

JEE MAIN 2026 (ONLINE) 2ND APRIL EVENING SHIFT — QUESTION PAPER

Max. Marks: 300
Questions: 75

Section A (MCQ) — 60 questions

- Q.1** Dimensions of universal gravitational constant (G) in terms of Planck's constant (h), distance (L), mass (M) and time (T) are _____.

[JEE Main 2026 (Online) 2nd April Evening Shift]

- (1) $[hTLM^{-2}]$ (2) $[hT^{-1}LM^{-2}]$
 (3) $[hTL^2M^{-2}]$ (4) $[h^{-1}T^{-1}LM^{-2}]$

Scan or tap for the full solution



- Q.2** A 0.5 kg mass is in contact against the inner wall of a cylindrical drum of radius 4 m rotating about its vertical axis. The minimum rotational speed of the drum to enable the mass to remain stuck to the wall (without falling) is 5 rad/s. The coefficient of friction between the drum's inner wall surface and mass is _____. (Take $g = 10 \text{ m/s}^2$)

[JEE Main 2026 (Online) 2nd April Evening Shift]

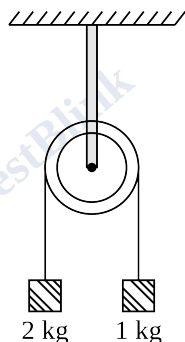
- (1) 0.1 (2) 0.5 (3) 0.7 (4) 0.3

Scan or tap for the full solution



- Q.3** Two blocks of masses 2 kg and 1 kg respectively, are tied to the ends of a string which passes over a light frictionless pulley as shown in the figure below. The masses are held at rest at the same horizontal level and then released. The distance traversed by the centre of mass in 2 s is _____ m. (Take $g = 10 \text{ m/s}^2$)

[JEE Main 2026 (Online) 2nd April Evening Shift]



- (1) 3.33 (2) 3.12 (3) 2.22 (4) 1.42

Scan or tap for the full solution



- Q.4** A particle having charge 10^{-9} C moving in x-y plane in fields of $0.4\hat{j} \text{ N/C}$ and $4 \times 10^{-3}\hat{k} \text{ T}$ experiences a force of $(4\hat{i} + 2\hat{j}) \times 10^{-10} \text{ N}$. The velocity of the particle at that instant is _____ m/s.

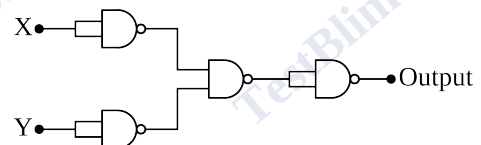
[JEE Main 2026 (Online) 2nd April Evening Shift]

- (1) $50\hat{i} + 100\hat{j}$ (2) $100\hat{i} + 50\hat{j}$
 (3) $-50\hat{i} + 100\hat{j}$ (4) $50\hat{i} - 100\hat{j}$

Scan or tap for the full solution



- Q.5** If X and Y are the inputs, the given circuit works as _____. [JEE Main 2026 (Online) 2nd April Evening Shift]



- (1) OR gate (2) AND gate
 (3) NAND gate (4) NOR gate

Scan or tap for the full solution



- Q.6** If a body of mass 1 kg falls on the earth from infinity, it attains velocity (v) and kinetic energy (k) on reaching the surface of earth. The values of v and k respectively are _____.

(Take radius of earth to be 6400 km and $g = 9.8 \text{ m/s}^2$) [JEE Main 2026 (Online) 2nd April Evening Shift]

- (1) 11.2 km/s; $6.27 \times 10^7 \text{ J}$
 (2) 11.2 km/s; $12.54 \times 10^7 \text{ J}$
 (3) 8.8 km/s; $6.27 \times 10^7 \text{ J}$
 (4) 8.8 km/s; $12.54 \times 10^7 \text{ J}$

Scan or tap for the full solution



- Q.7** In a screw gauge the zero of main scale reference line coincides with the fifth division of the circular scale when two studs are in contact. There are 100 divisions in circular scale and pitch of screw gauge is 0.1 mm. When diameter of a sphere is measured, the reading of main scale is 5 mm and 50th division of circular scale coincides with the reference line of main scale. The diameter of sphere is _____ mm.

