consider the following statements:

Statement I: The number of emitted photoelectrons Increases with increase in frequency of incident light.

Statement II: Kinetic energy of emitted photoelectrons increases with increase in frequency of incident light

Photocurrent ∝ Intensity.
KE↑ υ↑

A. Both the statements are correct

B. Both the statements are incorrect

C. Statement-1 is correct and Statement-2 is incorrect.

D. Statement-2 is correct and Statement-1 is incorrect.

JEE MAIN 2024 LIVE PAPER DISCUSSION

$l = 14$

A massless rod of length 14 meter has a point mass attached to one end while the other end is hinged. The rod is released from the position shown. The speed of the mass at the bottom most point is ($g = 10\ m/s^2$)

A $\sqrt{560}$ m/s

B $\sqrt{280}$ m/s

C $\sqrt{280\left(1+\frac{1}{\sqrt{2}}\right)}$ m/s

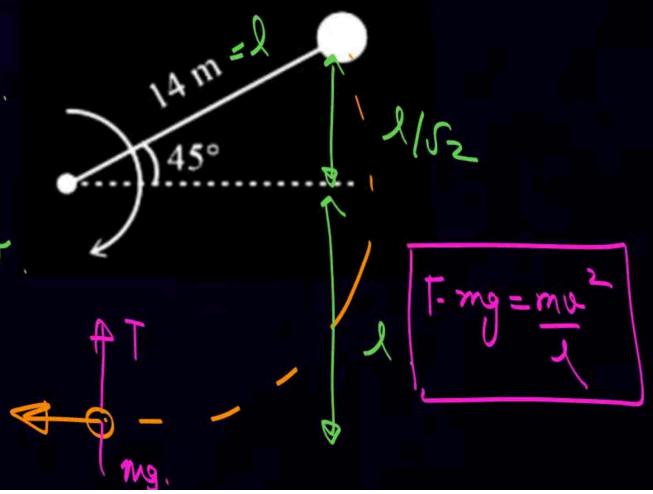
Ans

D $\sqrt{280\left(1+\frac{1}{\sqrt{3}}\right)}$ m/s

$mg\left(l+\frac{l}{\sqrt{2}}\right)=\frac{1}{2}mv^2$

$\sqrt{2gl\left(1+\frac{1}{\sqrt{2}}\right)}=v$

$\sqrt{280\left(1+\frac{1}{\sqrt{2}}\right)}=v$



$T-mg=\frac{mv^2}{l}$

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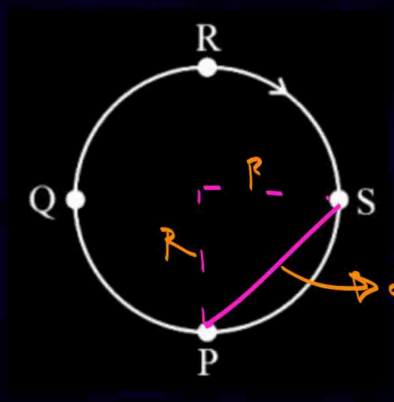
Four symmetrical points P, Q, R and S lie on a horizontal circle of radius of 4 km. What is the displacement when a car moves from P to S along the given circular path.

A. $4\sqrt{2}$ km Ans

B. 4 km

C. 8 km

D. 4π km



$disp = \sqrt{R^2 + R^2}$

$= R\sqrt{2} = 4\sqrt{2}$ km

JEE MAIN 2024 LIVE PAPER DISCUSSION

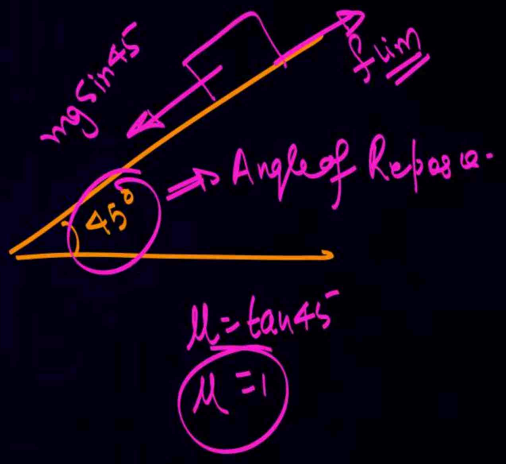
A block of mass 2 kg is placed on an inclined plane of inclination 45°. The block is at rest. The minimum coefficient of static friction is:

A. $1/2$

B. $\sqrt{3}$

C. $1/\sqrt{3}$

D. 1 Ans



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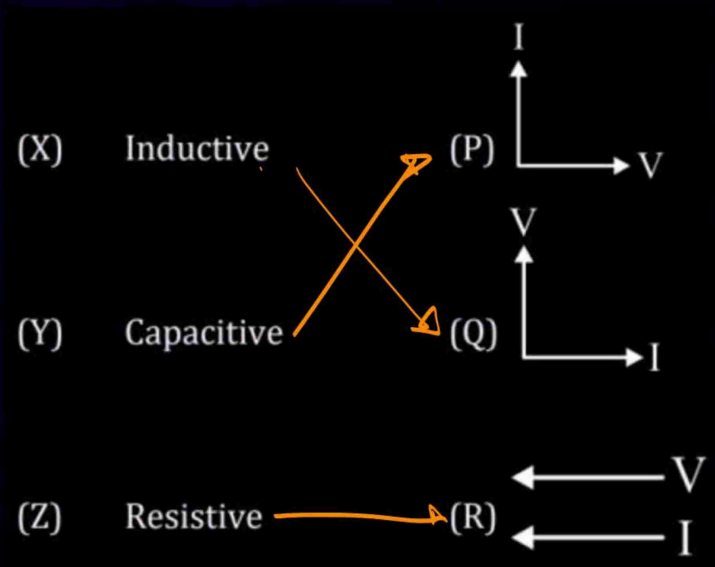
Correct match for phasors of voltage and current for given circuit elements is :

A $X \rightarrow P, Y \rightarrow Q, Z \rightarrow R$

B $X \rightarrow Q, Y \rightarrow P, Z \rightarrow R$ Ans

C $X \rightarrow P, Y \rightarrow R, Z \rightarrow Q$

D $X \rightarrow Q, Y \rightarrow R, Z \rightarrow P$



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In a YDSE setup, slit width are d and 4d, find the ratio of maximum intensity to minimum intensity

A. 9 : 1

B. 3 : 1

C. 4 : 1

D. 2 : 1

$I \propto$ Slit width

I

$4I$

$$\frac{I_{max}}{I_{min}} = \left(\frac{\sqrt{4I} + \sqrt{I}}{\sqrt{4I} - \sqrt{I}}\right)^2 = \left(\frac{3\sqrt{I}}{\sqrt{I}}\right)^2 = 9:1$$

JEE MAIN 2024 LIVE PAPER DISCUSSION

Arrange the following in ascending order of wavelength.

Cosmic γ X UV VIS IR. Mic Radio.

