

JEE MAIN 2025 (ONLINE) 4TH APRIL MORNING SHIFT — QUESTION PAPER

Max. Marks: 300
Questions: 75

Section A (MCQ) — 60 questions

- Q.1** Consider the sound wave travelling in ideal gases of He, CH₄, and CO₂. All the gases have the same ratio $\frac{P}{\rho}$, where P is the pressure and ρ is the density. The ratio of the speed of sound through the gases V_{He} : V_{CH₄} : V_{CO₂} is given by

[JEE Main 2025 (Online) 4th April Morning Shift]

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

Scan or tap for the full solution



- Q.2** In an electromagnetic system, the quantity representing the ratio of electric flux and magnetic flux has dimension of M^PL^QT^RA^S, where value of 'Q' and 'R' are

[JEE Main 2025 (Online) 4th April Morning Shift]

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

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- Q.3** Two simple pendulums having lengths l_1 and l_2 with negligible string mass undergo angular displacements θ_1 and θ_2 , from their mean positions, respectively. If the angular accelerations of both pendulums are same, then which expression is correct? [JEE Main 2025 (Online) 4th April Morning Shift]

- (1) $\theta_1 l_2 = \theta_2 l_1$ (2) $\theta_1 l_1 = \theta_2 l_2$
 (3) $\theta_1 l_2^2 = \theta_2 l_1^2$ (4) $\theta_1 l_1^2 = \theta_2 l_2^2$

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- Q.4** In a Young's double slit experiment, the slits are separated by 0.2 mm. If the slits separation is increased to 0.4 mm, the percentage change of the fringe width is :

[JEE Main 2025 (Online) 4th April Morning Shift]

- (1) 25% (2) 50% (3) 0% (4) 100%

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- Q.5** Current passing through a wire as function of time is given as $I(t) = 0.02t + 0.01$ A. The charge that will flow through the wire from $t = 1$ s to $t = 2$ s is

[JEE Main 2025 (Online) 4th April Morning Shift]

- (1) 0.02 C (2) 0.07 C (3) 0.06 C (4) 0.04 C

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- Q.6** An alternating current is represented by the equation, $i = 100\sqrt{2}\sin(100\pi t)$ ampere. The RMS value of current and the frequency of the given alternating current are

[JEE Main 2025 (Online) 4th April Morning Shift]

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

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- Q.7** Two liquids A and B have θ_A and θ_B as contact angles in a capillary tube. If $K = \cos \theta_A / \cos \theta_B$, then identify the correct statement:

[JEE Main 2025 (Online) 4th April Morning Shift]

- (1) K is negative, then liquid A and liquid B have convex meniscus.
 (2) K is negative, then liquid A and liquid B have concave meniscus.
 (3) K is zero, then liquid A has convex meniscus and liquid B has concave meniscus.
 (4) K is negative, then liquid A has concave meniscus and liquid B has convex meniscus.

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- Q.8** Which of the following are correct expressions for torque acting on a body?

($\vec{r}$ = position vector; $\vec{p}$ = linear momentum; $\vec{L}$ = angular momentum; $\vec{\alpha}$ = angular acceleration; I = moment of inertia; $\vec{F}$ = force; t = time)

- A. $\vec{\tau} = \vec{r} \times \vec{L}$ B. $\vec{\tau} = \frac{d}{dt}(\vec{r} \times \vec{p})$
 C. $\vec{\tau} = \vec{r} \times \frac{d\vec{p}}{dt}$ D. $\vec{\tau} = I\vec{\alpha}$
 E. $\vec{\tau} = \vec{r} \times \vec{F}$

Choose the correct answer from the options given below: [JEE Main 2025 (Online) 4th April Morning Shift]

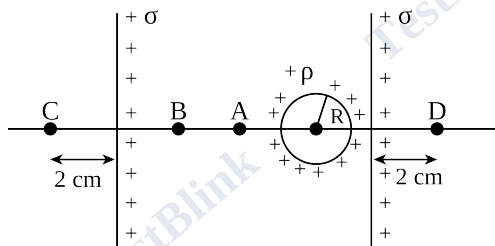
- (1) A, B, D and E Only (2) C and D Only
(3) B, C, D and E Only (4) B, D and E Only

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- Q.9** Two infinite identical charged sheets and a charged spherical body of charge density 'ρ' are arranged as shown in figure. Then the correct relation between the electrical fields at A, B, C and D points is:

[JEE Main 2025 (Online) 4th April Morning Shift]



- (1) $|\vec{E}_A| = |\vec{E}_B|$; $\vec{E}_C > \vec{E}_D$
(2) $\vec{E}_A = \vec{E}_B$; $\vec{E}_C = \vec{E}_D$
(3) $\vec{E}_C \neq \vec{E}_D$; $\vec{E}_A > \vec{E}_B$
(4) $\vec{E}_A > \vec{E}_B$; $\vec{E}_C = \vec{E}_D$

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- Q.10** Considering the Bohr model of hydrogen-like atoms, the ratio of the radius of 5th orbit of the electron in Li^{2+} and He^+ is

[JEE Main 2025 (Online) 4th April Morning Shift]

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

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- Q.11** When an object is placed 40 cm away from a spherical mirror an image of magnification $\frac{1}{2}$ is produced. To obtain an image with magnification of $\frac{1}{3}$, the object is to be moved :

[JEE Main 2025 (Online) 4th April Morning Shift]

- (1) 20 cm away from the mirror.
(2) 20 cm towards the mirror.
(3) 80 cm away from the mirror.
(4) 40 cm away from the mirror.

