JEE MAINS 2026

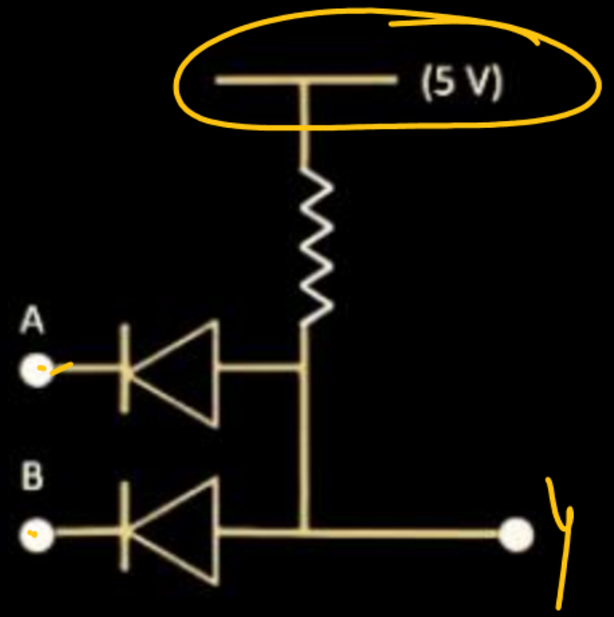
PAPER SOLUTION

28 JAN, SHIFT 2

Physics

Q) For the circuit given below, identify the logic gate.

(A) AND
(B) OR
(C) NAND
(D) NOR



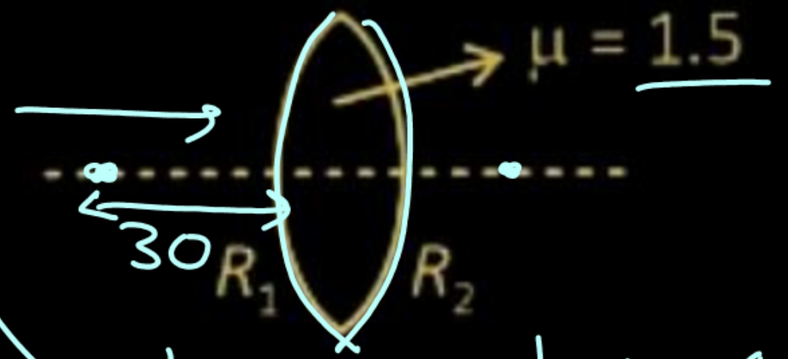
A	B	Y
0	0	0
0	1	0
0	0	0
1	1	1

Ans. (A)

Q) Object is placed at distance 30 cm from lens given below, then distance of image from lens is (R_1 = 10 cm, R_2 = 20 cm)

(A) 20 **(B) 24**

(C) 30 **(D) 36**



$$\frac{1}{f} = (\mu-1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$$

$$\frac{1}{f} = (1.5-1)\left(\frac{1}{10} - \frac{1}{(-20)}\right)$$

$$\frac{1}{f} = \frac{1}{2}\left[\frac{2}{20} + \frac{1}{20}\right]$$

$$\frac{1}{f} = \frac{3}{40}$$

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

$$\frac{1}{v} - \frac{1}{(-30)} = \frac{3}{40}$$

$$\frac{1}{v} + \frac{1}{30} = \frac{3}{40}$$

$$\frac{1}{v} = \frac{3}{40} - \frac{1}{30}$$

$$\frac{1}{v} = \frac{9-4}{120}$$

$$\frac{1}{v} = \frac{5}{120} \quad \frac{1}{24}$$

$$v = 24\text{ cm}$$

Ans. (B)

Q) Find kinetic energy of disc when block has fallen by 3 m.

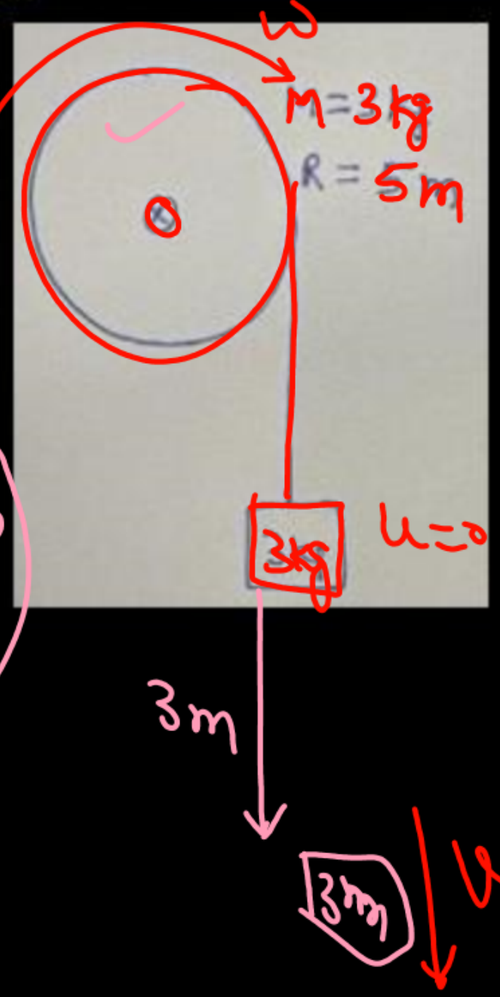
$$3\times10\times3 = \left(\frac{1}{2}\times3(5\omega)^2 + \left(\frac{1}{2}\left(\frac{3(5)^2}{2}\right)\omega^2\right)\right) - 0$$

$$30 = \left(\frac{25}{2}+\frac{25}{4}\right)\omega^2$$

$$\omega^2 = \frac{4\times30}{75}$$

$$\frac{1}{2}\times\frac{3\times25}{2}\left(\frac{4\times30}{75}\right)$$

$$= 30\,J$$



Q) If position vector is given as $\vec{r} = (x\hat{i} + y\hat{j} + z\hat{k})$ and if its signs are reversed then which of the following physical quantity remains unaffected?