(A) Gamma rays

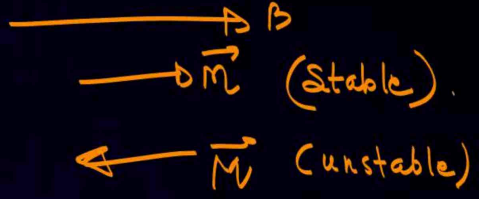
(B) X-ray

(C) Infra-red ray

(D) microwave

$\lambda_g < \lambda_x < \lambda_{IR} < \lambda_{mi}$

Magnetic moment 0.5 A/m^2, B = 8 mT, then work done for bringing the magnet most stable to least stable position.



$$W = MB(\cos\theta_1 - \cos\theta_2)$$

$$= 0.5 \times 8 \times 10^{-3} (\cos 0 - \cos\pi)$$

$$= 8\ mJ$$

The angular moment of 4th orbit by Bohr's theory

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

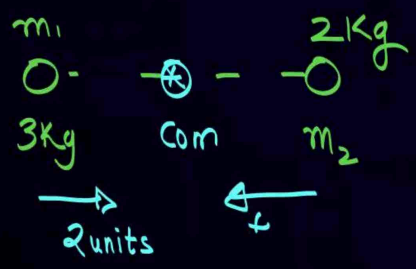
$$= \frac{4h}{2\pi} = \frac{2h}{\pi}$$

Sum of Rotational and translational degrees of freedom of CH_4 is 6

Total D.O.f =

Two masses m_1 = 3 kg and m_2 = 2 kg separated by a distance if 3 kg is displaced towards com by 2 units.

By what distance should mass m_2 be displaced towards COM so that COM remains fixed.



$$\Delta R_{com} = \frac{m_1 \Delta R_1 + m_2 \Delta R_2}{m_1 + m_2} = 0$$

$$3 \times 2 = 2x$$

$$x = 3$$

JEE MAIN 2024 LIVE PAPER DISCUSSION

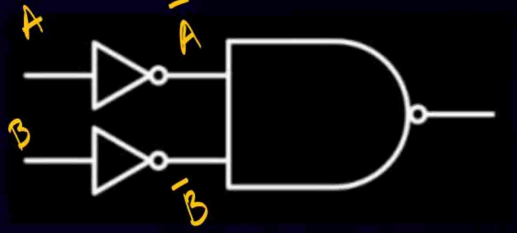
The figure given below represents which logic gate ?

A AND

B NAND

C OR Ans

D NOR



$\overline{A \cdot B} = \bar{A} + \bar{B}$

$= A + B$

OR

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Consider the following statements:

Statement I: The contact angle between solid and liquid depends on the solid as well as liquid.

Statement II: The rise in capillary does not depend on the radius of tube.

(A) Both the statements are correct

(B) Both the statements are incorrect

(C) Statement-1 is correct and Statement-2 is incorrect.

(D) Statement-2 is correct and Statement-1 is incorrect.

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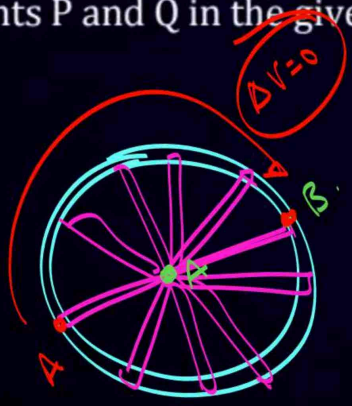
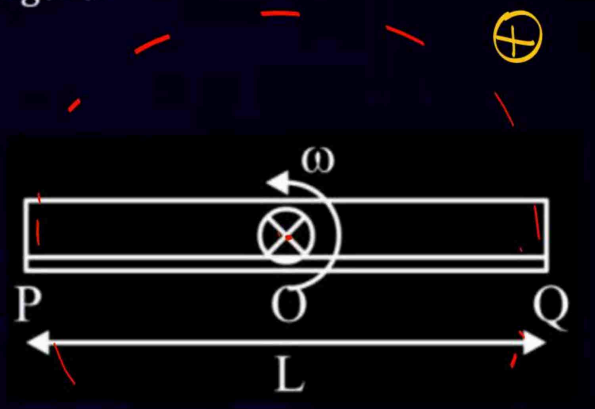
If magnetic field is perpendicular to the plane of rotation. Find potential difference between points P and Q in the given figure.





(A) $\frac{B\omega\ell^2}{2}$

(B) $\frac{B\omega\ell^2}{3}$

(C) $\frac{2B\omega\ell^2}{2}$

(D) zero

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Position of a particle performing SHM is given by $x = 100 \sin\left(\omega t + \frac{\pi}{3}\right)$. Find its initial velocity if time-period is 1.4 sec.

(A) $\frac{1000\,\pi}{7}$ m/s

(B) $\frac{500\,\pi}{7}$ m/s

(C) $\frac{1500\,\pi}{7}$ m/s

(D) $\frac{1000\,\pi}{3}$ m/s

$A\omega \cos 60 = v' = 100 \times \frac{2\pi}{1.4} \times \frac{1}{2}$

$= \frac{100\pi}{1.4}$

$= \frac{1000\pi}{14}$

$= \frac{500\pi}{7}$

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The time period of satellite depends on radius (R), universal gravitational constant (G) and mass of Planet (m).

A $2\pi\sqrt{\frac{R^3}{Gm}}$

B $2\pi\sqrt{\frac{Gm}{R^3}}$

C $2\pi\sqrt{\frac{R^2}{Gm}}$

D $2\pi\sqrt{\frac{R}{Gm}}$

$T^2 \propto R^3$.

$\frac{GMm}{R^2} = mR\omega^2$

$\sqrt{\frac{GM}{R^3}} = \frac{2\pi}{T}$

$T = 2\pi\sqrt{\frac{R^3}{GM}}$

JEE MAIN 2024 LIVE PAPER DISCUSSION

A body of mass 9 kg is at a height of 2R (radius of earth) from the surface of the earth. The weight if the body is_____N

$g' = g\left(\frac{R}{R+h}\right)^2 =$

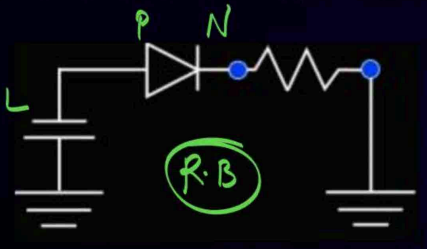
$g' = g\left(\frac{R}{3R}\right)^2$

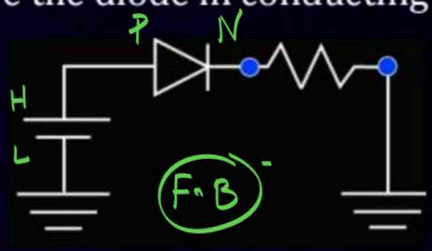
$= \frac{g}{9}$.

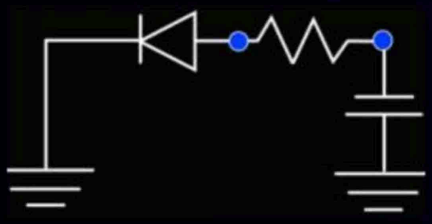
Weight $= mg' = 9 \times \frac{g}{9} = 10$

JEE MAIN 2024 LIVE PAPER DISCUSSION

Which of the following circuits would have the diode in conducting state ?