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- Q.12** In an experiment with a closed organ pipe, it is filled with water by $\left(\frac{1}{5}\right)$ th of its volume. The frequency of the fundamental note will change by

[JEE Main 2025 (Online) 4th April Morning Shift]

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

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- Q.13** A body of mass m is suspended by two strings making angles θ_1 and θ_2 with the horizontal ceiling with tensions T_1 and T_2 simultaneously. T_1 and T_2 are related by $T_1 = \sqrt{3}T_2$, the angles θ_1 and θ_2 are

[JEE Main 2025 (Online) 4th April Morning Shift]

- (1) $\theta_1 = 30^\circ$, $\theta_2 = 60^\circ$ with $T_2 = \frac{3mg}{4}$
(2) $\theta_1 = 45^\circ$, $\theta_2 = 45^\circ$ with $T_2 = \frac{3mg}{4}$
(3) $\theta_1 = 30^\circ$, $\theta_2 = 60^\circ$ with $T_2 = \frac{4mg}{5}$
(4) $\theta_1 = 60^\circ$, $\theta_2 = 30^\circ$ with $T_2 = \frac{mg}{2}$

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- Q.14** A small mirror of mass m is suspended by a massless thread of length l. Then the small angle through which the thread will be deflected when a short pulse of laser of energy E falls normal on the mirror (c = speed of light in vacuum and g = acceleration due to gravity)

[JEE Main 2025 (Online) 4th April Morning Shift]

- (1) $\theta = \frac{E}{mc\sqrt{gl}}$ (2) $\theta = \frac{E}{2mc\sqrt{gl}}$
(3) $\theta = \frac{3E}{4mc\sqrt{gl}}$ (4) $\theta = \frac{2E}{mc\sqrt{gl}}$

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- Q.15** Given below are two statements : one is labelled as **Assertion A** and the other is labelled as **Reason R**
Assertion (A): The kinetic energy needed to project a body of mass m from earth surface to infinity is $\frac{1}{2}mgR$, where R is the radius of earth.

Reason (R): The maximum potential energy of a body is zero when it is projected to infinity from earth surface.

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

[JEE Main 2025 (Online) 4th April Morning Shift]

- (1) A is false but R is true
 (2) Both A and R are true and R is the correct explanation of A
 (3) A is true but R is false
 (4) Both A and R are true but R is NOT the correct explanation of A

Scan or tap for the full solution



Q.16 The Boolean expression $Y = \overline{A}BC + \overline{A}\overline{C}$ can be realised with which of the following gate configurations.

- A. One 3-input AND gate, 3 NOT gates and one 2-input OR gate, one 2-input AND gate
 B. One 3-input AND gate, 1 NOT gate, one 2-input NOR gate and one 2-input OR gate
 C. 3-input OR gate, 3 NOT gates and one 2-input AND gate

Choose the correct answer from the options given below: [JEE Main 2025 (Online) 4th April Morning Shift]

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

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Q.17 The mean free path and the average speed of oxygen molecules at 300 K and 1 atm are 3×10^{-7} m and 600 m/s, respectively. Find the frequency of its collisions.

[JEE Main 2025 (Online) 4th April Morning Shift]

- (1) $5 \times 10^8/\text{s}$ (2) $9 \times 10^5/\text{s}$
 (3) $2 \times 10^{10}/\text{s}$ (4) $2 \times 10^9/\text{s}$

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Q.18 If $\vec{L}$ and $\vec{P}$ represent the angular momentum and linear momentum respectively of a particle of mass 'm' having position vector as $\vec{r} = a(\hat{i}\cos\omega t + \hat{j}\sin\omega t)$. The direction of force is

[JEE Main 2025 (Online) 4th April Morning Shift]

- (1) Opposite to the direction of $\vec{L}$
 (2) Opposite to the direction of $\vec{L} \times \vec{P}$
 (3) Opposite to the direction of $\vec{r}$
 (4) Opposite to the direction of $\vec{P}$

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Q.19 Given below are two statements: one is labelled as **Assertion A** and the other is labelled as **Reason R**
Assertion (A): In photoelectric effect, on increasing the intensity of incident light the stopping potential increases.

Reason (R): Increase in intensity of light increases the rate of photoelectrons emitted, provided the frequency of incident light is greater than threshold

frequency.

