

JEE (MAIN) 2025

MEMORY BASED QUESTIONS & TEXT SOLUTION

SHIFT-1

DATE & DAY: 04th April 2025 & Friday

PAPER-1

Duration: 3 Hrs.

Time: 09:00 – 12:00 IST

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SUBJECT: PHYSICS

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52395

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Selections in NEET (UG)/
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PART : PHYSICS

1. Mean free path for an ideal gas is to be observed 2×10^{-7} m while average speed of molecules of gas is observed to be 600 m/s, then frequency of collision is near by
(1) 4×10^7 Hz (2) 1.2×10^7 Hz (3) 3×10^6 Hz (4) 3×10^9 Hz

Ans. (3)

Sol. Given $\lambda = 2 \times 10^{-7}$

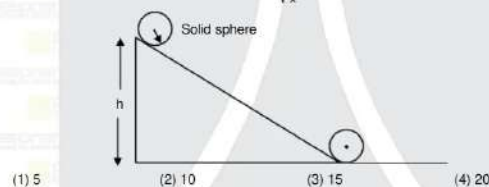
$v = 600$ m/s

$$\tau = \frac{2 \times 10^{-7}}{600} = \frac{1}{3} \times 10^{-9}$$

1

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2. A ring and a solid sphere released from rest from same height on enough rough inclined surface. Ratio of their speed when they reach at bottom is $\sqrt{\frac{7}{x}}$ m/s. Then x is :



Ans. (1) 5

Sol. (2)

For solid sphere total energy conservation

$E_i = E_f$

$$mgh = \frac{1}{2}mv^2 + \frac{1}{2}I\omega^2$$

$$mgh = \frac{1}{2} \left(\frac{2}{5}mR^2 \right) \omega^2 + \frac{1}{2}mv^2$$

$$gh = \frac{1}{5}R^2 \frac{v^2}{R^2} + \frac{1}{2}v^2$$

$$gh = \frac{7}{10}v^2$$

$$\sqrt{\frac{10}{7}gh} = v_s \quad \dots(1)$$

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For ring

$$mgh = \frac{1}{2} nR^2 \omega^2 + \frac{1}{2} m v^2$$

$$gh = \frac{1}{2} R^2 \frac{v^2}{R^2} + \frac{1}{2} v^2$$

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$$v_{ring} = gh \dots (2)$$

$$\frac{v_{ring}}{v_{solid}} = \frac{gh}{gh} = \frac{7}{10}$$

3. Which of the following is ratio of 5th bohr radius of He⁺ and Li²⁺ ?

- (1) $\frac{2}{3}$ (2) $\frac{3}{2}$ (3) $\frac{9}{4}$ (4) $\frac{4}{9}$

Ans. (2)

$$\text{Sol. } r_n = n^2 a_0$$

$$\frac{r_5}{r_2} = \frac{5^2}{2^2}$$

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4. If ratio of electric flux and magnetic flux dimension of is $M^2 L^2 T^2 A^2$ then (where, E represent electric field and B represent magnetic field)

- (1) (Q,R) $\rightarrow$ [1,1] (2) (Q,R) $\rightarrow$ [1,2] (3) (Q,R) $\rightarrow$ [1,-1] (4) (Q,R) $\rightarrow$ [1,0]

Ans. (3)

$$\text{Sol. } \frac{E}{B} = c$$

[where, c = speed of light]

dimension of $c \Rightarrow [m L T^{-1}]$

$$\text{dimension of } \left(\frac{E}{B} \right) \Rightarrow [M^2 L^2 T^{-2}]$$

$$Q \Rightarrow 1$$

$$R \Rightarrow -1$$

5. Distance between object and image is 30 cm by using spherical mirror of found length $\frac{x}{4}$, $m = -\frac{1}{3}$ there

- find 'x'
(1) 15 (2) 30 (3) 45 (4) 75

Ans. (3)

$$\text{Sol. } m = -\frac{1}{3} = -\frac{v}{u} \quad |v - u| = 30$$

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$$\frac{1}{f} = \frac{1}{v} + \frac{1}{u} \quad \rightarrow v = \frac{4}{3}$$

$$\frac{1}{f} = \frac{1}{15} + \frac{1}{45} \quad v = \frac{45}{3} \Rightarrow 15$$

$$= \frac{3+1}{45}$$

$$f = \frac{45}{4}, \quad \frac{x}{4} = \frac{45}{4}, \quad x = 45 \text{ Ans.}$$

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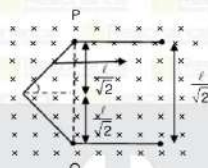
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6. A rods of equal length are joined as shown in the figure. Combined system is moving with speed 10 cm/s in a perpendicular magnetic field of $\frac{1}{\sqrt{2}}$ tesla. Find emf induced between point P and Q in millivolts (given $l = 10$ cm)



- (1) 30 (2) 10 (3) 35 (4) 25

Ans. (2)

Sol.

$$\text{Induced EMF} = B l v = \frac{1}{\sqrt{2}} \times 10 \times 10 = 10 \text{ mV}$$

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$$E = Bv = Bv(\frac{1}{\sqrt{2}})$$

$$\Rightarrow \frac{1}{\sqrt{2}} \times 10 \times 10^{-2} \times 10 \times 10^{-2} \times \sqrt{2} = 10 \text{ mV}$$

7. If slit width is increased to .02 to 0.4 then percentage change fringe width will be.
 (1) 20% (2) 25% (3) 60% (4) 50%

