

# Answer & Solutions *for* JEE MAIN 2026

Don't guess your JEE Main Score.

**Calculate it Instantly**

with our

**JEE Main Score  
Calculator.**

HOW TO  
GET YOUR  
SCORES

01

Open your response  
sheet on the JEE Main Site

02

Copy the link from the  
browser's Address bar

03

Paste it into the required  
field in the Calculator

 [jee-marks-calculator.aakash.ac.in/](http://jee-marks-calculator.aakash.ac.in/)



Scan the QR code  
to know more.

**ADMISSIONS OPEN FOR SESSION 2026-27**

Get up to

**90% Total Scholarship\***

Appear for Instant Admission cum Scholarship Test  
Register now for **FREE**, visit: [iacst.aakash.ac.in](http://iacst.aakash.ac.in)

SCAN TO REGISTER



\*Terms & Conditions Apply

# TRUST Aakash

## Stellar Ranks in JEE (Main) 2025

**2** Ranks in  
Top 10 AIR\*

**12** Ranks in  
Top 100 AIR\*

**39** Ranks in  
Top 500 AIR\*

\*Includes students of classroom, digital & distance across all categories.



Harsh  
Jha  
AIR  
**23**



Kushagra  
Baingaha  
AIR  
**7**



Shreyas  
Lohiya  
AIR  
**6**



Harssh  
A Gupta  
AIR  
**15**



Devya  
Rustagi  
AIR  
**28**



Shreyas  
Lohiya  
AIR  
**68**



Rujul  
Garg  
AIR  
**41**



Advay  
Mayank  
AIR  
**36**



Arush  
Anand  
AIR  
**64**



Kotha  
D Reddy  
AIR  
**74**

## Top Ranks in JEE (Advanced) 2025

**13** Ranks in  
Top 100 AIR\*

**51** Ranks in  
Top 500 AIR\*

**103** Ranks in  
Top 1000 AIR\*

\*Includes students of classroom, digital & distance across all categories.



Scan the QR Code  
to access JEE  
Cut-off 2025

## Aakashians Create History in International Olympiads

### Our Olympiads Results

**378** Classroom  
Students  
Aakashians Qualified  
in NSEs 2025-26

**777** Classroom  
Students  
Aakashians Qualified  
in IOQM 2025

**134** Classroom  
Students  
Aakashians Qualified  
in RMO 2025



**Aarav Gupta**  
**Gold Medalist**

66th International  
Mathematical Olympiad  
(IMO) 2025



**Yug Gandhi**  
**Gold Medalist**

Singapore Math  
Olympiad 2025



**Arjun Tyagi**  
**Gold Medalist**

International Olympiad  
in Artificial Intelligence  
(IOAI) 2025

HOME OF PROBLEM SOLVERS

**MATHEMATICS**

**SECTION - A**

**Multiple Choice Questions:** This section contains 20 multiple choice questions. Each question has 4 choices (1), (2), (3) and (4), out of which **ONLY ONE** is correct.

**Choose the correct answer:**

1. For three unit vectors  $\vec{a}, \vec{b}, \vec{c}$  satisfying

$$|\vec{a} - \vec{b}|^2 + |\vec{b} - \vec{c}|^2 + |\vec{c} - \vec{a}|^2 = 9 \text{ and}$$

$$|2\vec{a} + k\vec{b} + k\vec{c}| = 3, \text{ the positive value of } k \text{ is}$$

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

**Answer (4)**

Sol.  $|\vec{a}| = 1 = |\vec{b}| = |\vec{c}|$

$$|\vec{a} - \vec{b}|^2 = (\vec{a} - \vec{b}) \cdot (\vec{a} - \vec{b})$$

$$= 2 - 2\vec{a} \cdot \vec{b}$$

$$\Rightarrow \sum 2 - 2\vec{a} \cdot \vec{b} = 9$$

$$\Rightarrow \cos \theta_1 + \cos \theta_2 + \cos \theta_3 = -\frac{3}{2}$$

$$\Rightarrow \theta_1 = \theta_2 = \theta_3 = \frac{2\pi}{3}$$

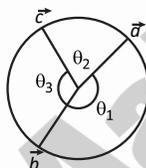
$$\Rightarrow \vec{a} \cdot \vec{b} = -\frac{1}{2}, \vec{b} \cdot \vec{c} = -\frac{1}{2}, \vec{c} \cdot \vec{a} = -\frac{1}{2}$$

$$|2\vec{a} + k\vec{b} + k\vec{c}|^2$$

$$= 4 + k^2 + k^2 + 2(2k + 2k + k^2) \left(-\frac{1}{2}\right)$$

$$= 2k^2 - 4k + 4 = (k - 2)^2 = 9$$

$$\Rightarrow k = 5$$



2. Let  $A, B$  and  $C$  be three  $2 \times 2$  matrices with real entries such that  $B = (I + A)^{-1}$  and  $A + C = I$ .

If  $BC = \begin{bmatrix} 1 & -5 \\ -1 & 2 \end{bmatrix}$  and  $CB \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} 12 \\ -6 \end{bmatrix}$ , then

$x_1 + x_2$  is

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

**Answer (3)**

Sol.  $B = (I + A)^{-1}$

$$B^{-1} = I + A$$

$$A + C = I \Rightarrow C = I - A$$

$$BC = (I + A)^{-1}(I - A)$$

$\therefore$  Any polynomial  $A$  commutes with any other polynomial in  $A$

$$\Rightarrow (I + A)^{-1}(I - A) = (I - A)(I + A)^{-1}$$

$$\Rightarrow AC = CB.$$

$$CB \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} 12 \\ -6 \end{bmatrix}$$

$$\begin{bmatrix} 1 & -5 \\ -1 & 2 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} 12 \\ -6 \end{bmatrix}$$

$$\left. \begin{matrix} x_1 - 5x_2 = 12 \\ -x_1 + 2x_2 = -6 \end{matrix} \right\} x_1 = 2, x_2 = -2$$

$$\Rightarrow x_1 + x_2 = 0$$

Our Problem *Solvers* shine bright in **JEE 2025**

**JEE (Advanced)**

ADVAY MAYANK  
**AIR 36**



RUJUL GARG  
**AIR 41**



ARUSH ANAND  
**AIR 64**



**JEE (MAIN)**

SHREYAS LOHIYA  
**AIR 6**  
Uttar Pradesh Topper  
**100** Overall



KUSHAGRA BAINGAHA  
**AIR 7**  
Uttar Pradesh Topper  
**100** Overall



HARSSH A GUPTA  
**AIR 15**  
Telangana Topper  
**100** Overall



3. A bag contains 10 balls out of which  $k$  are red and  $(10 - k)$  are black, where  $0 \leq k \leq 10$ . If three balls are drawn at random without replacement and all of them are found to be black, then the probability that the bag contains 1 red and 9 black balls is:

- (1)  $\frac{7}{55}$                       (2)  $\frac{7}{110}$   
(3)  $\frac{7}{11}$                       (4)  $\frac{14}{55}$

**Answer (4)**

$$\begin{aligned} \text{Sol. } P\left(\frac{1R+9B}{BBB}\right) &= \frac{P(1R+9B)P\left(\frac{BBB}{1R+9B}\right)}{P(BBB)} \\ &= \frac{\left(\frac{1}{10}\right) \cdot {}^9C_3}{\sum_{k=0}^{10} P\left(\frac{BBB}{kR+(10-k)B}\right) \cdot P(kR+(10-k)B)} \\ &= \frac{\frac{1}{10} \cdot {}^9C_3}{\sum_{k=0}^{10} \frac{{}^{10-k}C_3}{{}^{10}C_3}} = \frac{{}^9C_3}{\sum_{k=0}^{10} {}^{10-k}C_3} \\ &= \frac{{}^9C_3}{{}^{10}C_3 + {}^9C_3 + \dots + {}^3C_3} = \frac{{}^9C_3}{{}^{11}C_4} = \frac{14}{55} \\ &\Rightarrow \boxed{69} \end{aligned}$$

4. The value of

$$\lim_{x \rightarrow 0} \frac{\log_e (\sec(ex) \cdot \sec(e^2x) \dots \sec(e^{10}x))}{e^2 - e^{2\cos x}}$$

is equal to

- (1)  $\frac{(e^{10} - 1)}{2e^2(e^2 - 1)}$                       (2)  $\frac{(e^{20} - 1)}{2e^2(e^2 - 1)}$   
(3)  $\frac{(e^{10} - 1)}{2(e^2 - 1)}$                       (4)  $\frac{(e^{20} - 1)}{2(e^2 - 1)}$

**Answer (4)**

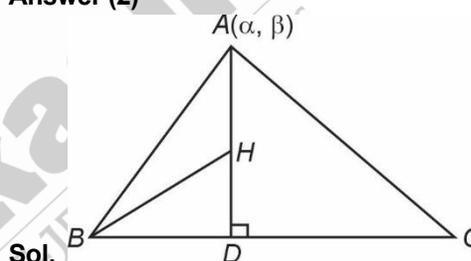
**Sol.**

$$\begin{aligned} &\lim_{x \rightarrow 0} \frac{\ln(\sec(ex)) + \ln(\sec(e^2x)) + \dots + \ln(\sec(e^{10}x))}{e^{2\cos x} \left[ \frac{e^{2-2\cos x} - 1}{(2-2\cos x)} \right] \frac{(2-2\cos x)}{x^2} x^2} \\ &= \frac{1}{e^2} \lim_{x \rightarrow 0} \frac{\ln(\sec ex) + \ln(\sec e^2x) + \dots + \ln(\sec e^{10}x)}{x^2} \\ &= \frac{1}{e^2} \lim_{x \rightarrow 0} \frac{e \tan ex + e^2 \tan e^2x + \dots + e^{10} \tan e^{10}x}{2x} \\ &= \frac{1}{2e^2} [e^2 + e^4 + \dots + e^{20}] \\ &= \frac{1}{2} \frac{(e^{20} - 1)}{e^2 - 1} \end{aligned}$$

5. Let ABC be an equilateral triangle with orthocenter at the origin and the side BC on the line  $x + 2\sqrt{2}y = 4$ . If the co-ordinates of the vertex A are  $(\alpha, \beta)$ , then the greatest integer less than or equal to  $|\alpha + \sqrt{2}\beta|$  is

- (1) 5                                      (2) 4  
(3) 3                                      (4) 2

**Answer (2)**



**Sol.**

$$\begin{aligned} AH : HD &= 2 : 1 \\ HD &= \frac{4}{3} \\ m_{AC} &= 2\sqrt{2} = \tan \theta \\ \Rightarrow \alpha &= \frac{8}{3} \cos \theta, \beta = \frac{8}{3} \sin \theta \\ &= \left( \frac{8}{9}, \frac{16\sqrt{2}}{9} \right) \\ \Rightarrow |\alpha + \sqrt{2}\beta| &= \left| \frac{40}{9} \right| = 4 \end{aligned}$$

Our Problem *Solvers* shine bright in **JEE 2025**

**JEE (Advanced)**

ADVAY  
MAYANK  
**AIR 36**



RUJUL  
GARG  
**AIR 41**



ARUSH  
ANAND  
**AIR 64**



**JEE (MAIN)**

SHREYAS  
LOHIYA  
**AIR 6**  
Uttar Pradesh Topper  
**100** Overall



KUSHAGRA  
BAINGAHA  
**AIR 7**  
Uttar Pradesh Topper  
**100** Overall



HARSHH  
A GUPTA  
**AIR 15**  
Telangana Topper  
**100** Overall



6. Let  $S = \{1, 2, 3, 4, 5, 6, 7, 8, 9\}$ . Let  $x$  be the number of 9-digit numbers formed using the digits of the set  $S$  such that only one digit is repeated and it is repeated exactly twice. Let  $y$  be the number of 9-digit numbers formed using the digits of the set  $S$  such that only two digits are repeated and each of these is repeated exactly twice. Then,