(A) Acceleration
(B) Velocity
(C) Displacement
(D) Torque

Ans. (D)

Q) If the mass number of nucleus is α, its radius is R_α. And another mass number is β then its radius is R_β; then R_α/R_β = ? [Given $\beta = 8\alpha$]

(A) 1
(B) 1/2
(C) 1/3
(D) 2

$$R = R_0 (A)^{1/3}$$

$$\frac{R_\alpha}{R_\beta} = \left(\frac{A_\alpha}{A_\beta}\right)^{1/3} = \left(\frac{\alpha}{8\alpha}\right)^{1/3} = \frac{1}{2}$$

Ans. (B)

Q) Which of the following physical quantities is not directly measurable?

(A) Displacement
(B) Electric potential
(C) Potential difference
(D) Acceleration

Ans. (B)

Q) Two light sources of 450 nm and 550 nm are used for YDSE with slit distance 2.25 mm and distance between the slits and screen is 1.5 m. Then the distance from central maxima for which minima of both wavelength coincide?

(A) 1.65 mm (B) 1.20 mm (C) 1.30 mm (D) 1.40 mm

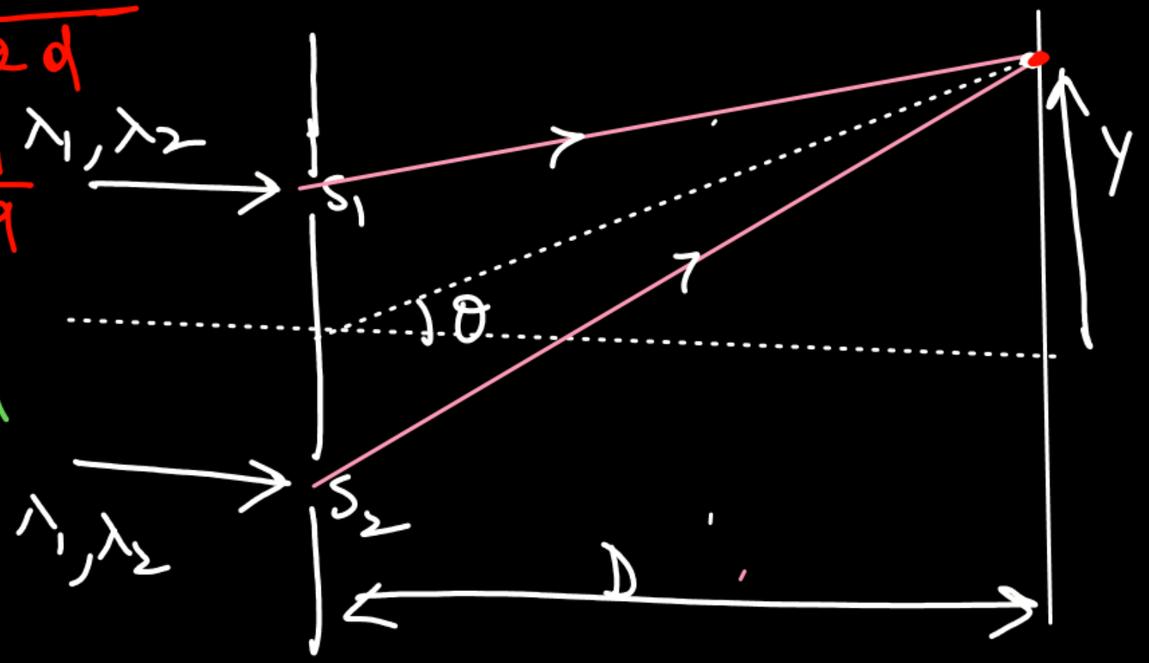
$$\frac{N_1\lambda_1 D}{2d} = \frac{N_2\lambda_2 D}{2d}$$

$$\frac{N_1}{N_2} = \frac{\lambda_2}{\lambda_1} = \frac{11}{9}$$

$N_1 = 11$

$N_2 = 9$

Ans. (A)



$d\sin\theta = N\frac{\lambda}{2}$

$[N = 1, 3, 5, 7, 9 \ldots]$

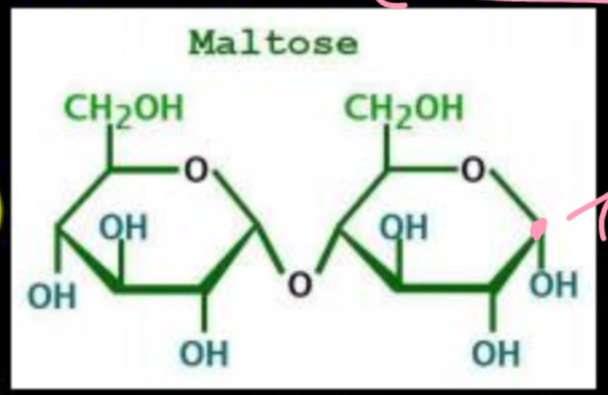
$\sin\theta \simeq \tan\theta = \frac{y}{D}$

