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# JEE (MAIN) 2025

## MEMORY BASED QUESTIONS & TEXT SOLUTION

**SHIFT-1**

**DATE & DAY:** 02nd April 2025 & Wednesday

**PAPER-1**

**Duration:** 3 Hrs.
**Time:** 09:00 – 12:00 IST

**SUBJECT: PHYSICS**


| Selections in JEE (Advanced)/ IIT-JEE Since 2002 | Selections in JEE (Main)/ AIEEE Since 2009 | Selections in NEET (UG)/ AIPMT/AIIMS Since 2012 |
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**Admission Open for 2025-26**

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

**100% Scholarship** on the basis of Class 10th & 12th & JEE (Main) 2025 %ile/ AIR

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## PART : PHYSICS

1. Which of the following statement (s) is correct is/are for the adiabatic process?
(A) Molar heat capacity is zero.

(B) Molar heat capacity is infinite
(C) Work done on gas is equal to increase in internal energy
(D) The increase in temperature results in decrease in internal energy

(1) AC (2) BC (3) CD (4) AD

**Ans.** **(1)**

**Sol.** $q + w = \Delta E$ Heat Capacity (C) $= \frac{Q}{n\Delta T}$

$w = \Delta E$ $Q = 0$

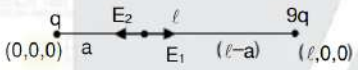
**2.** Two point charges q and 9q are placed at distance of $\ell$ from each other. Then the electric field is zero at

(1) Distance $\frac{\ell}{4}$ from charge 9q (2) Distance $\frac{3\ell}{4}$ from charge q

(3) Distance $\frac{\ell}{3}$ from charge 9 q (4) Distance $\frac{\ell}{4}$ from charge q

**Ans.** **(4)**

**Sol.**




$|E_1| = |E_2|$

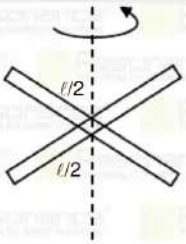
$\frac{kq}{a^2} = \frac{k_{9q}}{(\ell - a)^2}$, $\frac{1}{a} = \frac{3}{(\ell - a)}$

$\ell - a = 3a$

$a = \frac{\ell}{4}$

Distance $\frac{\ell}{4}$ from charge q.

**3.** The moment of Inertia of a uniform rod of mass m and length l is $\alpha$ when rotated about an axis passing through centre and perpendicular to the length. If the rod is broken into equal halves and arranged as shown then the moment of Inertia about the given axis is



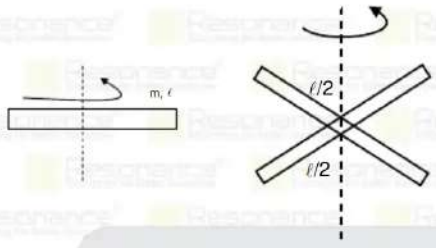

(1) 2 $\alpha$ (2) $\frac{\alpha}{2}$ (3) 4 $\alpha$ (4) $\frac{\alpha}{4}$

**Ans.** **(4)**





**Sol.**




$I = \frac{ml^2}{12}$, $\alpha = \frac{ml^2}{12}$

$I = I_1 + I_2$

$\left(\frac{m}{}\right)\left(\frac{l}{}\right)^2$ $\left(\frac{m}{}\right)\left(\frac{l}{}\right)^2$

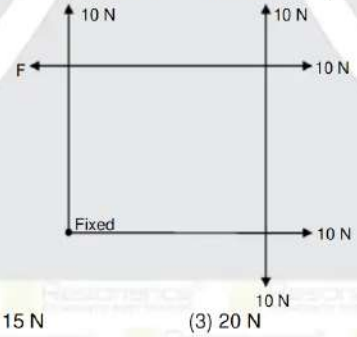
$$= \frac{(2)(2)}{12} + \frac{(2)(2)}{12}$$

$$= \frac{1}{8}\frac{ml^2}{12} + \frac{1}{8}\frac{ml^2}{12} = \frac{1}{4}\frac{ml^2}{12}$$

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

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

**4.** A square shape lamina of mass M kg is at rest . Find value of F (in N)




(1) 10 N (2) 15 N (3) 20 N (4) 30 N

**Ans.** **(1)**

**5.** Relation between magnetic susceptibility and magnetic permeability ?

(1) $\mu_r = 1 - x_m$ (2) $\mu_r = 1 + x_m$ (3) $\mu_0 = 1 + x_m$ (4) $\mu = 1 + x_m$

**Ans.** **(2)**

**Sol.** $\mu_r = 1 + x_m$

$$\frac{\mu}{\mu_0} = 1 + x_m$$

$$\mu = \mu_0 (1 + x_m)$$





**6.** The ratio of magnetic field to center of circular coil to magnetic field at distance x from the centre of circular coil $\left(\frac{x}{R} = \frac{3}{4}\right)$

(1) $\frac{64}{28}$ (2) $\frac{125}{64}$ (3) $\frac{135}{74}$ (4) $\frac{125}{32}$

**Ans.** **(2)**

**Sol.** Magnetic field at center of circular coil $\vec{\beta}_1 = \frac{\mu_0 I}{2R}$ .....(1)

magnetic field at distance x from the centre of circular coil is $\vec{\beta}_2 = \frac{\mu_0 I R^2}{2(R^2 + x^2)^{3/2}}$ .....(2)

Ratio

$$\frac{\vec{\beta}_1}{\vec{\beta}_2} = \frac{\frac{\mu_0 I}{2R}}{\frac{\mu_0 I R^2}{2(R^2 + x^2)^{3/2}}} = \frac{2(R^2 + x^2)^{3/2}}{2R^3}$$

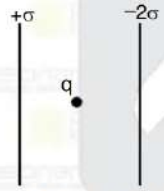
$$\Rightarrow \frac{R^3\left(1 + \frac{x^2}{R^2}\right)^{3/2}}{R^3}$$

$$= \left(1 + \frac{9}{16}\right)^{3/2}$$

$$\left(\frac{25}{16}\right)^{3/2} \Rightarrow \left(\frac{5}{4}\right)^3$$

$$\Rightarrow \frac{125}{64}$$

7.




