

JEE MAIN 2025 (ONLINE) 23RD JANUARY MORNING SHIFT

Question Paper · answer key at the end

Time: 3 Hours

Max. Marks: 300

Questions: 75

General Instructions:

1. The duration of the paper is 3 hours. It has 75 questions: Physics 25, Chemistry 25, Mathematics 25.
2. Each subject has Section A (multiple-choice questions, only one correct answer) and Section B (numerical-value questions).
3. Marking: +4 for each correct answer, -1 for each wrong answer, 0 for a question not answered.
4. The answer key is at the end. Scan the QR code beside any question for its step-by-step solution.
5. Practise this paper as a timed test on the real exam screen, free, at pyqside.com.

Section A (MCQ) — 60 questions

Q.1 Given below are two statements:

Statement-I: The hot water flows faster than cold water

Statement-II: Soap water has higher surface tension as compared to fresh water

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

[JEE Main 2025 (Online) 23rd January Morning Shift]

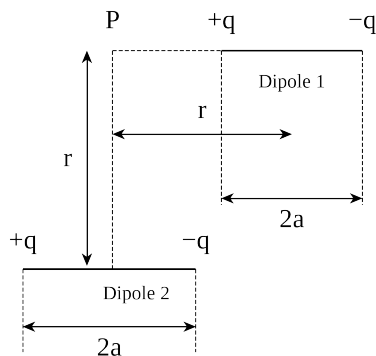
- Both Statement-I and Statement-II are false
- Both Statement-I and Statement-II are true
- Statement-I is false but Statement-II is true
- Statement-I is true but Statement-II is false

Scan or tap for the full solution



Q.2 A point particle of charge Q is located at P along the axis of an electric dipole 1 at a distance r as shown in the figure. The point P is also on the equatorial plane of a second electric dipole 2 at a distance r . The dipoles are made of opposite charge q separated by a distance $2a$. For the charge particle at P not to experience any net force, which of the following correctly describes the situation?

[JEE Main 2025 (Online) 23rd January Morning Shift]



$$(1) \frac{a}{r} \sim 0.5$$

$$(2) \frac{a}{r} \sim 3$$

$$(3) \frac{a}{r} \sim 10$$

$$(4) \frac{a}{r} \sim 20$$

Scan or tap for the full solution



Q.3 What is the lateral shift of a ray refracted through a parallel-sided glass slab of thickness ' h ' in terms of the angle of incidence ' i ' and angle of refraction ' r ', if the glass slab is placed in air medium?

[JEE Main 2025 (Online) 23rd January Morning Shift]

- h
- $\frac{h \cos(i-r)}{\sin r}$
- $\frac{h \tan(i-r)}{\tan r}$
- $\frac{h \sin(i-r)}{\cos r}$

Scan or tap for the full solution



Q.4 A sub-atomic particle of mass 10^{-30} kg is moving with a velocity 2.21×10^6 m/s. Under the matter wave consideration, the particle will behave closely like ($h = 6.63 \times 10^{-34}$ J.s)

[JEE Main 2025 (Online) 23rd January Morning Shift]

- X-rays
- Infra-red radiation
- Gamma rays
- Visible radiation

Scan or tap for the full solution



Q.5 The position of a particle moving on x-axis is given by $x(t) = Asint + B\cos^2 t + Ct^2 + D$, where t is time.

The dimension of $\frac{ABC}{D}$ is

[JEE Main 2025 (Online) 23rd January Morning Shift]

- L
- $L^3 T^{-2}$
- $L^2 T^{-2}$
- L^2

Scan or tap for the full solution



Q.6 Match List - I with List - II

List - I		List - II	
A.	Pressure varies inversely with volume of an ideal gas.	I.	Adiabatic process
B.	Heat absorbed goes partly to increase internal energy and partly to do work.	II.	Isochoric process
C.	Heat is neither absorbed nor released by a system.	III.	Isothermal process
D.	No work is done on or by a gas.	IV.	Isobaric process

Choose the correct answer from the options given below:

[JEE Main 2025 (Online) 23rd January Morning Shift]

- (1) A-I, B-III, C-II, D-IV
 (2) A-I, B-IV, C-II, D-III
 (3) A-III, B-I, C-IV, D-II
 (4) A-III, B-IV, C-I, D-II

Scan or tap for the full solution



- Q.7** A gun fires a lead bullet of temperature 300 K into a wooden block. The bullet having melting temperature of 600 K penetrates into the block and melts down. If the total heat required for the process is 625 J, then the mass of the bullet is _____ grams. (Latent heat of fusion of lead = $2.5 \times 10^4 \text{ J Kg}^{-1}$ and specific heat capacity of lead = $125 \text{ J Kg}^{-1} \text{ K}^{-1}$)

[JEE Main 2025 (Online) 23rd January Morning Shift]

- (1) 20 (2) 15 (3) 5 (4) 10

Scan or tap for the full solution



- Q.8** A solid sphere of mass 'm' and radius 'r' is allowed to roll without slipping from the highest point of an inclined plane of length 'L' and makes an angle 30° with the horizontal. The speed of the particle at the bottom of the plane is v_1 . If the angle of inclination is increased to 45° while keeping L constant. Then the new speed of the sphere at the bottom of the plane is v_2 . The ratio $v_1^2 : v_2^2$ is

[JEE Main 2025 (Online) 23rd January Morning Shift]

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

Scan or tap for the full solution



- Q.9** A radioactive nucleus n_2 has 3 times the decay constant as compared to the decay constant of another radioactive nucleus n_1 . If initial number of both nuclei are the same, what is the ratio of number of nuclei of n_2 to the number of nuclei of n_1 , after one half-life of n_1 ?