$$y = \frac{N\lambda D}{2d}$$

Chemistry

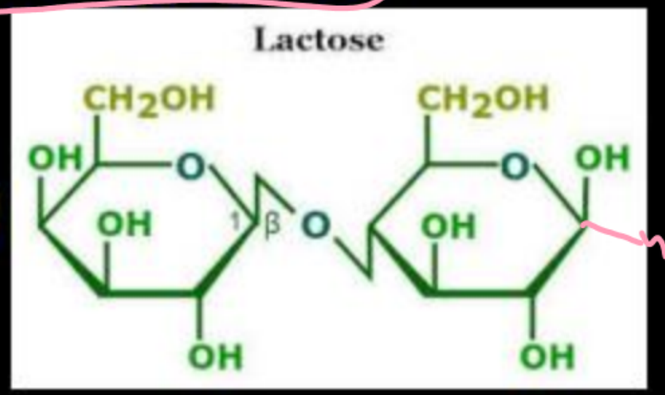
Q) Which one is non-reducing carbohydrate

(A)

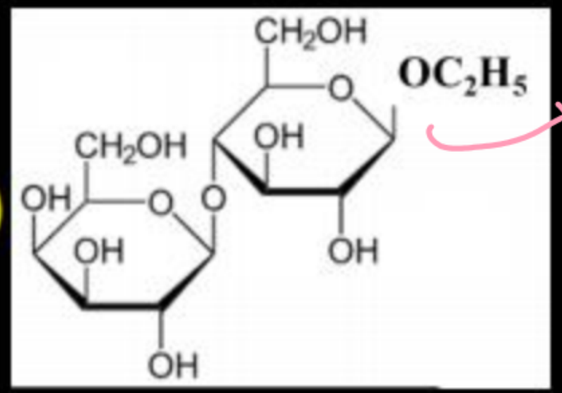


Red

(B)

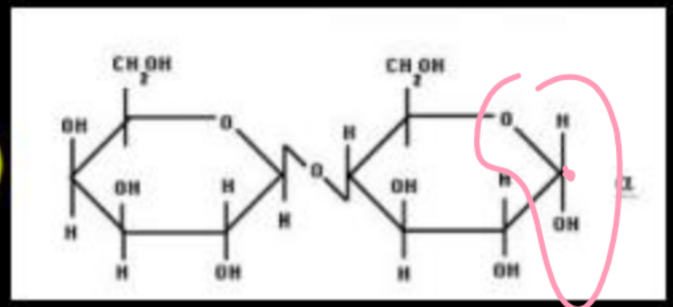


(C)



Acetal
Non-Red

(D)

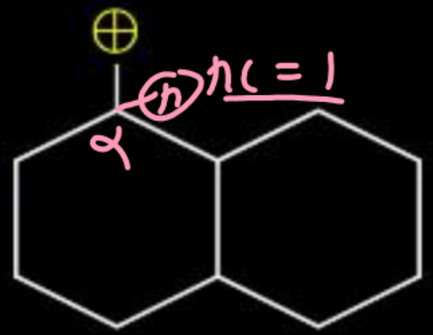


Hemi
Red

Ans. (C)

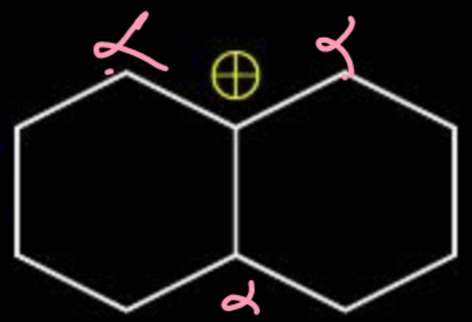
Q) Which pair have same hyper conjugation

(I)



$n_C = 1$

(II)

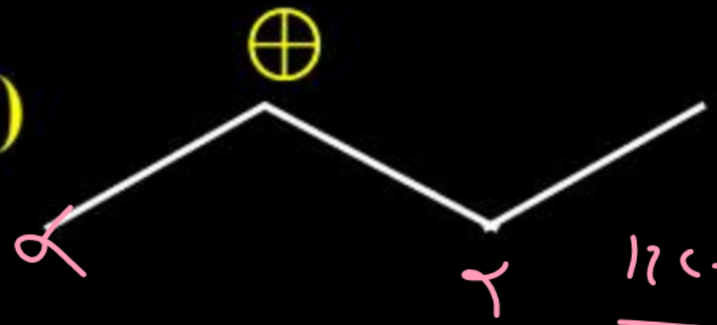


$n_C = 5$

(III)

$n_C = 5$

(IV)



$n_C = 5$

Q) Total number of compounds react with Heinsberg reagent and formed product is insoluble in base

- ✓ (A) N – methyl aniline → $Ph-NH-CH_3$ 2° Amine
- ✓ (B) N-phenyl aniline → $Ph-NH-Ph$ 2° Amine
- ✗ (C) N,N-di-methyl aniline
- ✗ (D) Aniline → $Ph-NH_2$ → $Ph-N<$ 3° Amine
- ✗ (E) Methanamine → $Me-NH_2$ 1° Amine
- ✓ (F) N – methyl ethanamine → $CH_3-CH_2-NH-CH_3$ 2° Amine

$A_3 \rightarrow 3$

Q) The plot of $\log_{10} K$ vs $\frac{1}{T}$ gives a straight line. The intercept and slope respectively are