[JEE Main 2026 (Online) 2nd April Evening Shift]

- (1) 5.045 (2) 5.055 (3) 5.450 (4) 5.550

Scan or tap for the full solution



- Q.8** The surface tension of a soap bubble is 0.03 N/m . The work done in increasing the diameter of bubble from 2 cm to 6 cm is $\alpha\pi \times 10^{-4} \text{ J}$. The value of α is _____. (Take $\pi = 3.14$)

[JEE Main 2026 (Online) 2nd April Evening Shift]

- (1) 0.86 (2) 0.64 (3) 1.92 (4) 7.68

Scan or tap for the full solution



- Q.9** A mixture of carbon dioxide and oxygen has volume 8310 cm^3 , temperature 300 K , pressure 100 kPa and mass 13.2 g . The number of moles of carbon dioxide and oxygen gases in the mixture respectively are _____. (Assume both carbon dioxide and oxygen gases behave like ideal gases) [$R = 8.31 \text{ J/mol K}$]

[JEE Main 2026 (Online) 2nd April Evening Shift]

- (1) 0.15 and 0.18 (2) 0.25 and 0.08
(3) 0.21 and 0.12 (4) 0.13 and 0.20

Scan or tap for the full solution



- Q.10** If an air bubble of diameter 2 mm rises steadily through a liquid of density 2000 kg/m^3 at a rate of 0.5 cm/s , then the coefficient of viscosity of liquid is _____ Poise. (Take $g = 10 \text{ m/s}^2$)

[JEE Main 2026 (Online) 2nd April Evening Shift]

- (1) 0.88 (2) 8.8 (3) 88.8 (4) 0.088

Scan or tap for the full solution



- Q.11** A spherical ball of mass 2 kg falls from a height of 10 m and is brought to rest after penetrating 10 cm into sand. The average force exerted by sand on the ball is _____ N. (Take $g = 10 \text{ m/s}^2$)

[JEE Main 2026 (Online) 2nd April Evening Shift]

- (1) 1980 (2) 2020 (3) 2000 (4) 1000

Scan or tap for the full solution



- Q.12** An electromagnetic wave travels in free space along the x -direction. At a particular point in space and time, $\vec{B} = 2 \times 10^{-7} \hat{j} \text{ T}$ is associated with this wave. The value of corresponding electric field $\vec{E}$ at this point is _____ V/m.

[JEE Main 2026 (Online) 2nd April Evening Shift]

- (1) $60\hat{k}$ (2) $-60\hat{k}$ (3) $30\hat{k}$ (4) $-600\hat{k}$

Scan or tap for the full solution



- Q.13** Two resistors of 200Ω and 400Ω are connected in series with a battery of 100 V . A bulb rated at 200 V , 100 W is connected across the 400Ω resistance. The potential drop across the bulb is _____ V.

[JEE Main 2026 (Online) 2nd April Evening Shift]

- (1) 25 (2) 50 (3) 66.6 (4) 100

Scan or tap for the full solution



- Q.14** Two metal plates (A, B) are kept horizontally with separation of $\left(\frac{12}{\pi}\right) \text{ cm}$, with plate A on the top. An atomizer jet sprays oil (density 1.5 g/cm^3) droplets of radius 1 mm horizontally. All oil droplets carry a charge 5 nC . The potentials V_A and V_B are required on plates A and B respectively in order to ensure the droplets do not descend. The values of V_A and V_B are _____. (Neglect the air resistance to the droplets and take $g = 10 \text{ m/s}^2$)

[JEE Main 2026 (Online) 2nd April Evening Shift]

- (1) 100 V and 580 V (2) 580 V and 100 V
(3) 60 V and 400 V (4) 0 V and -200 V

Scan or tap for the full solution



- Q.15** Two point charges $8 \mu\text{C}$ and $-2 \mu\text{C}$ are located at $x = 2 \text{ cm}$ and $x = 4 \text{ cm}$, respectively on the x -axis. The ratio of electric flux due to these charges through two spheres of radii 3 cm and 5 cm with their centers at the origin is _____.

[JEE Main 2026 (Online) 2nd April Evening Shift]

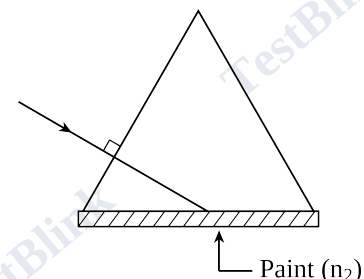
- (1) $4 : 1$ (2) $3 : 4$ (3) $4 : 3$ (4) $4 : 5$

Scan or tap for the full solution



- Q.16** One side of an equilateral prism is painted by a transparent material of refractive index n_2 . The refractive index of prism is 1.6 . The minimum value of n_2 required for total internal reflection from painted face is _____.