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

[JEE Main 2025 (Online) 4th April Morning Shift]

- (1) Both A and R are true and R is the correct explanation of A
 (2) A is false but R is true
 (3) Both A and R are true but R is NOT the correct explanation of A
 (4) A is true but R is false

Scan or tap for the full solution



Q.20 Two small spherical balls of mass 10 g each with charges $-2 \mu\text{C}$ and $2 \mu\text{C}$, are attached to two ends of very light rigid rod of length 20 cm. The arrangement is now placed near an infinite non-conducting charge sheet with uniform charge density of $100 \mu\text{C}/\text{m}^2$ such that length of rod makes an angle of 30° with electric field generated by charge sheet. Net torque acting on the rod is: (Take $\epsilon_0 = 8.85 \times 10^{-12} \text{ C}^2/\text{Nm}^2$)

[JEE Main 2025 (Online) 4th April Morning Shift]

- (1) 1.12 Nm (2) 2.24 Nm
 (3) 11.2 Nm (4) 112 Nm

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Q.21 For $A_2 + B_2 \rightleftharpoons 2AB$
 E_a for forward and backward reaction are 180 and 200 kJ mol^{-1} respectively.
 If catalyst lowers E_a for both reactions by 100 kJ mol^{-1} .

Which of the following statement is correct?

[JEE Main 2025 (Online) 4th April Morning Shift]

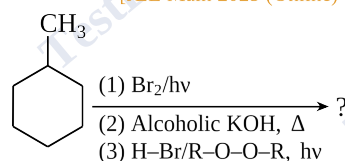
- (1) Catalyst does not alter the Gibbs energy change of a reaction.
 (2) The enthalpy change for the reaction is $+20 \text{ kJ mol}^{-1}$.
 (3) Catalyst can cause non-spontaneous reactions to occur.
 (4) The enthalpy change for the catalysed reaction is different from that of uncatalysed reaction.

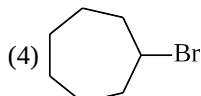
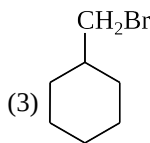
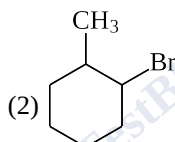
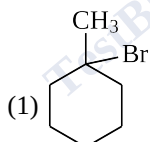
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Q.22 Predict the major product of the following reaction sequence:

[JEE Main 2025 (Online) 4th April Morning Shift]





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Q.23 Which one of the following about an electron occupying the 1s orbital in a hydrogen atom is incorrect?

(Bohr's radius is represented by a_0)

[JEE Main 2025 (Online) 4th April Morning Shift]

- (1) The probability density of finding the electron is maximum at the nucleus
- (2) The total energy of the electron is maximum when it is at a distance a_0 from the nucleus
- (3) The electron can be found at a distance $2a_0$ from the nucleus
- (4) The 1s orbital is spherically symmetrical

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Q.24 Rate law for a reaction between A and B is given by $r = k[A]^n[B]^m$. If concentration of A is doubled and concentration of B is halved from their initial value, the ratio of new rate of reaction to the initial rate of reaction $\left(\frac{r_2}{r_1}\right)$ is

[JEE Main 2025 (Online) 4th April Morning Shift]

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

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Q.25 Pair of transition metal ions having the same number of unpaired electrons is

[JEE Main 2025 (Online) 4th April Morning Shift]

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

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Q.26 On charging the lead storage battery, the oxidation state of lead changes from x_1 to y_1 at the anode and from x_2 to y_2 at the cathode. The values of x_1 , y_1 , x_2 , y_2 are respectively :

[JEE Main 2025 (Online) 4th April Morning Shift]

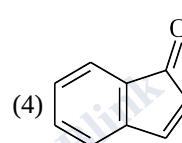
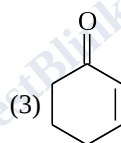
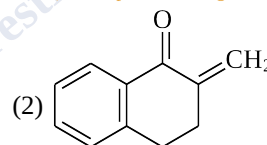
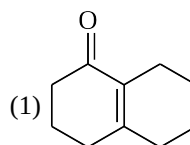
- (1) 0, +2, +4, +2 (2) +2, 0, 0, +4
 (3) +4, +2, 0, +2 (4) +2, 0, +2, +4

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Q.27 Aldol condensation is a popular and classical method to prepare α , β -unsaturated carbonyl compounds. This reaction can be both intermolecular and intramolecular. Predict which one of the following is not a product of intramolecular aldol condensation?

[JEE Main 2025 (Online) 4th April Morning Shift]

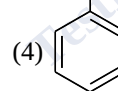
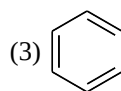
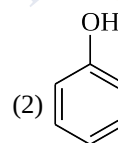
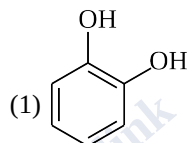


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Q.28 Benzene is treated with oleum to produce compound (X) which when further heated with molten sodium hydroxide followed by acidification produces compound (Y). The compound Y is treated with zinc metal to produce compound (Z). Identify the structure of compound (Z) from the following options.