- (1)  $45x = 7y$                       (2)  $29x = 5y$   
 (3)  $56x = 9y$                       (4)  $21x = 4y$

**Answer (4)**

**Sol.**  $x = {}^9C_8 \cdot {}^8C_1 \cdot \frac{9!}{2!} = \frac{9 \times 8 \times 9!}{2} = 9 \times 4 \times 9!$   
 $y = {}^9C_7 \cdot {}^7C_2 \cdot \frac{9!}{2!2!} = \frac{9 \times 7 \times 6 \times 9!}{2!} = 9 \times 21 \times 9!$   
 $\frac{y}{x} = \frac{21}{4} \Rightarrow 21x = 4y$

7. If  $g(x) = 3x^2 + 2x - 3, f(0) = -3$  and  $4g(f(x)) = 3x^2 - 32x + 72$ , then  $f(g(2))$  is equal to:

- (1)  $-\frac{7}{2}$                                       (2)  $\frac{7}{2}$   
 (3)  $\frac{25}{6}$                                       (4)  $-\frac{25}{6}$

**Answer (2)**

**Sol.**  $g(f(x)) = 3\left(\frac{x}{2}\right)^2 - 8x + 18$   
 Notice that  $g(x)$  is Quadratic, hence  $f(x)$  has to be linear with leading coefficient  $\frac{1}{2}$   
 $\Rightarrow f(x) = \frac{x}{2} + c$   
 $\therefore f(0) = -3 \Rightarrow f(x) = \frac{x-6}{2}$   
 Verify :  
 $g(f(x)) = 3\left(\frac{x-6}{2}\right)^2 + 2\left(\frac{x-6}{2}\right) - 3$

$$= \frac{1}{4} [3x^2 - 36x + 108 + 4x - 24 - 12]$$

$$= \frac{1}{4} (3x^2 - 32x + 72)$$

Now,  $f(g(2)) = f(13) = \frac{7}{2}$

8. The common difference of the A.P.:  $a_1, a_2, \dots, a_m$  is 13 more than the common difference of the A.P.:  $b_1, b_2, \dots, b_n$ . If  $b_{31} = -277, b_{43} = -385$  and  $a_{78} = 327$ , then  $a_1$  is equal to

- (1) 19                                      (2) 16  
 (3) 21                                      (4) 24

**Answer (1)**

**Sol.**  $d_1 = 13 + d_2$   
 $b_1 + 30d_2 = -277 \dots(i)$   
 $b_1 + 42d_2 = -385 \dots(ii)$

Solving (i) and (ii)  
 $12d_2 = -108$   
 $\Rightarrow d_2 = -9$   
 $\therefore d_1 = 4$   
 $a_{78} = a_1 + 77d_1 = 327$   
 $\Rightarrow a_1 = 327 - 77(4)$   
 $= 327 - 308 = 19$

9. Let  $f$  be a polynomial function such that  $f(x^2 + 1) = x^4 + 5x^2 + 2$ , for all  $x \in \mathbb{R}$ .

Then  $\int_0^3 f(x) dx$  is equal to

(1)  $\frac{41}{3}$                                       (2)  $\frac{33}{2}$   
 (3)  $\frac{5}{3}$                                       (4)  $\frac{27}{2}$

**Answer (2)**

Our Problem Solvers shine bright in **JEE 2025**

**JEE (Advanced)**

<b>ADVAY MAYANK</b> AIR 36		<b>RUJUL GARG</b> AIR 41		<b>ARUSH ANAND</b> AIR 64	
-------------------------------	--	-----------------------------	--	------------------------------	--

**JEE (MAIN)**

<b>SHREYAS LOHIYA</b> AIR 6 Uttar Pradesh Topper 100 Overall		<b>KUSHAGRA BAINGAHA</b> AIR 7 Uttar Pradesh Topper 100 Overall		<b>HARSSH A GUPTA</b> AIR 15 Telangana Topper 100 Overall	
---	--	--	--	--	--



$$\overline{PB} : -\hat{i} - 4\hat{j} - a\hat{k}$$

$$\left. \begin{aligned} |\overline{PA}|^2 &= 25 + (4 - a)^2 \\ |\overline{PB}|^2 &= 17 + a^2 \end{aligned} \right\} \text{equating, we get } a = 3,$$

$$b = 1, c = 3$$

12. Let  $S = \{x^3 + ax^2 + bx + c : a, b, c \in \mathbb{N} \text{ and } a, b, c \leq 20\}$  be a set of polynomials.

Then the number of polynomials in  $S$ , which are divisible by  $x^2 + 2$ , is

- (1) 10 (2) 20  
(3) 120 (4) 6

**Answer (1)**

**Sol.**  $x^3 + ax^2 + bx + c$

$$= x(x^2 + 2) + a(x^2 + 2) - 2x - 2a + bx + c$$

$$= (x^2 + 2)(x + a) + x(b - 2) + (c - 2a)$$

$$\therefore b = 2, c = 2a$$

$$(a, c) \equiv (a, 2a) \equiv (1, 2), (2, 4), \dots, (10, 20)$$

$\therefore$  total 10 elements

13. If  $\alpha, \beta$ , where  $\alpha < \beta$ , are the roots of the equation

$$\lambda x^2 - (\lambda + 3)x + 3 = 0 \text{ such that } \frac{1}{\alpha} - \frac{1}{\beta} = \frac{1}{3}, \text{ then the}$$

sum of all possible values of  $\lambda$  is

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

**Answer (4)**

**Sol.**  $\therefore \frac{1}{\alpha} - \frac{1}{\beta} = \frac{1}{3}$

$$\therefore 9(\alpha - \beta)^2 = \alpha^2 \beta^2 \quad \dots(1)$$

$$\therefore \alpha + \beta = \frac{\lambda + 3}{\lambda} \text{ and } \alpha \cdot \beta = \frac{3}{\lambda}$$

From eq. (1)

$$9 \left\{ \left( \frac{\lambda + 3}{\lambda} \right)^2 - \frac{12}{\lambda} \right\} = \frac{9}{\lambda^2}$$

$$\therefore (\lambda + 3)^2 - 12\lambda = 1$$

$$\text{or } \lambda^2 - 6\lambda + 8 = 0$$

Sum of all values of  $\lambda = 6$

14. The value of  $\sum_{k=1}^{\infty} (-1)^{k+1} \left( \frac{k(k+1)}{k!} \right)$  is

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

**Answer (3)**

**Sol.**  $\therefore \sum_{K=1}^{\infty} \frac{(-1)^{K+1} K(K+1)}{K!}$

$$= \sum_{K=1}^{\infty} \frac{(-1)^{K+1} ((K+1)+2)}{(K!)!}$$

$$= \sum_{K=1}^{\infty} \frac{(-1)^{K+1}}{(K-2)!} + \frac{2 \cdot (-1)^{K+1}}{(K-1)!}$$

$$= \left( -1 + \frac{1}{1!} - \frac{1}{2!} + \frac{1}{3!} - \frac{1}{4!} + \dots \right) + 2 \left( 1 - \frac{1}{1!} + \frac{1}{2!} - \frac{1}{3!} + \dots \right)$$

$$= -e^{-1} + 2e^{-1} = \frac{1}{e}$$

15. If  $\frac{\tan(A - B)}{\tan A} + \frac{\sin^2 C}{\sin^2 A} = 1$ ,  $A, B, C \in \left( 0, \frac{\pi}{2} \right)$ , then

- (1)  $\tan A, \tan C, \tan B$  are in A.P.  
(2)  $\tan A, \tan B, \tan C$  are in A.P.  
(3)  $\tan A, \tan B, \tan C$  are in G.P.  
(4)  $\tan A, \tan C, \tan B$  are in G.P.

**Answer (4)**

**Sol.**  $\frac{\tan(A - B)}{\tan A} + \frac{\sin^2 C}{\sin^2 A} = 1$

$$\Rightarrow \frac{\sin^2 C}{\sin^2 A} = \frac{1 - \tan(A - B)}{\tan A}$$

Our Problem Solvers shine bright in **JEE 2025**

**JEE (Advanced)**

 <b>ADVAY MAYANK</b> <b>AIR 36</b>	 <b>RUJUL GARG</b> <b>AIR 41</b>	 <b>ARUSH ANAND</b> <b>AIR 64</b>
---	---	--

**JEE (MAIN)**

 <b>SHREYAS LOHIYA</b> <b>AIR 6</b> <b>Uttar Pradesh Topper</b> <b>100 Overall</b>	 <b>KUSHAGRA BAINGAHA</b> <b>AIR 7</b> <b>Uttar Pradesh Topper</b> <b>100 Overall</b>	 <b>HARSSH A GUPTA</b> <b>AIR 15</b> <b>Telangana Topper</b> <b>100 Overall</b>
--	--	--



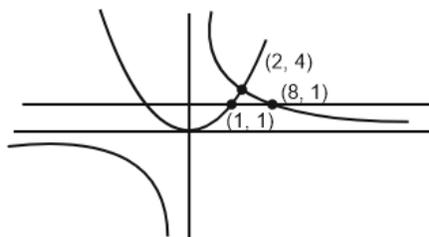
18. The area of the region

$$R = \{(x, y) : xy \leq 8, 1 \leq y \leq x^2, x \geq 0\}$$
 is

- (1)  $\frac{2}{3}(20\log_e(2) + 9)$       (2)  $\frac{2}{3}(24\log_e(2) - 7)$   
 (3)  $\frac{1}{3}(49\log_e(2) - 15)$       (4)  $\frac{1}{3}(40\log_e(2) + 27)$

Answer (2)

Sol.



$$\begin{aligned} \text{Area} &= \int_1^2 (x^2 - 1) dx + \int_2^8 \left(\frac{8}{x} - 1\right) dx \\ &= \left[\frac{x^3}{3} - x\right]_1^2 + 8 \ln x \Big|_2^8 - x \Big|_2^8 \\ &= \left(\frac{8}{3} - 2\right) - \left(\frac{1}{3} - 1\right) + 8[\ln 8 - \ln 2] - 6 \\ &= \frac{-14}{3} + 16 \ln 2 \\ &= \frac{2}{3}[24 \ln 2 - 7] \end{aligned}$$

19. Let  $y = y(x)$  be the solution of the differential equation  $x \frac{dy}{dx} - \sin 2y = x^3(2 - x^3) \cos^2 y, x \neq 0$ . If  $y(2) = 0$ , then  $\tan(y(1))$  is equal to

- (1)  $\frac{3}{4}$                                       (2)  $\frac{7}{4}$   
 (3)  $-\frac{3}{4}$                                       (4)  $-\frac{7}{4}$

Answer (2)