Find net electric force on point charge q :

(1) $\frac{3}{2}\frac{\sigma q}{\epsilon_0}$ (2) $\frac{3\sigma q}{\epsilon_0}$ (3) $\frac{\sigma q}{2\epsilon_0}$ (4) $\frac{3\sigma q}{\epsilon_0}$

**Ans.** **(1)**

**Sol.** $F = qE$

$$-q\left\{\frac{\sigma}{2\epsilon_0}+\frac{2\sigma}{2\epsilon_0}\right\}$$

$$=\frac{q\sigma}{2\epsilon_0}\times 3$$





8. Match the column

| Column – I | Column - II |
|---|---|
| (A) Coefficient of viscosity | (i) $M^{-1}LT^2$ |
| (B) Pressure gradient | (ii) $ML^{-1}T^{-1}$ |
| (C) compressibility | (iii) $ML^{-2}T^{-2}$ |
| (D) Plank constant | (iv) $ML^2T^{-1}$ |

(1) (A)- (i), (B)-(iii), C-(ii), D-(iv) (2) (A)- (iii), (B)-(ii), C-(i), D-(iv)

(3) (A)- ii, (B)-(iii), C-(iv), D-(i) (4) (A)- ii, (B)-(iii), C-(i), D-(iv)

**Ans.** **(4)**

**Sol.** (A) $F = 6\pi\eta rv$

$$\eta = \frac{mLT^{-2}}{L\times LT^{-1}}$$

$$\eta = mL^{-1}T^{-1}$$

(B) $$PG = \frac{p}{x} = \frac{F}{A\times x}$$

$$= \frac{mLT^{-2}}{L^2\times L}$$

$$= M\,L^{-2}T^{-2}$$

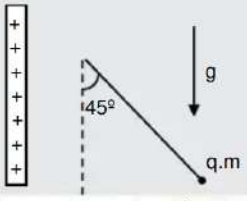
(C) $$Comp = \frac{1}{B}$$

$$= \frac{\Delta v}{\Delta p\times v} = \frac{A}{F}$$

$$= \frac{L^2}{MLT^{-2}}$$

$$= M^{-1}\,LT^2$$

9. The figure shown an infinite plane having uniform charge. density $\sigma$ and a small changed particle having charge q and mass m suspended by a light insulating thread. Find $\sigma$ if the charge is in equilibrium




(1) $2\epsilon_0 mg$ (2) $\epsilon_0 mg$ (3) $2q$ (4) $2q\epsilon_0$

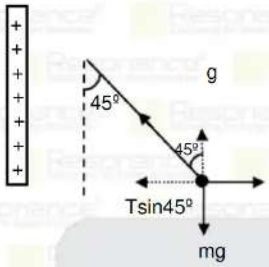
(1) $\frac{}{q}$ (2) $\frac{}{2q}$ (3) $\frac{}{\epsilon_0 mg}$ (4) $\frac{}{mg}$

**Ans.** **(1)**





**Sol.**




$T \sin 45° = E_q$ $T \cos 45° = mg$

$\frac{T}{\sqrt{2}} = E_q$ .....(i) $\frac{T}{\sqrt{2}} = mg$ .....(ii)

$E_q = mg$

$\frac{\sigma}{2\epsilon_0} = mg$

$\sigma = \frac{2\epsilon_0 mg}{q}$ ans.

**10.** Find the dimension of $ab^{-2}$ from the given formula $\left(P + \frac{a}{v^2}\right)(v - b) = RT$ where symbols have their usual meaning

(1) Energy (2) Energy density (3) Intensity (4) power

**Ans.** **(2)**

**Sol.** $\frac{a}{v^2} = p$

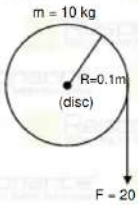
$\mathbf{a = pv^2}$

$\mathbf{b = v}$

$\frac{a}{b^2} = \frac{pv^2}{v^2} = P$

$P = \frac{[MLT^{-2}]}{[L^2]} = [ML^{-1}T^{-2}]$

**11.** Find angular velocity when 1 m rope is pulled.




(1) $\omega = 30\sqrt{2}$ rad/sec (2) $\omega = 20\sqrt{2}$ rad/sec (3) $\omega = 2\sqrt{2}$ rad/sec (4) $\omega = 2\sqrt{20}$ rad/sec

**Ans.** **(2)**

**Sol.** $C = I\alpha = F \times R$

$$\alpha = \frac{F}{\frac{1}{2}mk} = \frac{2F}{mk}$$

$I = \theta \times R$

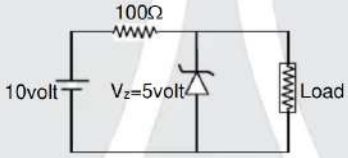
$w^2 = w^2 + 2\alpha\theta$

$$= 2 \times \frac{2F}{mk} \times \frac{1}{R}$$

$$\omega = \sqrt{\frac{4 \times 20}{10x} \times \frac{1}{0.1}}$$

$\omega = 20\sqrt{2}$

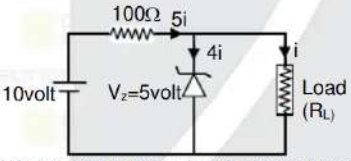
**12.** A zener diode of $V_z = 5$ volt is used as a voltage regulator. The unregulated supply voltage of the battery is 10 volt. The value of the series resistance is 100Ω. The current through the zener diode is 4 times the load current. The load resistance and the current through the load should be :




(1) 10 mA, 500 Ω (2) 5 mA, 200 Ω (3) 20 mA, 100 Ω (4) 15 mA, 300 Ω

**Ans.** **(1)**

**Sol.**




We have to assume that the zener breakdown is occurring. So the voltage across the zener diode as well as the load should be 5 volt. So the voltage across the series resistance will be

$$i_1 = \frac{10-5}{100} = 50mA$$

$5i = 50$ mA $\Rightarrow$ $I = 10$ mA

Resistance of the load should be $= \frac{\Delta v}{i} = \frac{5}{10 \times 10^{-3}} = 500\Omega$

**13.** Which statement is correct

(A) Energy of Ground state of H atom is equal to energy of $He^+$ atom in first excited state

(B) Energy of Ground state of H atom is equal to energy of $He^+$ atom is second excited state.