Ans. (4)

Sol. $\frac{\Delta\beta}{\beta} = \frac{\Delta\frac{1}{d}}{\frac{1}{d}} \times 100$

$$= \frac{\frac{1}{.04} - \frac{1}{.02}}{\frac{1}{.02}} \times 100$$

$$= \frac{.02}{.04 \times .02} \times .02 \times 100$$

$$= 50\%$$

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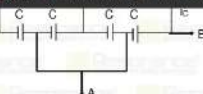
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- (1) 48 m ϕ (2) 64 m ϕ (3) 8 m ϕ (4) 16 m ϕ

Ans. (2)

Sol. $A - B = C + C + C + C$

$$= 4C$$

$$= 4 \times 15 \mu\phi$$

$$= 64 \mu\phi$$

9. Find ratio of Speed of sound in H_2 : Me then Co_2 If ratio of pressure and density are same for each gas

- (1) $\sqrt{\frac{5}{3}} \sqrt{\frac{4}{3}} \sqrt{\frac{7}{5}}$ (2) $\sqrt{\frac{5}{3}} \sqrt{\frac{3}{4}} \sqrt{\frac{7}{5}}$ (3) $\sqrt{\frac{5}{3}} \sqrt{\frac{4}{3}} \sqrt{\frac{6}{5}}$ (4) $\sqrt{\frac{3}{5}} \sqrt{\frac{4}{3}} \sqrt{\frac{7}{5}}$

Ans. (1)

Sol. Speed of sound in a gas = $\sqrt{\frac{\gamma RT}{M}} = \sqrt{\frac{\gamma p}{\rho}}$

γ for $H_2 \rightarrow \frac{5}{3}$, γ for $CO_2 = \frac{7}{5}$, γ for Me then $\frac{4}{3}$

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Speed of sound in H_2 $V_{H_2} = \sqrt{\frac{\frac{5}{3} RT}{4}}$

$$V_{H_2} = \sqrt{\frac{5}{12} RT}$$

Speed of sound in Co_2 $V_{Co_2} = \sqrt{\frac{\frac{4}{3} RT}{44}}$

$$V_{Co_2} = \sqrt{\frac{RT}{33}}$$

Ratio $\frac{V_{H_2}}{V_{Co_2}} = \frac{\sqrt{\frac{5}{12} RT}}{\sqrt{\frac{RT}{33}}}$

$$\Rightarrow \sqrt{\frac{5 \times 33}{12}}$$

$$= \frac{\sqrt{55}}{2}$$

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10. It AC current $i = 100\sqrt{2} \sin 100\pi t$ Find frequency & current

- (1) 100 A, 50 Hz (2) $100\sqrt{2}$ A, 50 Hz (3) 100 A, 100 Hz (4) $100\sqrt{2}$ A, 100 Hz

Ans. (1)

Sol. $i = 100 \text{ A}$

11. In spherical mirror distance between RO and RI is 30cm and magnification is $-\frac{1}{2}$, how much object shift

so magnification become $-\frac{1}{3}$

- (1) $\frac{40}{3}$ (2) $\frac{60}{3}$ (3) $\frac{90}{3}$ (4) $\frac{80}{3}$

Ans. (4)

Sol. Shift = $\left| \frac{80}{3} - 20 \right| = \frac{20}{3}$

Towards mirror

$$m_1 = \frac{1}{2} = \frac{y}{x}$$

$$x = 2y$$

$$x + y = 30$$

$$y = 10$$

$$x = 20$$

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

$$= \frac{3}{-20}$$

$$f = -\frac{20}{3}$$

$$3y = x$$

$$-\frac{3}{-20} = \frac{1}{-x} - \frac{1}{y}$$

$$\frac{3}{20} = \frac{4}{3y}$$

$$t = \frac{80}{9}$$

$$x = \frac{80}{3}$$

12. If $\frac{1}{5}$ th of volume of closed organ pipe is filled in water. Then percentage change in frequency

- (1) 25% (2) -25% (3) 20% (4) -20%

Ans. (1)

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Sol.

$$f = \frac{v}{4l} \times \frac{4}{5} \Rightarrow \frac{4v}{16l}$$

$$f' = \frac{v}{l/5} \Rightarrow \frac{5v}{l}$$

$$\% \text{ change in frequency} = \frac{f' - f}{f} \times 100$$

$$\Rightarrow \frac{\frac{5v}{l} - \frac{4v}{16l}}{\frac{4v}{16l}} \times 100$$

$$\Rightarrow \frac{1}{4} \times 100$$

$$= 25\% \text{ Ans.}$$

13. An electric dipole with charges $2\mu\text{C}$ and separation 20 cm is placed closed to an infinitely charge non-conducting sheet with surface charge density 100 cm^2 . Find the torque acting on the dipole if the dipole makes an angle 30° with the normal to the sheet?