Sol.  $x \frac{dy}{dx} - \sin 2y = x^3(2 - x^3) \cos^2 y$

$$\sec^2 y \frac{dy}{dx} - \frac{(2 \tan y)}{x} = x^2(2 - x^3)$$

Let  $\tan y = t$

$$\sec^2 y \frac{dy}{dx} = \frac{dt}{dx}$$

$$\frac{dt}{dx} - \frac{2t}{x} = x^2(2 - x^3)$$

$$\text{I.F.} = e^{-\int \frac{2}{x} dx} = \frac{1}{x^2}$$

$$\frac{t}{x^2} = \int (2 - x^3) dx$$

$$\frac{\tan y}{x^2} = 2x - \frac{x^4}{4} + C$$

$$\tan y = 2x^3 - \frac{x^6}{4} + cx^2$$

$$\therefore y(2) = 0$$

$$0 = 16 - 16 + C(2) \Rightarrow C = 0$$

$$\tan y = 2x^3 - \frac{x^6}{4}$$

$$\tan(y(1)) = 2 - \frac{1}{4}$$

$$= \frac{7}{4}$$

20. Let  $y = x$  be the equation of a chord of the circle  $C_1$  (in the closed half-plane  $x \geq 0$ ) of diameter 10 passing through the origin. Let  $C_2$  be another circle described on the given chord as its diameter. If the equation of the chord of the circle  $C_2$ , which passes through the point  $(2, 3)$  and is farthest from the center of  $C_2$ , is  $x + ay + b = 0$ , then  $a - b$  is equal to

- (1) 6    (2) -6  
 (3) 10    (4) -2

Answer (4)

Our Problem Solvers shine bright in **JEE 2025**

JEE (Advanced)

ADVAY  
MAYANK  
AIR 36



RUJUL  
GARG  
AIR 41



ARUSH  
ANAND  
AIR 64



SHREYAS  
LOHIYA  
AIR 6  
Uttar Pradesh Topper  
100 Overall



KUSHAGRA  
BAINGAHA  
AIR 7  
Uttar Pradesh Topper  
100 Overall

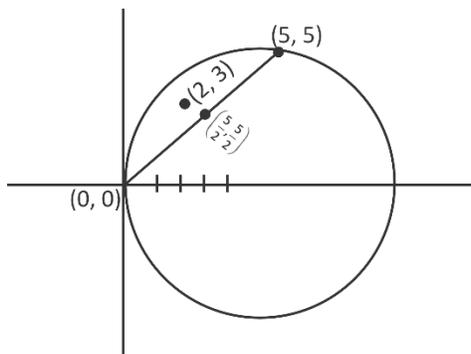


HARSSH  
A GUPTA  
AIR 15  
Telangana Topper  
100 Overall



Sol.  $x \geq 0$  and touching at  $x(0, 0)$

$$C_1 : (x-5)^2 + y^2 = 25$$



$$C_2 = (x-5)(x) + y(y-5) = 0$$

Since the distance of chord is maximum from centre

$$\left(\frac{5}{2}, \frac{5}{2}\right)$$

$$\Rightarrow (y-3) = (1)(x-2)$$

$$\Rightarrow (y-3) = (1)(x-2) = x-2$$

$$\Rightarrow x - y + 1 = 0$$

$$a = -1$$

$$b = 1$$

$$a - b = -2$$

### SECTION - B

**Numerical Value Type Questions:** This section contains 5 Numerical based questions. The answer to each question should be rounded-off to the nearest integer.

21. If  $k = \tan\left(\frac{\pi}{4} + \frac{1}{2}\cos^{-1}\left(\frac{2}{3}\right)\right) + \tan\left(\frac{1}{2}\sin^{-1}\left(\frac{2}{3}\right)\right)$ , then the number of solutions of the equation  $\sin^{-1}(kx-1) = \sin^{-1}x - \cos^{-1}x$  is \_\_\_\_\_

**Answer (1)**

$$\begin{aligned} \text{Sol. } k &= \tan\left(\frac{\pi}{4} + \frac{1}{2}\cos^{-1}\frac{2}{3}\right) + \tan\left(\frac{1}{2}\sin^{-1}\frac{2}{3}\right) \\ &= \tan\left(\frac{\pi}{4} + \frac{1}{2}\cos^{-1}\frac{2}{3}\right) + \tan\left(\frac{1}{2}\left(\frac{\pi}{2} - \cos^{-1}\frac{2}{3}\right)\right) \end{aligned}$$

$$= \tan\left(\frac{\pi}{4} + \frac{1}{2}\cos^{-1}\frac{2}{3}\right) + \tan\left(\frac{\pi}{4} - \frac{1}{2}\cos^{-1}\frac{2}{3}\right)$$

$$\text{Let } \frac{1}{2}\cos^{-1}\frac{2}{3} = \theta$$

$$= \tan\left(\frac{\pi}{4} + \theta\right) + \tan\left(\frac{\pi}{4} - \theta\right)$$

$$= \frac{1 + \tan\theta}{1 - \tan\theta} + \frac{1 - \tan\theta}{1 + \tan\theta}$$

$$= \frac{2(1 + \tan^2\theta)}{1 - \tan^2\theta} = \frac{2}{\cos^2\theta}$$

$$= \frac{2}{2/3} = 3$$

$$\text{Now } \sin^{-1}(kx-1) = \sin^{-1}x - \cos^{-1}x$$

$$\sin^{-1}(3x-1) = \sin^{-1}x - \frac{\pi}{2} + \sin^{-1}x$$

$$\sin^{-1}(3x-1) + \frac{\pi}{2} = 2\sin^{-1}x$$

$\therefore$  only positive value  $g x$  is zero

$\therefore$  No. of solution = 1

22. The value of  $\sum_{r=1}^{20} \left( \sqrt{\pi \left( \int_0^r x |\sin \pi x| dx \right)} \right)$  is \_\_\_\_\_

**Answer (210)**

$$\text{Sol. } \sum_{r=1}^{20} \sqrt{\pi \left( \int_0^r x |\sin \pi x| dx \right)}$$

Our Problem *Solvers* shine bright in **JEE 2025**

**JEE (Advanced)**

ADVAY  
MAYANK  
**AIR 36**



RUJUL  
GARG  
**AIR 41**



ARUSH  
ANAND  
**AIR 64**



SHREYAS  
LOHIYA  
**AIR 6**  
Uttar Pradesh Topper  
**100** Overall



KUSHAGRA  
BAINGAHA  
**AIR 7**  
Uttar Pradesh Topper  
**100** Overall



HARSSH  
A GUPTA  
**AIR 15**  
Telangana Topper  
**100** Overall



$$\int_0^1 x \sin \pi x dx = -\frac{x \cos \pi x}{\pi} + \int \frac{\cos \pi x}{\pi}$$

$$= -\frac{x \cos \pi x}{\pi} + \frac{\sin \pi x}{\pi^2} \Big|_0^1$$

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

$$\Rightarrow \sum_{r=1}^{20} \left| \sqrt{\pi \int_0^r x |\sin \pi x| dx} \right|$$

$$= \left| \sqrt{\pi \int_0^1 x |\sin \pi x| dx} \right| + \left| \sqrt{\pi \int_0^2 x |\sin \pi x| dx} \right| + \dots$$

$$\dots + \left| \sqrt{\pi \int_0^{20} x |\sin \pi x| dx} \right|$$

$$= \sqrt{1} + \sqrt{4} + \sqrt{9} + \dots + \sqrt{400}$$

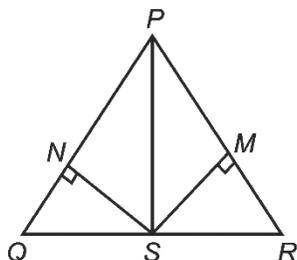
$$= 1 + 2 + 3 + \dots + 20$$

$$= \frac{20 \times 21}{2} = 210$$

23. Let  $PQR$  be a triangle such that  $\overline{PQ} = -2\hat{i} - \hat{j} + 2\hat{k}$  and  $\overline{PR} = a\hat{i} + b\hat{j} - 4\hat{k}$ ,  $a, b \in \mathbb{Z}$ . Let  $S$  be the point on  $QR$ , which is equidistant from the lines  $PQ$  and  $PR$ . If  $|\overline{PR}| = 9$  and  $\overline{PS} = \hat{i} - 7\hat{j} + 2\hat{k}$ , then the value of  $3a - 4b$  is \_\_\_\_\_

Answer (37)

Sol.



$$SM = SN$$

$$|\overline{PR}| = 9$$

$$a^2 + b^2 + 16 = 81$$

$$\boxed{a^2 + b^2 = 65}$$

$$\overline{PS} = \lambda \left( \frac{\overline{PQ}}{|\overline{PQ}|} + \frac{\overline{PR}}{|\overline{PR}|} \right)$$

$$\hat{i} - 7\hat{j} + 2\hat{k} = \lambda \left( \frac{-2\hat{i} - \hat{j} + 2\hat{k}}{3} + \frac{a\hat{i} + b\hat{j} - 4\hat{k}}{9} \right)$$

$$\Rightarrow \hat{i} - 7\hat{j} + 2\hat{k} = \frac{\lambda}{9} [(a-6)\hat{i} + (b-3)\hat{j} + 2\hat{k}]$$

$$\Rightarrow \boxed{\lambda = 9}$$
 from  $k$  component.

Now comparing  $i$  and  $j$  component

$$a - 6 = 1 \Rightarrow a = 7$$

$$b - 3 = -7 \Rightarrow b = -4$$

$$\Rightarrow 3a - 4b = 21 + 16$$

$$= 37$$

24. For some  $\theta \in \left(0, \frac{\pi}{2}\right)$ , let the eccentricity and the length of the latus rectum of the hyperbola  $x^2 - y^2 \sec^2 \theta = 8$  be  $e_1$  and  $l_1$ , respectively, and let the eccentricity and the length of the latus rectum of the ellipse  $x^2 \sec^2 \theta + y^2 = 6$  be  $e_2$  and  $l_2$ , respectively. If  $e_1^2 = e_2^2 (\sec^2 \theta + 1)$ , then

$$\left( \frac{l_1 l_2}{e_1 e_2} \right) \tan^2 \theta \text{ is equal to } \underline{\hspace{2cm}}$$

Answer (8)

Sol.  $H: \frac{x^2}{8} - \frac{y^2}{8 \cos^2 \theta} = 1$

Our Problem Solvers shine bright in **JEE 2025**

JEE (Advanced)

ADVAY  
MAYANK  
AIR 36



RUJUL  
GARG  
AIR 41



ARUSH  
ANAND  
AIR 64



SHREYAS  
LOHIYA  
AIR 6  
Uttar Pradesh Topper  
100 Overall



KUSHAGRA  
BAINGAHA  
AIR 7  
Uttar Pradesh Topper  
100 Overall



HARSSH  
A GUPTA  
AIR 15  
Telangana Topper  
100 Overall



$$e_1^2 = 1 + \frac{8\cos^2\theta}{8} = 1 + \cos^2\theta$$

$$l_1 = \frac{2 \cdot 8\cos^2\theta}{2\sqrt{2}} = 4\sqrt{2}\cos^2\theta$$

$$E: \frac{x^2}{6\cos^2\theta} + \frac{y^2}{6} = 1$$

$$e_2^2 = 1 - \frac{6\cos^2\theta}{6} = \sin^2\theta$$

$$l_2 = \frac{2 \cdot 6\cos^2\theta}{\sqrt{6}} = 2\sqrt{6}\cos^2\theta$$

$$e_1^2 = e_2^2(1 + \sec^2\theta)$$

$$\Rightarrow (1 + \cos^2\theta) = \sin^2\theta \left( \frac{1 + \cos^2\theta}{\cos^2\theta} \right)$$

$$\Rightarrow \tan^2\theta = 1 \Rightarrow \theta = \frac{\pi}{4}$$

$$\frac{l_1 \cdot l_2}{e_1 e_2} = \frac{4\sqrt{2}\cos^2\theta \cdot 2\sqrt{6}\cos^2\theta}{\sqrt{1 + \cos^2\theta} \cdot \sin\theta}$$

$$= \frac{4 \cdot \sqrt{2} \cdot \frac{1}{2} \cdot 2\sqrt{6} \cdot \frac{1}{2}}{\frac{\sqrt{3}}{2} \cdot \frac{1}{\sqrt{2}}} = \frac{4\sqrt{3}}{\sqrt{3}} \times 2 = 8$$

25. In a G.P., if the product of the first three terms is 27 and the set of all possible values for the sum of its first three terms is  $\mathbb{R} - (a, b)$ , then  $a^2 + b^2$  is equal to \_\_\_\_\_.