$\log K = \log A - \frac{E_a}{2.303RT}$

(A) $c = \log A, m = -\frac{E_a}{2.303R}$

(B) $c = -\frac{E_a}{2,303R'}, m = \log A$

(C) $c = -\log A, m = -\frac{E_a}{2.303R}$

(D) $c = \log A, m = \frac{E_n}{2.303R}$

$K = Ae^{-E_a/RT}$

$\ln k = \ln A - E_a/RT$

Ans. (A)

Q) Consider the following electromagnetic waves

Wavelength of A = 400nm

Frequency of B = 10^{16} sec^{-1}

Wave number of C = 10^4 cm^{-1}

Order of energies is :

(A) A > B > C

(B) B > A > C

(C) B > C > A

(D) C > A > B

$E_A = \frac{1240}{400} = 3.1 \times 1.6 \times 10^{-19}$ J

$E_B = h\nu = 6.6 \times 10^{-34} \times 10^{16}$

$= 6.6 \times 10^{-18}$

$E_C = hc\bar{\nu}$

$= 6.6 \times 10^{-34} \times 3 \times 10^{10} \times 10^4$

Ans. (B)

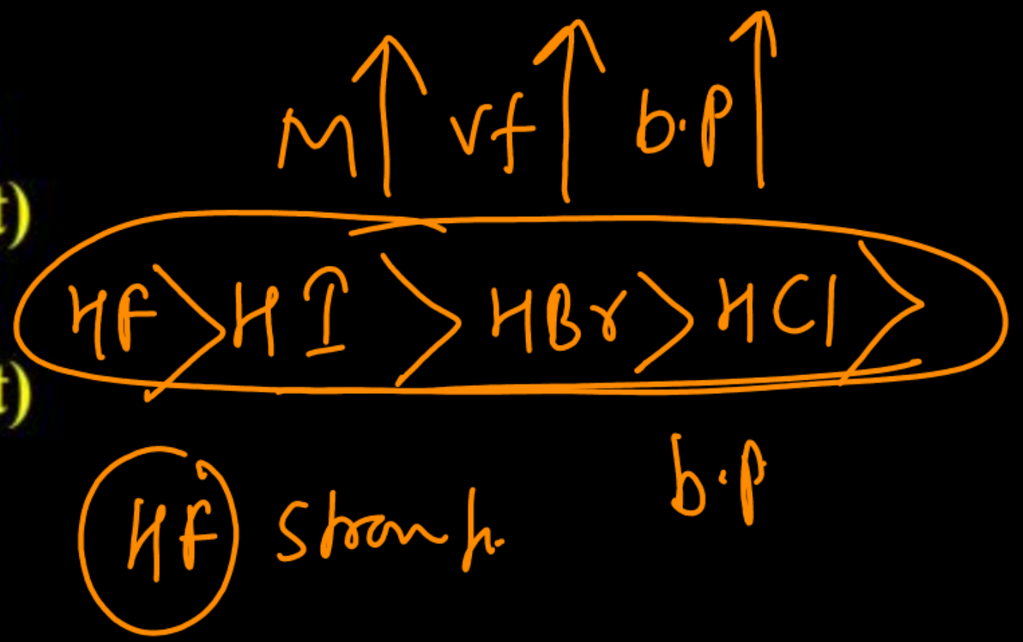
Q) Which of the following order is correct.

(A) HF > HI > HBr > HCl (Boiling point)

(B) HF > HI > HBR > HCl (Melting point)

(C) HI > HF > HBr > HCl (Boiling point)

(D) HI > HBr > HF > HCl (Melting point)



Ans. (A)

Q) Consider a reaction $A \rightleftharpoons B$. At 'T' K, the equilibrium concentration of A and B are 0.3 M and 0.315 M . Now, 0.1 mol of A is added to the flask of 1L , then equilibrium constant and equilibrium concentration of B are

(A) 1.05,0.35 M
(B) 0.95,0.37 M
(C) 1.05,0.37 M
(D) 0.95,0.35 M

Ans. (C)

	A	$\rightleftharpoons$	B
$t = t_{eq}$	0.3		0.315
$t \neq t_{eq}$	0.4		0.315
$t' = t_{eq}$	0.4 − x		0.315 + x