[JEE Main 2026 (Online) 2nd April Evening Shift]



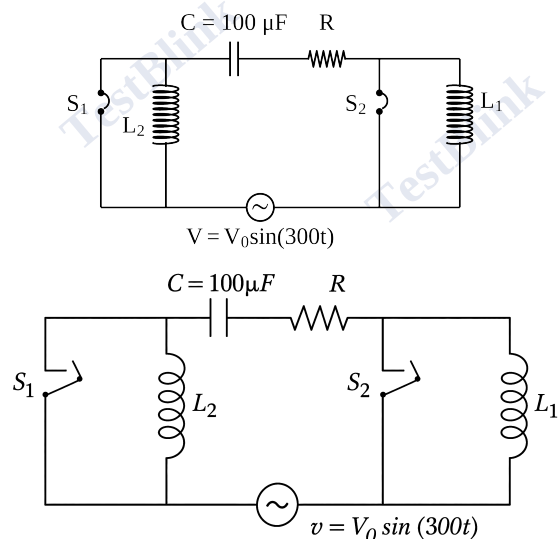
- (1) $\frac{3\sqrt{3}}{1.6}$ (2) $\sqrt{3}$ (3) $\frac{3.2}{\sqrt{3}}$ (4) $\frac{4\sqrt{3}}{5}$

Scan or tap for the full solution



- Q.17** The figure given below shows an LCR series circuit with two switches S_1 and S_2 . When switch S_1 is closed keeping S_2 open, the phase difference (ϕ) between the current and source voltage is 30° and phase difference is 60° when S_2 is closed keeping S_1 open. The value of $(3L_1 - L_2)$ is _____ H.

[JEE Main 2026 (Online) 2nd April Evening Shift]



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

Scan or tap for the full solution



- Q.18** A circular current loop of radius R is placed inside square loop of side length L ($L \gg R$) such that they are co-planar and their centers coincide. The permeability of free space is μ_0 . The mutual inductance between circular loop and square loop is _____.

[JEE Main 2026 (Online) 2nd April Evening Shift]

- (1) $2\sqrt{2} \frac{\mu_0 L^2}{R}$ (2) $\sqrt{2} \frac{\mu_0 L^2}{R}$
(3) $\sqrt{2} \frac{\mu_0 R^2}{L}$ (4) $2\sqrt{2} \frac{\mu_0 R^2}{L}$

Scan or tap for the full solution



- Q.19** The binding energy per nucleon of $^{209}_{83}\text{Bi}$ is _____ MeV.

[Take $m(^{209}_{83}\text{Bi}) = 208.980388 \text{ u}$, $m_p = 1.007825 \text{ u}$, $m_n = 1.008665 \text{ u}$, $1 \text{ u} = 931 \text{ MeV}/c^2$]

[JEE Main 2026 (Online) 2nd April Evening Shift]

- (1) 7.48 (2) 7.84 (3) 8.79 (4) 6.94

Scan or tap for the full solution



- Q.20** The equation of motion of a particle is given by $x = a \sin(50t + \pi/3)$ cm. The particle will come to rest at time t_1 and it will have zero acceleration at time t_2 . The t_1 and t_2 respectively are _____.

[JEE Main 2026 (Online) 2nd April Evening Shift]

- (1) $\frac{\pi}{300} \text{ s}, \frac{\pi}{75} \text{ s}$ (2) $\frac{\pi}{75} \text{ s}, \frac{\pi}{300} \text{ s}$
(3) $\frac{\pi}{300} \text{ s}, \frac{\pi}{25} \text{ s}$ (4) $\frac{\pi}{50} \text{ s}, \frac{\pi}{100} \text{ s}$

Scan or tap for the full solution



- Q.21** The ratio of mass percentage (w/w) of C : H in a hydrocarbon is 12 : 1. It has two carbon atoms. The weight (in g) of $\text{CO}_2(\text{g})$ formed when 3.38 g of this hydrocarbon is completely burnt in oxygen is : (Given : Molar mass in g mol^{-1} C : 12, H : 1, O : 16)

[JEE Main 2026 (Online) 2nd April Evening Shift]

- (1) 5.68 (2) 11.44 (3) 22.74 (4) 17.05

Scan or tap for the full solution



- Q.22** The first and second ionization constants of a weak dibasic acid H_2A are 8.1×10^{-8} and 1.0×10^{-13} respectively. 0.1 mol of H_2A was dissolved in 1 L of 0.1 M HCl solution. The concentration of HA^- in the resultant solution is:

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- (1) 0.1 M (2) $9.53 \times 10^{-6} \text{ M}$
(3) $8.1 \times 10^{-8} \text{ M}$ (4) $1.0 \times 10^{-13} \text{ M}$

Scan or tap for the full solution



- Q.23** SF_4 is isostructural with :

- A. $\text{BrF}_4^\ominus$ B. CH_4
C. $\text{IF}_4^\oplus$ D. XeF_4
E. XeO_2F_2

Choose the **correct** answer from the options given below : [JEE Main 2026 (Online) 2nd April Evening Shift]

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

Scan or tap for the full solution



- Q.24** Gas 'A' undergoes change from state 'X' to state 'Y'. In this process, the heat absorbed and work done by the gas is 10 J and 18 J respectively. Now gas is brought back to state 'X' by another process during which 6 J of heat is evolved. In the reverse process of 'Y' to 'X',

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- (1) 18 J of the work is done by the gas 'A'.
(2) 2 J of the work is done by the gas 'A'.
(3) 12 J of the work is done on the gas 'A' by the surrounding.
(4) 14 J of the work is done on the gas 'A' by the surrounding.

Scan or tap for the full solution



- Q.25** Solution A is prepared by dissolving 1 g of a protein (molar mass = $50,000 \text{ g mol}^{-1}$) in 0.5 L of water at 300 K. Its osmotic pressure is x bar. Solution B is made by dissolving 2 g of the same protein in 1 L of water at 300 K. Osmotic pressure of solution B is y bar. Entire solution of A is mixed with entire solution of B at the same temperature. The osmotic pressure of resultant solution is z bar. x , y and z respectively are:
($R = 0.083 \text{ L bar mol}^{-1} \text{ K}^{-1}$)

[JEE Main 2026 (Online) 2nd April Evening Shift]

- (1) 9.96×10^{-4} ; 9.96×10^{-4} ; 9.96×10^{-4}
 (2) 9.96×10^{-4} ; 9.96×10^{-4} ; 19.92×10^{-4}
 (3) 4.98×10^{-4} ; 4.98×10^{-4} ; 9.96×10^{-4}
 (4) 4.98×10^{-4} ; 4.98×10^{-4} ; 4.98×10^{-4}

Scan or tap for the full solution



- Q.26** At 25°C , 20.0 mL of 0.2 M weak monoprotic acid HX is titrated against 0.2 M NaOH. The pH of the solution (a) at the start of the titration (when NaOH has not been added) and (b) when 10 mL of NaOH is added respectively, are :

Given :

$$K_a = 5 \times 10^{-4}$$

$$\text{p}K_a = 3.3$$

$$\alpha \ll 1$$
 [JEE Main 2026 (Online) 2nd April Evening Shift]

(1)

(a)	(b)
0.7	2.0

(3)

(a)	(b)
1.1	2.2

(2)

(a)	(b)
2.0	3.3

(4)

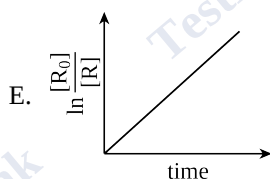
(a)	(b)
3.0	2.2

Scan or tap for the full solution



- Q.27** Consider the reaction $aX \longrightarrow bY$, for which the rate constant at 30°C is $1 \times 10^{-3} \text{ mol}^{-1} \text{ L s}^{-1}$. Which of the following statements are true?

- A. When concentration of 'X' is increased to four times, the rate of reaction becomes 16 times.
 B. The reaction is a second order reaction.
 C. The half-life period is independent of the concentration of X.
 D. Decomposition of N_2O_5 is an example of the above reaction.



above reaction.

Choose the **correct** answer from the options given below:

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

Scan or tap for the full solution



- Q.28** The correct set that contains all kinds (basic, acidic, amphoteric and neutral) of oxides is :

[JEE Main 2026 (Online) 2nd April Evening Shift]

- (1) Na_2O , K_2O , Al_2O_3 and As_2O_3
 (2) Al_2O_3 , As_2O_3 , CO and NO
 (3) K_2O , Cl_2O_7 , As_2O_3 and NO
 (4) Na_2O , N_2O , Al_2O_3 and CO

Scan or tap for the full solution



- Q.29** Given below are two statements :

Statement-I: The second ionization enthalpy of B, Al and Ga is in the order of $\text{B} > \text{Al} > \text{Ga}$.