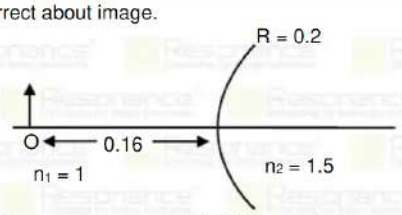
(C) Energy of H atom is equal to energy of $Li^{+3}$ atom in second excited state

(D) Energy of H atom is equal to energy of $Li^{+3}$ atom in their excited state

(1) AC (2) AD (3) BC (4) BD

**Ans.** **(1)**

**14.** Which of the following is correct about image.




(1) 0.4 cm left of current surface (2) 0.4 cm right of current surface
(3) 0.2 cm left of current surface (4) 0.2 cm right of current surface

**Ans.** **(1)**

**Sol.** $\frac{n_2}{v}-\frac{n_1}{u}=\frac{n_2-n_1}{R}$

$\frac{1.5}{v}-\frac{1}{-0.16}=\frac{1.5-1}{0.2}$

$\frac{1.5}{v}=\frac{0.5}{0.2}-\frac{1}{0.16}$

$=\frac{5}{2}-\frac{100}{16}$

$\frac{1.5}{v}=\frac{40}{16}-\frac{100}{16}=\frac{-60}{16}$

$v=-\frac{16\times1.5}{60}=-0.4$ cm

**15.** A cell phone has rating of 4.2 V, 5800 mA.hr. Find energy stored by cell phone battery within 1 hr.
(1) 65 kJ (2) 87 kJ (3) 123 kJ (4) 175 kJ

**Ans.** **(2)**

**Sol.** E = v i t

$=4.2\times\frac{5800}{1000}\times3600$

$=4.2\times58\times360$

$=42\times58\times36$

$=87696$

$=87$ kJ

**16.** $X_1=\sqrt{7}\sin(5t)$

$X_2=2\sqrt{7}\sin(5t+\pi/3)$

maximum acceleration for resultant SHM will be

(1) $2\sqrt{7}$ m/s$^2$ (2) $2\sqrt{10}$ m/s$^2$ (3) 175 m/s$^2$ (4) 125 m/s$^2$

**Ans.** **(3)**

**Sol.** $R=\sqrt{4(7)+7+2(\sqrt{7})(2\sqrt{2})\frac{1}{2}}$

$=\sqrt{35+14}$

$=\sqrt{49}$

$=7$

Resultant SHM will be

$x = 7\sin(5t+\phi)$

$\therefore$ Maximum acceleration = $a\omega^2 = 7\times25 = 175$ m/s$^2$





**17.** Angular separation between second maximum of left side of central maxima and third maxima of right side of central maxima is 30° when 628 nm light is used in YDSD then slit width in $\mu$m will be

**Ans.** **06.00**

**Sol.** $\frac{5\beta}{D}=\frac{\pi}{6}$

$\frac{5\lambda D}{Dd}=\frac{\pi}{6}$

$$d = 5\lambda \times \frac{6}{\pi}$$
$$= 5 \times 628 \times 10^{-9} \times 6$$
$$= 6000 \times 10^{-9}\ m$$
$$= 6 \times 10^{-6}\ m$$
$$= 6\ \mu m$$

**18.** A car travels a distance x with a constant speed of $v_1 = 5$ m/sec and then it travels further $\frac{3}{2}$ x distance with a constant speed of $v_2$ (in m/sec). If the average speed during the entire journey is $\frac{50}{7}$ m/sec. then write the value of $v_2$.

**Ans.** **10**

**Sol.**

$$\langle |V| \rangle = \frac{x + \frac{3}{2}x}{\frac{x}{v_1} + \frac{\frac{3}{2}x}{v_2}}$$

$$\frac{50}{7} = \frac{5\frac{x}{2}}{x\left(\frac{1}{5} + \frac{3}{2v_2}\right)} \Rightarrow v_2 = 10 \text{ m/sec}$$

**19.** A mono-atomic gas 'A' has only three translator degree of freedoms while a polyatomic gas has three translatory, three rotational and one vibrational mode. If the ratio if the adiabatic exponents $\frac{r_A}{r_B} = 1 + \frac{1}{n}$, then write the value of n in integers.

**Ans.** **3**

**Sol.** For the gas A, f = 3

$$\Rightarrow r_A = 1 + \frac{2}{f} = 1 + \frac{2}{3} = \frac{5}{3}$$

For the gas B, f = 3 + 3 + 2 = 8 (1 Vibrational mode = 2 vibrational degree of freedom)

$$r_B = 1 + \frac{2}{f} = 1 + \frac{2}{8} = \frac{5}{4}$$

$$\Rightarrow \frac{r_A}{r_B} = \frac{5/3}{5/4} = \frac{4}{3} = 1 + \frac{1}{n} \Rightarrow n = 3$$





**20.** The equation of wave front of a light wave is x + y + z = constant. The angle made by the direction of the light wave propagation with x-axis will be :