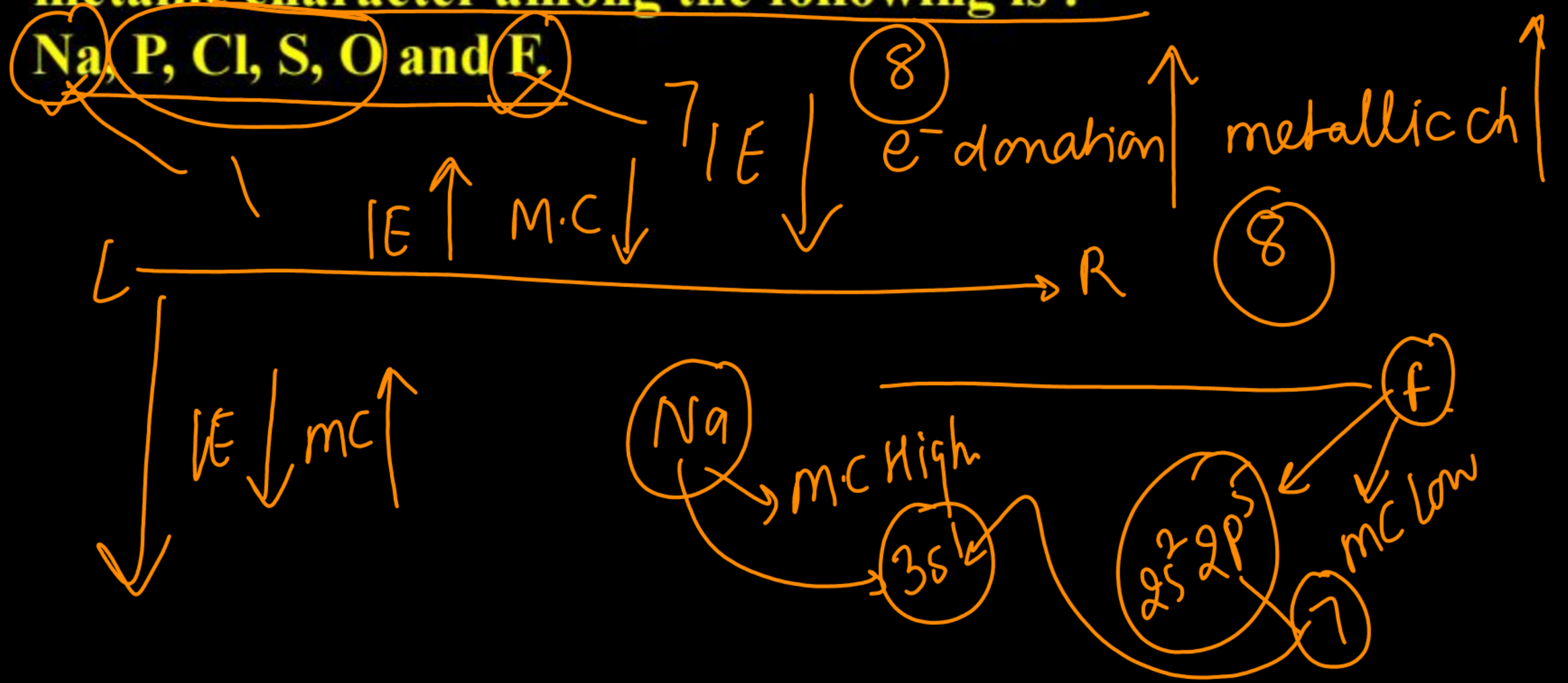
$$K_{eq} = \frac{0.315}{0.3} = 1.05$$

$$\frac{0.315}{0.3} = 1.05 = \frac{0.315 + x}{0.4 - x}$$

$$x = 0.057$$

Q) The sum of valence electron in element with most and least metallic character among the following is :

Na, P, Cl, S, O and F.



Q) Match the isostructural species

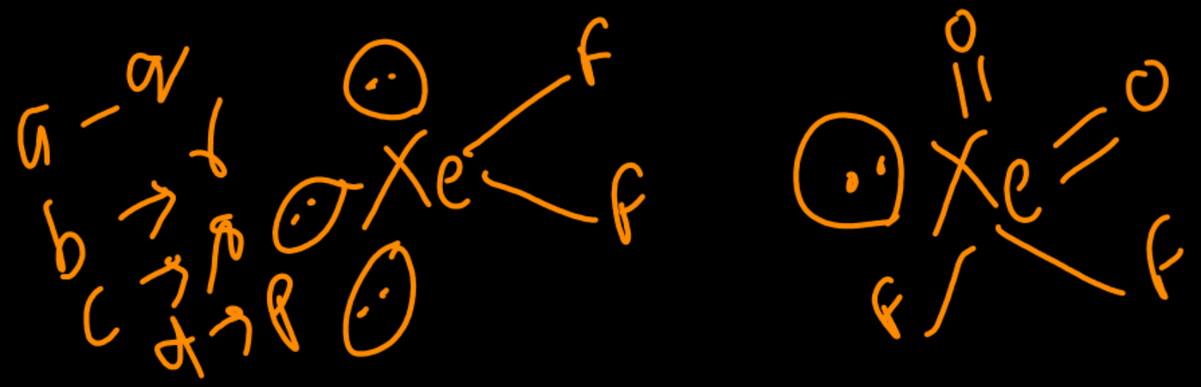
	Column-I		Column-II
(a)	XeO_3 3+1	(p)	BrF_5 5+1
(b)	XeF_2 2+3	(q)	NH_3 3+1
(c)	XeO_2F_2 4+1	(r)	I_3^- 2+3
(d)	$XeOF_4$ 5+1	(s)	SF_4 4+1

VSEPR SN

3+1

XeF_2 ⇒ 3 LP, 2 BP

2+3



Q) In 'S' estimation, 0.314 g of organic compound gave 0.4813 g of barium sulphade. What is % of 'S' in organic compound? (Report to nearest integer).