- (1) $\frac{12}{\epsilon_0} \times 10^{-5}\text{ Nm}$ (2) $\frac{2}{\epsilon_0} \times 10^{-5}\text{ Nm}$ (3) $\frac{4}{\epsilon_0} \times 10^{-5}\text{ Nm}$ (4) $\frac{1}{\epsilon_0} \times 10^{-5}\text{ Nm}$

Ans. (4)

Sol.

$$100\text{ C/m}^2$$

$$-2\mu\text{C}$$

$$30^\circ$$

$$\tau = PE \sin 30^\circ$$

$$\Rightarrow (\text{ad}) \left(\frac{6}{2\epsilon_0} \right) \frac{1}{2}$$

$$= \frac{2 \times 10^{-6} \times 0.2}{\epsilon_0} \times \frac{100}{y}$$

$$= \frac{1}{\epsilon_0} \times 10^{-5}$$

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14. **Assertion** : KE required to project body from surface of earth to infinity is $\frac{mgR}{2}$
Reason : Highest PE is zero between surface of earth and infinity
 (1) (A) and (R) are correct and (R) is correct explanation of (A)
 (2) (A) and (R) both are correct and (R) is not correct explanation of (A)
 (3) (A) is correct but (R) is incorrect
 (4) (A) is incorrect but (R) is correct

Ans. (4)

15. **Assertion** : In photoelectric effect, if intensity of monochromatic light is increased then stopping potential increase
Reason : Increased intensity results in increment of photocurrent.
 (1) Assertion is correct, Reason is correct and Reason is explanation of Assertion
 (2) Assertion is correct, Reason is correct and Reason is not correct explanation of Assertion

Ans. (3)

16. In two different capillary tube $\frac{\cos \theta_1}{\cos \theta_2} = z$ which option is correct
 (1) z is negative, if first meniscus is concave & second convex
 (2) z is negative, if first meniscus is convex & second concave
 (3) z is positive, if both are convex
 (4) z is positive, if first meniscus is convex & second concave

Ans. (2)

Sol. (1) $\Rightarrow$ convex
 (2) $\Rightarrow$ concave.

17. Two simple pendulums with angular amplitudes θ_1 and θ_2 have length of strings as l_1 and l_2 respectively. Choose the correct option's if the maximum angular acceleration are same.
 (1) $\theta_2 \times l_2 = \theta_1 \times l_1$ (2) $\theta_1 \times l_2 = \theta_2 \times l_1$
 (3) $\theta_1 \times l_2^2 = \theta_2 \times l_1^2$ (4) $\theta_2 \times l_2^2 = \theta_1 \times l_1^2$

Ans. (2)

Sol. $a_{\text{max}} = a_{\text{max}}$
 $\tau = mg \sin \theta = I \alpha$
 $mg \sin \theta = \frac{mr^2}{l} \alpha$

$$\theta_1 \times l_2 = \theta_2 \times l_1$$

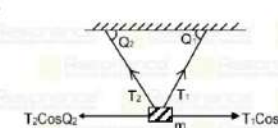
18. A block of mass m kg is connected to two strings as shown. If $T_1 = \sqrt{3} T_2$, then choose correct option
 (1) $Q_1 = 60^\circ$, $Q_2 = 30^\circ$ $T_1 = \frac{mg}{2}$ (2) $Q_1 = 60^\circ$, $Q_2 = 30^\circ$ $T_2 = \frac{mg}{2}$
 (3) $Q_1 = 30^\circ$, $Q_2 = 60^\circ$ $T_1 = \frac{3mg}{4}$ (4) $Q_1 = 30^\circ$, $Q_2 = 60^\circ$ $T_2 = \frac{3mg}{4}$

Ans. (2)

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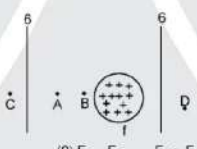
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Sol.



$T_2 \cos Q_2$
 $T_1 \cos Q_1 = T_2 \cos Q_2$
 $\sqrt{3} \cos Q_1 = \cos Q_2$
 $Q_1 = 60^\circ$, $Q_2 = 30^\circ$
 $T_2 \sin Q_2 = T_1 \sin Q_1 = mg$
 $\frac{T_2}{2} + \frac{T_1 \sqrt{3}}{2} = mg$
 $\frac{T_2}{2} + \frac{3T_2}{2} = mg$
 $T_2 = \frac{mg}{2}$

19. In arrangement shown, find the ratio of electric field at point A and B. (A and B are not considering sphere with volume charge density). Choose the correct relation between the magnitude of electric field at A, B, C, and D.



(1) $E_A \neq E_B$ $E_D > E_C$ (2) $E_A = E_B$ $E_D > E_C$
 (3) $E_A \neq E_B$ $E_C > E_D$ (4) $E_A = E_B$ $E_D > E_C$

Ans. (1)

20. If current $(i) = 0.02t + 0.01$, flow of charge from $t = 1$ to $t = 2$

- (1) 0.04 (2) 0.02 (3) 0.01 (4) 0.06

Ans. (1)

Sol. $q = \int i dt = \left(0.02 \frac{t^2}{2} + 0.01t \right)_1^2$
 $= (0.01 \times 4 + 0.02) - (0.01 \times 1 + 0) = 0.04$ Ans

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21. Light of energy E incident on bob of simple pendulum, Find its amplitude

Ans. $\sqrt{\frac{2Ea}{mg}}$

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$Ea = \frac{1}{2} m(mA)^2$

$\omega = \sqrt{\frac{g}{l}}$

$Ea = \frac{m}{2} A^2 \times \frac{g}{l}$

$A = \sqrt{\frac{2Ea}{mg}}$ Ans.

a = absorption power



22.

$d_2 = 2d_1$

$\eta_2 = 2\eta_1$

$\eta_1 = 4 \times 10^9$

$\eta_2 = x \times 10^9$ then find value of x .