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

**Ans.** **(2)**

**Sol.** The equation of the wavefront is

x + y + z = constant

The directional ratios of its normal (i.e. the direction of wave propagation) will be (1, 1, 1) so the directional cosines of its normal = $\left(\frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}\right)$

unit vector of the direction of light propagation

$$\hat{A} = \frac{1}{\sqrt{3}}\hat{i} + \frac{1}{\sqrt{3}}\hat{j} + \frac{1}{\sqrt{3}}\hat{k}$$

for angle with x-axis

$$\cos\theta = \frac{\hat{A}.\hat{i}}{|\hat{A}||\hat{i}|} = \frac{\left(\frac{1}{\sqrt{3}}\right)(1)}{1} = \frac{1}{\sqrt{3}}$$

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

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- Duration of One Lecture: **1.5 Hrs.** (90 Minutes)
- Classroom Teaching Hours.: **945 Hrs.**
- Testing Duration: **51 Hrs.**
- Total Academic Hours.: **996 Hrs.**

*Tentative

**SCHOLARSHIP UPTO 100%**
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CLASS STARTS
**7th April 2025**

TARGET: JEE (Main) 2026

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For 12th Passed Students

Course Features*

- Course Duration: **39 Weeks**
- Total No. of Lectures: **577** (P: 192 | C: 193 | M: 192)
- Duration of One Lecture: **1.5 Hrs.** (90 Minutes)
- Classroom Teaching Hours.: **865 Hrs.**
- Testing Duration: **36 Hrs.**
- Total Academic Hours.: **901 Hrs.**

*Tentative

CLASS STARTS
7th April 2025

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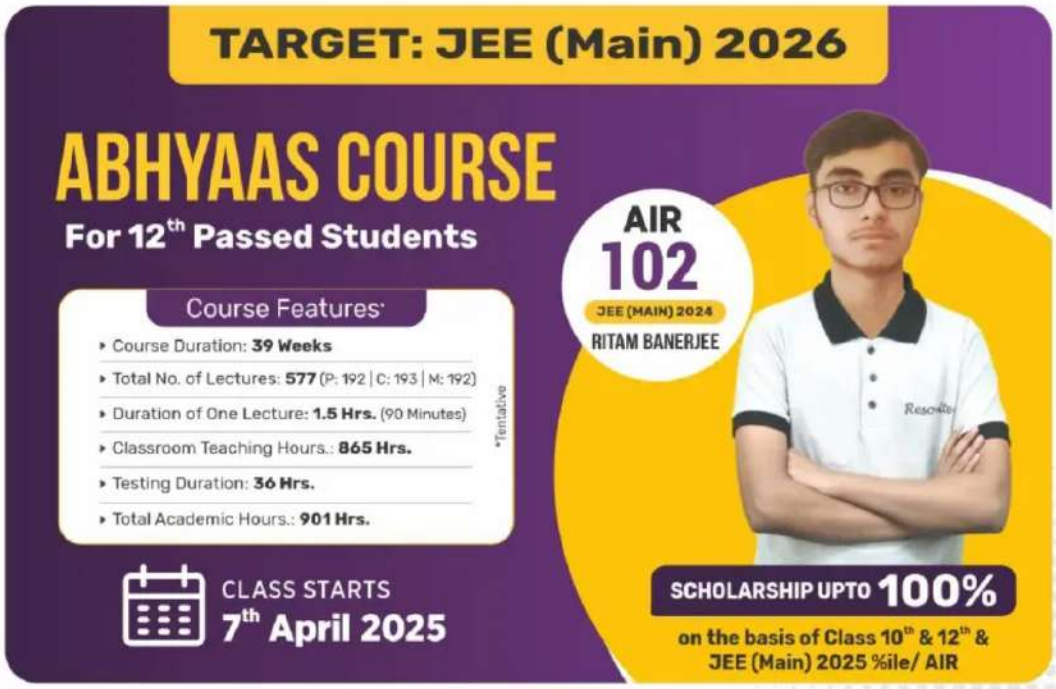






## PART : CHEMISTRY

**1.** Among Cr, Mn, Co & Fe which exists as $[M(CN)_6]^{3-}$. The metal with maximum $E^{\circ}(M^{3+}/M^{2+})$ has n electron in eg. orbitals. Find n.

**Ans.** **(0)**

**Sol.** $E^{0}_{M^{3+}/M^{2+}}$ is max. for Co

$[Co(CN)_6]^{3-} \Rightarrow Co^{4+} + 5FL \Rightarrow t_{2g}^{5}\ e_g^{0}$

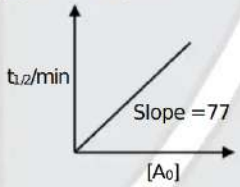
Number of $e^-$ in eg orbital = 0

**2.** Find shape of $Ax_4y$, x, y → 1st & 2nd most E.N. A react monoatomic element of p-block with lowest I.E..

**Sol.** A → Xe; X → F; Y → O

Shape – Square pyramidal.

**3.** After 10 min conc. of [A] $= \times 10^{-2}$
Initial conc. $= 2.5 \times 10^{-2}$ M




**Ans.** **(18)**

**Sol.** For Zero order reaction $\frac{1}{2k} = 77$ $\quad \therefore \ k = 0.0065$

$C_t = Co - kt$
$x \times 10^{-2} = 2.5 \times 10^{-1} - 0.0065 \times 10$
$\therefore \ x = 18.5$

**4.** **Statement-I :** Al has greater covalent radius than Ga.
**Statement-II :** Al has greater ionic radius than Ga.
(1) Both statement I and statement II are false
(2) Both Statement I and statement II are true
(3) Statement I is true but statement II is false
(4) Statement I is false but statement II is true

**Ans.** **(3)**

**Sol.** **Statement-I :** True
**Statement-II :** False





**5.** $P_S = 500$ $\quad n_A = 1$ mole
$P_A^\circ = 200$ $\quad n_B = 3$ mole
$P_B^\circ = ?$
Find which component will be less volatile?