[JEE Main 2025 (Online) 4th April Morning Shift]



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Q.29 One mole of an ideal gas expands isothermally and reversibly from 10 dm^3 to 20 dm^3 at 300 K. ΔU , q and work done in the process respectively are
 Given: $R = 8.3 \text{ J K}^{-1} \text{ mol}^{-1}$
 $\ln 10 = 2.3$
 $\log 2 = 0.30$
 $\log 3 = 0.48$

[JEE Main 2025 (Online) 4th April Morning Shift]

- (1) 0, 21.84 kJ, -1.726 J
 (2) 0, 21.84 kJ, 21.84 kJ
 (3) 0, 1.718 kJ, -1.718 J
 (4) 0, -17.18 kJ, 1.718 J

Scan or tap for the full solution



Q.30 Given below are two statements.

Statement-I: The dipole moment of $\text{CH}_3\text{-CH}=\text{CH-CH=O}$ is greater than $\text{CH}_3\text{-CH}_2\text{-CH}_2\text{-CH=O}$

Statement-II: $\text{C}_1\text{-C}_2$ bond length of $\text{CH}_3\text{-CH}=\text{CH-CH=O}$ is greater than $\text{C}_1\text{-C}_2$ bond length of $\text{CH}_3\text{-CH}_2\text{-CH}_2\text{-CH=O}$

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

[JEE Main 2025 (Online) 4th April Morning Shift]

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

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Q.31 Which one of the following complexes will have $\Delta_o = 0$ and $\mu = 5.96$ B.M.?

[JEE Main 2025 (Online) 4th April Morning Shift]

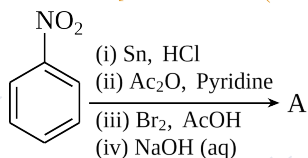
- (1) $[\text{FeF}_6]^{4-}$ (2) $[\text{Mn}(\text{SCN})_6]^{4-}$
 (3) $[\text{Co}(\text{NH}_3)_6]^{3+}$ (4) $[\text{Fe}(\text{CN})_6]^{4-}$

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Q.32 The major product (A) formed in the following reaction sequence is

[JEE Main 2025 (Online) 4th April Morning Shift]



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

Scan or tap for the full solution



Q.33 Given below are two statements:

Statement-I: Nitrogen forms oxides with +1 to +5 oxidation states due to the formation of $p\pi\text{-}p\pi$ bond with oxygen.

Statement-II: Nitrogen does not form halides with +5 oxidation state due to the absence of d-orbital in it.

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

[JEE Main 2025 (Online) 4th April Morning Shift]

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

Scan or tap for the full solution



Q.34 Number of stereoisomers possible for the complexes, $[\text{CrCl}_3(\text{py})_3]$ and $[\text{CrCl}_2(\text{ox})_2]^{3-}$ are respectively (py = pyridine, ox = oxalate)

[JEE Main 2025 (Online) 4th April Morning Shift]

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

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Q.35 An organic compound (X) with molecular formula $\text{C}_3\text{H}_6\text{O}$ is not readily oxidised. On reduction it gives $\text{C}_3\text{H}_8\text{O}$ (Y) which reacts with HBr to give a bromide (Z) which is converted to Grignard reagent. This Grignard reagent on reaction with (X) followed by hydrolysis gives 2,3-dimethylbutan-2-ol.

Compounds (X), (Y) and (Z) respectively are:

[JEE Main 2025 (Online) 4th April Morning Shift]

- (1) $\text{CH}_3\text{CH}_2\text{CHO}$, $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$, $\text{CH}_3\text{CH}_2\text{CH}_2\text{Br}$
 (2) CH_3COCH_3 , $\text{CH}_3\text{CH}(\text{OH})\text{CH}_3$, $\text{CH}_3\text{CH}(\text{Br})\text{CH}_3$
 (3) CH_3COCH_3 , $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$, $\text{CH}_3\text{CH}(\text{Br})\text{CH}_3$
 (4) $\text{CH}_3\text{CH}_2\text{CHO}$, $\text{CH}_3\text{CH}=\text{CH}_2$, $\text{CH}_3\text{CH}(\text{Br})\text{CH}_3$

Scan or tap for the full solution



Q.36 Let us consider a reversible reaction at temperature, T. In this reaction, both ΔH and ΔS were observed to have positive values. If the equilibrium temperature is T_e , then the reaction becomes spontaneous at:

[JEE Main 2025 (Online) 4th April Morning Shift]

- (1) $T_e > T$ (2) $T > T_e$ (3) $T = T_e$ (4) $T_e = 5T$

Scan or tap for the full solution



Q.37 Which of the following molecule(s) show/s paramagnetic behavior?