[JEE Main 2025 (Online) 23rd January Morning Shift]

- (1) $1/4$ (2) $1/8$ (3) 4 (4) 8

Scan or tap for the full solution



- Q.10** A light hollow cube of side length 10 cm and mass 10 g, is floating in water. It is pushed down and released to execute simple harmonic oscillations. The time period of oscillations is $y\pi \times 10^{-2} \text{ s}$, where the value of y is (Acceleration due to gravity, $g = 10 \text{ m/s}^2$, density of water = 10^3 kg/m^3)

[JEE Main 2025 (Online) 23rd January Morning Shift]

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

Scan or tap for the full solution



- Q.11** A spherical surface of radius of curvature R, separates air from glass (refractive index = 1.5). The centre of curvature is in the glass medium. A point object 'O' placed in air on the optic axis of the surface, so that its real image is formed at 'I' inside glass. The line OI intersects the spherical surface at P and $PO = PI$. The distance PO equals to

[JEE Main 2025 (Online) 23rd January Morning Shift]

- (1) 5R (2) 2R (3) 1.5R (4) 3R

Scan or tap for the full solution



- Q.12** Consider a circular disc of radius 20 cm with centre located at the origin. A circular hole of radius 5 cm is cut from this disc in such a way that the edge of the hole touches the edge of the disc. The distance of centre of mass of residual or remaining disc from the origin will be

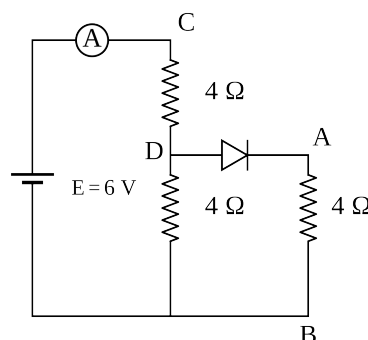
[JEE Main 2025 (Online) 23rd January Morning Shift]

- (1) 1.5 cm (2) 2.0 cm (3) 0.5 cm (4) 1.0 cm

Scan or tap for the full solution



- Q.13** Refer to the circuit diagram given in the figure. which of the following observations are correct?



- A. Total resistance of circuit is $6\ \Omega$
 B. Current in Ammeter is 1 A
 C. Potential across AB is 4 Volts.
 D. Potential across CD is 4 Volts
 E. Total resistance of the circuit is $8\ \Omega$.

Choose the correct answer from the options given below:

[JEE Main 2025 (Online) 23rd January Morning Shift]

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

Scan or tap for the full solution



Q.14 The electric field of an electromagnetic wave in free space is

$$\vec{E} = 57 \cos [7.5 \times 10^6 t - 5 \times 10^{-3} (3x + 4y)] (4\hat{i} - 3\hat{j}) \text{ N/C.}$$

The associated magnetic field in Tesla is

[JEE Main 2025 (Online) 23rd January Morning Shift]

- (1) $\vec{B} = \frac{57}{3 \times 10^8} \cos [7.5 \times 10^6 t - 5 \times 10^{-3} (3x + 4y)] (\hat{k})$
 (2) $\vec{B} = \frac{57}{3 \times 10^8} \cos [7.5 \times 10^6 t - 5 \times 10^{-3} (3x + 4y)] (5\hat{k})$
 (3) $\vec{B} = -\frac{57}{3 \times 10^8} \cos [7.5 \times 10^6 t - 5 \times 10^{-3} (3x + 4y)] (\hat{k})$
 (4) $\vec{B} = -\frac{57}{3 \times 10^8} \cos [7.5 \times 10^6 t - 5 \times 10^{-3} (3x + 4y)] (5\hat{k})$

Scan or tap for the full solution



Q.15 The electric flux is $\phi = \alpha\sigma + \beta\lambda$ where λ and σ are linear and surface charge density, respectively. $\left(\frac{\alpha}{\beta}\right)$ represents

[JEE Main 2025 (Online) 23rd January Morning Shift]

- (1) displacement (2) charge
 (3) electric field (4) area

Scan or tap for the full solution



Q.16 Consider a moving coil galvanometer (MCG):

- A. The torsional constant in moving coil galvanometer has dimensions $[ML^2T^{-2}]$
 B. Increasing the current sensitivity may not necessarily increase the voltage sensitivity.
 C. If we increase number of turns (N) to its double (2N), then the voltage sensitivity doubles.
 D. MCG can be converted into an ammeter by introducing a shunt resistance of large value in parallel with galvanometer.
 E. Current sensitivity of MCG depends inversely on number of turns of coil.

Choose the correct answer from the options given below:

[JEE Main 2025 (Online) 23rd January Morning Shift]

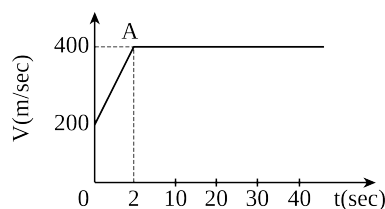
- (1) A, D Only (2) A, B Only
 (3) A, B, E Only (4) B, D, E Only

Scan or tap for the full solution



Q.17 The motion of an airplane is represented by velocity-time graph as shown below. The distance covered by airplane in the first 30.5 second is _____ km.