**Sol.** $P_S = P_A^\circ X_A + P_B^\circ X_B$

$500 = 200 \times \frac{1}{4} + P_B^\circ \times \frac{3}{4}$

$2000 = 200 + 3P_B^\circ$
$P_B^\circ = 600$ mm mg.
So, A will be less volatile.

**6.** $CaCO_3 + 2HCl \longrightarrow CaCl_2 + CO_2 + H_2O$
mass of $CaCl_2 = ?$
100 g of $CaCo_3$ and 250 ml of 0.76 M of HCl are mixed.

**Sol.** $CaCO_3 + 2HCl \longrightarrow CaCl_2 + Co_2 + H_2O$
$n = 1$ $\quad 0.19$ (LR)
$n_f$ $\quad 0.095$
$\therefore \ m_{CaCl_2}$ produced $= 0.095 \times 111 = 10.545$ g

**7.** Which of these carbon atoms forms least and most stable free radical respectively

$HC \equiv C - CH_2 - CH_2 - CH_2 - CH_3$
1 $\quad$ 2 $\quad$ 3 $\quad$ 4

(1) 1, 2 $\quad$ (2) 2, 3 $\quad$ (3) 2, 1 $\quad$ (4) 1, 3

**8.** Which of the following gives fastest hydrolysis:

(1) $CH_3-\overset{\overset{O}{\|}}{C}-Cl$ (2) $CH_3-\overset{\overset{O}{\|}}{C}-NH_2$ (3) $CH_3-\overset{\overset{O}{\|}}{C}-O-CH_3$ (4) $CH_3-\overset{\overset{O}{\|}}{C}-O-\overset{\overset{O}{\|}}{C}-CH_3$

**9.** Identify optically in active amino acid.

Alanine

Valine

Glycine

Aspartic acid

**10.** Which is correct order of basic strength in aq. medium

(1) $CH_3NH_2$ (2) $(CH_3)_2NH$ (3) $(CH_3)_3N$ (4) $NH_2-NH_2$

**11.** Which is anti aromatic molecule

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





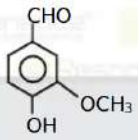
**12.** Correct statement is

(1) All naturally occurring amino acids are optically active

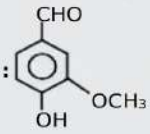
(2) All natural amino acids except glycine has 1 chiral centre

(3) All natural amino acids except proline have primary amine functional group

(4) All natural occurring amino acids are neutral amines acids.

**13.** **Statement-I :** 

reacts with conc. NaOH to give product that gives Tollens reaction positive.

**Statement-II :**  reacts with NaOH to give Aldol reaction.

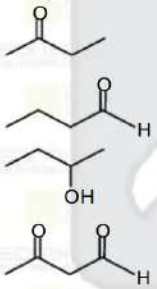
(1) Both Statement I and statement II are true (2) Both statement I and statement II are false

(3) Statement I is true but statement II is false (4) Statement I is false but statement II is true

**14.** But-2-en + $Br_2 \xrightarrow{CCl_4}$ (A)

(A) $\xrightarrow[\text{excess}]{NaNH_2}$ (B) $\xrightarrow{HgSO_4,H_2SO_4}$ (C)

Identify (C).



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# JEE (MAIN) 2025

## MEMORY BASED QUESTIONS & TEXT SOLUTION

**SHIFT-1**

**DATE & DAY:** 02nd April 2025 & Wednesday

**PAPER-1**

**Duration:** 3 Hrs.
**Time:** 09:00 – 12:00 IST

**SUBJECT: MATHEMATICS**


| Selections in JEE (Advanced)/ IIT-JEE Since 2002 | Selections in JEE (Main)/ AIEEE Since 2009 | Selections in NEET (UG)/ AIPMT/AIIMS Since 2012 |
|---|---|---|
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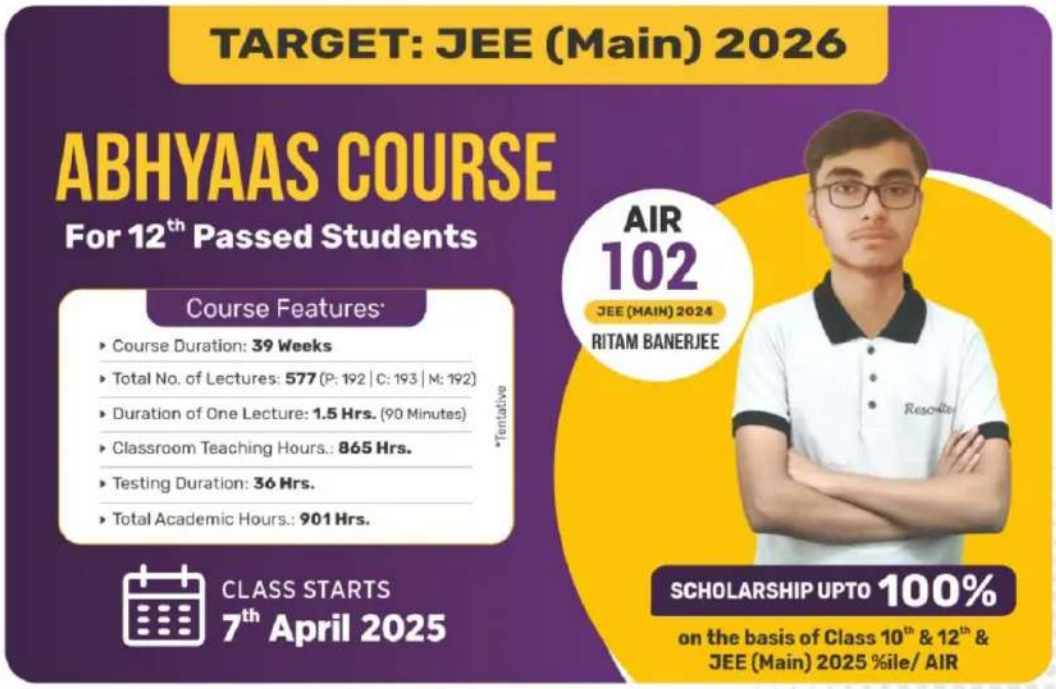






## PART : MATHEMATICS

**1.** Let $\alpha, \beta$ are roots of quadratic equation and $P_n = \alpha^n + \beta^n$, $P_{10} = 123$, $P_9 = 76$, $P_8 = 47$ and $P_1 = 1$ the quadratic equation whose roots are $\frac{1}{\alpha}$ and $\frac{1}{\beta}$.