$\frac{\eta_2}{\eta_1} = \left(\frac{d_1}{d_2} \right)^2 \times \frac{\eta_1}{\eta_2}$

$\eta_2 = 4 \times 10^9 \times \left(\frac{1}{2} \right)^2 \times \frac{1}{2}$

$\eta_2 = 0.5 \times 10^9$

$x = 0.5$

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AIR
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For 12th Passed Students



JEE (Adv.) 2024
ISHAM GUPTA

SCHOLARSHIP UPTO 100%

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- Total No. of Lectures: **630** (P:210 | D: 210 | M: 210)
- Duration of One Lecture: **1.5 Hrs.** (90 Minutes)
- Classroom Teaching Hours: **945 Hrs.**
- Testing Duration: **51 Hrs.**
- Total Academic Hours: **996 Hrs.**

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For 12th Passed Students

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- Course Duration: **39 Weeks**
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- Duration of One Lecture: **1.5 Hrs.** (90 Minutes)
- Classroom Teaching Hours: **865 Hrs.**
- Testing Duration: **36 Hrs.**
- Total Academic Hours: **901 Hrs.**

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SCHOLARSHIP UPTO 100%
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CLASS STARTS
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PAPER-1

Duration: 3 Hrs.

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Admission Open for 2025-26

Target: JEE (Advanced) | JEE (Main) | NEET (UG) | PCCP (Class V to X)

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TARGET: JEE (Adv.) 2024



**AIR
31**

JEE (Adv.) 2024

ISHAAN GUPTA

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on the basis of Class 10th & 12th &
JEE (Main) 2025 %ile/ AIR

VISHESH COURSE

For 12th Passed Students

Course Features:

- Course Duration: **42 Weeks**
- Total No. of Lectures: **630** (P: 210 | C: 210 | M: 210)
- Duration of One Lecture: **1.5 Hrs.** (90 Minutes)
- Classroom Teaching Hours.: **945 Hrs.**
- Testing Duration: **51 Hrs.**
- Total Academic Hours.: **996 Hrs.**

*Tentative



CLASS STARTS

7th April 2025

TARGET: JEE (Main) 2026

ABHYAAS COURSE

For 12th Passed Students

Course Features:

- Course Duration: **39 Weeks**
- Total No. of Lectures: **577** (P: 192 | C: 193 | M: 192)
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- Classroom Teaching Hours.: **865 Hrs.**
- Testing Duration: **36 Hrs.**
- Total Academic Hours.: **901 Hrs.**

*Tentative

**AIR
102**

JEE (Main) 2024

RITAM BANERJEE



SCHOLARSHIP UPTO 100%

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JEE (Main) 2025 %ile/ AIR



CLASS STARTS

7th April 2025



| JEE(Main) 2025 | DATE : 04-04-2025 (SHIFT-1) | PAPER-1 | MEMORY BASED | CHEMISTRY

PART : CHEMISTRY

1. For the complex $[\text{Cr}(\text{ox})_2\text{Cl}_2]^{-3}$ and $[\text{CrCl}_3(\text{py})_3]$ total number of stereo isomers is respectively:
(1) 3, 2 (2) 2, 3 (3) 2, 2 (4) 3, 3

Ans. (1)

Sol. In $[\text{Cr}(\text{ox})_2\text{Cl}_2]^{-3}$ out of cis and trans, cis isomers is optically active.
 $[\text{CrCl}_3(\text{py})_3]$ is of type $[\text{Ma}_3\text{b}_3]$ and will have fac and mer geometric isomers.

2. Amongst the following species in which number of unpaired electrons is same is :

(1) Cr^{+2} , Mn^{+2} (2) Ti^{+2} , Co^{+2} (3) V^{+2} , Co^{+2} (4) Cu^{+2} , Zn^{+2}

Ans. (3)

Sol. $\text{V}^{+2} [\text{Ar}]3d^3$, $n = 3$
 $27\text{Co}^{+2} [\text{Ar}]3d^7$, $n = 3$

3. Determine ratio of radius of 5th Bohr's orbit for He⁺ and Li²⁺

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

Ans. (2)

Sol. $r \propto \frac{n^2}{Z}$ or $r \propto \frac{1}{Z}$ (if n same)

$$\frac{r_{\text{He}}}{r_{\text{Li}^{2+}}} = \frac{3}{2}$$

4. Given rate law $r = k[A]^n[B]^m$. If conc. of B is halved and A is doubled then determine ratio of final rate to initial rate

- (1) 2^n (2) 2^m (3) 2^{n-m} (4) 2^{m-n}

Ans. (3)

Sol. $\frac{r'}{r} = \frac{k\left(\frac{2}{1}\right)^n\left(\frac{1}{2}\right)^m}{k\left(\frac{1}{1}\right)^n\left(\frac{1}{1}\right)^m} = 2^{n-m}$

5. Given following pairs for atomic radius

- (I) (B < Al) (II) (Al < Ga) (III) (Ga < In) (IV) (In < Tl)

Among these one pair is incorrect. In, incorrect pair in +3 oxidation state element's whose ionic radius is more is having atomic number :

- (1) 13 (2) 31 (3) 49 (4) 5

Ans. (2)

Sol. $r : {}_{13}\text{Al} > {}_{31}\text{Ga}$
where as ionic radius : $\text{Al}^{+3} < \text{Ga}^{+3}$

6. Among the following paramagnetic species are

O_2 , F_2 , N_2 , H_2 , S_2 (vapour)

- (1) N_2 , H_2 , S_2 (vapour)