[JEE Main 2025 (Online) 23rd January Morning Shift]



- (1) 12 (2) 6 (3) 3 (4) 9

Scan or tap for the full solution



Q.18 Regarding self-inductance:

- A. The self-inductance of the coil depends on its geometry.
 B. Self-inductance does not depend on the permeability of the medium.
 C. Self-induced e.m.f. opposes any change in the current in a circuit.
 D. Self-inductance is electromagnetic analogue of mass in mechanics.
 E. Work needs to be done against self-induced e.m.f. in establishing the current.

Choose the correct answer from the options given below:

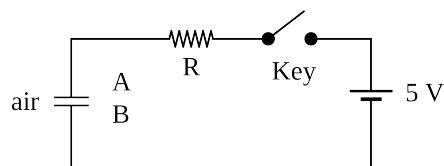
[JEE Main 2025 (Online) 23rd January Morning Shift]

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

Scan or tap for the full solution



Q.19 Identify the valid statements relevant to the given circuit at the instant when the key is closed.



- A. There will be no current through resistor R.
 B. There will be maximum current in the connecting wires.
 C. Potential difference between the capacitor plates A and B is minimum.
 D. Charge on the capacitor plates is minimum.
 Choose the correct answer from the options given below:

[JEE Main 2025 (Online) 23rd January Morning Shift]

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

Scan or tap for the
full solution



Q.20 Given a thin convex lens (refractive index μ_2), kept in a liquid (refractive index μ_1 , $\mu_1 < \mu_2$) having radii of curvatures $|R_1|$ and $|R_2|$. Its second surface is silver polished. Where should an object be placed on the optic axis so that a real and inverted image is formed at the same place?

[JEE Main 2025 (Online) 23rd January Morning Shift]

- (1) $\frac{(\mu_2 + \mu_1)|R_1|}{(\mu_2 - \mu_1)}$
(2) $\frac{\mu_1|R_1| \cdot |R_2|}{\mu_2(2|R_1| + |R_2|) - \mu_1\sqrt{|R_1| \cdot |R_2|}}$
(3) $\frac{\mu_1|R_1| \cdot |R_2|}{\mu_2(|R_1| + |R_2|) - \mu_1|R_1|}$
(4) $\frac{\mu_1|R_1| \cdot |R_2|}{\mu_2(|R_1| + |R_2|) - \mu_1|R_2|}$

Scan or tap for the
full solution



Q.21 Given below are two statements:

Statement-I: In Lassaigne's test, the covalent organic molecules are transformed into ionic compounds.

Statement-II: The sodium fusion extract of an organic compound having N and S gives prussian blue colour with FeSO_4 and $\text{Na}_4[\text{Fe}(\text{CN})_6]$

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

[JEE Main 2025 (Online) 23rd January Morning Shift]

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

Scan or tap for the
full solution



Q.22 Match the List - I with List - II

Classification of molecules based on octet rule		Example	
A.	Molecules obeying octet rule	I.	NO , NO_2
B.	Molecules with incomplete octet	II.	BCl_3 , AlCl_3
C.	Molecules with incomplete octet with odd electron	III.	H_2SO_4 , PCl_5
D.	Molecules with expanded octet	IV.	CCl_4 , CO_2

Choose the correct answer from the options given below:

[JEE Main 2025 (Online) 23rd January Morning Shift]

- (1) A-IV, B-I, C-III, D-II
(2) A-II, B-IV, C-III, D-I
(3) A-IV, B-II, C-I, D-III
(4) A-III, B-II, C-I, D-IV

Scan or tap for the
full solution



Q.23 What amount of bromine will be required to convert 2 g of phenol into 2,4,6-tribromophenol?
(Given molar mass in g mol^{-1} of C, H, O, Br are 12, 1, 16, 80 respectively)

[JEE Main 2025 (Online) 23rd January Morning Shift]

- (1) 6.0 g (2) 10.22 g (3) 20.44 g (4) 4.0 g

Scan or tap for the
full solution



Q.24 The correct set of ions (aqueous solution) with same colour from the following is:

[JEE Main 2025 (Online) 23rd January Morning Shift]

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

Scan or tap for the
full solution



Q.25 $\text{FeO}_4^{2-} \xrightarrow{+2.0 \text{ V}} \text{Fe}^{3+} \xrightarrow{+0.8 \text{ V}} \text{Fe}^{2+} \xrightarrow{-0.5 \text{ V}} \text{Fe}^0$

In the above diagram, the standard electrode potentials are given in volts (over the arrow).