Statement-II: The correct order in terms of first ionization enthalpy is $\text{Si} < \text{Ge} < \text{Pb} < \text{Sn}$.

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

[JEE Main 2026 (Online) 2nd April Evening Shift]

- (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

Scan or tap for the full solution



- Q.30** Given below are two statements :

Statement-I: Among Zn, Mn, Sc and Cu, the energy required to remove the third valence electron is highest for Zn and lowest for Sc.

Statement-II: The correct order of the following complexes in terms of CFSE is $[\text{Co}(\text{H}_2\text{O})_6]^{2+} < [\text{Co}(\text{H}_2\text{O})_6]^{3+} < [\text{Co}(\text{en})_3]^{3+}$.

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

[JEE Main 2026 (Online) 2nd April Evening Shift]

- (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

Scan or tap for the full solution

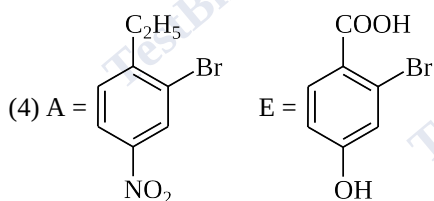
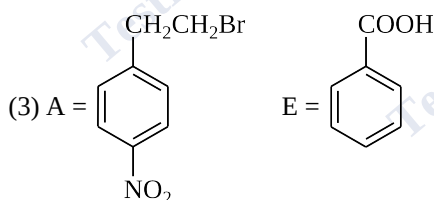
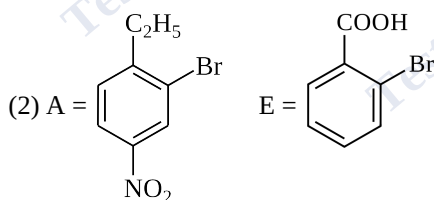
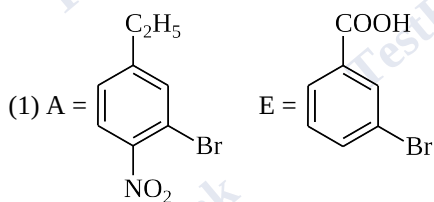


- Q.31** Which of the following complexes will show coordination isomerism?

- A. $[\text{Ag}(\text{NH}_3)_2][\text{Ag}(\text{CN})_2]$
 B. $[\text{Co}(\text{NH}_3)_6][\text{Cr}(\text{CN})_6]$
 C. $[\text{Co}(\text{NH}_3)_6][\text{Co}(\text{CN})_6]$
 D. $[\text{Fe}(\text{NH}_3)_6][\text{Co}(\text{CN})_6]$
 E. $[\text{Co}(\text{NH}_3)_6][\text{Fe}(\text{CN})_6]$

Choose the **correct** answer from the options given below:

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Q.39 Identify the correct pair having amino acid (A) and the hormone (B) that is iodinated derivative of the amino acid (A).

(T and Y represent one letter code for amino acids)

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- (1) Amino acid (A) - T Hormone (B) - Insulin
 (2) Amino acid (A) - T Hormone (B) - Thyroxine
 (3) Amino acid (A) - Y Hormone (B) - Thyroxine
 (4) Amino acid (A) - Y Hormone (B) - Insulin

Scan or tap for the full solution



Q.40 Among Fe^{2+} , Fe^{3+} , Cr^{2+} and Zn^{2+} , the ion that shows positive borax bead test and with highest ionisation enthalpy is :

[JEE Main 2026 (Online) 2nd April Evening Shift]

- (1) Fe^{2+} (2) Zn^{2+} (3) Cr^{2+} (4) Fe^{3+}

Scan or tap for the full solution



Q.41 Let α, β be the roots of the equation $x^2 - 3x + r = 0$, and $\frac{\alpha}{2}, 2\beta$ be the roots of the equation $x^2 + 3x + r = 0$.

If the roots of the equation $x^2 + 6x = m$ are $2\alpha + \beta + 2r$ and $\alpha - 2\beta - \frac{r}{2}$, then m is equal to :

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- (1) -135 (2) -567 (3) 135 (4) 567

Scan or tap for the full solution



Q.42 Let the circles $C_1: |z| = r$ and $C_2: |z - 3 - 4i| = 5$, $z \in \mathbb{C}$, be such that C_2 lies within C_1 .

