1 - JEE Main Maths 23-Jan 2026 Shift -1

Q1. Let α and β respectively be the maximum and the minimum values of the function

$f\left(\theta\right) = 4\left(\sin^4\left(\frac{7\pi}{2} - \theta\right) + \sin^4\left(11\pi + \theta\right)\right) - 2\left(\sin^6\left(\frac{3\pi}{2} - \theta\right) + \sin^6\left(9\pi - \theta\right)\right), \quad \theta \in R$.

Then $\alpha + 2\beta$ is equal to: **[2026]**

1) 5
2) 3
3) 4
4) 6

Q2. Let $A = \{-2, -1, 0, 1, 2, 3, 4\}$. Let R be a relation on A defined by xRy if and only if $2x + y \leq 2$. Let l be the number of elements in R. Let m and n be the minimum number of elements required to be added in R to make it reflexive and symmetric relations respectively. Then $l + m + n$ is equal to: **[2026]**

1) 33
2) 32
3) 35
4) 34

Q3. The value of the integral $\int_{\frac{\pi}{24}}^{\frac{5\pi}{24}} \frac{dx}{1 + \sqrt[3]{\tan 2x}}$ is: **[2026]**

1) $\frac{\pi}{3}$
2) $\frac{\pi}{18}$
3) $\frac{\pi}{12}$
4) $\frac{\pi}{6}$

Q4. A building construction work can be completed by two masons A and B together in 22.5 days. Mason A alone can complete the construction work in 24 days less than mason B alone. Then mason A alone will complete the construction work in: **[2026]**

1) 24 days
2) 36 days
3) 42 days
4) 30 days

Q5. The sum of all possible values of $n \in N$, so that the coefficients of x, x^2 and x^3 in the expansion of $\left(1 + x^2\right)^2 (1 + x)^n$, are in arithmetic progression, is: **[2026]**

1) 3
2) 7
3) 9
4) 12

Q6. Let the direction cosines of two lines satisfy the equations $4l + m - n = 0$ and $2mn + 10nl + 3lm = 0$. Then the cosine of the acute angle between these lines is: **[2026]**

1) $\frac{10}{\sqrt{38}}$
2) $\frac{20}{3\sqrt{38}}$
3) $\frac{10}{7\sqrt{38}}$
4) $\frac{10}{3\sqrt{38}}$

Q7. Let $f(x) = \int \frac{\left(2 - x^2\right).e^x}{\left(\sqrt{1+x}\right)(1-x)^{3/2}} dx$. If $f(0) = 0$, then $f\left(\frac{1}{2}\right)$ is equal to: **[2026]**

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

Q8. Let $f(x) = \begin{cases} \frac{ax^2 + 2ax + 3}{4x^2 + 4x - 3}, & x \neq -\frac{3}{2}, \frac{1}{2} \\ b, & x = -\frac{3}{2}, \frac{1}{2} \end{cases}$

be continuous at $x = -\frac{3}{2}$. If $fof\left(x\right) = \frac{7}{5}$, then x is equal to: **[2026]**

1) 1.4
2) 0
3) 1
4) 2

Q9. Let $y = y\left(x\right)$ be the solution of the differential equation $x^4\ dy + \left(4x^3y + 2\sin x\right)dx = 0, \quad x > 0$, $y\left(\frac{\pi}{2}\right) = 0$. Then $\pi^4 y\left(\frac{\pi}{3}\right)$ is equal to: **[2026]**

1) 81
2) 72
3) 92
4) 64

Q10. A rectangle is formed by the lines $x = 0$, $y = 0$, $x = 3$, and $y = 4$. Let the line L be perpendicular to $3x + y + 6 = 0$ and divide the area of the rectangle into two equal parts. Then the distance of the point $\left(\frac{1}{2}, -5\right)$ from the line L is equal to: **[2026]**

1) $\sqrt{10}$
2) $2\sqrt{5}$
3) $2\sqrt{10}$
4) $3\sqrt{10}$

Q11. Let the mean and variance of 8 numbers $-10, -7, -1, x, y, 9, 2, 16$ be $\frac{7}{2}$ and $\frac{293}{4}$, respectively. Then the mean of 4 numbers $x, y, x + y + 1, |x - y|$ is: **[2026]**

1) 9
2) 12
3) 10
4) 11

Q12. Let $S = \left\{z : 3 \leq |2z - 3\left(1 + i\right)| \leq 7\right\}$ be a set of complex numbers. Then $\min\limits_{z \in S} \left|\left(z + \frac{1}{2}\left(5 + 3i\right)\right)\right|$ is equal to: **[2026]**

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

Q13. The value of $\frac{{}^{100}C_{50}}{51} + \frac{{}^{100}C_{51}}{52} + \cdots + \frac{{}^{100}C_{100}}{101}$ is: **[2026]**

1) $\frac{2^{100}}{101}$
2) $\frac{2^{100}}{100}$
3) $\frac{2^{101}}{101}$
4) $\frac{2^{101}}{100}$

Q14. Let the domain of the function $f(x) = \log_3\log_5\log_7\left(9x - x^2 - 13\right)$ be the interval (m, n). Let the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ have eccentricity $\frac{n}{3}$ and the length of the latus rectum $\frac{8m}{3}$. Then $b^2 - a^2$ is equal to: **[2026]**

1) 9
2) 11
3) 5
4) 7

Q15. The vertices B and C of a triangle ABC lie on the line $\frac{x}{1} = \frac{1 - y}{-2} = \frac{z - 2}{3}$. The coordinates of A and B are (1,6,3) and (4,9,α) respectively and C is at a distance of 10 units from B. The area (in sq. units) of ΔABC is: **[2026]**