**Answer (90)**

**Sol.** Let first three terms be  $\frac{a}{r}, a, ar$

$$\frac{a}{r} \cdot a \cdot ar = 27$$

$$a^3 = 27$$

$$a = 3$$

$$\text{Now } S = \frac{a}{r} + a + ar$$

$$\Rightarrow S = \frac{3}{r} + 3 + 3r$$

$$\text{If } r > 0 \Rightarrow r + \frac{1}{r} \geq 2$$

$$r < 0 \Rightarrow r + \frac{1}{r} \leq -2$$

Case I:

If  $r > 0$

$$S = 3 \left[ r + \frac{1}{r} + 1 \right]$$

$$S \geq 9$$

Case II

If  $r < 0$

$$S = 3 \left( r + \frac{1}{r} + 1 \right)$$

$$S \leq -3$$

$$S \in (-\infty, -3] \cup [9, \infty)$$

$$S \in \mathbb{R} - (-3, 9)$$

$$a = -3 \quad b = 9$$

$$a^2 + b^2 = 90$$

Our Problem *Solvers* shine bright in **JEE 2025**

**JEE (Advanced)**

ADVAY  
MAYANK  
**AIR 36**



RUJUL  
GARG  
**AIR 41**



ARUSH  
ANAND  
**AIR 64**



SHREYAS  
LOHIYA  
**AIR 6**  
Uttar Pradesh Topper  
**100** Overall



KUSHAGRA  
BAINGAHA  
**AIR 7**  
Uttar Pradesh Topper  
**100** Overall



HARSSH  
A GUPTA  
**AIR 15**  
Telangana Topper  
**100** Overall



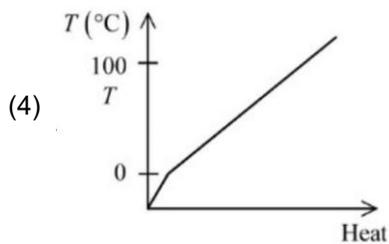
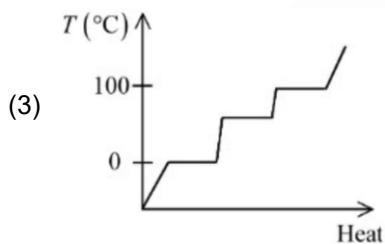
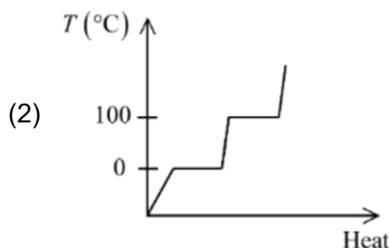
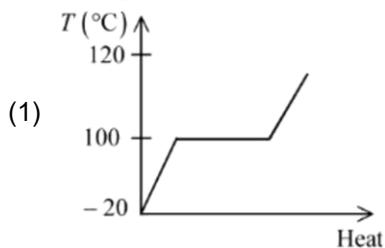
**PHYSICS**

**SECTION - A**

**Multiple Choice Questions:** This section contains 20 multiple choice questions. Each question has 4 choices (1), (2), (3) and (4), out of which **ONLY ONE** is correct.

**Choose the correct answer :**

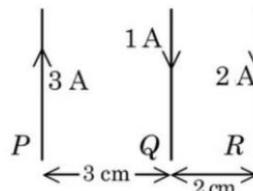
26. Which of the following best represents the temperature versus heat supplied graph for water, in the range of  $-20^{\circ}\text{C}$  to  $120^{\circ}\text{C}$ ?



**Answer (2)**

**Sol.**  $-20^{\circ}\text{C}$  to  $0^{\circ}\text{C}$   $q = mS_{\text{ice}}\Delta T$  at  $0^{\circ}\text{C}$  phase change take place.  $0^{\circ}\text{C}$  to  $100^{\circ}\text{C}$ ,  $q = ms_{\text{w}}\Delta T$  at  $100^{\circ}\text{C}$  phase change take place.

27. Three long straight wires carrying current are arranged mutually parallel as shown in the figure. The force experienced by 15 cm length of wire Q is \_\_\_\_\_.



$(\mu_0 = 4\pi \times 10^{-7} \text{ T.m/A})$

- (1)  $6 \times 10^{-6}$  N towards P
- (2)  $6 \times 10^{-6}$  N towards R
- (3)  $6 \times 10^{-7}$  N towards R
- (4)  $6 \times 10^{-7}$  N towards P

**Answer (2)**

**Sol.** B at location of mid wire

$$= \frac{\mu_0 3}{2\pi \times 3 \times 10^{-2}} + \frac{\mu_0 \times 2}{2\pi \times 2 \times 10^{-2}}$$

$$= 10^{-7} (2 \times 10^2 + 2 \times 10^2) = 4 \times 10^{-5}$$

$$F = 4 \times 10^{-5} \times 1 \times 15 \times 10^{-2}$$

$$= 60 \times 10^{-7}$$

$$= 6 \times 10^{-6} \text{ N}$$

28. The electric current in the circuit is given as  $i = i_0 (t/T)$ . The r.m.s current for the period  $t = 0$  to  $t = T$  is \_\_\_\_\_.

- (1)  $\frac{i_0}{\sqrt{2}}$
- (2)  $i_0$
- (3)  $\frac{i_0}{\sqrt{3}}$
- (4)  $\frac{i_0}{\sqrt{6}}$

**Answer (3)**

Our Problem *Solvers* shine bright in **JEE 2025**

**JEE (Advanced)**

 <b>ADVAY MAYANK</b> <b>AIR 36</b>	 <b>RUJUL GARG</b> <b>AIR 41</b>	 <b>ARUSH ANAND</b> <b>AIR 64</b>
---	---	--

**JEE (MAIN)**

 <b>SHREYAS LOHIYA</b> <b>AIR 6</b> Uttar Pradesh Topper <b>100</b> Overall	 <b>KUSHAGRA BAINGAHA</b> <b>AIR 7</b> Uttar Pradesh Topper <b>100</b> Overall	 <b>HARSSH A GUPTA</b> <b>AIR 15</b> Telangana Topper <b>100</b> Overall
---	---	---

Sol.  $i = i_0 \frac{t}{T}$

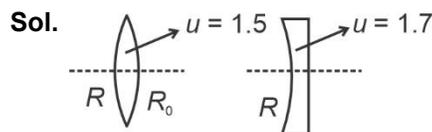
$$i_{rms}^2 = \frac{\int_0^T \frac{i_0^2 t^2 dt}{T^2}}{\int_0^T dt} = \frac{i_0^2 \frac{T}{3}}{T}$$

$$i_{rms} = \frac{i_0}{\sqrt{3}}$$

29. The magnitudes of power of a biconvex lens (refractive index 1.5) and that of a plano-concave lens (refractive index = 1.7) are same. If the curvature of planoconcave lens exactly matches with the curvature of back surface of the biconvex lens, then ratio of radius of curvature of front and back surface of the biconvex lens is \_\_\_\_ .

- (1) 2 : 5                      (2) 12 : 5  
(3) 5 : 12                    (4) 5 : 2

**Answer (4)**



$$f_1 = |f_2|$$

$$(1.5 - 1) \left( \frac{1}{R} - \frac{1}{-R_0} \right) = \left| (1.7 - 1) \left( \frac{1}{-R_0} - \frac{1}{\infty} \right) \right|$$

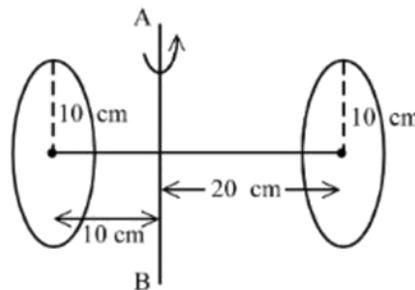
$$\frac{1}{2R} + \frac{1}{2R_0} = \frac{7}{10R_0}$$

$$\frac{1}{2R} = \frac{1}{5R_0}$$

$$\frac{R}{R_0} = \frac{5}{2}$$

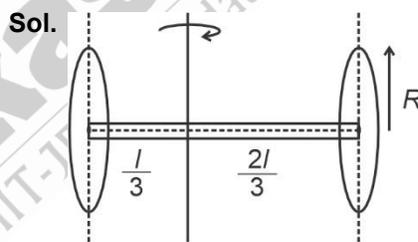
30. Two circular discs of radius each 10 cm are joined at their centres by a rod of length 30 cm and mass 600 gm as shown in figure.

If the mass of each disc is 600 gm and applied torque between two discs is  $43 \times 10^5$  dyne.cm, the angular acceleration of the discs about the given axis AB is \_\_\_\_ rad/s<sup>2</sup>.



- (1) 11  
(2) 22  
(3) 27  
(4) 100

**Answer (1)**



$$I = \frac{mR^2}{4} + \frac{ml^2}{9} + \frac{mR^2}{4} + \frac{m \cdot 4l^2}{9} + \frac{ml^2}{12} + \frac{ml^2}{36}$$

$$I = \frac{mR^2}{2} + \frac{2ml^2}{3}$$

$$I = 3.9 \times 10^{-2} \text{ kgm}^2$$

$$\alpha = \frac{\tau}{I} = \frac{0.43}{3.9 \times 10^{-2}} = 11$$

Our Problem Solvers shine bright in **JEE 2025**

**JEE (Advanced)**

ADVAY  
MAYANK  
**AIR 36**



RUJUL  
GARG  
**AIR 41**



ARUSH  
ANAND  
**AIR 64**



**JEE (MAIN)**

SHREYAS  
LOHIYA  
**AIR 6**  
Uttar Pradesh Topper  
**100** Overall



KUSHAGRA  
BAINGAHA  
**AIR 7**  
Uttar Pradesh Topper  
**100** Overall



HARSSH  
A GUPTA  
**AIR 15**  
Telangana Topper  
**100** Overall







Sol.  $V = \frac{ER}{R+r}$

$l \propto \frac{R}{r+R}$

$\frac{120}{180} = \frac{4(12+r)}{12(4+r)}$

$r = 4 \Omega$

37. An atom  ${}^8_3X$  is bombarded by shower of fundamental particles and in 10 s this atom absorbed 10 electrons, 10 protons and 9 neutrons. The percentage growth in the surface area of the nucleons is recorded by

- (1) 900%                      (2) 250%  
 (3) 150%                      (4) 225%

**Answer (4)**

Sol. Number of nucleons initially = 8

Number of nucleons finally = 8 + 10 + 9 = 27

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

$Area_1 = 4\pi R_0^2(8)^{\frac{2}{3}} = 4k$

$Area_2 = 4\pi R_0^2(27)^{\frac{2}{3}} = 9k$

% change =  $\frac{9-4}{4} \times 100 = 225\%$

38. When both jaws of vernier callipers touch each other, zero mark of the vernier scale is right to zero mark of main scale, 4<sup>th</sup> mark on vernier scale coincides with certain mark on the main scale. While measuring the length of a cylinder, observer observes 15 divisions on main scale and 5<sup>th</sup> division of vernier scale coincides with a main scale division. Measured length of cylinder is \_\_\_\_\_ mm.