If z_1 moves on C_1 , z_2 moves on C_2 and $\min|z_1 - z_2| = 2$, then $\max|z_1 - z_2|$ is equal to :

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- (1) 12 (2) 17 (3) 22 (4) 24

Scan or tap for the full solution



Q.43 If the system of equations

$$x + 5y + 6z = 4,$$

$$2x + 3y + 4z = 7,$$

$$x + 6y + az = b$$

has infinitely many solutions, then the point (a, b) lies on the line

[JEE Main 2026 (Online) 2nd April Evening Shift]

- (1) $y - x = 3$ (2) $x - y = 3$
 (3) $x + y = 11$ (4) $x + y = 12$

Scan or tap for the full solution



Q.44 Let $a_1, a_2, a_3, \dots$ be an A.P. and $g_1 = a_1, g_2, g_3, \dots$ be an increasing G.P. If $a_1 = a_2 + g_2 = 1$ and $a_3 + g_3 = 4$, then $a_{10} + g_5$ is equal to:

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- (1) 81 (2) 76 (3) 62 (4) 55

Scan or tap for the full solution



Q.45 The sum $\frac{1^3}{1} + \frac{1^3 + 2^3}{1 + 3} + \frac{1^3 + 2^3 + 3^3}{1 + 3 + 5} + \dots$ up to 8 terms, is :

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- (1) 70 (2) 71 (3) 72 (4) 73

Scan or tap for the full solution



Q.46 If for $3 \leq r \leq 30$, $({}^{30}C_{30-r}) + 3({}^{30}C_{31-r}) + 3({}^{30}C_{32-r}) + ({}^{30}C_{33-r}) = {}^m C_r$, then m equals :

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- (1) 31 (2) 32 (3) 33 (4) 34

Scan or tap for the full solution



- Q.47** Let p_n denote the total number of triangles formed by joining the vertices of an n -side regular polygon. If $p_{n+1} - p_n = 66$, then the sum of all distinct prime divisors of n is :

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

Scan or tap for the full solution



- Q.48** A man throws a fair coin repeatedly. He gets 10 points for each head he throws and 5 points for each tail he throws. If the probability that he gets exactly 30 points is $\frac{m}{n}$, $\gcd(m, n) = 1$, then $m + n$ is equal to :

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- (1) 53 (2) 55 (3) 107 (4) 105

Scan or tap for the full solution



- Q.49** The mean and variance of n observations are 8 and 16, respectively. If the sum of the first $(n-1)$ observations is 48 and the sum of squares of the first $(n-1)$ observations is 496, then the value of n is :

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- (1) 21 (2) 16 (3) 13 (4) 7

Scan or tap for the full solution



- Q.50** Let a circle pass through the origin and its centre be the point of intersection of two mutually perpendicular lines $x + (k-1)y + 3 = 0$ and $2x + k^2y - 4 = 0$. If the line $x - y + 2 = 0$ intersects the circle at the points A and B, then $(AB)^2$ is equal to :

[JEE Main 2026 (Online) 2nd April Evening Shift]

- (1) 10 (2) 27 (3) 18 (4) 34

Scan or tap for the full solution



- Q.51** Let O be the origin, and P and Q be two points on the rectangular hyperbola $xy = 12$ such that the midpoint of the line segment PQ is $\left(\frac{1}{2}, -\frac{1}{2}\right)$. Then the area of the triangle OPQ equals :

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- (1) $\frac{3}{2}$ (2) $\frac{5}{2}$ (3) $\frac{7}{2}$ (4) $\frac{9}{2}$

Scan or tap for the full solution



- Q.52** Let the parabola $y = x^2 + px + q$ passing through the point $(1, -1)$ be such that the distance between its vertex and the x -axis is minimum. Then the value of $p^2 + q^2$ is :

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

Scan or tap for the full solution



- Q.53** Let $P = \{\theta \in [0, 4\pi] : \tan^2 \theta \neq 1\}$ and $S = \{a \in \mathbb{Z} : 2(\cos^8 \theta - \sin^8 \theta) \sec 2\theta = a^2, \theta \in P\}$. Then $n(S)$ is:

[JEE Main 2026 (Online) 2nd April Evening Shift]