The value of $E^\circ(\text{FeO}_4^{2-}/\text{Fe}^{2+})$ is :

[JEE Main 2025 (Online) 23rd January Morning Shift]

- (1) 1.2 V (2) 2.1 V (3) 1.4 V (4) 1.7 V

Scan or tap for the
full solution



Q.26 $\text{CrCl}_3 \cdot x\text{NH}_3$ can exist as a complex. 0.1 molal aqueous solution of this complex shows a depression in freezing point of 0.558°C . Assuming 100% ionisation of this complex and coordination number of Cr is 6, the complex will be (Given $K_f = 1.86 \text{ K kg mol}^{-1}$)

[JEE Main 2025 (Online) 23rd January Morning Shift]

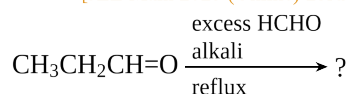
- (1) $[\text{Cr}(\text{NH}_3)_5\text{Cl}]\text{Cl}_2$ (2) $[\text{Cr}(\text{NH}_3)_4\text{Cl}_2]\text{Cl}$
(3) $[\text{Cr}(\text{NH}_3)_6]\text{Cl}_3$ (4) $[\text{Cr}(\text{NH}_3)_3\text{Cl}_3]$

Scan or tap for the
full solution



Q.27 The major product of the following reaction is :

[JEE Main 2025 (Online) 23rd January Morning Shift]



- (1) $\text{CH}_3-\text{C}-\text{CH}=\text{O}$
 $\quad \quad \quad \parallel$
 $\quad \quad \quad \text{CH}_2$
- (2) $\text{CH}_3-\text{CH}_2-\text{CH}_2-\text{OH}$
- (3) $\text{CH}_3-\text{C}-\text{CH}_2-\text{OH}$
 $\quad \quad \quad \swarrow \quad \searrow$
 $\quad \quad \quad \text{CH}_2-\text{OH} \quad \text{CH}_2-\text{OH}$
- (4) $\text{CH}_3-\text{C}-\text{CH}=\text{O}$
 $\quad \quad \quad |$
 $\quad \quad \quad \text{CH}_2-\text{OH}$

Scan or tap for the
full solution



Q.28 Propane molecule on chlorination under photochemical condition gives two di-chloro products, "x" and "y". Amongst "x" and "y", "x" is an optically active molecule. How many tri-chloro products (consider only structural isomers) will be obtained from "x" when it is further treated with chlorine under the photochemical condition?

[JEE Main 2025 (Online) 23rd January Morning Shift]

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

Scan or tap for the
full solution



Q.29 The incorrect statement among the following is

[JEE Main 2025 (Online) 23rd January Morning Shift]

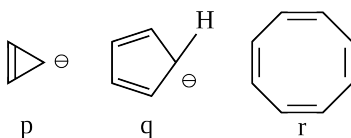
- (1) PH_3 shows lower proton affinity than NH_3 .
 (2) SO_2
 can act as an oxidizing agent, but not as a reducing agent.
 (3) NO_2 can dimerise easily.
 (4) PF_3 exists but NF_5 does not.

Scan or tap for the
full solution



Q.30 The correct stability order of the following species/molecules is :

[JEE Main 2025 (Online) 23rd January Morning Shift]



- (1) $q > r > p$ (2) $q > p > r$
 (3) $p > q > r$ (4) $r > q > p$

Scan or tap for the
full solution



Q.31 2.8×10^{-3} mol of CO_2 is left after removing 10^{21} molecules from its 'x' mg sample. The mass of CO_2 taken initially is

Given: $N_A = 6.02 \times 10^{23} \text{ mol}^{-1}$

[JEE Main 2025 (Online) 23rd January Morning Shift]

- (1) 98.3 mg (2) 196.2 mg
 (3) 150.4 mg (4) 48.2 mg

Scan or tap for the
full solution



Q.32 Given below are two statements:

Statement-I: Fructose does not contain an aldehydic group but still reduces Tollen's reagent

Statement-II: In the presence of base, fructose undergoes rearrangement to give glucose.

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

[JEE Main 2025 (Online) 23rd January Morning Shift]

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

Scan or tap for the
full solution



Q.33 Which of the following happens when NH_4OH is added gradually to the solution containing 1 M A^{2+} and 1M B^{3+} ions?

Given : $K_{sp} [\text{A}(\text{OH})_2] = 9 \times 10^{-10}$ and
 $K_{sp} [\text{B}(\text{OH})_3] = 27 \times 10^{-18}$ at 298 K.

[JEE Main 2025 (Online) 23rd January Morning Shift]

- (1) $\text{A}(\text{OH})_2$ will precipitate before $\text{B}(\text{OH})_3$
 (2) $\text{A}(\text{OH})_2$ and $\text{B}(\text{OH})_3$ will precipitate together
 (3) Both $\text{A}(\text{OH})_2$ and $\text{B}(\text{OH})_3$ do not show precipitation with NH_4OH
 (4) $\text{B}(\text{OH})_3$ will precipitate before $\text{A}(\text{OH})_2$

Scan or tap for the
full solution



Q.34 Ice at -5°C is heated to become vapor with temperature of 110°C at atmospheric pressure. The entropy change associated with this process can be obtained from

[JEE Main 2025 (Online) 23rd January Morning Shift]