(Least count of Vernier calliper = 0.1 mm)

- (1) 15.4                      (2) 15.1  
 (3) 15.5                      (4) 15.9

**Answer (2)**

Sol. Zero error =  $4LC = 0.4$  mm

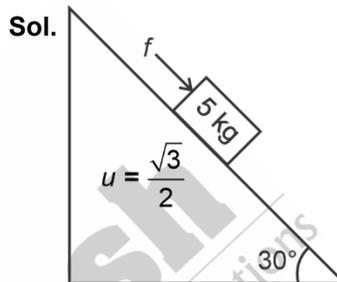
Length =  $15 \text{ MSD} + 5LC - 0.4$  mm  
 =  $15 \text{ MSD} + 0.1$  mm  
 = 15.1 mm

39. A block of mass 5 kg is moving on an inclined plane which makes an angle of 30° with the horizontal. Friction coefficient between the block and inclined plane surface is  $\frac{\sqrt{3}}{2}$ . The force to be applied on the block so that the block will move down without acceleration is \_\_\_\_\_ N.

( $g = 10 \text{ m/s}^2$ ).

- (1) 7.5                              (2) 15  
 (3) 25                              (4) 12.5

**Answer (4)**



$f_{\text{max}} = \frac{\sqrt{3}}{2} \cdot 50 \cdot \frac{\sqrt{3}}{2} = 50 \times \frac{3}{4}$

$F + 50 \cdot \frac{1}{2} = 50 \cdot \frac{3}{4}$

$F = \frac{50}{4} = 12.5 \text{ N}$

40. Two wires A and B made of different materials of lengths 6.0 cm and 5.4 cm, respectively and area of cross sections  $3.0 \times 10^{-5} \text{ m}^2$  and  $4.5 \times 10^{-5} \text{ m}^2$ , respectively are stretched by the same magnitude under a given load. The ratio of the Young's modulus of A to that of B is x : 3. The value of x is \_\_\_\_\_.

- (1) 2                              (2) 1  
 (3) 5                              (4) 4

**Answer (3)**

Our Problem Solvers shine bright in **JEE 2025**

**JEE (Advanced)**

 <b>ADVAY MAYANK</b> <b>AIR 36</b>	 <b>RUJUL GARG</b> <b>AIR 41</b>	 <b>ARUSH ANAND</b> <b>AIR 64</b>
--	--	---

**JEE (MAIN)**

 <b>SHREYAS LOHIYA</b> <b>AIR 6</b> Uttar Pradesh Topper <b>100</b> Overall	 <b>KUSHAGRA BAINGAHA</b> <b>AIR 7</b> Uttar Pradesh Topper <b>100</b> Overall	 <b>HARSSH A GUPTA</b> <b>AIR 15</b> Telangana Topper <b>100</b> Overall
---	--	--

Sol.  $\Delta l = \frac{Fl}{AY}$

$$\frac{l_1}{A_1 Y_1} = \frac{l_2}{A_2 Y_2}$$

$$\begin{aligned} \frac{Y_1}{Y_2} &= \frac{l_1}{l_2} \cdot \frac{A_2}{A_1} \\ &= \frac{6}{5.4} \times \frac{4.5}{3} \\ &= \frac{5}{3} \end{aligned}$$

41. 10 kg of ice at  $-10^\circ\text{C}$  is added to 100 kg of water to lower its temperature from  $25^\circ\text{C}$ . Consider no heat exchange to surroundings. The decrement to the temperature of water is \_\_\_\_\_  $^\circ\text{C}$ .

(specific heat of ice =  $2100 \text{ J/Kg}\cdot^\circ\text{C}$ , specific heat of water =  $4200 \text{ J/Kg}\cdot^\circ\text{C}$ , latent heat of fusion of ice =  $3.36 \times 10^5 \text{ J/Kg}$ )

- (1) 10  
(2) 11.6  
(3) 15  
(4) 67

**Answer (1)**

Sol.

10 kg ice  $-10^\circ\text{C}$

$\downarrow Q_1 = 210 \text{ kJ}$

10 kg ice  $0^\circ\text{C}$

$\downarrow Q_2 = 3360 \text{ kJ}$

10 g water  $0^\circ\text{C}$

100 kg water  $25^\circ\text{C}$

$\downarrow Q_4 = 100 \times 4.2 \times (25 - T)$

Water at  $T^\circ\text{C}$

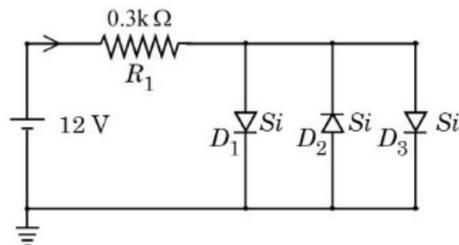
$\xrightarrow{Q_3 = 10 \times 4.2 \times T}$

$Q_1 + Q_2 + Q_3 = Q_4$

$\Rightarrow 210 + 3360 + 42 T = 420 (25 - T)$

$T = 15^\circ\text{C}$

42. Assuming in forward bias condition there is a voltage drop of  $0.7 \text{ V}$  across a silicon diode, the current through diode  $D_1$  in the circuit is \_\_\_\_\_ mA. (Assume all diodes in the given circuit are identical)?



- (1) 17.6  
(2) 18.8  
(3) 20.15  
(4) 11.7

**Answer (2)**



$$I = \frac{12 - 0.7}{0.3} = 37.6 \text{ mA}$$

$$\begin{aligned} \text{Current through } \Phi_1 &= \frac{37.6}{2} \\ &= 18.8 \text{ mA} \end{aligned}$$

43. Water drops fall from a tap on the floor, 5 m below, at regular intervals of time, the first drop strikes the floor when the sixth drop begins to fall. The height at which the fourth drop will be from ground, at the instant when the first drop strikes the ground is \_\_\_\_\_ m. ( $g = 10 \text{ m/s}^2$ )
- (1) 2.5  
(2) 4.2  
(3) 4.0  
(4) 3.8

**Answer (2)**

Our Problem Solvers shine bright in **JEE 2025**

**JEE (Advanced)**

ADVAY  
MAYANK  
**AIR 36**



RUJUL  
GARG  
**AIR 41**



ARUSH  
ANAND  
**AIR 64**



**JEE (MAIN)**

SHREYAS  
LOHIYA  
**AIR 6**  
Uttar Pradesh Topper  
**100** Overall



KUSHAGRA  
BAINGAHA  
**AIR 7**  
Uttar Pradesh Topper  
**100** Overall



HARSSH  
A GUPTA  
**AIR 15**  
Telangana Topper  
**100** Overall



Sol. Let time between two consecutive drops to

$$\frac{1}{2}g(5t_0)^2 = H = \text{height of tap}$$

$$H = \frac{25}{2}gt_0^2$$

$$t_0 = \frac{1}{5}$$

Distance of fourth drop from tap

$$= \frac{1}{2}g(2t_0)^2$$

$$= \frac{4}{5}$$

$$= 0.8$$

Height = 5 - 0.8

$$= 4.2 \text{ m}$$

44. The electric field of an electromagnetic wave travelling through a medium is given by  $\vec{E}(x, t) = 25 \sin(2.0 \times 10^{15}t - 10^7x) \hat{n}$  then the refractive index of the medium is \_\_\_\_\_.

(All given measurement are in SI units)?

(1) 1.7

(2) 1.2

(3) 1.5

(4) 2

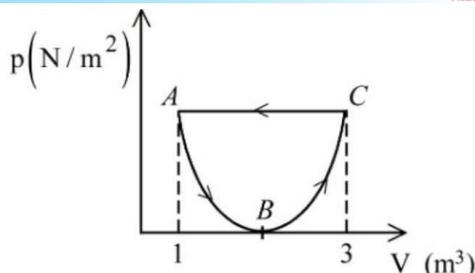
Answer (3)

Sol. Speed of EMW in medium ( $v$ ) =  $\frac{2 \times 10^{15}}{10^7}$   
 $= 2 \times 10^8$

$$\mu = \frac{c}{v}$$

$$= 1.5$$

45. In the following  $p - V$  diagram the equation of state along the curved path is given by  $(V - 2)^2 = 4ap$  where  $a$  is a constant. The total work done in the closed path is



(1)  $-\frac{1}{3a}$

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

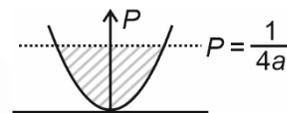
(3)  $+\frac{1}{3a}$

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

Answer (1)

Sol. Work done = Area

$\therefore$  area can be easily calculated by shifting the vertex of parabola at origin.



$$\text{Area} = \int_{-1}^1 \left( \frac{1}{4a} - \frac{v^2}{4a} \right) dv$$

$$= -\frac{1}{3a}$$

SECTION - B

**Numerical Value Type Questions:** This section contains 5 Numerical based questions. The answer to each question should be rounded-off to the nearest integer.

46. A convex lens of refractive index 1.5 and focal length  $f = 18 \text{ cm}$  is immersed in water. The difference in focal lengths of the given lens when it is in water and in air is  $\alpha \times f$ . The value of  $\alpha$  is \_\_\_\_\_. (refractive index of water =  $4/3$ )

Answer (3)

Our Problem Solvers shine bright in **JEE 2025**

JEE (Advanced)

ADVAY MAYANK  
AIR 36



RUJUL GARG  
AIR 41



ARUSH ANAND  
AIR 64



JEE (MAIN)

SHREYAS LOHIYA  
AIR 6  
Uttar Pradesh Topper  
100 Overall



KUSHAGRA BAINGAHA  
AIR 7  
Uttar Pradesh Topper  
100 Overall



HARSH A GUPTA  
AIR 15  
Telangana Topper  
100 Overall



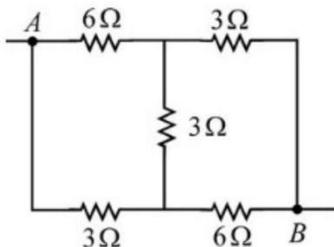
Sol.  $\frac{1}{f} = (\mu - 1) \left( \frac{1}{R_1} - \frac{1}{R_2} \right)$

$$\frac{1}{18} = (1.5 - 1) \left( \frac{1}{R_1} - \frac{1}{R_2} \right)$$

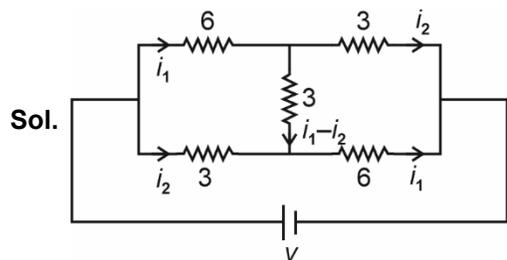
$$\frac{1}{f_w} = \left( \frac{1.5}{\frac{4}{3}} - 1 \right) \left( \frac{1}{R_1} - \frac{1}{R_2} \right)$$

$$f_w = 18 \times 4 = 72 \text{ cm}$$

47. The equivalent resistance between the points *A* and *B* in the following circuit is  $\frac{x}{5} \Omega$ . The value of *x* is \_\_\_\_\_.



**Answer (21)**



$$-6i_1 - 3(i_1 - i_2) + 3i_2 = 0$$

$$-3i_2 - 6i_1 + v = 0$$

$$R = \frac{v}{i_1 + i_2} = \frac{v}{\frac{5v}{21}} = \frac{21}{5}$$

48. The displacement of a particle, executing simple harmonic motion with time period *T*, is expressed as  $x(t) = A \sin \omega t$ , where *A* is the amplitude. The maximum value of potential energy of this oscillator is found at  $t = T/2\beta$ . The value of  $\beta$  is \_\_\_\_\_.