- (2) O_2 , S_2 (vapour)

- (3) N_2 , O_2

- (4) H_2 , O_2 , S_2 (vapour)

Ans. (2)

Sol. Theory based

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| JEE(Main) 2025 | DATE : 04-04-2025 (SHIFT-1) | PAPER-1 | MEMORY BASED | CHEMISTRY

7. In one L, HCl solution of pH = 1, how many liter of water should be added so that pH becomes 2 ?

Ans. (9)

Sol. Dilution formula

$$10^{-1} \times 1 = 10^{-2} \times V_f$$

$$V_f = 10 \text{ L}$$

$$\Delta V = 9 \text{ L}$$

8. In lead storage battery during use what is change in oxidation number of lead at anode & cathode ?

	Anode	Cathode
(1)	$0 \rightarrow 2$	$4 \rightarrow 2$
(2)	$4 \rightarrow 2$	$0 \rightarrow 2$
(3)	$0 \rightarrow 2$	$2 \rightarrow 4$
(4)	$2 \rightarrow 0$	$4 \rightarrow 2$

Ans. (1)

Sol. In use $\text{Pb} + \text{PbO}_2 + \text{H}_2\text{SO}_4 \rightarrow \text{PbSO}_4 + \text{H}_2\text{O}$

9. $\text{MnO}_4^- \xrightarrow{\text{H}^+}$

Then change in oxidation number of Mn = x

$\text{Fe}^{+3} + \text{CH}_3\text{COO}^- \rightarrow$ deep red complex

In complex in configuration of Fe number of d electrons = y

Determine x + y

Ans. (10)

Sol. x = 5



Non redox reaction ${}_{26}\text{Fe}^{+3} : [\text{Ar}] 3d^5$

y = 5

10. At 300 K in isothermal expansion of 1 mol of an ideal gas volume increases from 10 dm³ to 20 dm³.

Determine ΔE, W and Q

Determine ΔE , W and Q

$$\{R = 8.3 \frac{J}{mole/K}\} \quad \{\log 2 = 0.30\}$$

	ΔE	W	Q
(1)	0	-1720.34 J	+1720.34 J
(2)	0	+1720.34 J	-1720.34 J
(3)	+1720.34 J	-1720.34 J	0
(4)	-1720.34 J	0	+1720.34 J

Ans. (1)

Sol. $W = -2.303 nRT \log \frac{V_2}{V_1}$

$$= -2.303 \times 1 \times 8.3 \times 300 \times \log 2$$

$$= -1720.34 J$$

$$\Delta E = 0 = Q + W \text{ for isothermal process of an IG}$$

11. Amongst the following in which complex CFSE = 0 and spin only magnetic moment is 5.91 BM

(1) $[FeF_6]^{4-}$ (2) $[Mn(SCN)_6]^{4-}$ (3) $[Fe(CN)_6]^{4-}$ (4) $[Co(NH_3)_6]^{3+}$

Ans. (2)

Sol. In Mn^{2+} (d^5) with wfl



$$CFSE = 3 \times (-0.4 \Delta_0) + 2 \times (0.6 \Delta_0) = 0$$

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| JEE(Main) 2025 | DATE : 04-04-2025 (SHIFT-1) | PAPER-1 | MEMORY BASED | CHEMISTRY

12. Select incorrect statement regarding H-atom:

- (1) Probability density is highest at nucleus
- (2) s-orbital is spherical in shape
- (3) At a_0 (Bohr's radius) energy of electron is maximum
- (4) 1s orbital has no radial node

Ans. (3)

Sol. Energy of electron is minimum at a_0

13. **Statement-I:** N forms with O compounds in +1 to +5 oxidation state due to $p\pi-p\pi$ bonding.

Statement-II: NCls cannot be formed due to unavailability of 2d subshell.

- (1) Statement I is correct but Statement II is incorrect.
- (2) Both Statement I & Statement II are correct.
- (3) Statement I is incorrect but Statement II is correct.
- (4) Both Statement I & Statement II are incorrect.

Ans. (2)

Sol. Theory based.



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JEE (MAIN) 2025

MEMORY BASED QUESTIONS & TEXT SOLUTION

SHIFT-1

DATE & DAY: 04th April 2025 & Friday

PAPER-1

Duration: 3 Hrs.

Time: 09:00 – 12:00 IST

SUBJECT: MATHEMATICS

Selections in JEE (Advanced)/
IIT-JEE Since 2002

52395

Selections in JEE (Main)/
AIEEE Since 2009

257576

Selections in NEET (UG)/
AIPMT/AIIMS Since 2012

22494

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**AIR
102**

JEE (Main) 2024
RITAM BANERJEE



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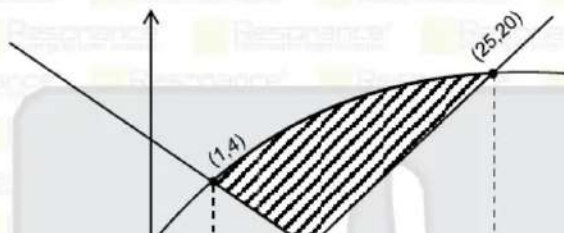


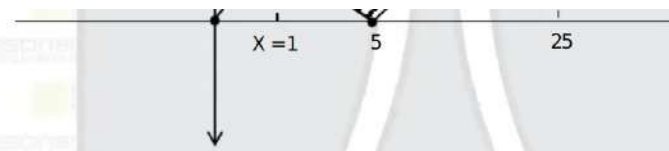
CLASS STARTS
7th April 2025

PART : MATHEMATICS

1. Area bounded by curves $|x - 5| < y \leq 4\sqrt{x}$ is A, then the value of 3A is equal to
(1) 368 (2) 81 (3) 225 (4) 96