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

Scan or tap for the full solution



- Q.54** Let the vectors $\vec{a} = -\hat{i} + \hat{j} + 3\hat{k}$ and $\vec{b} = \hat{i} + 3\hat{j} + \hat{k}$. For some $\lambda, \mu \in \mathbb{R}$, let $\vec{c} = \lambda\vec{a} + \mu\vec{b}$. If $\vec{c} \cdot (3\hat{i} - 6\hat{j} + 2\hat{k}) = 10$ and $\vec{c} \cdot (\hat{i} + \hat{j} + \hat{k}) = -2$, then $|\vec{c}|^2$ is equal to :

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- (1) 8 (2) 12 (3) 14 (4) 15

Scan or tap for the full solution



- Q.55** Let the point A be the foot of perpendicular drawn from the point $P(a, b, 0)$ on the line

$$\frac{x-1}{2} = \frac{y-2}{1} = \frac{z-\alpha}{3}.$$

If the midpoint of the line segment PA is $\left(0, \frac{3}{4}, -\frac{1}{4}\right)$, then the value of $a^2 + b^2 + \alpha^2$ is equal to :

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

Scan or tap for the full solution



- Q.56** Two adjacent sides of a parallelogram PQRS are given by $\vec{PQ} = \hat{j} + \hat{k}$ and $\vec{PS} = \hat{i} - \hat{j}$. If the side PS is rotated about the point P by an acute angle α in the plane of the parallelogram so that it becomes perpendicular to the side PQ, then $\sin^2\left(\frac{5\alpha}{2}\right) - \sin^2\left(\frac{\alpha}{2}\right)$ is equal to:

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

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- Q.57** The value of $\int_0^{20\pi} (\sin^4 x + \cos^4 x) dx$ is equal to:

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- (1) $\frac{15\pi}{2}$ (2) 25π (3) 15π (4) $\frac{25\pi}{2}$

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- Q.58** Let $f(x)$ be a polynomial of degree 5, and have extrema at $x = 1$ and $x = -1$. If $\lim_{x \rightarrow 0} \left(\frac{f(x)}{x^3}\right) = -5$, then $f(2) - f(-2)$ is equal to:

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- (1) 0 (2) 50 (3) 92 (4) 112

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Q.59 Let $f(x) = \int \left(\frac{16x+24}{x^2+2x-15} \right) dx$. If $f(4) = 14 \log_e(3)$ and $f(7) = \log_e(2^\alpha \cdot 3^\beta)$, $\alpha, \beta \in \mathbb{N}$, then $\alpha + \beta$ is equal to :

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- (1) 31 (2) 37 (3) 39 (4) 41

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Q.60 Let $x = x(y)$ be the solution of the differential equation $2y^2 \frac{dx}{dy} - 2xy + x^2 = 0$, $y > 1$, $x(e) = e$. Then $x(e^2)$ is equal to:

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

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Section B (Numerical) — 15 questions

Q.61 In a Young's double slit experiment, the intensity at some point on the screen is found to be $\frac{3}{4}$ times of the maximum of the interference pattern. The path difference between the interfering waves at this point is $\frac{\lambda}{x}$ where λ is wavelength of the incident light. The value of x is _____.

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Q.62 Using Bohr's model, calculate the ratio of the magnetic fields generated due to the motion of the electrons in the 2nd and 4th orbits of hydrogen atom _____.

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Q.63 5 moles of unknown gas is heated at constant volume from 10 °C to 20 °C. The molar specific heat of this gas at constant pressure $c_p = 8$ cal/mol.°C and $R = 8.36$ J/mol.°C. The change in the internal energy of the gas is _____ calorie.

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Q.64 If sunlight is focused on a paper using convex lens, it starts burning the paper in shortest time when the lens is kept at 30 cm above the paper. If the radius of curvature of the lens is 60 cm then the refractive index of the lens material is $\frac{\alpha}{10}$. The value of α is _____.

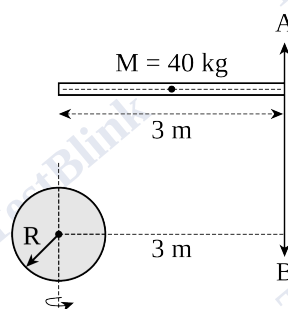
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Q.65 Moment of inertia about an axis AB for a rod of mass 40 kg and length 3 m is same as that of a solid sphere of mass of 10 kg and radius R about an axis parallel to AB axis with separation of 3 m as shown in figure below. The value of R is given as $\sqrt{\frac{\alpha}{2}}$. The value of α is _____.