**Answer (2)**

Sol.  $x = A \sin(\omega t)$

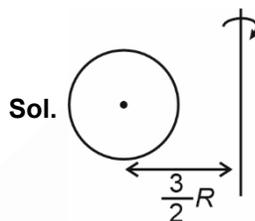
Potential energy is maximum at extreme position.

$$t = \frac{T}{4}, \frac{3T}{4}, \frac{5T}{4}, \dots$$

$$\beta = 2$$

49. A solid sphere of radius 10 cm is rotating about an axis which is at a distance 15 cm from its centre. The radius of gyration about this axis is  $\sqrt{n}$  cm. The value of *n* is

**Answer (265)**



$$I = \frac{2}{5} mR^2 + m \cdot \frac{9}{4} R^2$$

$$I = \frac{53}{20} mR^2$$

$$k = \sqrt{\frac{53}{20}} \times 10 \text{ cm}$$

$$= \sqrt{265} \text{ cm}$$

50. The ratio of de Broglie wavelength of a deuteron with kinetic energy *E* to that of an alpha particle with kinetic energy 2*E*, is *n* : 1. The value of *n* is \_\_\_\_\_. (Assume mass of proton = mass of neutron) :

**Answer (2)**

Sol.  $\lambda = \frac{h}{\sqrt{2mKE}}$

$$\frac{\lambda_D}{\lambda_\alpha} = \frac{\sqrt{2E \times 4}}{\sqrt{E \times 2}} = 2$$

Our Problem *Solvers* shine bright in **JEE 2025**

**JEE (Advanced)**

ADVAY  
MAYANK  
**AIR 36**



RUJUL  
GARG  
**AIR 41**



ARUSH  
ANAND  
**AIR 64**



**JEE (MAIN)**

SHREYAS  
LOHIYA  
**AIR 6**  
Uttar Pradesh Topper  
**100** Overall



KUSHAGRA  
BAINGAHA  
**AIR 7**  
Uttar Pradesh Topper  
**100** Overall



HARSSH  
A GUPTA  
**AIR 15**  
Telangana Topper  
**100** Overall



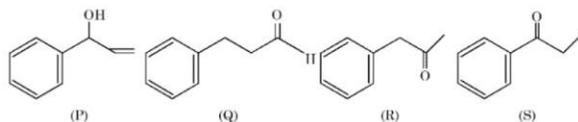
**CHEMISTRY**

**SECTION - A**

**Multiple Choice Questions:** This section contains 20 multiple choice questions. Each question has 4 choices (1), (2), (3) and (4), out of which **ONLY ONE** is correct.

**Choose the correct answer :**

51. Given below are the four isomeric compounds (P, Q, R, S)



Identify **correct** statements from below.

- A. Q, R and S will give precipitate with 2,4-DNP.
- B. P and Q will give positive Bayer's test.
- C. Q and R will give sooty flame.
- D. R and S will give yellow precipitate with  $I_2 / NaOH$ .
- E. Q alone will deposit silver with Tollen's reagent

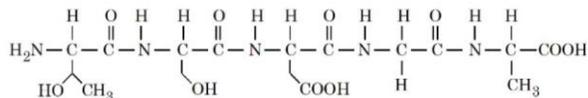
Choose the correct option.

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

**Answer (4)**

**Sol.** A, C and E are correct.

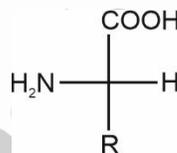
52. In the given pentapeptide, find out an essential amino acid (Y) and the sequence present in the pentapeptide:



(1)	(Y)	(Sequence)
	Serine	Thr-Ser-Asp-Ala-Gly
(2)	(Y)	(Sequence)
	Threonine	Thr-Ser-Asp-Gly-Ala
(3)	(Y)	(Sequence)
	Threonine	Ser-Thr-Asp-Gly-Ala
(4)	(Y)	(Sequence)
	Serine	Ser-Asp-Thr-Ala-Gly

**Answer (2)**

**Sol.** The general form of  $\alpha$ -amino acid:



$R \Rightarrow HO - CH_2 - \Rightarrow$  Serine (Ser)

$R \Rightarrow CH_3 - CHOH - \Rightarrow$  Threonine (Thr) (essential amino acid)

$R \Rightarrow HOOC - CH_2 - \Rightarrow$  Aspartic acid (Asp)

$R \Rightarrow CH_3 - \Rightarrow$  Alanine (Ala)

$R \Rightarrow H - \Rightarrow$  Glycine (Gly)

53. In period 4 of the periodic table, the elements with highest and lowest atomic radii are respectively.

- (1) K & Se                                      (2) Rb & Br
- (3) Na & Cl                                    (4) K & Br

**Answer (4)**

**Sol.** Radius decreases down the group

Highest – K

Lowest – Br

Our Problem *Solvers* shine bright in **JEE 2025**

**JEE (Advanced)**

ADVAY  
MAYANK  
**AIR 36**



RUJUL  
GARG  
**AIR 41**



ARUSH  
ANAND  
**AIR 64**



**JEE (MAIN)**

SHREYAS  
LOHIYA  
**AIR 6**  
Uttar Pradesh Topper  
**100** Overall



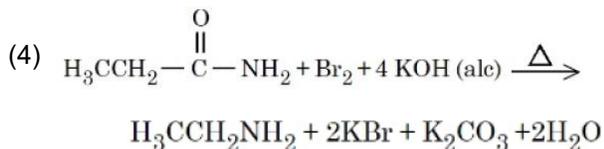
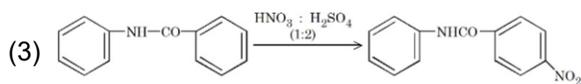
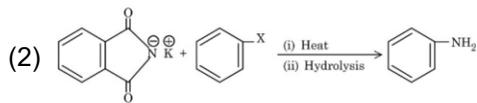
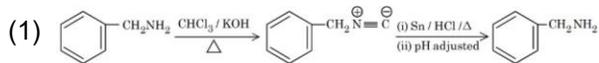
KUSHAGRA  
BAINGAHA  
**AIR 7**  
Uttar Pradesh Topper  
**100** Overall



HARSSH  
A GUPTA  
**AIR 15**  
Telangana Topper  
**100** Overall



54. Consider the following reactions giving major product. Identify the correct reaction.



**Answer (4)**

**Sol.** Reaction 4 is Hoffmann Bromamide degradation.

55. Given below are two statements:

**Statement I:** Griss-Ilosvay test is used for the detection of nitrite ion, which involves the use of sulphanilic acid and  $\alpha$ -naphthylamine reagent.

**Statement II:** In the above test, sulphanilic acid is diazotized by the acidified nitrite ion, which on further coupling with  $\alpha$ -naphthylamine forms an azo-dye.

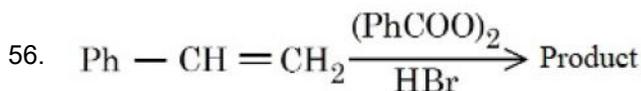
In the light of the above statements, choose the correct answer from the options given below

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

**Answer (4)**

**Sol.** Statement-I is correct

Statement II is correct



Consider the above reaction

- A. The reaction proceeds through a more stable radical intermediate.
- B. The role of peroxide is to generate  $H^\cdot$  (Hydrogen radical).
- C. During this reaction, benzene is formed as a byproduct.
- D. 1-Bromo-2-phenylethane is formed as the minor product.
- E. The same reaction in absence of peroxide proceeds via carbocation intermediate.

Identify the correct statements. Choose the **correct** answer from the options given below:

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

**Answer (2)**

**Sol.** A is correct

C is correct

E is correct

57.  $20.0 \text{ dm}^3$  of an ideal gas 'X' at 600 K and 0.5 MPa undergoes isothermal reversible expansion until pressure of the gas is 0.2 MPa. Which of the following option is correct?

(Given:  $\log 2 = 0.3010$  and  $\log 5 = 0.6989$ )

- (1)  $w = -9.1 \text{ kJ}$ ,  $\Delta U = 0$ ,  $\Delta H = 0$ ;  $q = 9.1 \text{ kJ}$
- (2)  $w = +4.1 \text{ kJ}$ ,  $\Delta U = 0$ ,  $\Delta H = 0$ ;  $q = -4.1 \text{ kJ}$
- (3)  $w = -3.9 \text{ kJ}$ ,  $\Delta U = 0$ ,  $\Delta H = 0$ ;  $q = 3.9 \text{ kJ}$
- (4)  $w = 9.1 \text{ J}$ ,  $\Delta U = 9.1 \text{ J}$ ,  $\Delta H = 0$ ;  $q = 0$

**Answer (1)**

**Sol.**  $\Delta E = 0$ ,  $\Delta H = 0$

$$w = -2.303 \times PV \log \frac{5}{2}$$

$$= -2.303 \times 0.5 \times 10^6 \times 20 \times 10^{-3} [0.3979]$$

$$\Rightarrow -9.1 \text{ kJ}$$

$$q = +9.1 \text{ kJ}$$

Our Problem *Solvers* shine bright in **JEE 2025**

**JEE (Advanced)**

ADVAY  
MAYANK  
AIR 36



RUJUL  
GARG  
AIR 41



ARUSH  
ANAND  
AIR 64



**JEE (MAIN)**

SHREYAS  
LOHIYA  
AIR 6  
Uttar Pradesh Topper  
100 Overall



KUSHAGRA  
BAINGAHA  
AIR 7  
Uttar Pradesh Topper  
100 Overall



HARSSH  
A GUPTA  
AIR 15  
Telangana Topper  
100 Overall



58. Given below are two statements:

**Statement I:** The number of species among  $\text{BF}_4^-$ ,  $\text{SiF}_4$ ,  $\text{XeF}_4$  and  $\text{SF}_4$ , that have unequal E – F bond lengths is two. Here, E is the central atom.

**Statement II:** Among  $\text{O}_2^-$ ,  $\text{O}_2^{2-}$ ,  $\text{F}_2$  and  $\text{O}_2^+$ ,  $\text{O}_2^-$  has the highest bond order.

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

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

**Answer (3)**

**Sol.** Statement-I is incorrect as only  $\text{SF}_4$  have unequal bond length.

Statement-II is incorrect as  $\text{O}_2^+$  have highest bond order.

59. An organic compound undergoes first order decomposition. The time taken for decomposition to  $\left(\frac{1}{8}\right)^{\text{th}}$  and  $\left(\frac{1}{10}\right)^{\text{th}}$  of its initial concentration are  $t_{1/8}$  and  $t_{1/10}$  respectively.