- (1) $\int_{268\text{K}}^{273\text{K}} C_{p,m} dT + \frac{\Delta H_{m, \text{fusion}}}{T_f} + \frac{\Delta H_{m, \text{vaporisation}}}{T_b}$
 $+ \int_{273\text{K}}^{373\text{K}} C_{p,m} dT + \int_{373\text{K}}^{383\text{K}} C_{p,m} dT$
- (2) $\int_{268\text{K}}^{383\text{K}} C_p dT + \frac{\Delta H_{\text{melting}}}{273} + \frac{\Delta H_{\text{boiling}}}{373}$
- (3) $\int_{268\text{K}}^{383\text{K}} C_p dT + \frac{q_{\text{rev}}}{T}$
- (4) $\int_{268\text{K}}^{273\text{K}} \frac{C_{p,m}}{T} dT + \frac{\Delta H_{m, \text{fusion}}}{T_f} + \frac{\Delta H_{m, \text{vaporisation}}}{T_b}$
 $+ \int_{273\text{K}}^{373\text{K}} \frac{C_{p,m}}{T} dT + \int_{373\text{K}}^{383\text{K}} \frac{C_{p,m}}{T} dT$

Scan or tap for the
full solution



Q.35 Match the **List - I** with **List - II**

Name reaction		Product obtainable	
A.	Swarts reaction	I.	Ethyl benzene

Name reaction		Product obtainable	
B.	Sandmeyer's reaction	II.	Ethyl iodide
C.	Wurtz Fittig reaction	III.	Cyanobenzene
D.	Finkelstein reaction	IV.	Ethyl fluoride

Choose the correct answer from the options given below:

[JEE Main 2025 (Online) 23rd January Morning Shift]

- (1) A-II, B-III, C-I, D-IV
 (2) A-II, B-I, C-III, D-IV
 (3) A-IV, B-I, C-III, D-II
 (4) A-IV, B-III, C-I, D-II

Scan or tap for the full solution



Q.36 The element that does not belong to the same period of the remaining elements (modern periodic table) is:

[JEE Main 2025 (Online) 23rd January Morning Shift]

- (1) Platinum (2) Osmium
 (3) Iridium (4) Palladium

Scan or tap for the full solution



Q.37 The d-electronic configuration of an octahedral Co (II) complex having magnetic moment of 3.95 BM is:

[JEE Main 2025 (Online) 23rd January Morning Shift]

- (1) $e^4 t_2^3$ (2) $t_2^6 e_g^1$ (3) $t_2^5 e_g^2$ (4) $t_2^3 e_g^0$

Scan or tap for the full solution



Q.38 The complex that shows Facial - Meridional isomerism is :

[JEE Main 2025 (Online) 23rd January Morning Shift]

- (1) $[\text{Co}(\text{en})_2\text{Cl}_2]^+$ (2) $[\text{Co}(\text{NH}_3)_3\text{Cl}_3]$
 (3) $[\text{Co}(\text{NH}_3)_4\text{Cl}_2]^+$ (4) $[\text{Co}(\text{en})_3]^{3+}$

Scan or tap for the full solution



Q.39 Heat treatment of muscular pain involves radiation of wavelength of about 900 nm. Which spectral line of H atom is suitable for this?

Given : Rydberg constant $R_H = 10^5 \text{ cm}^{-1}$,
 $h = 6.6 \times 10^{-34} \text{ J s}$, $c = 3 \times 10^8 \text{ m/s}$

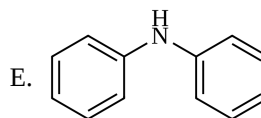
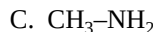
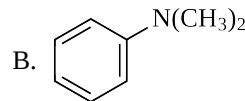
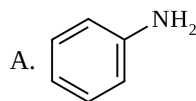
[JEE Main 2025 (Online) 23rd January Morning Shift]

- (1) Lyman series, $\infty \rightarrow 1$
 (2) Balmer series, $\infty \rightarrow 2$
 (3) Paschen series, $5 \rightarrow 3$
 (4) Paschen series, $\infty \rightarrow 3$

Scan or tap for the full solution



Q.40 Which among the following react with Hinsberg's reagent?



Choose the correct answer from the options given below :

[JEE Main 2025 (Online) 23rd January Morning Shift]

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

Scan or tap for the full solution



Q.41 Let a curve $y = f(x)$ pass through the points (0,5) and $(\log_e 2, k)$. If the curve satisfies the differential equation $2(3 + y)e^{2x}dx - (7 + e^{2x})dy = 0$, then k is equal to

[JEE Main 2025 (Online) 23rd January Morning Shift]

- (1) 32 (2) 8 (3) 4 (4) 16

Scan or tap for the full solution



Q.42 Let P be the foot of the perpendicular from the point $Q(10, -3, -1)$ on the line $\frac{x-3}{7} = \frac{y-2}{-1} = \frac{z+1}{-2}$. Then the area of the right angled triangle PQR, where R is the point (3, -2, 1), is

[JEE Main 2025 (Online) 23rd January Morning Shift]

- (1) $\sqrt{30}$ (2) $9\sqrt{15}$
 (3) $3\sqrt{30}$ (4) $8\sqrt{15}$

Scan or tap for the full solution



Q.43 The number of words, which can be formed using all the letters of the word "DAUGHTER", so that all the vowels never come together, is :

[JEE Main 2025 (Online) 23rd January Morning Shift]

- (1) 34000 (2) 37000 (3) 35000 (4) 36000

Scan or tap for the full solution



Q.44 Let $f(x) = \log_e x$ and $g(x) = \frac{x^4 - 2x^3 + 3x^2 - 2x + 2}{2x^2 - 2x + 1}$.