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Q.66 The surface of sodium metal is irradiated with radiation of wavelength x nm. The kinetic energy of ejected electrons is 2.8×10^{-20} J. The work function of sodium is 2.3 eV. The value of x is _____ $\times 10^2$ nm. (Nearest integer)
(Given : $h = 6.6 \times 10^{-34}$ J s; $1 \text{ eV} = 1.6 \times 10^{-19}$ J; $c = 3.0 \times 10^8 \text{ m s}^{-1}$)

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Q.67 Consider the following gas phase reaction being carried out in a closed vessel at 25°C.
 $2A(g) \longrightarrow 4B(g) + C(g)$

time (min)	total pressure of the system (mm Hg)
30	300
∞	600

The pressure of C(g) at 30 minutes time interval would be _____ mm Hg. (nearest integer)

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- Q.68** Consider the following two half-cell reactions along with the standard reduction potential given :
- $$\text{CO}_2 + 6\text{H}^+ + 6\text{e}^- \longrightarrow \text{CH}_3\text{OH} + \text{H}_2\text{O}$$
- $$E^\circ_{\text{red}} = 0.02 \text{ V}$$
- $$\frac{1}{2}\text{O}_2 + 2\text{H}^+ + 2\text{e}^- \longrightarrow \text{H}_2\text{O} \quad E^\circ_{\text{red}} = 1.23 \text{ V}$$
- A fuel cell was set up using the above two reactions such that the cell operates under the standard condition of 1 bar pressure and 298 K temperature. The fuel cell works with 80% efficiency. If the work derived from the cell using 1 mol of CH_3OH is used to compress an ideal gas isothermally against a constant pressure of 1 kPa, then the change in the volume of the gas,
- $$\Delta V = \text{_____ m}^3. \text{ (nearest integer)}$$
- Given : $F = 96500 \text{ C mol}^{-1}$

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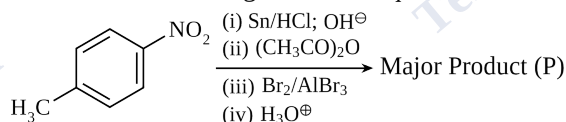


- Q.69** Number of paramagnetic ions among the following d- and f-block metal ions is _____.
 Mn^{2+} , Cu^{2+} , Zn^{2+} , Yb^{2+} , Sc^{3+} , La^{3+} , Gd^{3+} , Lu^{3+} , Ti^{4+} , Ce^{4+}
 (Atomic number of Mn = 25, Cu = 29, Zn = 30, Yb = 70, Sc = 21, La = 57, Gd = 64, Lu = 71, Ti = 22, Ce = 58)

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- Q.70** Consider the following reactions sequence



When the product (P) is subjected to Carius analysis using AgNO_3 , 1.0 g of the product (P) will produce _____ g of the precipitate of AgBr. (Nearest Integer)

(Given : molar mass in g mol^{-1} C : 12, H : 1, O : 16, N : 14, Br : 80, Ag : 108)

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- Q.71** Let $A = \{2, 3, 4, 5, 6\}$. Let R be a relation on the set $A \times A$ given by $(x, y)R(z, w)$ if and only if x divides z and $y \leq w$. Then the number of elements in R is _____.

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- Q.72** Consider the matrices $A = \begin{bmatrix} 2 & -2 \\ 4 & -2 \end{bmatrix}$ and

$B = \begin{bmatrix} 3 & 9 \\ 1 & 3 \end{bmatrix}$. If matrices P and Q are such that $PA = B$ and $AQ = B$, then the absolute value of the sum of the diagonal elements of $2(P + Q)$ is _____.

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- Q.73** Let A be the point (3, 0) and circles with variable diameter AB touch the circle $x^2 + y^2 = 36$ internally. Let the curve C be the locus of the point B. If the eccentricity of C is e, then $72e^2$ is equal to _____.

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- Q.74** If the area of the region bounded by $16x^2 - 9y^2 = 144$ and $8x - 3y = 24$ is A, then $3(A + 6\log_e(3))$ is equal to _____.

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- Q.75** The number of points in the interval $[2, 4]$, at which the function $f(x) = \left[x^2 - x - \frac{1}{2} \right]$, where $[\cdot]$ denotes the greatest integer function, is discontinuous, is _____.

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ANSWER KEY

Section A (MCQ) — 60 questions

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

Section B (Numerical) — 15 questions

Ques.	61	62	63	64	65	66	67
Ans.	6	32	300	20	15	5	20
Ques.	68	69	70	71	72	73	74
Ans.	560	3	1	120	34	18	24
Ques.	75						
Ans.	10						