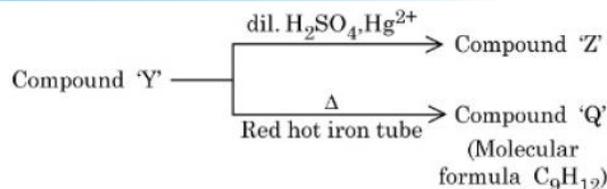
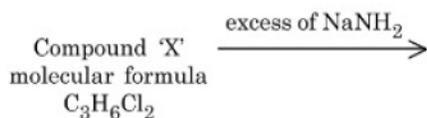
What is the value of  $\frac{t_{1/8}}{t_{1/10}} \times 10$ ? ( $\log 2 = 0.3$ )

- (1) 0.9
- (2) 30
- (3) 9
- (4) 3

**Answer (3)**

**Sol.**  $\frac{t_{1/8}}{t_{1/10}} = \frac{\log 8}{\log 10} = 0.9 \Rightarrow \frac{t_{1/8}}{t_{1/10}} \times 10 = 9$

60. Given below are two statements for the following reaction sequence.



**Statement I:** Compound 'Z' will give yellow precipitate with NaOI.

**Statement II:** Compound 'Q' has two different types of 'H' atoms (aromatic : aliphatic) in the ratio 1 : 3.

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

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

**Answer (4)**

**Sol.**  $\text{X} = \text{C}_3\text{H}_6\text{Cl}_2$

$\text{Y} = \text{CH}_3 - \text{C} \equiv \text{CH}$

$\text{Z} = \text{CH}_3 - \overset{\text{O}}{\parallel} \text{C} - \text{CH}_3$

$\text{Q} =$

61. Consider a weak base 'B' of  $\text{pK}_b = 5.699$ . 'x' mL of 0.02 M HCl and 'y' mL of 0.02 M weak base 'B' are mixed to make 100 mL of a buffer of pH 9 at  $25^\circ\text{C}$ . The values of 'x' and 'y' respectively are

[Given:  $\log 2 = 0.3010$ ,  $\log 3 = 0.4771$ ,  $\log 5 = 0.699$ ]

- |      |  |   |   |      |      |  |     |  |   |   |      |      |     |  |   |   |      |      |   |     |  |   |   |      |      |
|------|--|---|---|------|------|--|-----|--|---|---|------|------|-----|--|---|---|------|------|---|-----|--|---|---|------|------|
| (1)  | <table border="1"><tr><td>x</td><td>y</td></tr><tr><td>85.7</td><td>14.3</td></tr></table> | x | y | 85.7 | 14.3 | <table border="1"><tr><td>(2)</td><td><table border="1"><tr><td>x</td><td>y</td></tr><tr><td>42.7</td><td>57.3</td></tr></table></td></tr> <tr><td>(3)</td><td><table border="1"><tr><td>x</td><td>y</td></tr><tr><td>14.3</td><td>85.7</td></tr></table></td><td><table border="1"><tr><td>(4)</td><td><table border="1"><tr><td>x</td><td>y</td></tr><tr><td>11.1</td><td>88.9</td></tr></table></td></tr> </table> </td></tr></table> | (2) | <table border="1"><tr><td>x</td><td>y</td></tr><tr><td>42.7</td><td>57.3</td></tr></table> | x | y | 42.7 | 57.3 | (3) | <table border="1"><tr><td>x</td><td>y</td></tr><tr><td>14.3</td><td>85.7</td></tr></table> | x | y | 14.3 | 85.7 | <table border="1"><tr><td>(4)</td><td><table border="1"><tr><td>x</td><td>y</td></tr><tr><td>11.1</td><td>88.9</td></tr></table></td></tr> </table> | (4) | <table border="1"><tr><td>x</td><td>y</td></tr><tr><td>11.1</td><td>88.9</td></tr></table> | x | y | 11.1 | 88.9 |
| x    | y  |   |   |      |      |  |     |  |   |   |      |      |     |  |   |   |      |      |   |     |  |   |   |      |      |
| 85.7 | 14.3   |   |   |      |      |  |     |  |   |   |      |      |     |  |   |   |      |      |   |     |  |   |   |      |      |
| (2)  | <table border="1"><tr><td>x</td><td>y</td></tr><tr><td>42.7</td><td>57.3</td></tr></table> | x | y | 42.7 | 57.3 |  |     |  |   |   |      |      |     |  |   |   |      |      |   |     |  |   |   |      |      |
| x    | y  |   |   |      |      |  |     |  |   |   |      |      |     |  |   |   |      |      |   |     |  |   |   |      |      |
| 42.7 | 57.3   |   |   |      |      |  |     |  |   |   |      |      |     |  |   |   |      |      |   |     |  |   |   |      |      |
| (3)  | <table border="1"><tr><td>x</td><td>y</td></tr><tr><td>14.3</td><td>85.7</td></tr></table> | x | y | 14.3 | 85.7 | <table border="1"><tr><td>(4)</td><td><table border="1"><tr><td>x</td><td>y</td></tr><tr><td>11.1</td><td>88.9</td></tr></table></td></tr> </table>  | (4) | <table border="1"><tr><td>x</td><td>y</td></tr><tr><td>11.1</td><td>88.9</td></tr></table> | x | y | 11.1 | 88.9 |     |  |   |   |      |      |   |     |  |   |   |      |      |
| x    | y  |   |   |      |      |  |     |  |   |   |      |      |     |  |   |   |      |      |   |     |  |   |   |      |      |
| 14.3 | 85.7   |   |   |      |      |  |     |  |   |   |      |      |     |  |   |   |      |      |   |     |  |   |   |      |      |
| (4)  | <table border="1"><tr><td>x</td><td>y</td></tr><tr><td>11.1</td><td>88.9</td></tr></table> | x | y | 11.1 | 88.9 |  |     |  |   |   |      |      |     |  |   |   |      |      |   |     |  |   |   |      |      |
| x    | y  |   |   |      |      |  |     |  |   |   |      |      |     |  |   |   |      |      |   |     |  |   |   |      |      |
| 11.1 | 88.9   |   |   |      |      |  |     |  |   |   |      |      |     |  |   |   |      |      |   |     |  |   |   |      |      |

**Answer (3)**

Our Problem Solvers shine bright in **JEE 2025**

**JEE (Advanced)**

ADVAY  
MAYANK  
AIR 36



RUJUL  
GARG  
AIR 41



ARUSH  
ANAND  
AIR 64



**JEE (MAIN)**

SHREYAS  
LOHIYA  
AIR 6  
Uttar Pradesh Topper  
100 Overall



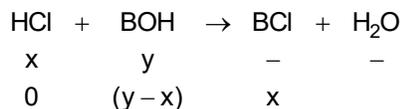
KUSHAGRA  
BAINGAHA  
AIR 7  
Uttar Pradesh Topper  
100 Overall



HARSSH  
A GUPTA  
AIR 15  
Telangana Topper  
100 Overall



**Sol.**  $x + y = 100$



$$\text{pH} = 9, \text{pOH} = 5$$

$$5 = 5.699 + \log \frac{\text{Salt}}{\text{Base}}$$

$$-0.699 = \log \frac{\text{Salt}}{\text{Base}}$$

$$\Rightarrow \frac{\text{Salt}}{\text{Base}} = \frac{1}{5}$$

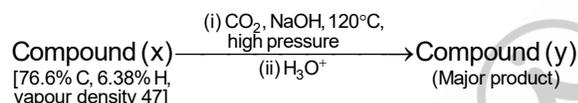
$$\Rightarrow \frac{x}{y-x} = \frac{1}{5}$$

$$5x = y - x$$

$$6x = y$$

$$\Rightarrow x = 14.3, y = 85.7$$

62. Consider the following reaction sequence:



Compound (y) develops characteristic colour with neutral  $\text{FeCl}_3$  solution.

Identify the **INCORRECT** statement from the following for the above sequence.

- (1) Both compounds x and y will dissolve in NaOH
- (2) Compound y will dissolve in  $\text{NaHCO}_3$  and evolve a gas
- (3) Compound x is more acidic than compound y
- (4) Both compounds x and y will burn with sooty flame

**Answer (3)**

**Sol.** x = phenol

y = salicylic acid

Compound y is more acidic.

63. The correct statement among the following is:

- (1)  $\text{Ni}(\text{CO})_4$  and  $[\text{NiCl}_4]^{2-}$  are diamagnetic and  $[\text{Ni}(\text{CN})_4]^{2-}$  is paramagnetic.
- (2)  $\text{Ni}(\text{CO})_4$  is diamagnetic and  $[\text{NiCl}_4]^{2-}$  and  $[\text{Ni}(\text{CN})_4]^{2-}$  are paramagnetic.
- (3)  $[\text{Ni}(\text{CN})_4]^{2-}$  and  $[\text{NiCl}_4]^{2-}$  are diamagnetic and  $\text{Ni}(\text{CO})_4$  is paramagnetic.
- (4)  $\text{Ni}(\text{CO})_4$  and  $[\text{Ni}(\text{CN})_4]^{2-}$  are diamagnetic and  $[\text{NiCl}_4]^{2-}$  is paramagnetic.

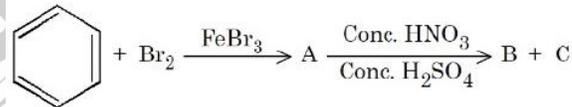
**Answer (4)**

**Sol.**  $[\text{Ni}(\text{CN})_4]^{2-}$  = diamagnetic

$[\text{Ni}(\text{CO})_4]$  = diamagnetic

$[\text{Ni}(\text{Cl})_4]^{2-}$  = paramagnetic

64. Method used for separation of mixture of products (B and C) obtained in the following reaction is



- (1) simple distillation
- (2) steam distillation
- (3) sublimation
- (4) fractional distillation

**Answer (4)**

**Sol.** A. Bromobenzene

B. Ortho-nitro bromobenzene

C. Para-nitro bromobenzene

Both B and C can be separated using fractional distillation.

Our Problem *Solvers* shine bright in **JEE 2025**

**JEE (Advanced)**

ADVAY  
MAYANK  
**AIR 36**



RUJUL  
GARG  
**AIR 41**



ARUSH  
ANAND  
**AIR 64**



SHREYAS  
LOHIYA  
**AIR 6**  
Uttar Pradesh Topper  
**100** Overall



KUSHAGRA  
BAINGAHA  
**AIR 7**  
Uttar Pradesh Topper  
**100** Overall



HARSSH  
A GUPTA  
**AIR 15**  
Telangana Topper  
**100** Overall



65. At T(K), 2 moles of liquid A and 3 moles of liquid B are mixed. The vapour pressure of ideal solution formed is 320 mm Hg. At this stage, one mole of A and one mole of B are added to the solution. The vapour pressure is now measured as 328.6 mm Hg. The vapour pressure (in mm Hg) of A and B are respectively:

- (1) 400, 300
- (2) 600, 400
- (3) 500, 200
- (4) 300, 200

**Answer (3)**

**Sol.**  $x_A = \frac{2}{5}$ ;  $x_B = \frac{3}{5}$

$$320 = P_A^\circ \left(\frac{2}{5}\right) + P_B^\circ \left(\frac{3}{5}\right)$$

$$\boxed{1600 = 2P_A^\circ + 3P_B^\circ} \Rightarrow \boxed{4800 = 6P_A^\circ + 9P_B^\circ}$$

New solution;

$$n_A = 3$$

$$n_B = 4$$

$$x_A = \frac{3}{7}; \quad x_B = \frac{4}{7}$$

$$328.6 = P_A^\circ \left(\frac{3}{7}\right) + P_B^\circ \left(\frac{4}{7}\right)$$

$$\boxed{2300.2 = 3P_A^\circ + 4P_B^\circ}$$

↓

$$\boxed{4600.4 = 6P_A^\circ + 8P_B^\circ}$$

$$\Rightarrow P_B^\circ = 199.6 \approx 200$$

$$P_A^\circ = 500.6 \approx 500$$

66. Regarding the hydrides of group 15 elements  $\text{EH}_3$  (E = N, P, As, Sb), select the correct statement from the following:

- A. The stability of hydrides decreases down the group.
  - B. The basicity of hydrides decreases down the group.
  - C. The reducing character increases down the group.
  - D. The boiling point increases down the group.
- Choose the **correct** answer from the options given below:

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

**Answer (2)**

**Sol.** A is correct

B is correct

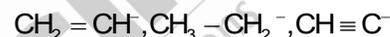
C is correct

BP     $\text{NH}_3$      $\text{PH}_3$      $\text{AsH}_3$      $\text{SbH}_3$      $\text{BiH}_3$

(K)    238    185    210    254    290

D is incorrect

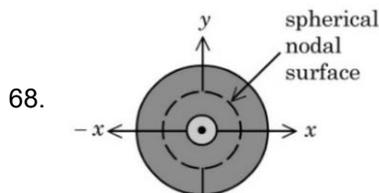
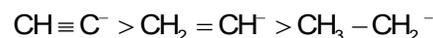
67. CORRECT order of stability for the following is



- (1)  $\text{CH} \equiv \overset{\cdot}{\text{C}} > \text{CH}_2 = \overset{\cdot}{\text{C}}\text{H} > \text{CH}_3 - \overset{\cdot}{\text{C}}\text{H}_2$
- (2)  $\text{CH}_3 - \overset{\cdot}{\text{C}}\text{H}_2 > \text{CH}_2 = \overset{\cdot}{\text{C}}\text{H} > \text{CH} \equiv \overset{\cdot}{\text{C}}$
- (3)  $\text{CH}_2 = \overset{\cdot}{\text{C}}\text{H} > \text{CH} \equiv \overset{\cdot}{\text{C}} > \text{CH}_3 - \overset{\cdot}{\text{C}}\text{H}_2$
- (4)  $\text{CH} \equiv \overset{\cdot}{\text{C}} > \text{CH}_3 - \overset{\cdot}{\text{C}}\text{H}_2 > \text{CH}_2 = \overset{\cdot}{\text{C}}\text{H}$

**Answer (1)**

**Sol.** Order of stability



68.