Ans. (1)
Sol.





$$y = x - 5 \text{ \& } y = 4\sqrt{x}$$

$$4\sqrt{x} = x - 5$$

$$x - 4\sqrt{x} - 5 = 0$$

$$\sqrt{x} = 5, \sqrt{x} = -1$$

$$x = 25$$

$$\text{Solving } y = 5 - x \text{ \& } y = 4\sqrt{x}$$

$$x + 4\sqrt{x} - 5 = 0$$

$$\sqrt{x} = 1 \Rightarrow x = 1$$

Required area

$$= \int_1^{25} 4\sqrt{x} \, dx - \frac{1}{2} \times 4 \times 4 - \frac{1}{2} \times 20 \times 20$$

$$= \left(4 \cdot x^{3/2} \cdot \frac{2}{3} \right)_1^{25} - 8 - 200$$

$$= \frac{8}{3} (25 \times 5 - 1) - 208$$

$$= \frac{8}{3} \times 124 - 208$$

$$A = \frac{992 - 624}{3}$$

$$\text{Now } 3A = 368$$

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| JEE(Main) 2025 | DATE : 04-04-2025 (SHIFT-1) | PAPER-1 | MEMORY BASED | MATHEMATICS

2. In the expansion of $\left(2^{\frac{1}{3}} + 3^{\frac{1}{3}}\right)^n$, if $\frac{T_{15} \text{ from beginning}}{T_{15} \text{ from end}} = \frac{1}{6}$, then the value of nC_3 is equal to :

(1) 2200

(2) 2300

(3) 2400

(4) none of these

Ans. (2)

$$\text{Sol. } \therefore T_{15} \text{ from beginning} = {}^nC_{14} \left(2^{\frac{1}{3}}\right)^{n-14} \left(3^{\frac{1}{3}}\right)^{14}$$

$$T_{15} \text{ from end} = {}^nC_{14} \left(3^{\frac{1}{3}}\right)^{n-14} \left(2^{\frac{1}{3}}\right)^{14}$$

$$\frac{{}^nC_{14} 2^{\frac{n-14}{3}} \cdot 3^{\frac{14}{3}}}{{}^nC_{14} 2^{\frac{14}{3}} \cdot 3^{\frac{(n-14)}{3}}} = \frac{1}{6}$$

$$2^{\frac{n-28}{3}} \cdot 3^{\frac{n-28}{3}} = \frac{1}{6} = 6^{-1}$$

$$\frac{n-28}{3} = -1 \quad n = 25$$

$$\therefore {}^nC_3 = {}^{25}C_3 = \frac{25 \times 24 \times 23}{3 \times 2 \times 1} = 2300$$

3. The sum of 40 terms of $1^2 + 3 + 5^2 + 7 + 9^2 + \dots$ is equal to

(1) 39600

(2) 41880

(3) 43500

(4) 38500

Ans. (2)

$$\text{Sol. } \sum_{r=1}^{20} (4r-3)^2 + \sum_{r=1}^{20} (4r-1)$$

$$\begin{aligned}
 &= \sum_{r=1}^{20} (16r^2 - 24r + 9 + 4r - 1) \\
 &= \sum_{r=1}^{20} (16r^2 - 20r + 8) \\
 &= \frac{16 \times 20 \times 21 \times 41}{6} - \frac{20 \times 20 \times 21}{2} + 160 \\
 &= 16 \times 70 \times 41 - 10 \times 420 + 160 \\
 &= 41880
 \end{aligned}$$

4. If roots of $x^2 - 4x - n = 0$ are integral, $n \in \mathbb{N}$ and $n \in [20, 100]$ then number of values of 'n'

Ans. (6)

Sol. $D = \text{Perfect square}$

$$16 + 4n = \ell^2$$

$$n = \frac{\ell^2 - 16}{4}$$

ℓ	n
6	5
8	12
10	21

Values of n are 21, 32, 45, 60, 77, 86

So total values of $n = 6$

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| JEE(Main) 2025 | DATE : 04-04-2025 (SHIFT-1) | PAPER-1 | MEMORY BASED | MATHEMATICS

5. If the arithmetic mean of binomial coefficient in the expansion of $(x+y)^{2n-3}$ is equal to 16, then the length of perpendicular drawn from the point $(2n-1, n^2-4n)$ to the line $x+y=8$, is equal to

- (1) $3\sqrt{2}$ (2) $4\sqrt{2}$ (3) $5\sqrt{2}$ (4) $6\sqrt{2}$

Ans. (1)

Sol. $\therefore \frac{{}^{2n-3}C_0 + {}^{2n-3}C_1 + {}^{2n-3}C_2 + \dots + {}^{2n-3}C_{2n-3}}{2n-2} = 16$

$$2^{2n-3} = 16(2n-2) = 2^5(n-1)$$

$$\Rightarrow 2^{2n-8} = (n-1)$$

$$\Rightarrow n = 5$$

$$\therefore (2n-1, n^2-4n) = (9, 5)$$

$$\therefore \text{Required length} = \left| \frac{9+5-8}{\sqrt{1+1}} \right| = 3\sqrt{2}$$