$\therefore S = \frac{32x}{.314} \times 100$

$BaSO_4 \Rightarrow \frac{.4813}{137+32+64} = x$

$S = x$ mole

$mass = x \times 32\,g$

Math

Q) The sum of coefficients of x^{499} and x^{500} in the binomial expansion of $(1+x)^{1000} + (1+x)^{999}(x) + x^2(1+x)^{998} + \cdots + x^{1000}$ is

(A) ${}^{1002}C_{501}$ **(B)** ${}^{1001}C_{501}$

(C) ${}^{1001}C_{500}$ **(D)** ${}^{1002}C_{500}$

1001 terms

$r = \frac{x}{1+x}$

$$(1+x)^{1000}\left(\frac{1-\left(\frac{x}{1+x}\right)^{1001}}{1-\frac{x}{1+x}}\right) = (1+x)^{1001} - x^{1001}$$

${}^{1000}C_{499} + {}^{1001}C_{500} = {}^{1002}C_{500}$

Ans. (D)

Q) If $\sum_{r=1}^{25} \frac{r}{r^4 + r^2 + 1} = \frac{p}{q'}$, where p and q are coprime positive integer, then p + q is equal to

(A) 841 (B) 984 (C) 976 (D) 890

$$\sum_{r=1}^{25} \frac{r}{(r^2+1)^2 - r^2}$$

$$\sum_{r=1}^{25} \frac{r}{(r^2-r+1)(r^2+1+r)} = \sum_{r=1}^{25} \frac{1}{2}\left(\frac{1}{r^2-r+1} - \frac{1}{r^2+1+r}\right)$$

$$= \frac{1}{2}\left(1 - \frac{1}{3} + \frac{1}{3} - \frac{1}{7} + \cdots + \frac{1}{625-25+1} - \frac{1}{625+1+25}\right)$$

$$\frac{1}{2}\left(1 - \frac{1}{651}\right) = \frac{1}{2}\left(\frac{650}{651}\right) = \frac{325}{651}$$

$p+q$
$325+651$
$= 976$

Ans. (C)

Q) $\frac{6}{3^{26}}+\frac{10}{3^{25}}+\frac{10.2}{3^{24}}+\frac{10.2^2}{3^{23}}+\cdots+\frac{10.2^{24}}{3}$ is equal to

(A) 2^{25} (B) 2^{26} ✓ (C) 3^{26} (D) 3^{25}

$$S=\frac{6}{3^{26}}+\frac{10}{3^{25}}\left(1+6+6^2+\cdots+6^{24}\right)$$

$$=\frac{6}{3^{26}}+\frac{10}{3^{25}}\cdot\frac{(6^{25}-1)}{6-1}$$

$$=\frac{6}{3^{26}}+\frac{2}{3^{25}}(6^{25}-1)=\frac{6}{3^{26}}+\frac{2\cdot 2^{25}\cdot 3^{24}}{3^{24}}-\frac{2}{3^{25}}\cdot\frac{3}{3}=2^{26}$$

Ans. (B)

Q) The value of $\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} \frac{12(3+[x])}{3+[\sin x]+[\cos x]}\,dx$ **is equal to**

(A) $3+10\pi$
(B) $11\pi+2$
(C) $10\pi+2$
(D) $11\pi+4$

$$I=\int_{-\pi/2}^{-1}\frac{12(3-2)}{3-1+0}dx+\int_{-1}^{0}\frac{12(3-1)}{3-1+0}dx+\int_{0}^{1}\frac{36}{3}dx+\int_{1}^{\pi/2}\frac{48}{3}dx$$

$$=6(-1+\pi/2)+12(0+1)+12(1-0)+16(\pi/2-1)$$

$$=11\pi+2$$

Ans. (B)

Q) By the principal of inverse trigonometric function, the value of $\tan\left(2\sin^{-1}\left(\frac{2}{\sqrt{13}}\right) - 2\cos^{-1}\left(\frac{3}{\sqrt{10}}\right)\right)$ is

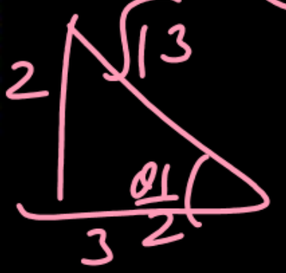
(A) $\frac{31}{55}$ (B) $\frac{33}{56}$ (C) $\frac{32}{59}$ (D) $\frac{38}{55}$

$\alpha_1 = 2\sin^{-1}\left(\frac{2}{\sqrt{13}}\right)$, $\alpha_2 = 2\cos^{-1}\left(\frac{3}{\sqrt{10}}\right)$

$\frac{\alpha_1}{2} = \sin^{-1}\left(\frac{2}{\sqrt{13}}\right) \Rightarrow \sin\frac{\alpha_1}{2} = \frac{2}{\sqrt{13}}$

$\frac{\alpha_2}{2} = \cos^{-1}\left(\frac{3}{\sqrt{10}}\right)$

$\cos\frac{\alpha_2}{2} = \frac{3}{\sqrt{10}}$



$= \frac{\tan\alpha_1 - \tan\alpha_2}{1 + \tan\alpha_1\tan\alpha_2} = \frac{\frac{12}{5} - \frac{3}{4}}{1 + \frac{12}{5}\times\frac{3}{4}}$

$\sin\alpha_1 = 2\times\frac{2}{\sqrt{13}}\times\frac{3}{\sqrt{13}} = \frac{12}{13}$

$\sin\alpha_2 = 2\times\frac{1}{\sqrt{10}}\times\frac{3}{\sqrt{10}} = \frac{3}{5}$

Ans. (B)