A 

B 

C 

D 

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Two conductor have same mass, resistivity and radius of A is 2 mm and of B is 4 mm. If Resistance of B is 2 ohm find R of A

A

B

$r_1 = 2mm$

$R_1 = \_$

$r_2 = 4mm$

$R_2 = 2.$

$$\rho\pi r_1^2 l_1 = \rho\pi r_2^2 l_2$$

$$\frac{l_1}{l_2} = \left(\frac{r_2}{r_1}\right)^2$$

$$\frac{R_1}{R_2} = \frac{l_1}{l_2} \times \frac{r_2^2}{r_1^2} = \left(\frac{r_2}{r_1}\right)^4$$

$$R_1 = \left(\frac{2}{1}\right)^4 \times 2 = 32\,\Omega$$

JEE MAIN 2024 LIVE PAPER DISCUSSION

One mole of an ideal monoatomic gas compressed adiabatically from volume 2 V to V. If initially temperature of gas was T then the magnitude of work done in this process is

(Moderate)

A $\frac{3}{2}RT\,(2^{1/2}-1)$

B $\frac{3}{2}RT\,(2^{2/3}-1)$ Ans

C $\frac{2}{3}RT\,(2^{2/3}-1)$

D $\frac{2}{3}RT\,(2^{1/2}-1)$

adia $PV^{\gamma} = \text{Const}$

$n = 1$ $TV^{\gamma-1} = \text{Const}$

$C_v = \frac{3R}{2}$ $T2^{\gamma-1}V^{\gamma-1} = T_f V^{\gamma-1}$

$C_p = \frac{5R}{2}$ $T2^{5/3-1} = T_f$

$\gamma = \frac{5}{3}$ $2^{2/3}T = T_f$

$W_{by\,K} = \frac{P_f V_f - P_i V_i}{1-\gamma}$

$= \frac{nR(T_f - T_i)}{1-\gamma}$

$= \frac{RT(2^{2/3}-1)}{1-5/3}$

Mag $= \frac{3}{2}RT(2^{2/3}-1)$

Adia.

$\Delta Q = 0$

$\cancel{\Delta Q}^{\,0} = \Delta U + W.$

$-\Delta U = W$

$-nC_v\Delta T = W$

$$-\frac{nR\Delta T}{\gamma - 1} = W$$

$PV^{\gamma} = \text{Const}$

$IV^{\gamma} = \text{Const}$

$TV^{\gamma-1} = \text{Const}$

$PV = nRT.$

$P = \frac{nRT}{V}$

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- Only your Short Notes Revise.
  If not
  Mind Map Series.
- Shift discussions → Solve.


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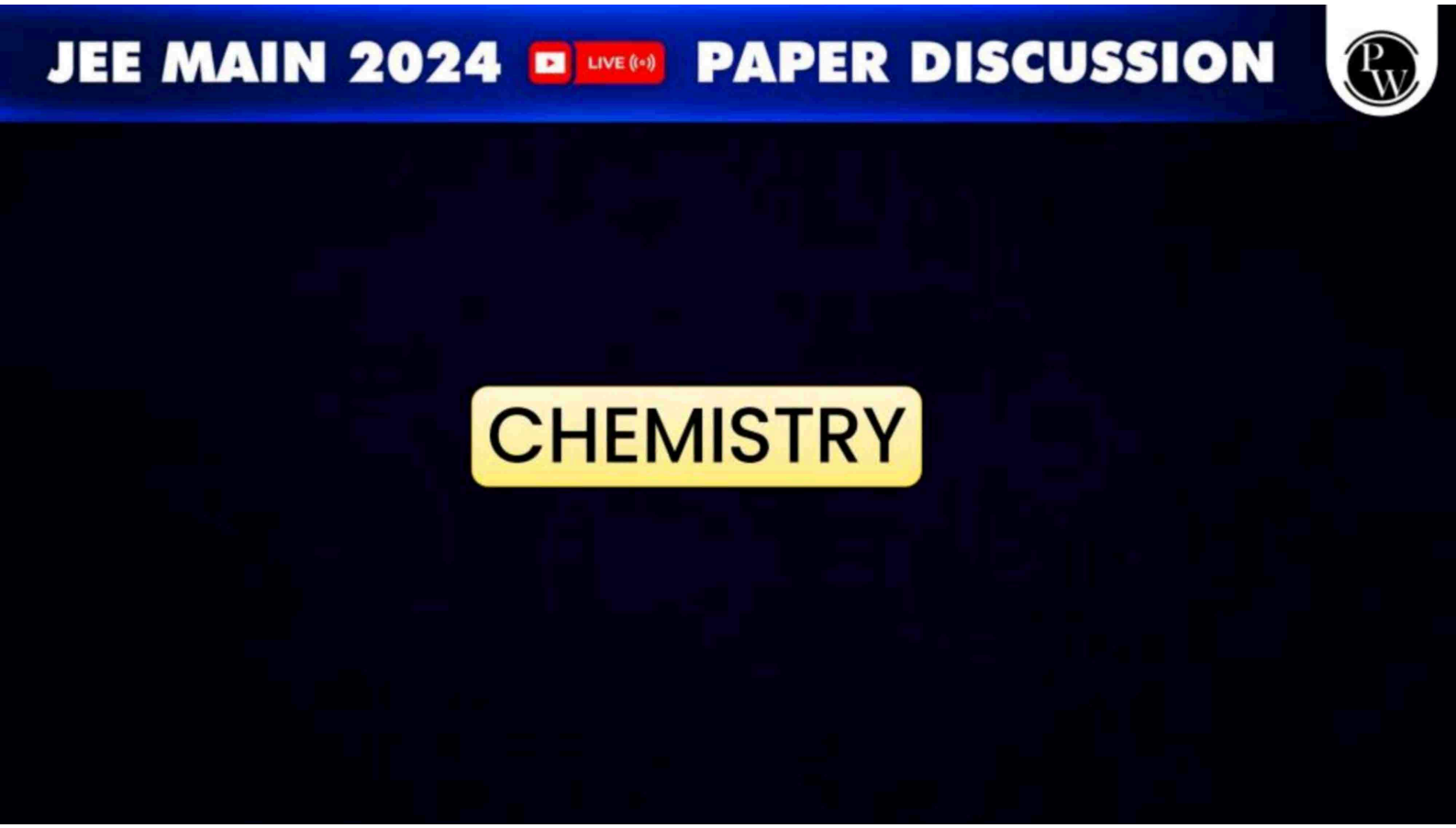
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ORGANIC CHEMISTRY