(1) $x^2 + x - 1 = 0$ (2) $x^2 - x + 1 = 0$
(3) $x^2 + x + 1 = 0$ (4) $x^2 - x - 1 = 0$

**Ans.** **(1)**

**Sol.** $P(x) = ax^2 + bx + c$, $P_1 = 1 \Rightarrow \alpha + \beta = 1 \Rightarrow -\frac{b}{a} = 1 \Rightarrow a = -b$

$aP_{10} + bP_9 + cP_8 = 0$
$123a + 76b + 47c = 0$
$47a + 47c = 0$
$a = -c = -b$
So, equation $x^2 - x - 1 = 0$.

$\alpha+\beta=1, \alpha\beta=-1$

Sum $=\frac{1}{-1}$ and Prod $=\frac{1}{-1}$

$x^2-(-1)x+(-1)=x^2+x-1=0.$

**2.** The total number of 10 digits numbers formed by only {0, 1, 2} where 1 should be used atleast 5 times and 2 should be used exactly three times, is

**Ans.** **(2892)**

**Sol.**

| 0 digit | 1 digit | 2 digit |
|---|---|---|
| 2 | 5 | 3 |
| 1 | 6 | 3 |
| 0 | 7 | 3 |

numbers when 0 is used two times

$=\frac{9!}{4!\,3!\,2!}+\frac{9!}{2!\,5!\,2!}$

when 0 is used 1 time.

$\frac{10!}{1!\,6!\,3!}-\frac{9!}{6!\,3!}$

$=\frac{10!}{7!\,3!}$

Total $=2892$





**3.** If $a_1, a_2, a_3, \ldots\ldots$ is an A.P. and $\sum_{k=1}^{12} a_{2k-1} = -\frac{72}{5}\, a_1$ and $\sum_{k=1}^{n} a_k = 0$ then value of n is

(1) 8 (2) 9 (3) 10 (4) 11

**Ans.** **(4)**

**Sol.** $\sum_{k=1}^{12} a_{2k-1} = -\frac{72}{5}\, a_1$

$\frac{12}{2}[2a_1+11(2d)] = -\frac{72}{5}a_1$

$12a_1+132d = -\frac{72}{5}a_1$

$60a_1+660d = -72a_1$

$132a_1+660d=0$

$2a_1+10d=0$

$a_1+5d=0$

$\sum_{k=1}^{n} a_k = 0$

$\frac{n}{2}[2a_1+(n-1)d]=0$

$2a_1+(n-1)d=0$

$-10d+(n-1)d=0$

$-10+n-1=0$

$n=11$

**4.** If $\lfloor\underline{50}$ is exactly divisible by $3^n$ then find maximum value of n.

(1) 20 (2) 22 (3) 18 (4)16

**Ans.** **(2)**

**Ans.** **(2)**

**Sol.** $E(3)=\left[\frac{50}{3}\right]+\left[\frac{50}{3^2}\right]+\left[\frac{50}{3^3}\right]=16+5+1=22$

$\therefore$ Exponent of 3 in $\lfloor 50 \rfloor$ 22.

$\therefore \lfloor 50 \rfloor = 3^{22}.\lambda \qquad \therefore \qquad n=22.$

**5.** Let $f(x)=2x^3-9ax^2+12a^2x+1$, f(x) has maxima at $x=p$ and minima at $x=q$ such that $p^2=q$ then find f(3).

(1) 37 (2) 38 (3) 40 (4) 45

**Ans.** **(1)**

**Sol.** $f(x)=2x^3-9ax^2+12a^2x+1$

$f'(x)=6x^2-18ax+12a^2$

$f'(x)=6(x^2-3ax+2a^2)=6(x-a)(x-2a)$


$\therefore \quad x=p=a$ and $x=q=2a$

Given $p^2=q$

$\therefore \quad a^2=2a$

$\Rightarrow \quad a=0$ or $2$

$\Rightarrow \quad a=2 \quad (a\neq 0)$

$\therefore \quad f(3)=37$



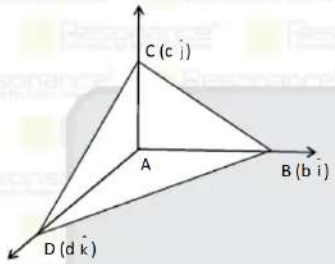


**6.** Let ABCD is a tetrahedron in which $\angle BAC$, $\angle CAD$, $\angle BAD$ is at right angle and area of faces. ABC, BAD & CAD are 5, 7 and 6 respectively then area of face BCD is –

(1) $\sqrt{55}$ (2) $\sqrt{220}$ (3) $\sqrt{110}$ (4) $\sqrt{340}$

**Ans.** **(3)**

**Sol.** Let Consider A at origin and B, C, D at x, y & z axes




now

$\text{ar } \Delta ABC=\left|\frac{1}{2}bc\right|=5$

$\text{ar } \Delta ABD=\left|\frac{1}{2}bd\right|=7$

$\Delta ACD=\left|\frac{1}{2}cd\right|=6$

Now area of $\Delta BCD$

$=\frac{1}{2}\left|\overrightarrow{BC}\times\overrightarrow{BD}\right|=$

$\overrightarrow{BC}\times\overrightarrow{BD}=(c\hat{j}-b\hat{i})\times(d\hat{k}-b\hat{i})$

$=\begin{vmatrix} i & j & k \\ -b & c & 0 \\ -b & 0 & d \end{vmatrix}$

$=i(cd)-j(-bd)+k(bc)$

$\text{are BCD}=\frac{1}{2}\sqrt{(cd)^2+(bd)^2+(bc)^2}$

$=\frac{1}{2}\sqrt{100+196+144}$

$= \frac{1}{2}\sqrt{440}$

$= \sqrt{110}$





**7.** Three distinct numbers are selected from set {1, 2, 3, ....., 40}, then find probability that they form an increasing G.P.