$(t_1-t_2)^2=(t_1+t_2)^2-4t_1t_2$

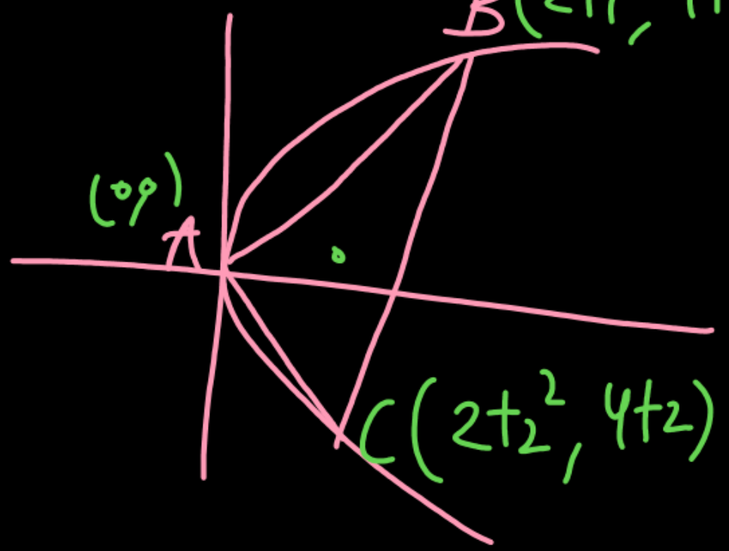
Q) Let a triangle ABC such that $A \equiv (0,0)$ and vertices B and C lie on the parabola $y^2=8x$ such that $\left(\frac{7}{3},\frac{4}{3}\right)$ is the centroid of the ΔABC then $(BC)^2$ is equal to

(A) 120 (B) 150 (C) 90 (D) 110

$(t_1+t_2)=1=\frac{7}{2}+2t_1t_2 \Rightarrow t_1t_2=-\frac{5}{4}$

$\frac{7}{3}=\frac{2(t_1^2+t_2^2)}{3} \Rightarrow t_1^2+t_2^2=\frac{7}{2}$

$\frac{4t_1+4t_2}{3}=\frac{4}{3} \Rightarrow t_1+t_2=1$



$BC^2=(2t_1^2-2t_2^2)^2+(4t_1-4t_2)^2$

$=4(t_1+t_2)^2(t_1-t_2)^2+16(t_1-t_2)^2$

$=4(t_1-t_2)^2[(t_1+t_2)^2+4]$

$=4\times 4\times 5$

Ans. (A)

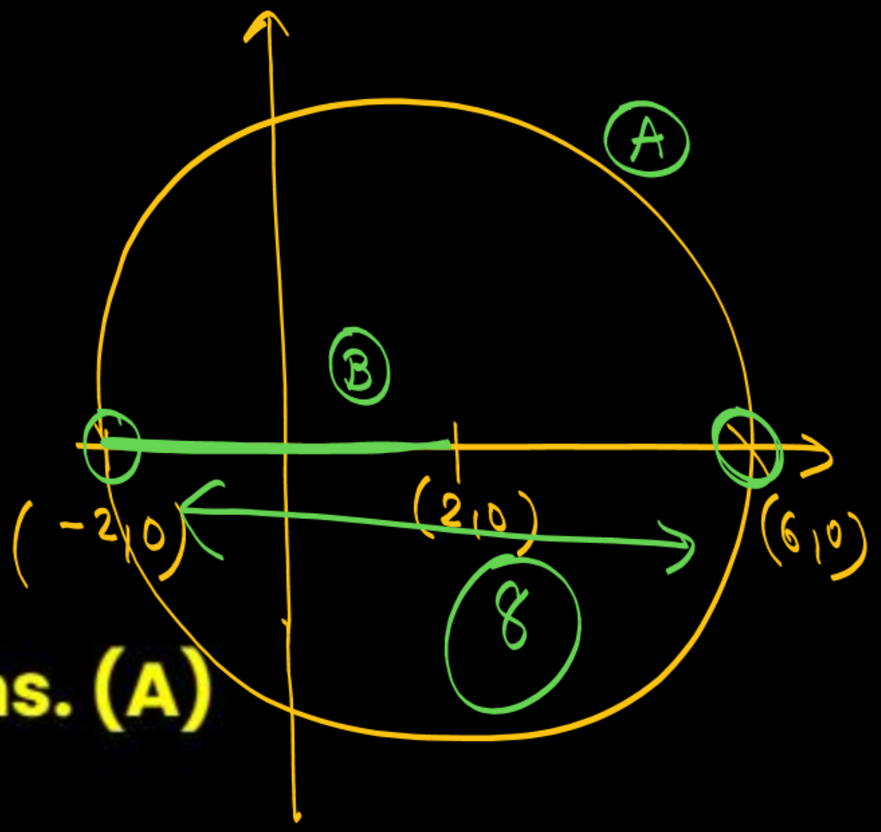
Geometry

Q) Let $A = \{Z \in C: |Z-2| \leq 4\}$ and $B = \{Z \in C: |Z-2| + |Z+2| \leq 4\}$ then $\max\{Z_1 - Z_2\}: Z_1 \in A$ and $Z_2 \in B$ is equal to

(A) 8 (B) 6 (C) 4 (2)

$(2,0)$ $(-2,0)$

$PA + PB \leq 4$ (AB)



Ans. (A)

Q) Let $A = \begin{bmatrix} 3 & -4 \\ 1 & -1 \end{bmatrix}$ and B be a 2×2 matrix such that $A^{100} = 100B + I$, then sum of all elements of B^{100} is

$100B = A^{100} - I$

$A^2 = \begin{pmatrix} 3 & -4 \\ 1 & -1 \end{pmatrix}\begin{pmatrix} 3 & -4 \\ 1 & -1 \end{pmatrix}$