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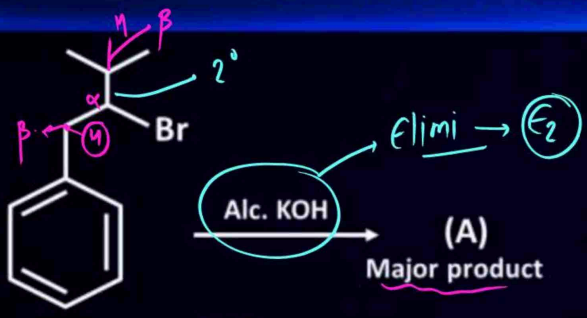
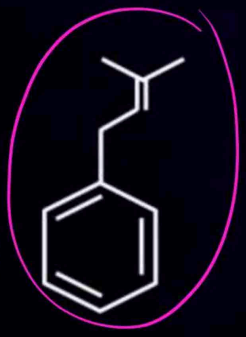
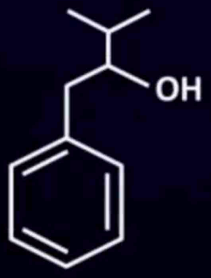
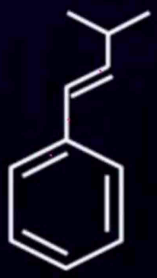


ϵlimi → E_2

Major product A is:

A 

B 

C 

D 

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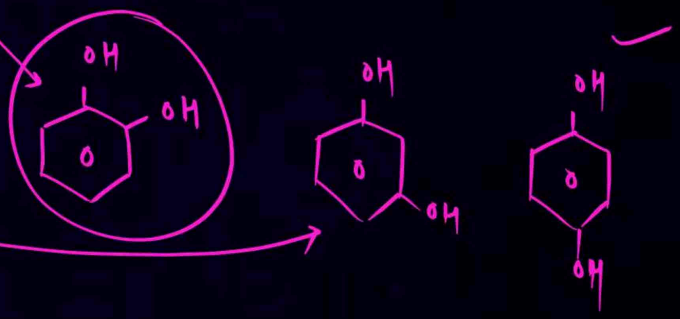
IUPAC name of Catechol is

A Benzene, 1,2-diol

B Benzene-1,3-diol

C Benzene-1,4-diol

D 3-Hydroxyphenol



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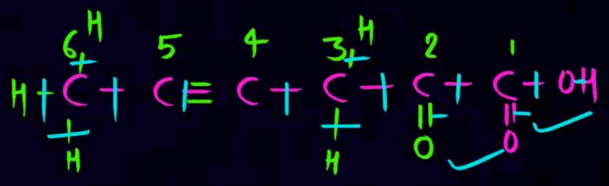
What is the sum of number of σ and π bonds present in 2-oxo-hex-4-yn-oic acid?



4π

14σ

18

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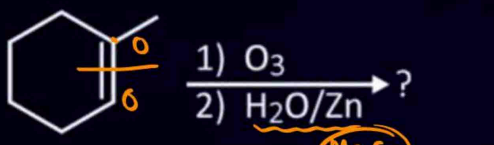
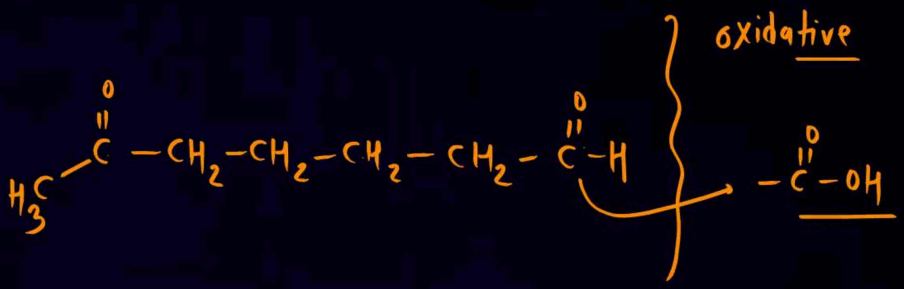
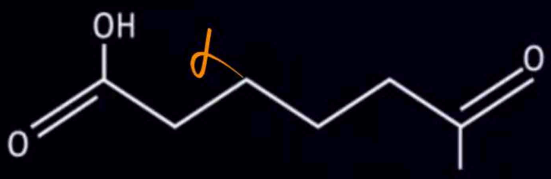
Major product of given compound

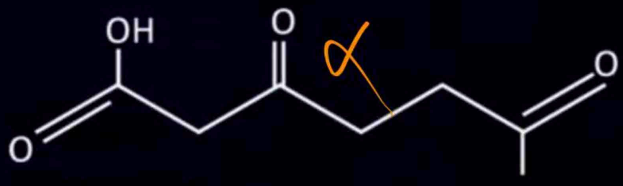




A 

B 

C 

D 

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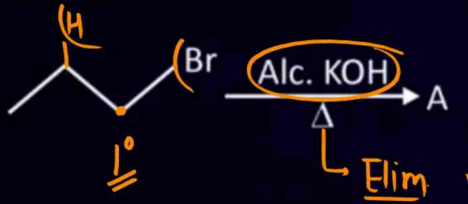
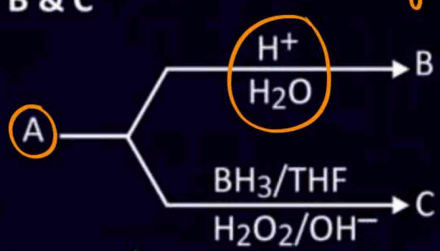
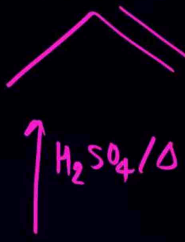
Correct statement of relation between A, B & C



Acidic Hydrol



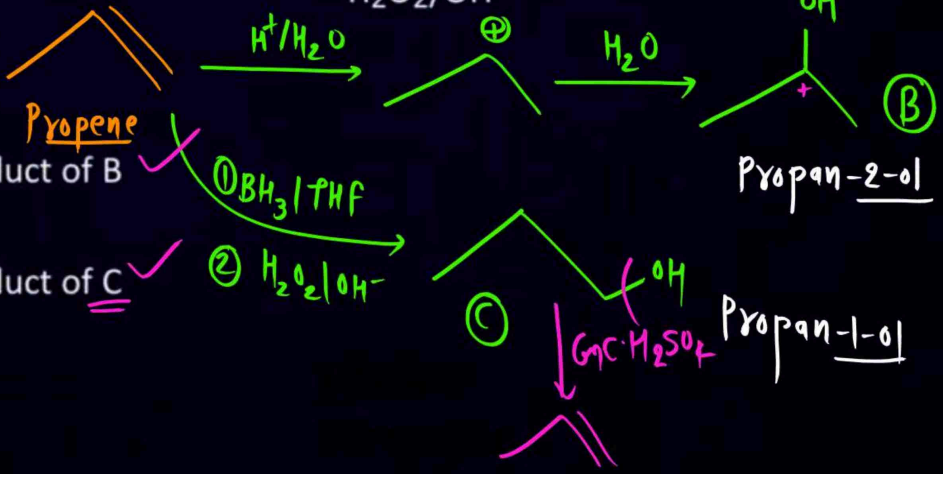


A B & C functional isomers ✗

B A is acidic dehydration product of B

C A is acidic dehydration product of C ✓

D Both (B) and (C) correct ✓



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Match the column:

Column-I (Molecules)	Column-II (Relation)
(A) Glucose & Fructose	(P) Anomers
(B) α-D-Glucose & β-D-Glucose	(Q) Function isomers
(C) Glucose & Mannose	(R) Epimers
(D) α-Ribose & α- Glucose	(S) Homologues

Aldose Ketose (Q)

(B) ⇒ (Anomer) (P)

(C) Epimer (C-2) (R)

(D) (S)

(S) Homologues

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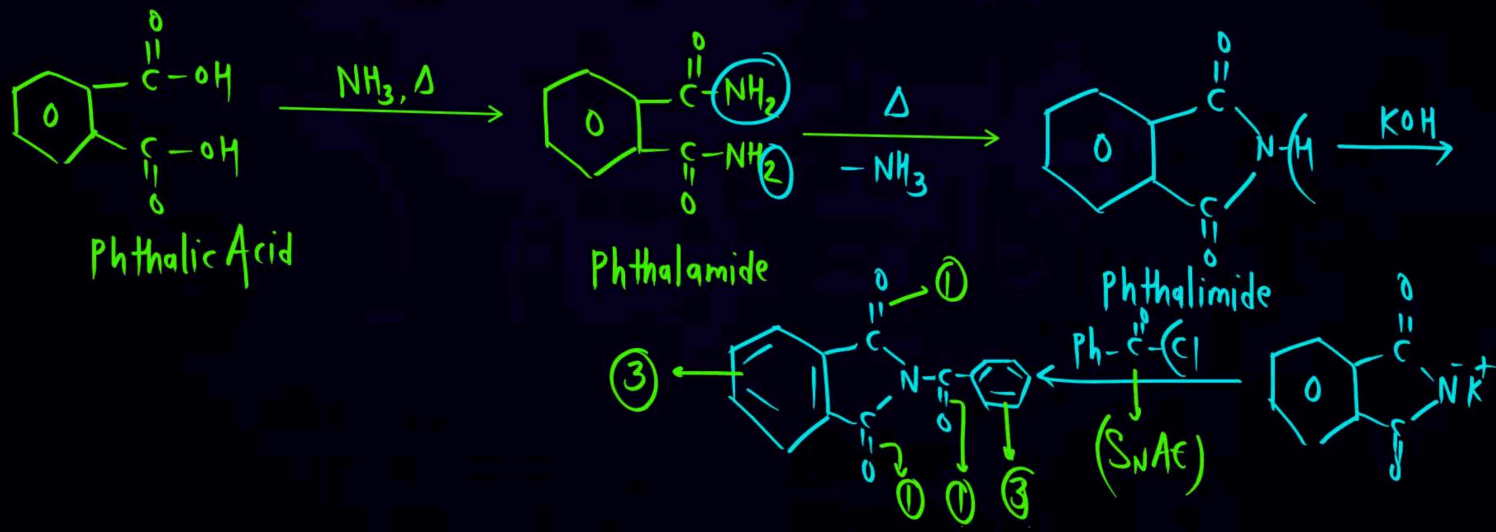
Phthalamide $\xrightarrow[KOH]{Ph-\overset{O}{\overset{\|}{C}}-Cl}$ product "X"; Number of π-bonds in product "X"

9



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Which of the following is uses in adsorption chromatography