- A. O_2 B. N_2
 C. F_2 D. S_2
 E. Cl_2

Choose the correct answer from the options given below:

[JEE Main 2025 (Online) 4th April Morning Shift]

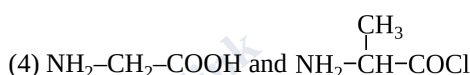
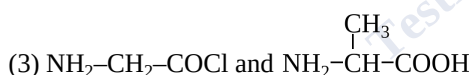
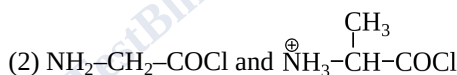
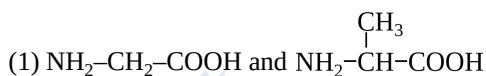
- (1) A & C only (2) A & E Only
 (3) A & D Only (4) B Only

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- Q.38** Identify the pair of reactants that upon reaction, with elimination of HCl will give rise to the dipeptide Gly-Ala.

[JEE Main 2025 (Online) 4th April Morning Shift]



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- Q.39** Given below are the pairs of group 13 elements showing their relation in terms of atomic radius. ($B < Al$), ($Al < Ga$), ($Ga < In$) and ($In < Tl$). Identify the elements present in the incorrect pair and in that pair find out the element (X) that has higher ionic radius (M^{3+}) than the other one. The atomic number of the element (X) is

[JEE Main 2025 (Online) 4th April Morning Shift]

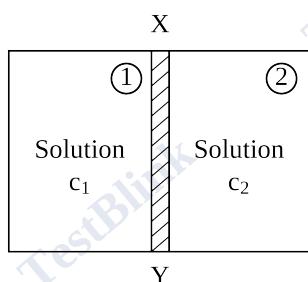
- (1) 49 (2) 81 (3) 31 (4) 13

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- Q.40** XY is the membrane/partition between two chambers 1 and 2 containing sugar solutions of concentration c_1 and c_2 ($c_1 > c_2$) mol L^{-1} . For the reverse osmosis to take place identify the correct condition.

(Here p_1 and p_2 are pressures applied on chamber 1 and 2.)



- A. Membrane/Partition : Cellophane, $p_1 > p_2$
 B. Membrane/Partition : Porous, $p_2 > p_1$
 C. Membrane/Partition : Parchment paper, $p_1 > p_2$
 D. Membrane/Partition : Cellophane, $p_2 > p_1$
 Choose the correct answer from the options given below: [JEE Main 2025 (Online) 4th April Morning Shift]

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

Scan or tap for the full solution



- Q.41** Let $f: \mathbb{R} \rightarrow \mathbb{R}$ be a continuous function satisfying $f(0) = 1$ and $f(2x) - f(x) = x$ for all $x \in \mathbb{R}$. If $\lim_{n \rightarrow \infty} \left\{ f(x) - f\left(\frac{x}{2^n}\right) \right\} = G(x)$, then $\sum_{r=1}^{10} G(r^2)$ is equal to [JEE Main 2025 (Online) 4th April Morning Shift]
- (1) 215 (2) 420 (3) 385 (4) 540

Scan or tap for the full solution



- Q.42** Let the shortest distance between the lines $\frac{x-3}{3} = \frac{y-\alpha}{-1} = \frac{z-3}{1}$ and $\frac{x+3}{-3} = \frac{y+7}{2} = \frac{z-\beta}{4}$ be $3\sqrt{30}$. Then the positive value of $5\alpha + \beta$ is

[JEE Main 2025 (Online) 4th April Morning Shift]

- (1) 42 (2) 40 (3) 48 (4) 46

Scan or tap for the full solution



- Q.43** Let $A = \{1, 6, 11, 16, \dots\}$ and $B = \{9, 16, 23, 30, \dots\}$ be the sets consisting of the first 2025 terms of two arithmetic progressions. Then $n(A \cup B)$ is

[JEE Main 2025 (Online) 4th April Morning Shift]

- (1) 3814 (2) 4003 (3) 4027 (4) 3761

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- Q.44** The length of the latus-rectum of the ellipse, whose foci are (2, 5) and (2, -3) and eccentricity is $\frac{4}{5}$, is

[JEE Main 2025 (Online) 4th April Morning Shift]

- (1) $\frac{50}{3}$ (2) $\frac{18}{5}$ (3) $\frac{6}{5}$ (4) $\frac{10}{3}$

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- Q.45** Consider the equation $x^2 + 4x - n = 0$, where $n \in [20, 100]$ is a natural number. Then the number of all distinct values of n , for which the given equation has integral roots, is equal to

[JEE Main 2025 (Online) 4th April Morning Shift]

- (1) 6 (2) 5 (3) 8 (4) 7

Scan or tap for the full solution



- Q.46** Consider the sets $A = \{(x, y) \in \mathbb{R} \times \mathbb{R} : x^2 + y^2 = 25\}$, $B = \{(x, y) \in \mathbb{R} \times \mathbb{R} : x^2 + 9y^2 = 144\}$, $C = \{(x, y) \in \mathbb{Z} \times \mathbb{Z} : x^2 + y^2 \leq 4\}$ and $D = A \cap B$. The total number of one-one functions from the set D to the set C is:

[JEE Main 2025 (Online) 4th April Morning Shift]

- (1) 15120 (2) 18290 (3) 17160 (4) 19320

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- Q.47** $1 + 3 + 5^2 + 7 + 9^2 + \dots$ up to 40 terms is equal to
[JEE Main 2025 (Online) 4th April Morning Shift]
(1) 40870 (2) 41880 (3) 43890 (4) 33980

Scan or tap for the full solution



- Q.48** If $10\sin^4\theta + 15\cos^4\theta = 6$, then the value of $\frac{27\operatorname{cosec}^6\theta + 8\sec^6\theta}{16\sec^8\theta}$ is

[JEE Main 2025 (Online) 4th April Morning Shift]

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

Scan or tap for the full solution



- Q.49** 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

[JEE Main 2025 (Online) 4th April Morning Shift]

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

Scan or tap for the full solution



- Q.50** Let $f: [0, \infty) \rightarrow \mathbb{R}$ be a differentiable function such that

$$f(x) = 1 - 2x + \int_0^x e^{x-t} f(t) dt \text{ for all } x \in [0, \infty).$$

Then the area of the region bounded by $y = f(x)$ and the coordinate axes is

[JEE Main 2025 (Online) 4th April Morning Shift]

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

Scan or tap for the full solution



- Q.51** The probability of forming a 12 persons committee from 4 engineers, 2 doctors and 10 professors containing at least 3 engineers and at least 1 doctor, is

[JEE Main 2025 (Online) 4th April Morning Shift]

- (1) $\frac{129}{182}$ (2) $\frac{17}{26}$ (3) $\frac{19}{26}$ (4) $\frac{103}{182}$

Scan or tap for the full solution



- Q.52** A box contains 10 pens of which 3 are defective. A sample of 2 pens is drawn at random and let X denote the number of defective pens. Then the variance of X is

[JEE Main 2025 (Online) 4th April Morning Shift]

- (1) $\frac{11}{15}$ (2) $\frac{2}{15}$ (3) $\frac{3}{5}$ (4) $\frac{28}{75}$

Scan or tap for the full solution



- Q.53** Consider two vectors $\vec{u} = 3\hat{i} - \hat{j}$ and $\vec{v} = 2\hat{i} + \hat{j} - \lambda\hat{k}$, $\lambda > 0$. The angle between them is given by $\cos^{-1}\left(\frac{\sqrt{5}}{2\sqrt{7}}\right)$. Let $\vec{v} = \vec{v}_1 + \vec{v}_2$, where $\vec{v}_1$ is parallel to $\vec{u}$ and $\vec{v}_2$ is perpendicular to $\vec{u}$. Then the value of $|\vec{v}_1|^2 + |\vec{v}_2|^2$ is equal to

[JEE Main 2025 (Online) 4th April Morning Shift]

- (1) $\frac{23}{2}$ (2) $\frac{25}{2}$ (3) 10 (4) 14

Scan or tap for the full solution



- Q.54** For an integer $n \geq 2$, if the arithmetic mean of all coefficients in the binomial expansion of $(x + y)^{2n-3}$ is 16, then the distance of the point $P(2n-1, n^2-4n)$ from the line $x + y = 8$ is

[JEE Main 2025 (Online) 4th April Morning Shift]

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

Scan or tap for the full solution



- Q.55** Let A and B be two distinct points on the line $L: \frac{x-6}{3} = \frac{y-7}{2} = \frac{z-7}{-2}$. Both A and B are at a distance $2\sqrt{17}$ from the foot of perpendicular drawn from the point $(1, 2, 3)$ on the line L . If O is the origin, then $\vec{OA} \cdot \vec{OB}$ is equal to

[JEE Main 2025 (Online) 4th April Morning Shift]

- (1) 49 (2) 21 (3) 47 (4) 62

Scan or tap for the full solution



- Q.56** Let $f, g: (1, \infty) \rightarrow \mathbb{R}$ be defined as $f(x) = \frac{2x+3}{5x+2}$ and $g(x) = \frac{2-3x}{1-x}$. If the range of the function $f \circ g: [2, 4] \rightarrow \mathbb{R}$ is $[\alpha, \beta]$, then $\frac{1}{\beta-\alpha}$ is equal to

[JEE Main 2025 (Online) 4th April Morning Shift]

- (1) 56 (2) 2 (3) 29 (4) 68

Scan or tap for the full solution



- Q.57** If $\lim_{x \rightarrow 1^+} \frac{(x-1)(6+\lambda\cos(x-1))+\mu\sin(1-x)}{(x-1)^3} = -1$, where $\lambda, \mu \in \mathbb{R}$, then $\lambda + \mu$ is equal to