$A^2 = \begin{pmatrix} 5 & -8 \\ 2 & -3 \end{pmatrix}$

pattern

$\therefore A^n = \begin{pmatrix} 2n+1 & -4n \\ n & 1-2n \end{pmatrix}$

$A^{100} = \begin{pmatrix} 201 & -400 \\ 100 & -199 \end{pmatrix} - \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$

$\begin{pmatrix} 2 & -4 \\ 1 & -2 \end{pmatrix} = \frac{1}{100}\begin{pmatrix} 200 & -400 \\ 100 & -200 \end{pmatrix} = B$

Ans. (0)

$$B^2 = \begin{pmatrix} 2 & 1 \\ 1 & -2 \end{pmatrix}\begin{pmatrix} 2 & 1 \\ 1 & -2 \end{pmatrix} = \begin{pmatrix} 0 & 0 \\ 0 & 0 \end{pmatrix}$$

$$B^{100} = \begin{pmatrix} 0 & 0 \\ 0 & 0 \end{pmatrix}$$

$$\boxed{\Sigma = 0}$$

Q) Statement I: $25^{13} + 20^{13} + 8^{13} + 3^{13}$ is divisible by 7.

Statement II: The integral value of $(7 + 4\sqrt{3})^{25}$ is an odd number

(A) Neither statements are correct
(B) Only statement I is correct
(C) Only statement II is correct
(D) Both the statements are correct

Ans. (D)

$\frac{a^n + b^n}{a+b} =$ n: odd

$25^{13} + 3^{13} = 7K$

$20^{13} + 8^{13} = 7m$

$7 + 4\sqrt{3} \simeq 7 + 4 \times 1.73$

$\simeq 7 + 6.92$

odd no $\simeq (13.92)$

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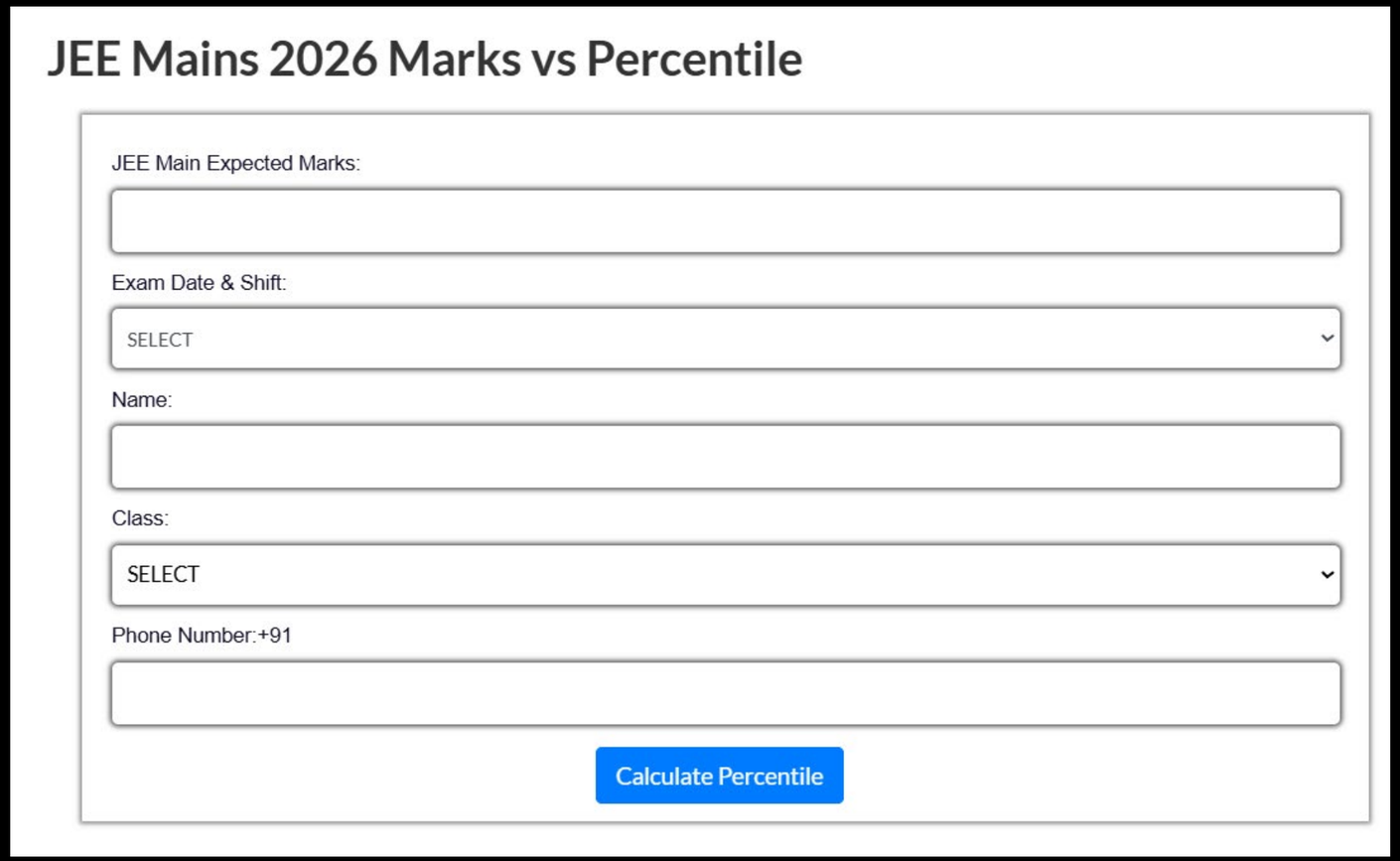

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