(1) $\frac{1}{520}$ (2) $\frac{3}{520}$ (3) $\frac{7}{520}$ (4) $\frac{11}{520}$

**Ans.** **(1)**

**Sol.** Given set is {1, 2, 3, .... , 40}

$h(s) = {}^{40}C_3$

a, b, c is G.P. $\therefore b^2 = ac$

a =1 then c =4, 9, 16 , 25, 36

a =2 then c =8, 18, 32

a =3 then c =12, 27

a =4 then c =9, 16, 25, 36

a =5 then c =20

a =6 then c =24

a =7 then c =28

a =8 then c =32

a =9 then c =36

Total cases =19 =h (A)

$\therefore P(A) = \frac{h(A)}{h(s)}$

$= \frac{19}{{}^{40}C_3} = \frac{19\times 3.2.1}{40.39.38}$

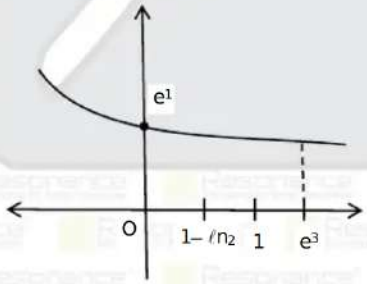
$= \frac{1}{520}$

**8.** $\int_0^{e^3}\left[\frac{1}{e^{x-1}}\right]dx = \alpha - \ell n2$ then $\alpha$ is equal to (where [x] denotes greatest integer less the or equal to x).

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

**Ans.** **(1)**

**Sol.**




$\int_0^{1-\ell n_2} 2dx + \int_{1-\ell n_2}^{1} 1dx + \int_1^{e^3} 0dx$

$= (2x)_0^{1-\ell n_2} + (x)_{1-\ell n_2}^{1} + 0$

$= 2 - 2\ell n2 + 1 - (1 - \ell n2)$

$= 2 - \ell n2 = \alpha - \ell n2$

So, $\alpha = 2$

**9.** The term independent of x in the expansion of $\left(\frac{x+1}{x^{\frac{2}{3}}+1-x^{\frac{1}{3}}}-\frac{x-1}{x-\sqrt{x}}\right)^{10}$ is

(1) 252 (2) 60 (3) 210 (4) 45

**Ans.** **(3)**

**Sol.** $\left(\left(x^{\frac{1}{3}}+1\right)-\left(\frac{\sqrt{x}+1}{\sqrt{x}}\right)\right)^{10}$

$\left(x^{\frac{1}{3}}-\frac{1}{x^{\frac{1}{2}}}\right)^{10}$

$T_{r+1}={}^{10}C_r\, x^{\frac{r}{3}}\left(-\frac{1}{x^{\frac{1}{2}}}\right)^{10-r}$

$\frac{r}{3}-\left(\frac{10-r}{2}\right)=0$

$2r-30+3r=0$

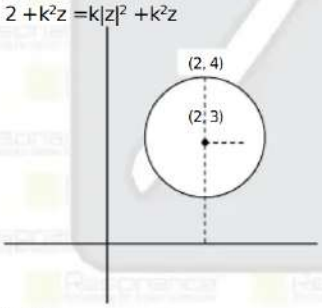
$r=6$

${}^{10}C_6={}^{10}C_4=210$

**10.** If $|z|=1$ and $\frac{2+k^2z}{\bar{z}+k}=kz$ where $k\in R$ then the maximum value of $k+k^2i$ from $|z-(2+3i)|=1$ is

**Ans.** **(2)**

**Sol.** $2+k^2z=k|z|^2+k^2z$




$k=2$

$2+4i=2$

**11.** Area bounded by region $\{(x, y) : |4-x^2| \le y \le x^2 | x \ge 0 | y \le 4\}$ is

(1) $\frac{1}{3}\left[40\sqrt{2}-48\right]$ (2) $\frac{1}{3}\left[40\sqrt{2}+48\right]$

(3) $\frac{1}{2}\left[40\sqrt{2}-48\right]$ (4) $\frac{1}{2}\left[40\sqrt{2}+48\right]$

**Ans.** **(1)**

**Sol.** Solving $4-x^2=x^2$

$x=\pm\sqrt{2}$

Required region is as $x \ge 0$

$$=\int_{\sqrt{2}}^{2} x^2-(4-x^2)dx+\int_{2}^{2\sqrt{2}} 4-(x^2-4)dx$$

$$=\int_{\sqrt{2}}^{2}(2x^2-4)dx+\int_{2}^{2\sqrt{2}}(8-x^2)dx$$

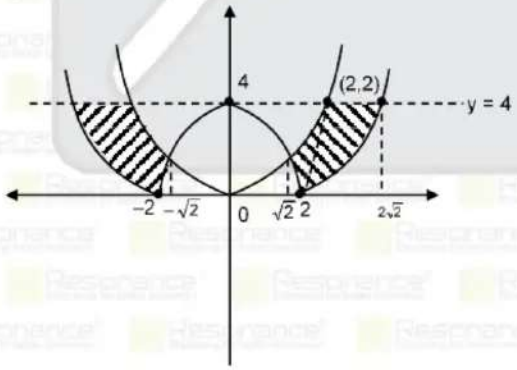
$$=\left[\left(2\frac{x^3}{3}-4x\right)_{\sqrt{2}}^{2}\right]+\left[8x-\frac{x^3}{3}\right]_{2}^{2\sqrt{2}}$$