A Silica gel

B Alumina

C Benzene

D Both A & B


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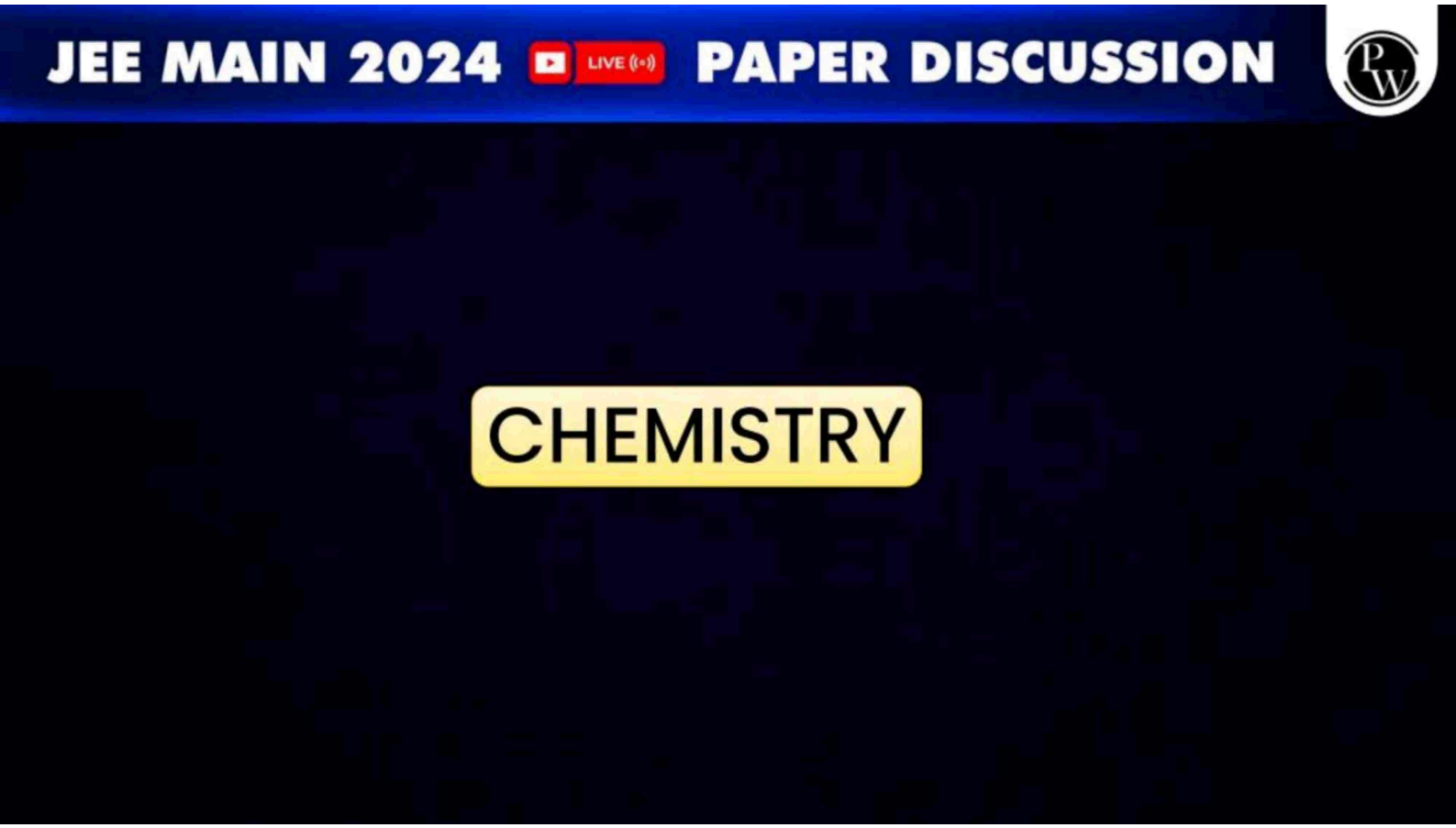
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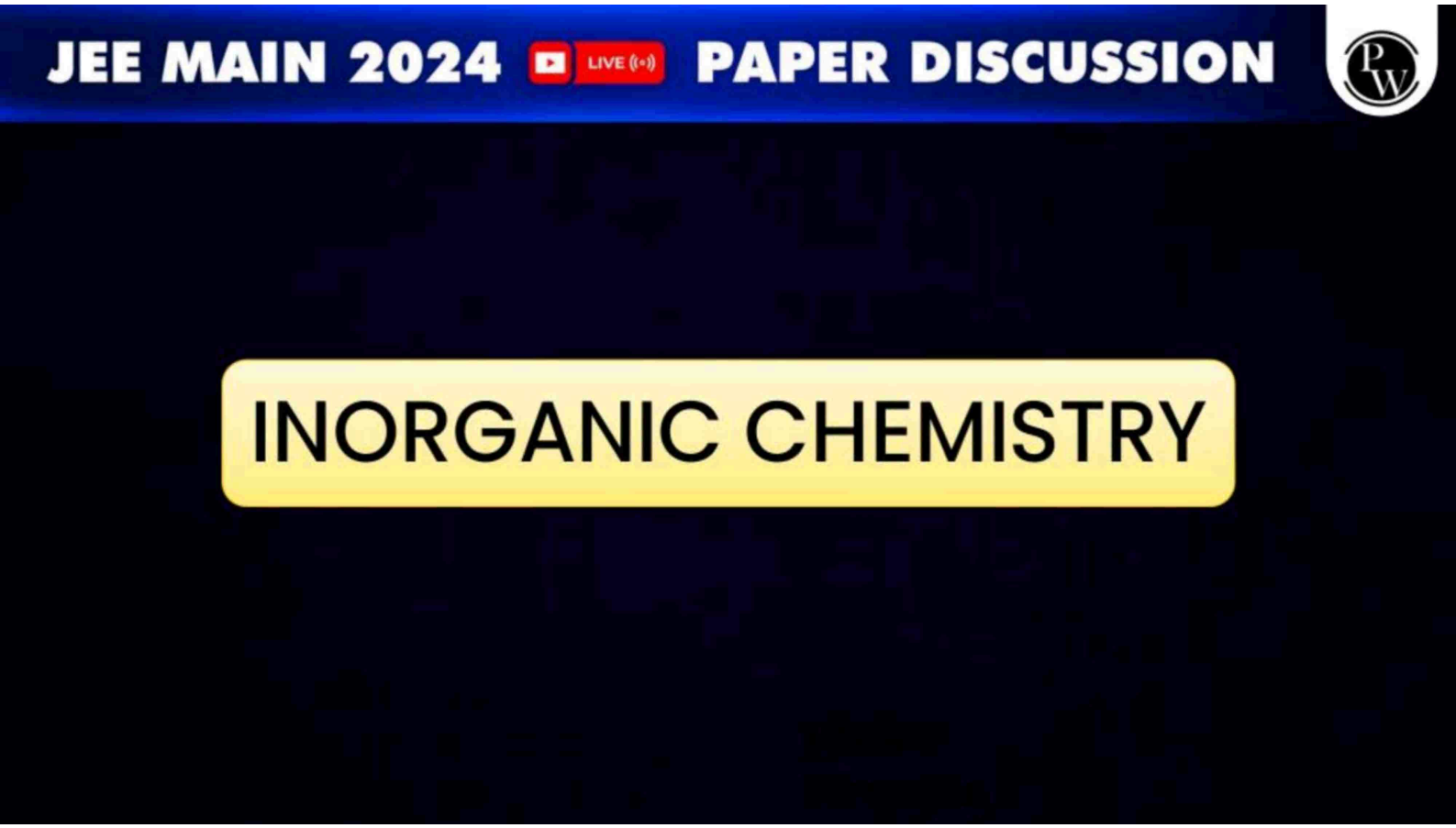
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JEE MAIN 2024 LIVE PAPER DISCUSSION

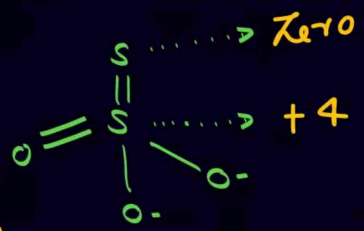
Which of the following have pyramidal shape?

A $S_2O_3^{2-}$

B SO_4^{2-} → sp^3

C SO_3^{2-}

D $S_2O_7^{2-}$



JEE MAIN 2024 LIVE PAPER DISCUSSION

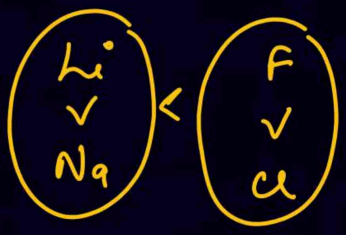
The correct order of ionisation enthalpy for Li, Na, Cl, F is:

A Na < Li < Cl < F

B Li < Na < Cl < F

C Na < Li < F < Cl

D F < Cl < Li < Na



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Arrange the following in increasing order of their first ionisation enthalpy:

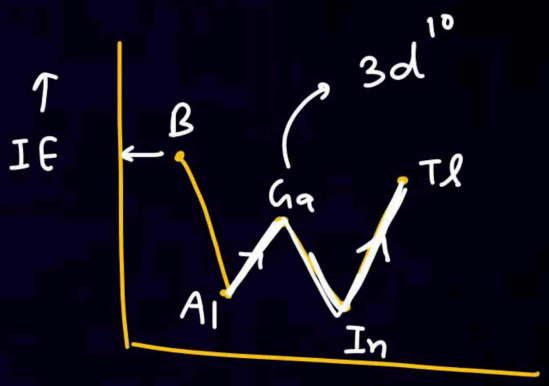
Al, Ga, In, Tl, B

A. Tl < In < Ga < Al < B

B. In < Al < Ga < Tl < B

C. In < Ga < Al < B < Tl

D. B < Al < Ga < In < Tl



B > Tl > Ga > Al > In

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Find out the number of unpaired electrons in d-subshell for $[Co(H_2O)_6]^{3+}$.

A 3

B 4

C 0

D 2

Co^{3+} H_2O : SFL

d^6 — — e_g

↑↓ ↑↓ ↑↓ t_{2g}

JEE MAIN 2024 LIVE PAPER DISCUSSION

Which statement is/are incorrect?

(i) o-nitrophenol has intermolecular hydrogen bonding.

(ii) HF has intermolecular hydrogen bonding.

(iii) The hydrogen bonds have strong influence on the structure and properties of the compounds.

(iv) The magnitude of H-bonding depends on the physical state of the compound.