Then the domain of $f \circ g$ is

[JEE Main 2025 (Online) 23rd January Morning Shift]

- (1) $(0, \infty)$ (2) $[1, \infty)$ (3) R (4) $[0, \infty)$

Scan or tap for the full solution



- Q.45** Let the position vectors of the vertices A, B and C of a tetrahedron ABCD be $\hat{i} + 2\hat{j} + \hat{k}$, $\hat{i} + 3\hat{j} - 2\hat{k}$ and $2\hat{i} + \hat{j} - \hat{k}$ respectively. The altitude from the vertex D to the opposite face ABC meets the median line segment through A of the triangle ABC at the point E. If the length of AD is $\frac{\sqrt{110}}{3}$ and the volume of the tetrahedron is $\frac{\sqrt{805}}{6\sqrt{2}}$, then the position vector of E is

[JEE Main 2025 (Online) 23rd January Morning Shift]

- (1) $\frac{1}{6}(7\hat{i} + 12\hat{j} + \hat{k})$ (2) $\frac{1}{12}(7\hat{i} + 4\hat{j} + 3\hat{k})$
 (3) $\frac{1}{6}(12\hat{i} + 12\hat{j} + \hat{k})$ (4) $\frac{1}{2}(\hat{i} + 4\hat{j} + 7\hat{k})$

Scan or tap for the full solution



- Q.46** If $\frac{\pi}{2} \leq x \leq \frac{3\pi}{4}$, then $\cos^{-1}\left(\frac{12}{13}\cos x + \frac{5}{13}\sin x\right)$ is equal to

[JEE Main 2025 (Online) 23rd January Morning Shift]

- (1) $x + \tan^{-1}\frac{5}{12}$ (2) $x - \tan^{-1}\frac{4}{3}$
 (3) $x + \tan^{-1}\frac{4}{5}$ (4) $x - \tan^{-1}\frac{5}{12}$

Scan or tap for the full solution



- Q.47** One die has two faces marked 1, two faces marked 2, one face marked 3 and one face marked 4. Another die has one face marked 1, two faces marked 2, two faces marked 3 and one face marked 4. The probability of getting the sum of numbers to be 4 or 5, when both the dice are thrown together, is

[JEE Main 2025 (Online) 23rd January Morning Shift]

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

Scan or tap for the full solution



- Q.48** The value of $(\sin 70^\circ)(\cot 10^\circ \cot 70^\circ - 1)$ is

[JEE Main 2025 (Online) 23rd January Morning Shift]

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

Scan or tap for the full solution



- Q.49** If the function

$$f(x) = \begin{cases} \frac{2}{x}\{\sin(k_1 + 1)x + \sin(k_2 - 1)x\}, & x < 0 \\ 4, & x = 0 \\ \frac{2}{x}\log_e\left(\frac{2 + k_1x}{2 + k_2x}\right), & x > 0 \end{cases}$$

is continuous at $x = 0$, then $k_1^2 + k_2^2$ is equal to :

[JEE Main 2025 (Online) 23rd January Morning Shift]

- (1) 5 (2) 10 (3) 20 (4) 8

Scan or tap for the full solution



- Q.50** If the system of equations
 $(\lambda - 1)x + (\lambda - 4)y + \lambda z = 5$
 $\lambda x + (\lambda - 1)y + (\lambda - 4)z = 7$
 $(\lambda + 1)x + (\lambda + 2)y - (\lambda + 2)z = 9$
 has infinitely many solutions, then $\lambda^2 + \lambda$ is equal to

[JEE Main 2025 (Online) 23rd January Morning Shift]

- (1) 20 (2) 10 (3) 6 (4) 12

Scan or tap for the full solution



- Q.51** The value of $\int_{e^2}^{e^4} \frac{1}{x} \left(\frac{e^{((\log_e x)^2 + 1)^{-1}}}{e^{((\log_e x)^2 + 1)^{-1}} + e^{((6 - \log_e x)^2 + 1)^{-1}}} \right) dx$ is

[JEE Main 2025 (Online) 23rd January Morning Shift]

- (1) 1 (2) $\log_e 2$ (3) e^2 (4) 2

Scan or tap for the full solution



- Q.52** Marks obtained by all the students of class 12 are presented in a frequency distribution with classes of equal width. Let the median of this grouped data be 14 with median class interval 12-18 and median class frequency 12. If the number of students whose marks are less than 12 is 18, then the total number of students is :

[JEE Main 2025 (Online) 23rd January Morning Shift]

- (1) 52 (2) 44 (3) 40 (4) 48

Scan or tap for the full solution



- Q.53** Let $\left| \frac{\bar{z} - i}{2\bar{z} + i} \right| = \frac{1}{3}$, $z \in \mathbb{C}$, be the equation of a circle with center at C. If the area of the triangle, whose vertices are at the points (0,0), C and $(\alpha, 0)$ is 11 square units, then α^2 equals:

[JEE Main 2025 (Online) 23rd January Morning Shift]

- (1) $\frac{121}{25}$ (2) 100 (3) $\frac{81}{25}$ (4) 50

Scan or tap for the full solution



- Q.54** Let $I(x) = \int \frac{dx}{(x-11)^{\frac{11}{13}}(x+15)^{\frac{15}{13}}}$. If

$$I(37) - I(24) = \frac{1}{4} \left(\frac{1}{b^{\frac{1}{13}}} - \frac{1}{c^{\frac{1}{13}}} \right), \quad b, c \in \mathbb{N}, \text{ then}$$