[JEE Main 2025 (Online) 4th April Morning Shift]

- (1) 20 (2) 19 (3) 18 (4) 17

Scan or tap for the full solution



- Q.58** Let the three sides of a triangle lie on the lines $4x - 7y + 10 = 0$, $x + y = 5$ and $7x + 4y = 15$. Then the distance of its orthocentre from the orthocentre of the triangle formed by the lines $x = 0$, $y = 0$ and $x + y = 1$ is

[JEE Main 2025 (Online) 4th April Morning Shift]

- (1) $\sqrt{20}$ (2) 20 (3) $\sqrt{5}$ (4) 5

Scan or tap for the full solution



- Q.59** In the expansion of $\left(\sqrt[3]{2} + \frac{1}{\sqrt[3]{3}}\right)^n$, $n \in \mathbb{N}$, if the ratio of 15th term from the beginning to the 15th term from the end is $\frac{1}{6}$, then the value of ${}^nC_3$ is

[JEE Main 2025 (Online) 4th April Morning Shift]

- (1) 4960 (2) 2300 (3) 1040 (4) 4060

Scan or tap for the full solution



- Q.60** Considering the principal values of the inverse trigonometric functions,

$$\sin^{-1}\left(\frac{\sqrt{3}}{2}x + \frac{1}{2}\sqrt{1-x^2}\right), \quad -\frac{1}{2} < x < \frac{1}{\sqrt{2}}, \quad \text{is}$$

equal to [JEE Main 2025 (Online) 4th April Morning Shift]

- (1) $\frac{-5\pi}{6} - \sin^{-1}x$ (2) $\frac{5\pi}{6} - \sin^{-1}x$
 (3) $\frac{\pi}{6} + \sin^{-1}x$ (4) $\frac{\pi}{4} + \sin^{-1}x$

Scan or tap for the full solution



Section B (Numerical) — 15 questions

- Q.61** A circular ring and a solid sphere having same radius roll down on an inclined plane from rest without slipping. The ratio of their velocities when reached at the bottom of the plane is $\sqrt{\frac{x}{5}}$ where $x =$

[JEE Main 2025 (Online) 4th April Morning Shift]

Scan or tap for the full solution



- Q.62** Distance between object and its image (magnified by $-\frac{1}{3}$) is 30 cm. The focal length of the mirror used is $\left(\frac{x}{4}\right)$ cm, where magnitude of value of x is

[JEE Main 2025 (Online) 4th April Morning Shift]

Scan or tap for the full solution



- Q.63** Two slabs with square cross section of different materials (1, 2) with equal sides (l) and thickness d_1 and d_2 such that $d_2 = 2d_1$ and $l > d_2$. Considering lower edges of these slabs are fixed to the floor, we apply equal shearing force on the narrow faces. The angle of deformation is $\theta_2 = 2\theta_1$. If the shear modulus of material 1 is $4 \times 10^9 \text{ N/m}^2$, then shear modulus of material 2 is $x \times 10^9 \text{ N/m}^2$, where value of x is _____.

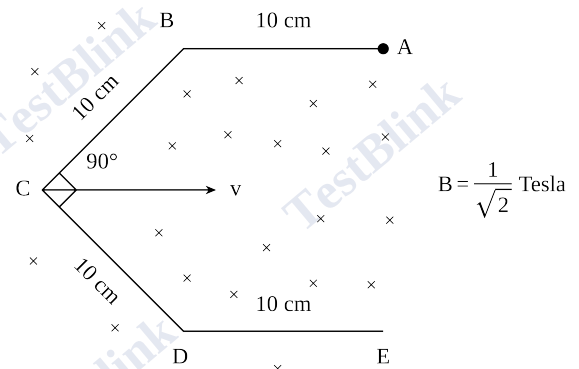
[JEE Main 2025 (Online) 4th April Morning Shift]

Scan or tap for the full solution



- Q.64** Conductor wire ABCDE with each arm 10 cm in length is placed in magnetic field of $\frac{1}{\sqrt{2}}$ Tesla, perpendicular to its plane. When conductor is pulled towards right with constant velocity of 10 cm/s, induced emf between points A and E is _____ mV.

[JEE Main 2025 (Online) 4th April Morning Shift]

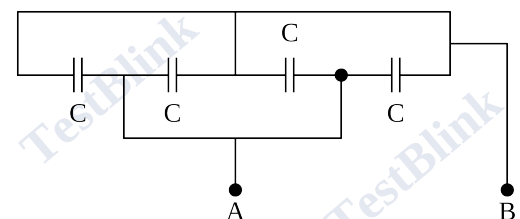


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- Q.65** Four capacitors each of capacitance $16 \mu\text{F}$ are connected as shown in the figure. The capacitance between points A and B is : _____ (in μF).