A Only (I)

B (i), (ii), (iii), (iv)

C (i), (ii)

D (iii), (iv)

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MnO_2 + Salt (X) + conc. $H_2SO_4 \longrightarrow$ Greenish yellow gas is produced salt X is:

(A) NaF

(B) NaCl $\longrightarrow$ H^+Cl^- $\xrightarrow{MnO_2}$ Cl_2

(C) NaBr

(D) NaI

JEE MAIN 2024 LIVE PAPER DISCUSSION

We have a complex of Fe^{3+} ion having electronic configuration according to crystal field theory is $t_{2g}^{5}e_{g}^{0}$. If the complex is $[Fe(NH_3)_x(CN)_y]$, then value of (X+Y) is

$x + y = CN = 6$

$CN = 6$


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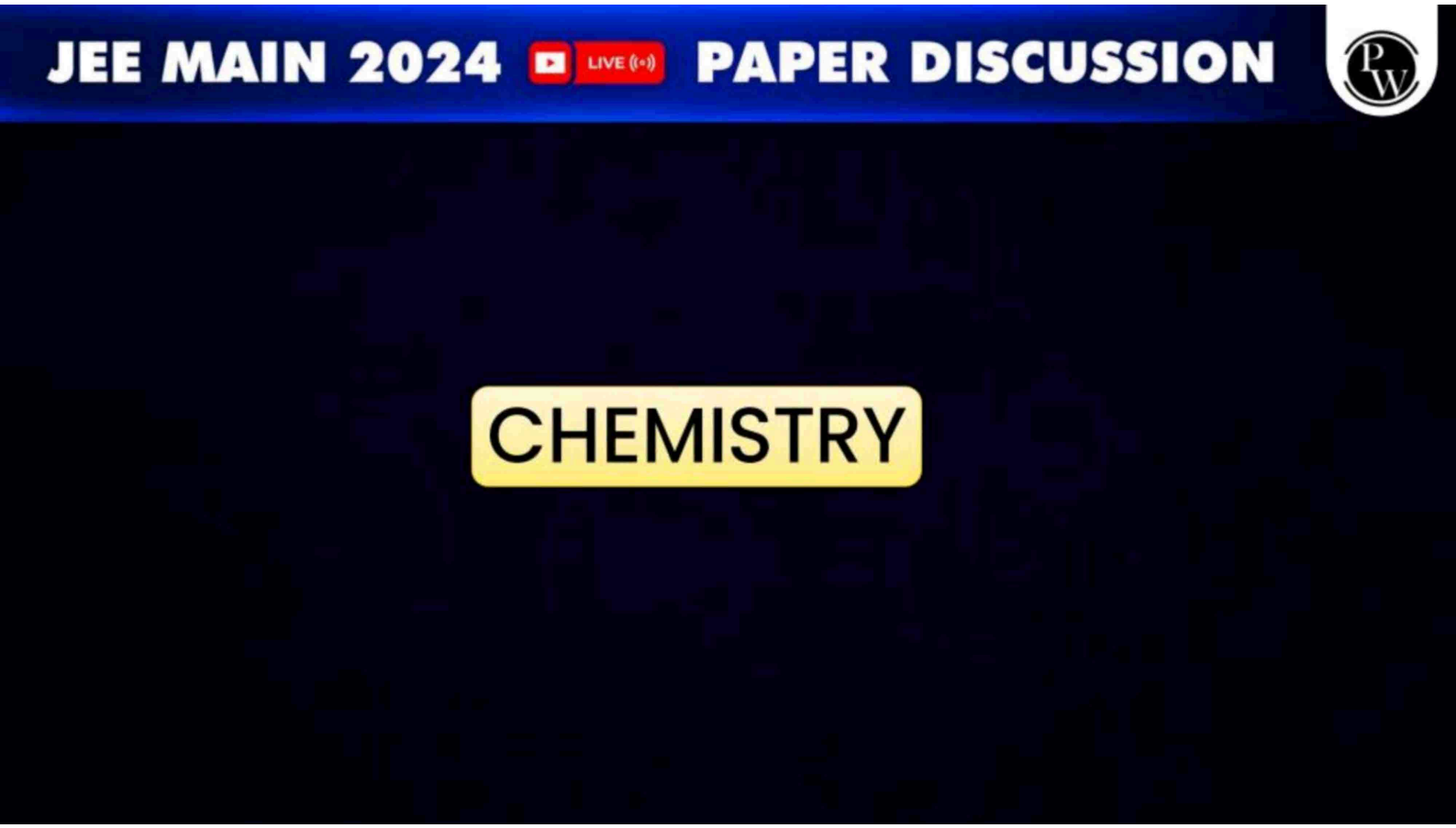
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PHYSICAL CHEMISTRY

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$K.E = h\nu - h\nu_0$ Expected !

Consider the following statements:

F **Statement I:** The number of emitted photoelectrons increases with increase in frequency of incident light.

T **Statement II:** Kinetic energy of emitted photoelectrons increases with increase in frequency of incident light.

A Statement I is true but statement II is false

B Statement I is false but statement II is true

C Both statement I and statement II are true

D Both statement I and statement II are false

$SO_2 + \frac{1}{2} O_2 \rightleftharpoons SO_3 \quad ; K_c$

$2SO_3 \rightleftharpoons 2SO_2 + O_2 \quad ; K_c'$

$\left(\frac{1}{K_c}\right)^2 = K_c'$

JEE MAIN 2024 LIVE PAPER DISCUSSION

What is the angular momentum of 4th orbit?

A h/π

B $2h/\pi$

C $4h/\pi$

D $8h/\pi$

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

$n = 4$

$$\text{angular momentum} = \frac{4h}{2\pi} = \frac{2h}{\pi}$$

JEE MAIN 2024 LIVE PAPER DISCUSSION

One mole of an ideal monoatomic gas initially at temperature T is compressed adiabatically from 2V to V, then the magnitude of work done in this process is:

$dU = dW$

$T_1 V_1^{\gamma-1} = T_2 V_2^{\gamma-1}$ → reversible adiabatic

$C_V = \frac{3}{2}R$

$\gamma = \frac{5}{3}$

$T(2V)^{\frac{2}{3}} = T_2 V^{\frac{2}{3}}$

$T_2 = 2^{\frac{2}{3}} \cdot T$

$\Delta U = nC_V \Delta T$

$= 1 \times \frac{3}{2}R(T_2 - T)$

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

$= \frac{3}{2}RT\left(2^{\frac{2}{3}} - 1\right)$

(A) $\frac{3}{2}RT(2^{\frac{1}{2}} - 1)$

(B) $\frac{3}{2}RT(2^{\frac{2}{3}} - 1)$

(C) $\frac{2}{3}RT(2^{\frac{2}{3}} - 1)$

(D) $\frac{2}{3}RT(\sqrt{2} - 1)$

$$-P_{ext}(V_2 - V_1) = nC_V(T_2 - T_1)$$

$$-P_2\left(\frac{nRT_2}{P_2} - \frac{nRT_1}{P_1}\right) = nC_V(T_2 - T_1)$$

irreversible

$T_2 = ?$

JEE MAIN 2024 LIVE PAPER DISCUSSION

Which of the following statement is incorrect?

A. In homogeneous mixture composition is uniform

B. Compounds are formed when atoms of different element combine together in any ratio

C. Atoms of same element have identical atomic mass and properties

D. In heterogeneous mixture composition is not uniform

JEE MAIN 2024 LIVE PAPER DISCUSSION

Calculate heat for isothermal process if expansion occurs from 20 L to 60 L against 5 atm external pressure.