Figure 1. electron probability density for 2s orbital

Our Problem Solvers shine bright in **JEE 2025**

**JEE (Advanced)**

ADVAY  
MAYANK  
AIR 36



RUJUL  
GARG  
AIR 41



ARUSH  
ANAND  
AIR 64



SHREYAS  
LOHIYA  
AIR 6  
Uttar Pradesh Topper  
100 Overall



KUSHAGRA  
BAINGAHA  
AIR 7  
Uttar Pradesh Topper  
100 Overall



HARSSH  
A GUPTA  
AIR 15  
Telangana Topper  
100 Overall



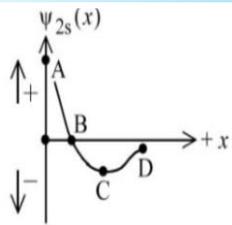


Figure 2. wave function for 2s orbital

Which of the following point in Figure 2 most accurately represents the nodal surface as shown in Figure 1?

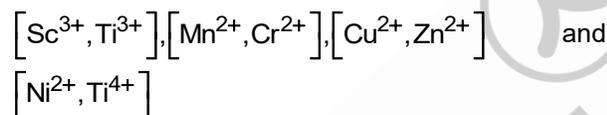
- (1) A
- (2) C
- (3) B
- (4) D

**Answer (3)**

**Sol.**  $\Psi = 0$  for node

69. Given below are two statements:

**Statement I:** The number of pairs, from the following, in which both the ions are coloured in aqueous solution is 3.



**Statement II:**  $\text{Th}^{4+}$  is the strongest reducing agent among  $\text{Th}^{4+}$ ,  $\text{Ce}^{4+}$ ,  $\text{Gd}^{3+}$  and  $\text{Eu}^{2+}$ .

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

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

**Answer (4)**

**Sol.**  $\text{Sc}^{3+}$ ,  $\text{Zn}^{2+}$  and  $\text{Ti}^{4+}$  are colourless

Statement I is Incorrect

Statement II is Incorrect

70. The wave numbers of three spectral lines of H atom are considered. Identify the set of spectral lines belonging to Balmer series.

(R = Rydberg constant)

- (1)  $\frac{3R}{4}, \frac{3R}{16}, \frac{7R}{144}$
- (2)  $\frac{7R}{144}, \frac{3R}{16}, \frac{16R}{255}$
- (3)  $\frac{5R}{36}, \frac{3R}{16}, \frac{21R}{100}$
- (4)  $\frac{5R}{36}, \frac{8R}{9}, \frac{15R}{16}$

**Answer (3)**

**Sol.** First line

$$(3 \rightarrow 2) \quad \frac{1}{\lambda} = R \times 1 \times \left[ \frac{1}{4} - \frac{1}{9} \right]$$

$$= \frac{5R}{36}$$

Second line

$$(4 \rightarrow 2) \quad \frac{1}{\lambda} = R \times 1 \times \left[ \frac{1}{4} - \frac{1}{16} \right]$$

$$= \frac{3R}{16}$$

Third line

$$(5 \rightarrow 2) \quad \frac{1}{\lambda} = R \times 1 \times \left[ \frac{1}{4} - \frac{1}{25} \right]$$

$$= \frac{21R}{100}$$

**SECTION - B**

**Numerical Value Type Questions:** This section contains 5 Numerical based questions. The answer to each question should be rounded-off to the nearest integer.

71. 500 mL of 1.2 M KI solution is mixed with 500 mL of 0.2 M  $\text{KMnO}_4$  solution in basic medium. The liberated iodine was titrated with standard 0.1 M  $\text{Na}_2\text{S}_2\text{O}_3$  solution in the presence of starch indicator till the blue color disappeared. The volume (in L) of  $\text{Na}_2\text{S}_2\text{O}_3$  consumed is \_\_\_\_\_. (Nearest integer)

**Answer (3)**

Our Problem Solvers shine bright in **JEE 2025**

**JEE (Advanced)**

ADVAY  
MAYANK  
AIR 36



RUJUL  
GARG  
AIR 41



ARUSH  
ANAND  
AIR 64



**JEE (MAIN)**

SHREYAS  
LOHIYA  
AIR 6  
Uttar Pradesh Topper  
100 Overall



KUSHAGRA  
BAINGAHA  
AIR 7  
Uttar Pradesh Topper  
100 Overall



HARSSH  
A GUPTA  
AIR 15  
Telangana Topper  
100 Overall



Sol. m.eq. of  $\text{KMnO}_4 = 300$  (Limiting reagent)

m.eq. of  $\text{KI} = 600$

$$\Rightarrow 300 = n_{\text{I}_2} \times 2$$

$$n_{\text{I}_2} = 150 \text{ m.moles}$$

$n_{\text{Hypo}} = 300 \text{ m.moles}$

$$300 = 0.1 \times V$$

$$V = 3000 \text{ mL}$$

$$= 3 \text{ L}$$

72. 0.53 g of an organic compound (x) when heated with excess of nitric acid (concentrated) and then with silver nitrate gave 0.75 g of silver bromide precipitate. 1.0 g of (x) gave 1.32 g of  $\text{CO}_2$  gas on combustion. The percentage of hydrogen in the compound (x) is \_\_\_\_\_. [Nearest Integer]

[Given: Molar mass in  $\text{g mol}^{-1}$  H : 1, C : 12, Br : 80, Ag : 108, O : 16; Compound (x) :  $\text{C}_x\text{H}_y\text{Br}_z$ ]

**Answer (4)**

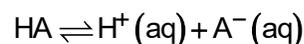
Sol. The compound is  $\text{C}_x\text{H}_y\text{Br}_z$

$$\% \text{Br} = \frac{0.75 \times 80}{188 \times 0.53} \times 100\% \approx 60.2\%$$

$$\% \text{C} = \frac{1.32 \times 12}{44 \times 1} \times 100\% = 36\%$$

$$\% \text{H} = 100 - (60 + 36)\% \\ = \approx 4\%$$

73. Consider the dissociation equilibrium of the following weak acid



If the  $\text{pK}_a$  of the acid is 4, then the pH of 10 mMHA solution is \_\_\_\_\_. (Nearest integer)

[Given: The degree of dissociation can be neglected with respect to unity]

**Answer (3)**

Sol.  $\text{HA} \rightleftharpoons \text{H}^+ (\text{aq}) + \text{A}^- (\text{aq})$

$$\text{pK}_a(\text{Ha}) = 4$$

$$\therefore \text{K}_a = 10^{-4}$$

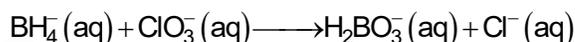
$$[\text{H}^+] = \sqrt{C \cdot \text{K}_a}$$

$$= \sqrt{10^{-2} \times 10^{-4}}$$

$$[\text{H}^+] = \sqrt{10^{-6}} = 10^{-3}$$

$$\therefore \text{pH} = 3$$

74. Consider the following redox reaction taking place in acidic medium



If the Nernst equation for the above balanced reaction is

$$E_{\text{cell}} = E_{\text{cell}}^\circ - \frac{RT}{nF} \ln Q,$$

then the value of  $n$  is \_\_\_\_\_. (Nearest integer)

**Answer (24)**

Sol.  $\Delta(\text{oxidation number})$  for Reduction = 6

$\Delta(\text{oxidation number})$  for oxidation =  $2 \times 4 = 8$

$$n = \text{LCM}(6, 8)$$

$$= 24$$

75. X is the number of geometrical isomers exhibited by  $[\text{Pt}(\text{NH}_3)(\text{H}_2\text{O})\text{BrCl}]$ .

Y is the number of optically inactive isomer(s) exhibited by  $[\text{CrCl}_2(\text{ox})_2]^{3-}$

Z is the number of geometrical isomers exhibited by  $[\text{Co}(\text{NH}_3)_3(\text{NO}_2)_3]$ .

The value of  $X + Y + Z$  is \_\_\_\_\_.

**Answer (6)**

Our Problem Solvers shine bright in **JEE 2025**

JEE (Advanced)

ADVAY  
MAYANK  
AIR 36



RUJUL  
GARG  
AIR 41



ARUSH  
ANAND  
AIR 64



SHREYAS  
LOHIYA  
AIR 6  
Uttar Pradesh Topper  
100 Overall

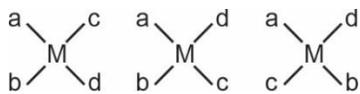
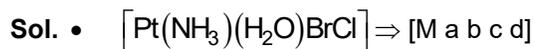


KUSHAGRA  
BAINGAHA  
AIR 7  
Uttar Pradesh Topper  
100 Overall



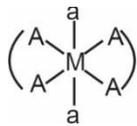
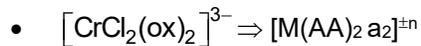
HARSSH  
A GUPTA  
AIR 15  
Telangana Topper  
100 Overall





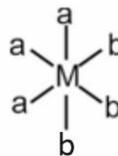
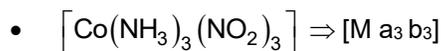
$\Rightarrow$  3 geometrical isomers.

$X = 3$

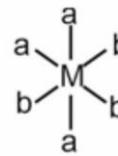


$\Rightarrow$  Optically inactive

$Y = 1$



fac



mer

$Z = 2$

$X + Y + Z = 6$



**Aakash**  
Medical | IIT-JEE | Foundations

Our Problem *Solvers* shine bright in **JEE 2025**

JEE (Advanced)

ADVAY  
MAYANK  
**AIR 36**



RUJUL  
GARG  
**AIR 41**



ARUSH  
ANAND  
**AIR 64**



SHREYAS  
LOHIYA  
**AIR 6**  
Uttar Pradesh Topper  
**100** Overall



KUSHAGRA  
BAINGAHA  
**AIR 7**  
Uttar Pradesh Topper  
**100** Overall



HARSSH  
A GUPTA  
**AIR 15**  
Telangana Topper  
**100** Overall