$$=\left[\left(\frac{16}{3}-8\right)-\left(\frac{4\sqrt{2}}{3}-4\sqrt{2}\right)\right]+\left[\left(16\sqrt{2}-\frac{16\sqrt{2}}{3}\right)-\left(16-\frac{8}{3}\right)\right]$$

$$=\left[\frac{-8}{3}+\frac{8}{3}\sqrt{2}\right]+\left[\frac{32\sqrt{2}}{3}-\sqrt{2}\right]$$

$$=\frac{1}{3}\left[8\sqrt{2}-8+32\sqrt{2}-40\right]$$

$$=\frac{1}{3}\left[40\sqrt{2}-48\right]$$



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**12.** If $\lim\limits_{x\to 0}\frac{x^2\sin(\alpha x)-(\gamma-1)e^{x^2}}{\sin(2x)-\beta x}=3$ then the value of $\beta+\gamma-\alpha$ is

(1) $-1$ (2) 7 (3) 4 (4) 3

**Ans.** **(2)**

$x^2\left(\alpha x-\frac{\alpha^3x^3}{3!}+\ldots\right)-(\gamma-1)\left[1+x^2+\frac{x^4}{2!}+\ldots\right]$

**Sol.** $\lim\limits_{x\to 0} \dfrac{x\left(\alpha x - \dfrac{31}{\quad}+\ldots\right) - (\gamma-1)\left[1+x+\dfrac{21}{\quad}+\ldots\right]}{2x-\dfrac{(2x)^3}{31}+\ldots-\beta x}$

$$\lim_{x\to 0} \frac{-(\gamma-1)-(\gamma-1)x^2+\alpha x^3+\frac{(\gamma-1)}{21}x^4+\ldots.}{(2-\beta)x-\frac{8}{6}-x^3+\ldots.} = 3$$

$\gamma = 1, \beta = 2, \dfrac{\alpha}{-4/3} = 3, \alpha = -4$

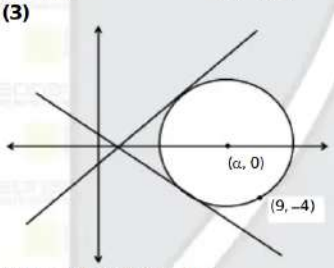
$\beta + \gamma - \alpha = 2 + 1 - (-4) = 7$

**13.** Two circles touches line $x + y = 3$ & $x - y = 3$ also passes through $(9, -4)$ then absolute difference of radius of two circles is

(1) $\sqrt{90}$ (2) $\sqrt{72}$ (3) $\sqrt{80}$ (4) $\sqrt{120}$

**Ans.** **(3)**

**Sol.**




Both circle touches lines
$x + y = 3$ and $x - y = 3$
so centre lies on x-axis. Let centre $(\alpha, 0)$ let radius r
$(x-\alpha)^2 + y^2 = r^2$
it passes through $(9, -4)$
$(9-\alpha)^2 + 16 = r^2$ ____(1)
also it touches $x + y = 3$

so $\left|\dfrac{\alpha + 0 - 3}{\sqrt{2}}\right| = r$

$\alpha - 3 = \pm\sqrt{2}\, r$

$\alpha = \pm\sqrt{2}\, r + 3$

put in (1)

$(9 - (\pm\sqrt{2}\, r + 3))^2 = r^2 - 16$

$(36 + 2r^2 \pm 12\sqrt{2}\, r) = r^2 - 16$

$r^2 \pm 12\sqrt{2}\, r + 52 = 0$

Let radius $r_1$ & $r_2$

$(r_1 - r_2) = \sqrt{\left(12\sqrt{2}\right)^2 - 4\times 52} = \sqrt{288 - 208} = \sqrt{80}$





**14.** Let P is any point on ellipse $\dfrac{x^2}{18} + \dfrac{y^2}{9} = 1$ if $S_1$ and $S_2$ are focii of ellipse then product of maximum and minimum value of product of length $PS_1$ & $PS_2$ is –

**Ans.** **(162)**

**Sol.** Let P $(3\sqrt{2}\cos\theta, 3\sin\theta)$

$PS_1$ & $PS_2 = (a - ex_1)(a - ex_2)$

$= a2 - e^2x_1^2$

$= 18 - \dfrac{1}{2} \times (18\cos^2\theta)$

$= 18 - 9\cos^2\theta$

So maximum & minimum values are 18 & 9

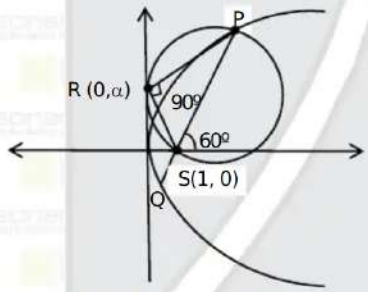
$= 18 \times 9 = 162$

**15.** Focal Chord PQ of the parabola $y^2 = 4x$ makes an angle 60º with positive x-axis where P in I$^{st}$ quadrant. A circle is drawn with SP as diameter touches the tangent at the vectex of the parabola at $(0, \alpha)$ the $\alpha^2$ is (where S is focus of parabola)

(1) 1 (2) 2 (3*) 3 (4) 4

**Ans. (3)**

**Sol.**




Let $P(t^2, 2t)$

$$m_{SP} = \frac{2t-0}{t^2-1} = \tan 60^\circ$$

$$\Rightarrow \sqrt{3}t^2 - 2t - \sqrt{3} = 0$$

$$\Rightarrow (\sqrt{3}t+1)(t-\sqrt{3}) = 0$$

$$\Rightarrow t = \sqrt{3}$$

$\therefore$ Point P is $(3, 2\sqrt{3})$

$\therefore$ tangent at P is

$2\sqrt{3}\,y = 2(x+3)$

at R $x = 0$

$\therefore \alpha = \sqrt{3}$

$\therefore \alpha^2 = 3$

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