6. Let $10 \sin^4 \theta + 15 \cos^4 \theta = 6$

Then value of

$$\frac{27 \operatorname{cosec}^6 \theta + 8 \sec^6 \theta}{16 \sec^8 \theta} \text{ is equal to}$$

- (1) $\frac{3}{5}$ (2) $\frac{2}{5}$ (3) $\frac{35}{16}$ (4) $\frac{19}{16}$

Ans. (2)

Sol. Let $\sin^2 \theta = t$

$$10t^2 + 15(1-t)^2 = 6$$

$$25t^2 - 30t + 9 = 0$$

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

$$\sin^2 \theta = \frac{3}{5}$$

$$\cos^2 \theta = \frac{2}{5}$$

Now

$$\frac{27 \operatorname{cosec}^6 \theta + 8 \sec^6 \theta}{16 \sec^8 \theta}$$

$$= 27 \left(\frac{125}{27} \right) + 8 \left(\frac{125}{8} \right)$$

$$= \frac{16 \times \frac{625}{16}}{\frac{125 + 125}{625}} = \frac{10}{25} \Rightarrow \frac{2}{5}$$

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Resonance® | JEE(Main) 2025 | DATE : 04-04-2025 (SHIFT-1) | PAPER-1 | MEMORY BASED | MATHEMATICS

7. The value of $\int_{-1}^1 \frac{(1+\sqrt{|x|-x})e^x + (\sqrt{|x|-x})e^{-x}}{e^x + e^{-x}} dx$ is equal to

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

Ans. (3)

Sol. Using $\int_{-a}^a f(x) dx = \int_0^a f(x) + f(-x) dx$, we obtain

Given integral

$$= \int_0^1 \frac{(1+\sqrt{|x|-x})e^x + (\sqrt{|x|-x})e^{-x} + (1+\sqrt{|x|+x})e^{-x} + (\sqrt{|x|+x})e^x}{e^x + e^{-x}} dx$$

$$= \int_0^1 \frac{e^x + e^{-x} + (\sqrt{|x|-x})(e^x + e^{-x}) + (\sqrt{|x|+x})(e^{-x} + e^x)}{e^x + e^{-x}} dx$$

$$= \int_0^1 (1 + \sqrt{|x|-x} + \sqrt{|x|+x}) dx = \int_0^1 (1 + \sqrt{2x}) dx$$

$$= 1 + \sqrt{2} \cdot \frac{x^{\frac{3}{2}}}{\left(\frac{3}{2}\right)} \Big|_0^1 = 1 + \frac{2\sqrt{2}}{3}$$

8. If two foci of an ellipse are (2, 5) and (2, -3) and its $e = 4/5$, then the length of latus rectum of this ellipse is equal to

- (1) $\frac{18}{5}$ (2) $\frac{9}{5}$ (3) $\frac{16}{5}$ (4) $\frac{12}{5}$

Ans. (1)

Sol. $\therefore 2ae = \sqrt{64} = 8$

$$\Rightarrow ae = 4 \Rightarrow a = 5 \text{ (as } e = 4/5)$$

$$\therefore ae = 4$$

$$a^2 - b^2 = 16 \Rightarrow b^2 = 9$$

$$\therefore \ell (\text{L. R}) = \frac{2b^2}{a} = \frac{18}{5}$$

9. Let $A = \{1, 6, 11, 16, \dots \text{ upto } 2025 \text{ terms}\}$ & $B = \{9, 16, 23, \dots \text{ upto } 2025 \text{ terms}\}$ then $n(A \cap B)$ is ____.

- (1) 3761 (2) 3650 (3) 3810 (4) 3619

Ans. (1)

Sol. Common first term = 16

and common difference of common term be 35

$$\text{Last term of set A is } = 1 + 2024 \times 5$$

$$= 10121$$

$$\text{Last term of set B } = 9 + 2024 \times 9$$

$$= 14168 + 9$$

$$= 14177$$

Now Let number of common term be n .

$$16 + (n-1) \times 35 \leq 10121$$

$$35n - 19 \leq 10121$$

$$35n \leq 10140$$

$$n \leq 289.7$$

So 289 terms are common

$$\text{Now } n(A \cap B) = 2025 + 2025 - 289 = 3761$$

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| JEE(Main) 2025 | DATE : 04-04-2025 (SHIFT-1) | PAPER-1 | MEMORY BASED | MATHEMATICS

10. There are 10 pens in which 3 are defective. 2 samples of pen are selected randomly. Let x be number of defective pen, then variance of probability distribution of number of defective pen is equal to

(1) $\frac{28}{75}$

(2) $\frac{37}{75}$

(3) $\frac{26}{75}$

(4) $\frac{23}{75}$

Ans. (1)

x	0	1	2
$P(x)$	$\frac{{}^7C_2}{{}^{10}C_2}$	$\frac{{}^7C_1 \times {}^3C_1}{{}^{10}C_2}$	$\frac{{}^3C_2}{{}^{10}C_2}$

$$\text{Variance} = \sum P_i(x_i)^2 - \left(\sum P_i x_i \right)^2$$

$$= \left(0 + \frac{21}{45} \times 1^2 + \frac{3}{45} \times 2^2 \right) - \left(0 + \frac{21}{45} \times 1 + \frac{3}{45} \times 2 \right)^2$$

$$= \frac{33}{45} - \left(\frac{27}{45} \right)^2$$

$$= \frac{11}{15} - \left(\frac{3}{5} \right)^2$$

$$= \frac{55 - 27}{75}$$

$$= \frac{28}{75}$$

11. A committee of 12 members is formed randomly out of 4 Engineers, 2 Doctors and 10 Professors. Find the probability that the committee has atleast 3 Engineers and atleast 1 Doctor.