[JEE Main 2025 (Online) 4th April Morning Shift]



Scan or tap for the full solution



- Q.66** The pH of a 0.01 M weak acid HX ($K_a = 4 \times 10^{-10}$) is found to be 5. Now the acid solution is diluted with excess of water so that the pH of the solution changes to 6. The new concentration of the diluted weak acid is given as $x \times 10^{-4} \text{ M}$. The value of x is _____ (nearest integer)

[JEE Main 2025 (Online) 4th April Morning Shift]

Scan or tap for the full solution



- Q.67** In Dumas' method for estimation of nitrogen 1 g of an organic compound gave 150 mL of nitrogen collected at 300 K temperature and 900 mm Hg pressure. The percentage composition of nitrogen in the compound is _____ % (nearest integer) (Aqueous tension at 300 K = 15 mm Hg)

[JEE Main 2025 (Online) 4th April Morning Shift]

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- Q.68** Fortification of food with iron is done using $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$. The mass in grams of the $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$ required to achieve 12 ppm of iron in 150 kg of wheat is _____ (Nearest integer) [Given: Molar mass of Fe, S and O respectively are 56, 32 and 16 g mol^{-1}]

[JEE Main 2025 (Online) 4th April Morning Shift]

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- Q.69** KMnO_4 acts as an oxidising agent in acidic medium. 'X' is the difference between the oxidation states of Mn in reactant and product. 'Y' is the number of 'd' electrons present in the brown red precipitate formed at the end of the acetate ion test with neutral ferric chloride. The value of $X + Y$ is _____.

[JEE Main 2025 (Online) 4th April Morning Shift]

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- Q.70** The total number of hydrogen bonds of a DNA-double Helix strand whose one strand has the following sequence of bases is _____.
5'-G-G-C-A-A-A-T-C-G-G-C-T-A-3'

[JEE Main 2025 (Online) 4th April Morning Shift]

Scan or tap for the full solution



- Q.71** Let C be the circle $x^2 + (y - 1)^2 = 2$, E_1 and E_2 be two ellipses whose centres lie at the origin and major axes lie on x-axis and y-axis respectively. Let the straight line $x + y = 3$ touch the curves C, E_1 and E_2 at $P(x_1, y_1)$, $Q(x_2, y_2)$ and $R(x_3, y_3)$ respectively. Given that P is the mid point of the line segment QR and $PQ = \frac{2\sqrt{2}}{3}$, the value of $9(x_1y_1 + x_2y_2 + x_3y_3)$ is equal to _____.

[JEE Main 2025 (Online) 4th April Morning Shift]

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- Q.72** Let m and n be the number of points at which the function $f(x) = \max \{x, x^3, x^5, \dots, x^{21}\}$, $x \in \mathbb{R}$, is not differentiable and not continuous, respectively. Then $m + n$ is equal to _____.

[JEE Main 2025 (Online) 4th April Morning Shift]

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- Q.73** Let $A = \begin{bmatrix} \cos \theta & 0 & -\sin \theta \\ 0 & 1 & 0 \\ \sin \theta & 0 & \cos \theta \end{bmatrix}$. If for some $\theta \in (0, \pi)$, $A^2 = A^T$, then the sum of the diagonal elements of the matrix $(A + I)^3 + (A - I)^3 - 6A$ is equal to _____.

[JEE Main 2025 (Online) 4th April Morning Shift]

Scan or tap for the full solution



- Q.74** If the area of the region $\{(x, y) : |x - 5| \leq y \leq 4\sqrt{x}\}$ is A, then 3A is equal to _____.

[JEE Main 2025 (Online) 4th April Morning Shift]

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- Q.75** Let $A = \{z \in \mathbb{C} : |z - 2 - i| = 3\}$,
 $B = \{z \in \mathbb{C} : \text{Re}(z - iz) = 2\}$ and $S = A \cap B$. Then $\sum_{z \in S} |z|^2$ is equal to _____.

[JEE Main 2025 (Online) 4th April Morning Shift]

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ANSWER KEY

Section A (MCQ) — 60 questions

Ques.	1	2	3	4	5	6	7	8	9	10	11
Ans.	3	4	1	2	4	4	4	3	3	2	4
Ques.	12	13	14	15	16	17	18	19	20	21	22
Ans.	2	4	4	1	3	4	3	2	1	1	2
Ques.	23	24	25	26	27	28	29	30	31	32	33
Ans.	2	2	4	4	2	3	3	2	2	2	1
Ques.	34	35	36	37	38	39	40	41	42	43	44
Ans.	2	2	2	3	3	3	1	3	4	4	2
Ques.	45	46	47	48	49	50	51	52	53	54	55
Ans.	1	3	2	1	1	4	1	4	4	4	3
Ques.	56	57	58	59	60						
Ans.	1	3	3	2	3						

Section B (Numerical) — 15 questions

Ques.	61	62	63	64	65
Ans.	4 or 3.5	45	1	10	64
Ques.	66	67	68	69	70
Ans.	25	20	9	10	33
Ques.	71	72	73	74	75
Ans.	46	3	6	368	22