3(b + c) is equal to

[JEE Main 2025 (Online) 23rd January Morning Shift]

- (1) 39 (2) 22 (3) 40 (4) 26

Scan or tap for the full solution



- Q.55** If the line $3x - 2y + 12 = 0$ intersects the parabola $4y = 3x^2$ at the points A and B, then at the vertex of the parabola, the line segment AB subtends an angle equal to

[JEE Main 2025 (Online) 23rd January Morning Shift]

- (1) $\frac{\pi}{2} - \tan^{-1}\left(\frac{3}{2}\right)$ (2) $\tan^{-1}\left(\frac{9}{7}\right)$
 (3) $\tan^{-1}\left(\frac{11}{9}\right)$ (4) $\tan^{-1}\left(\frac{4}{5}\right)$

Scan or tap for the full solution



- Q.56** If the first term of an A.P. is 3 and the sum of its first four terms is equal to one-fifth of the sum of the next four terms, then the sum of the first 20 terms is equal to

[JEE Main 2025 (Online) 23rd January Morning Shift]

- (1) -120 (2) -1200 (3) -1080 (4) -1020

Scan or tap for the full solution



- Q.57** Let the arc AC of a circle subtend a right angle at the centre O. If the point B on the arc AC, divides the arc AC such that $\frac{\text{length of arc AB}}{\text{length of arc BC}} = \frac{1}{5}$, and $\vec{OC} = \alpha\vec{OA} + \beta\vec{OB}$, then $\alpha + \sqrt{2}(\sqrt{3} - 1)\beta$ is equal to

[JEE Main 2025 (Online) 23rd January Morning Shift]

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

Scan or tap for the full solution



- Q.58** Let the area of a $\triangle PQR$ with vertices $P(5,4)$, $Q(-2,4)$ and $R(a,b)$ be 35 square units. If its orthocenter and centroid are $O\left(2, \frac{14}{5}\right)$ and $C(c,d)$ respectively, then $c + 2d$ is equal to

[JEE Main 2025 (Online) 23rd January Morning Shift]

- (1) 3 (2) $\frac{7}{3}$ (3) 2 (4) $\frac{8}{3}$

Scan or tap for the full solution



- Q.59** If A, B, and $(\text{adj}(A^{-1}) + \text{adj}(B^{-1}))$ are non-singular matrices of same order, then the inverse of $A(\text{adj}(A^{-1}) + \text{adj}(B^{-1}))^{-1}B$, is equal to

[JEE Main 2025 (Online) 23rd January Morning Shift]

- (1) $\frac{AB^{-1}}{|A|} + \frac{BA^{-1}}{|B|}$
 (2) $\text{adj}(B^{-1}) + \text{adj}(A^{-1})$
 (3) $AB^{-1} + A^{-1}B$
 (4) $\frac{1}{|AB|}(\text{adj}(B) + \text{adj}(A))$

Scan or tap for the full solution



- Q.60** Let $R = \{(1,2), (2,3), (3,3)\}$ be a relation defined on the set $\{1,2,3,4\}$. Then the minimum number of elements, needed to be added in R so that R becomes an equivalence relation, is:

[JEE Main 2025 (Online) 23rd January Morning Shift]

- (1) 9 (2) 8 (3) 7 (4) 10

Scan or tap for the full solution



Section B (Numerical) — 15 questions

- Q.61** Two particles are located at equal distance from origin. The position vectors of those are represented by $\vec{A} = 2\hat{i} + 3n\hat{j} + 2\hat{k}$ and $\vec{B} = 2\hat{i} - 2\hat{j} + 4p\hat{k}$, respectively. If both the vectors are at right angle to each other, the value of n^{-1} is _____.

[JEE Main 2025 (Online) 23rd January Morning Shift]

Scan or tap for the full solution



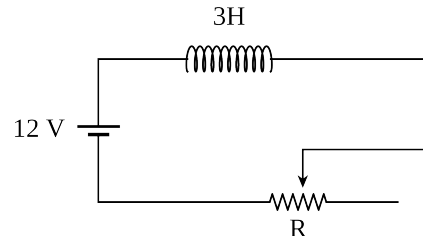
- Q.62** A force $\vec{f} = x^2y\hat{i} + y^2\hat{j}$ acts on a particle in a plane $x + y = 10$. The work done by this force during a displacement from (0,0) to (4 m, 2 m) is _____ Joule (round off to the nearest integer)

[JEE Main 2025 (Online) 23rd January Morning Shift]

Scan or tap for the full solution



Q.63



In the given circuit the sliding contact is pulled outwards such that electric current in the circuit changes at the rate of 8 A/s. At an instant when R is 12 Ω , the value of the current in the circuit will be _____ A.

[JEE Main 2025 (Online) 23rd January Morning Shift]

Scan or tap for the full solution



- Q.64** A positive ion A and a negative ion B has charges 6.67×10^{-19} C and 9.6×10^{-10} C, and masses 19.2×10^{-27} kg and 9×10^{-27} kg respectively. At an instant, the ions are separated by a certain distance r. At that instant the ratio of the magnitudes of electrostatic force to gravitational force is $P \times 10^{-13}$, where the value of P is _____.