(1) $\frac{103}{182}$

(2) $\frac{129}{182}$

(3) $\frac{107}{182}$

(4) $\frac{109}{182}$

Ans. (2)

Sol. Engineers = 4, Doctors = 2, Professors = 10

$$n(S) = {}^{16}C_{12} = {}^{16}C_4 = 14 \times 13 \times 10$$

$\therefore$	$n(A) =$	Eng.	Dr.	Pr.	
	3	1	8	$= {}^4C_3 \times {}^2C_1 \times {}^{10}C_8 = 4 \times 2 \times 45 = 360$	
	4	1	7	$= {}^4C_4 \times {}^2C_1 \times {}^{10}C_7 = 1 \times 2 \times 120 = 240$	
	3	2	7	$= {}^4C_3 \times {}^2C_2 \times {}^{10}C_7 = 4 \times 1 \times 120 = 480$	
	4	2	6	$= {}^4C_4 \times {}^2C_2 \times {}^{10}C_6 = 1 \times 1 \times 210 = 210$	

$$\therefore n(A) = 1290$$

$$\therefore P(\text{Reqd.}) = \frac{n(A)}{n(S)} = \frac{1290}{14 \times 13 \times 10} = \frac{129}{14 \times 13} = \frac{129}{182}$$

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12. If $\lim_{x \rightarrow 1^+} \frac{(1-x)(1+\lambda \cos(x-1))+\mu \sin(1-x)}{(1-x)^3} = -1$, then $\lambda + \mu$ is equal to

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

Ans. (1)

Sol. $\lim_{h \rightarrow 0} \frac{(-h)[1+\lambda \cosh] + \mu(\sin(-h))}{-h^3}$

$$= \lim_{h \rightarrow 0} \frac{-h \left[1 + \lambda \left(1 - \frac{h^2}{2!} + \dots \right) \right] + \mu \left(-h + \frac{h^3}{3!} \right)}{-h^3}$$

Now $\frac{-h(1+\lambda+\mu) + h^3 \left(\frac{\lambda}{2} + \frac{\mu}{6} \right)}{-h^3} = -1$

Now $\lambda + \mu = -1$ and $-\frac{\lambda}{2} - \frac{\mu}{6} = -1$

Now $\lambda + \mu = -1$

13. If $A = \begin{bmatrix} \cos \theta & 0 & -\sin \theta \\ 0 & 1 & 0 \\ \sin \theta & 0 & \cos \theta \end{bmatrix}$, such that $A^2 = A^T$, then find trace of $((A+I)^3 + (A-I)^3 - 6A)$

Ans. (6)

Sol. $A^2 = A^T \Rightarrow \begin{bmatrix} \cos \theta & 0 & -\sin \theta \\ 0 & 1 & 0 \\ \sin \theta & 0 & \cos \theta \end{bmatrix} \begin{bmatrix} \cos \theta & 0 & -\sin \theta \\ 0 & 1 & 0 \\ \sin \theta & 0 & \cos \theta \end{bmatrix} = \begin{bmatrix} \cos \theta & 0 & \sin \theta \\ 0 & 1 & 0 \\ -\sin \theta & 0 & \cos \theta \end{bmatrix}$

$\Rightarrow \begin{bmatrix} \cos 2\theta & 0 & -\sin 2\theta \\ 0 & 1 & 0 \\ \sin 2\theta & 0 & \cos 2\theta \end{bmatrix} = \begin{bmatrix} \cos \theta & 0 & \sin \theta \\ 0 & 1 & 0 \\ -\sin \theta & 0 & \cos \theta \end{bmatrix}$

$\Rightarrow \cos 2\theta = \cos \theta, \sin 2\theta = -\sin \theta \Rightarrow 2\cos^2 \theta - \cos \theta - 1 = 0, \sin \theta (2\cos \theta + 1) = 0$

$\Rightarrow (\cos \theta - 1)(2\cos \theta + 1) = 0, \sin \theta (2\cos \theta + 1) = 0$

$\Rightarrow \cos \theta = 1, \sin \theta = 0$ or $\cos \theta = -\frac{1}{2}$

$\Rightarrow \theta = 2n\pi$ or $\theta = 2m\pi \pm \frac{2\pi}{3}$

$A = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$ or $A = \begin{bmatrix} -\frac{1}{2} & 0 & -\frac{\sqrt{3}}{2} \\ 0 & 1 & 0 \\ \frac{\sqrt{3}}{2} & 0 & -\frac{1}{2} \end{bmatrix}$ or $A = \begin{bmatrix} -\frac{1}{2} & 0 & \frac{\sqrt{3}}{2} \\ 0 & 1 & 0 \\ \frac{\sqrt{3}}{2} & 0 & -\frac{1}{2} \end{bmatrix}$

$\Rightarrow A A^T = I \Rightarrow A(A^2) = A A^T \Rightarrow A^3 = I$
 $(A+I)^3 = A^3 + 3A^2 + 3A + I$
 $(A-I)^3 = A^3 - 3A^2 + 3A - I$
 $((A+I)^3 + (A-I)^3 - 6A) = 2A^3 = 2I \Rightarrow \text{Trace} = 6$

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