$1\ atm\text{-}lt = 101.3\ J$

$dU = dq + dw$ ($dU = 0$)

$dq = -dw$

constant pressure $\Rightarrow$ irreversible process.

$\int dw = -P_{ext} \int dV$

$W_{irr} = -P_{ext}(V_2 - V_1)$

$= -5(60-20) = -200\ atm\text{-}lt.$

$dq = +200\ atm\text{-}lt$

$= 200 \times 101.3\ J$

$dU = nC_v dT$

if for any case if $dT = 0$ then $dU = 0$

(True or False)

JEE MAIN 2024 LIVE PAPER DISCUSSION

Arrange in increasing wavelength order:

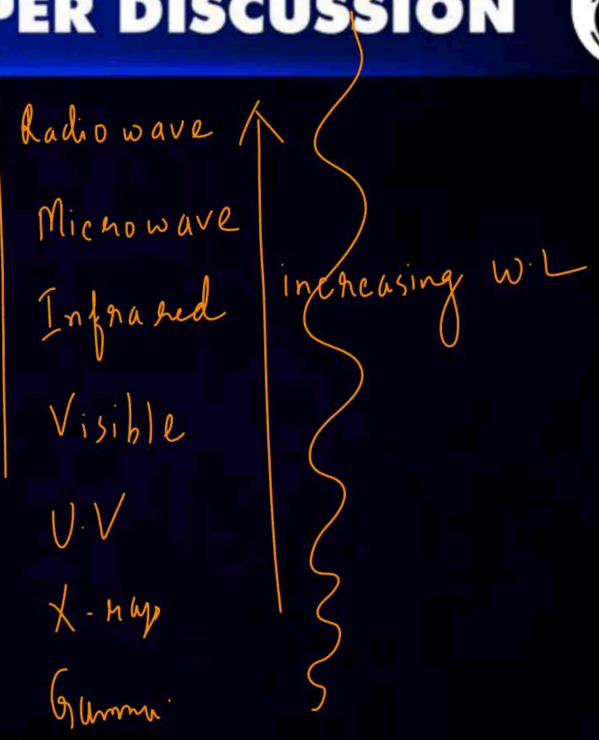
Gamma rays, X-Rays, U.V. Rays, I.R Rays

(A) Gamma rays < X-rays < UV rays < IR

(B) Gamma rays < UV rays < X-rays < IR

(C) X-rays < UV rays < IR < Gamma rays

(D) UV rays < IR < X-rays < Gamma rays



JEE MAIN 2024 LIVE PAPER DISCUSSION

For the graph between molar conductivity (Λ_m) VS $\sqrt{conc.}$, the correct unit of slope will be

$\wedge_m = \wedge_m^\infty - b\sqrt{C}$

we need to find out the unit of 'b'

$\wedge_m \Rightarrow S\ cm^2\ mol^{-1}$

Unit of 'b' $= \dfrac{S\ cm^2\ mol^{-1}}{\left(\frac{mol}{cm^3}\right)^{\frac{1}{2}}} = S\ cm^{\frac{7}{2}}\ mol^{-\frac{3}{2}}$

A. $S\ cm^{1/2}\ mol^{-1/2}$

B. $S\ cm^{3/2}\ mol^{-2}$

C. $S\ cm^{7/2}\ mol^{-3/2}$

D. $S\ cm^{5/2}\ mol^{-3/2}$

JEE MAIN 2024 LIVE PAPER DISCUSSION

Good problem.

For the reaction: $A + B \longrightarrow C$

Rate = $K[A]^{1/2}[B]^{1/2}$, where $K = 4.6 \times 10^{-2}\ sec^{-1}$

Initial concentration of A and B are 1 M respectively. Find time required such that concentration of A becomes 0.1 M.

$$-\frac{d[A]}{dt} = k[A]^{\frac{1}{2}}[B]^{\frac{1}{2}}$$

$$-\frac{d(1-x)}{dt} = k(1-x)^{\frac{1}{2}}(1-x)^{\frac{1}{2}}$$

$$\frac{dx}{dt} = k(1-x)$$

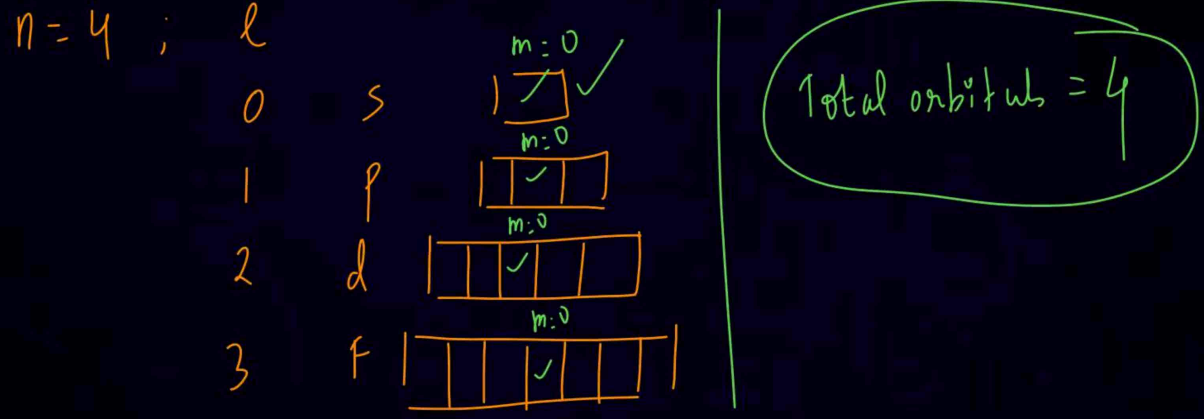
	A	$+ B \longrightarrow$	C
	1		–
	$1-x$	$1-x$	x

$$\int \frac{dx}{1-x} = k\int dt$$

$$-\ln(1-x)\Big|_0^{0.1} = kt$$

$$t = \frac{2.3}{4.6 \times 10^{-2}} = 50\ sec$$

How many orbitals have following set of quantum numbers n=4, m=0 ?



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3 gm of acetic acid is dissolved in 500 gm of water, depression in freezing point observed is $X \times 10^{-1}$ find out the value of X ____2____ (nearest integer).
Given: Ka of acetic acid is 1.8×10^{-5} and K_f of water is 1.86 K/molal

$$\alpha = \sqrt{\frac{Ka}{c}} = \sqrt{\frac{1.8\times10^{-5}}{0.1}} = 0.013$$

$$CH_3COOH \rightleftharpoons CH_3COO^- + H^+ \quad (i > 1)$$

$$i = 1 + (n-1)\alpha$$

$$i = 1 + (2-1)\alpha = 1 + \alpha$$

$$\text{molarity} = \text{molality} = \frac{3/60}{500/1000} = 0.1\ M$$

$$\Delta T_f = (1+\alpha)\cdot 1.86 \times 0.1$$

$$= 1.013 \times 1.86 \times 0.1$$

$$= 1.86 \times 10^{-1}$$


PW
THANK
YOU