(Take $\frac{1}{4\pi\epsilon_0} = 9 \times 10^9 \text{ Nm}^2\text{C}^{-2}$ and universal

gravitational constant as $6.67 \times 10^{-11} \text{ Nm}^2 \text{ kg}^{-2}$)

[JEE Main 2025 (Online) 23rd January Morning Shift]

Scan or tap for the full solution



- Q.65** An ideal gas initially at 0°C temperature, is compressed suddenly to one fourth of its volume. If the ratio of specific heat at constant pressure to that at constant volume is $3/2$, the change in temperature due to the thermodynamic process is _____ K.

[JEE Main 2025 (Online) 23rd January Morning Shift]

Scan or tap for the full solution



- Q.66** For the thermal decomposition of $\text{N}_2\text{O}_5(\text{g})$ at constant volume, the following table can be formed, for the reaction mentioned below.



Sr. No.	Time/s	Total pressure/(atm)
1	0	0.6
2	100	'x'

$x = \text{_____} \times 10^{-3} \text{ atm}$ [nearest integer]

Given : Rate constant for the reaction is $4.606 \times 10^{-2} \text{ s}^{-1}$.

[JEE Main 2025 (Online) 23rd January Morning Shift]

Scan or tap for the full solution



- Q.67** The standard enthalpy and standard entropy of decomposition of N_2O_4 to NO_2 are 55.0 kJ mol^{-1} and 175.0 J/K/mol respectively. The standard free energy change for this reaction at 25°C in J mol^{-1} is _____ (Nearest integer)

[JEE Main 2025 (Online) 23rd January Morning Shift]

Scan or tap for the full solution



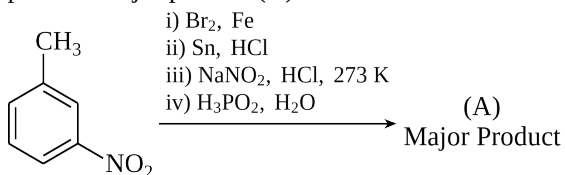
- Q.68** If 1 mM solution of ethylamine produces $\text{pH} = 9$, then the ionization constant (K_b) of ethylamine is 10^{-x} . The value of x is _____ (nearest integer). [The degree of ionization of ethylamine can be neglected with respect to unity.]

[JEE Main 2025 (Online) 23rd January Morning Shift]

Scan or tap for the full solution



- Q.69** Consider the following sequence of reactions to produce major product (A)



Molar mass of product (A) is _____ g mol^{-1} .

(Given molar mass in g mol^{-1} of C : 12, H : 1, O : 16, Br : 80, N : 14, P : 31)

[JEE Main 2025 (Online) 23rd January Morning Shift]

Scan or tap for the full solution



- Q.70** During "S" estimation, 160 mg of an organic compound gives 466 mg of barium sulphate. The percentage of Sulphur in the given compound is _____ %.

(Given molar mass in g mol^{-1} of

Ba:137, S:32, O:16)

[JEE Main 2025 (Online) 23rd January Morning Shift]

Scan or tap for the full solution



- Q.71** The sum of all rational terms in the expansion of $(1 + 2^{1/3} + 3^{1/2})^6$ is equal to _____.

[JEE Main 2025 (Online) 23rd January Morning Shift]

Scan or tap for the full solution



- Q.72** If the set of all values of a , for which the equation $5x^3 - 15x - a = 0$ has three distinct real roots, is the interval (α, β) , then $\beta - 2\alpha$ is equal to _____.

[JEE Main 2025 (Online) 23rd January Morning Shift]

Scan or tap for the full solution



- Q.73** If the equation $a(b - c)x^2 + b(c - a)x + c(a - b) = 0$ has equal roots, where $a + c = 15$ and $b = \frac{36}{5}$, then $a^2 + c^2$ is equal to _____.

[JEE Main 2025 (Online) 23rd January Morning Shift]

Scan or tap for the full solution



- Q.74** Let the circle C touch the line $x - y + 1 = 0$, have the centre on the positive x -axis, and cut off a chord of length $\frac{4}{\sqrt{13}}$ along the line $-3x + 2y = 1$. Let H

be the hyperbola $\frac{x^2}{\alpha^2} - \frac{y^2}{\beta^2} = 1$, whose one of the foci is the centre of C and the length of the transverse axis is the diameter of C . Then $2\alpha^2 + 3\beta^2$ is equal to _____.

[JEE Main 2025 (Online) 23rd January Morning Shift]

Scan or tap for the full solution



- Q.75** If the area of the larger portion bounded between the curves $x^2 + y^2 = 25$ and $y = |x - 1|$ is $\frac{1}{4}(b\pi + c)$, $b, c \in \mathbb{N}$, then $b + c$ is equal to _____

[JEE Main 2025 (Online) 23rd January Morning Shift]

Scan or tap for the full solution



ANSWER KEY

Section A (MCQ) — 60 questions

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

Section B (Numerical) — 15 questions

Ques.	61	62	63	64	65
Ans.	3	152	3	BONUS	273
Ques.	66	67	68	69	70
Ans.	897	2850	7	171	40
Ques.	71	72	73	74	75
Ans.	612	30	117	19	77