1) $5\sqrt{13}$
2) $10\sqrt{13}$
3) $20\sqrt{13}$
4) $15\sqrt{13}$

Q16. Let $\vec{a} = -\hat{i} + \hat{j} + 2\hat{k}$, $\vec{b} = \hat{i} - \hat{j} - 3\hat{k}$, $\vec{c} = \vec{a} \times \vec{b}$ and $\vec{d} = \vec{c} \times \vec{a}$. Then $\left(\vec{a} - \vec{b}\right) \cdot \vec{d}$ is equal to: **[2026]**

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

Q17. Let the line $y - x = 1$ intersect the ellipse $\frac{x^2}{2} + \frac{y^2}{1} = 1$ at the points A and B. Then the angle made by the line segment AB at the center of the ellipse is: **[2026]**

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

Q18. Among the statements:

I: If $\begin{vmatrix} 1 & \cos\alpha & \cos\beta \\ \cos\alpha & 1 & \cos\gamma \\ \cos\beta & \cos\gamma & 1 \end{vmatrix} = \begin{vmatrix} 0 & \cos\alpha & \cos\beta \\ \cos\alpha & 0 & \cos\gamma \\ \cos\beta & \cos\gamma & 0 \end{vmatrix}$, then $\cos^2\alpha + \cos^2\beta + \cos^2\gamma = \frac{3}{2}$, and

II: If $\begin{vmatrix} x^2 + x & x + 1 & x - 2 \\ 2x^2 + 3x - 1 & 3x & 3x - 3 \\ x^2 + 2x + 3 & 2x - 1 & 2x - 1 \end{vmatrix} = px + q$, then $p^2 = 196q^2$. **[2026]**

1) only I is true
2) both are false
3) only II is true
4) both are true

Q19. Number of solutions of $\sqrt{3}\cos 2\theta + 8\cos\theta + 3\sqrt{3} = 0$, $\theta \in [-3\pi, 2\pi]$ is: **[2026]**

1) 5
2) 0
3) 3
4) 4

Q20. If α and $\beta\ (\alpha < \beta)$ are the roots of the equation $\left(-2 + \sqrt{3}\right)\left(|\sqrt{x} - 3|\right) + \left(x - 6\sqrt{x}\right) + \left(9 - 2\sqrt{3}\right) = 0$, $x \geq 0$, then $\sqrt{\frac{\beta}{\alpha}} + \sqrt{\alpha\beta}$ is equal to: **[2026]**

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

Q21. Let $|A| = 6$, where A is a 3×3 matrix. If $\left|\text{adj}\left(3\ \text{adj}\left(A^2 \cdot\ \text{adj}\left(2A\right)\right)\right)\right| = 2^m \cdot 3^n$, $m, n \in N$, then $m + n$ is equal to _____. **[2026]**

Q22. From the first 100 natural numbers, two numbers first a and then b are selected randomly without replacement. If the probability that $a - b \geq 10$ is $\frac{m}{n}$, $\gcd(m, n) = 1$, then $m + n$ is equal to _____. **[2026]**

Q23. Let the area of the region bounded by the curve $y = \max\{\sin x, \cos x\}$, lines $x = 0$, $x = \frac{3\pi}{2}$, and the x-axis be A. Then $A + A^2$ is equal to _____. **[2026]**

Q24. Let f be a twice differentiable non-negative function such that $\left(f(x)\right)^2 = 25 + \int_0^x \left(\left(f(t)\right)^2 + \left(f'(t)\right)^2\right)dt$. Then the mean of $f\left(\log_e\left(1\right)\right), f\left(\log_e\left(2\right)\right), \ \ldots, \ f\left(\log_e\left(625\right)\right)$ is equal to _____ . **[2026]**

Q25. The number of 4-letter words, with or without meaning, which can be formed using the letters PQRPQRSTUVP, is _____. **[2026]**

2 - JEE Main Physics 23-Jan 2026 Shift -1

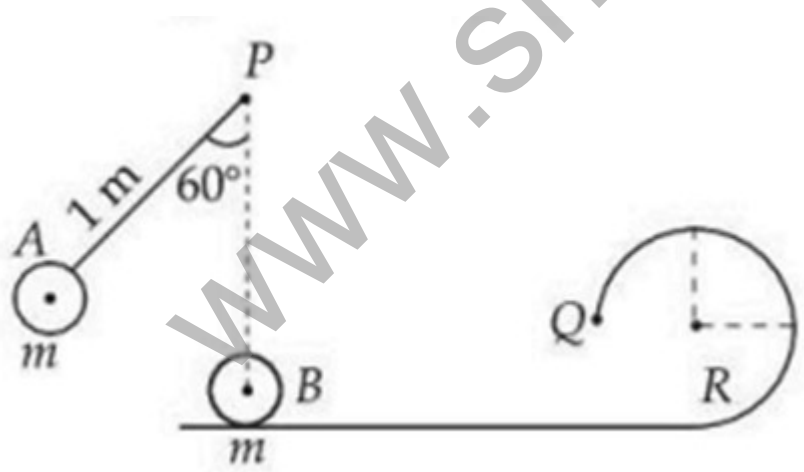
Q26. Match List – I with List – II. **[2026]**

	List – I		List – II
	(Relation)		(Law)
A.	$\oint \vec{E} \cdot d\vec{l} = -\frac{d}{dt}\oint \vec{B} \cdot \vec{da}$	I.	Ampere's circuital law
B.	$\oint \vec{B} \cdot \vec{dl} = \mu_0\left(I + \varepsilon_0\frac{d\Phi_E}{dt}\right)$	II.	Faraday's laws of electromagnetic induction
C.	$\oint \vec{E} \cdot \vec{da} = \frac{1}{\varepsilon_0}\int_V \rho dV$	III.	Ampere–Maxwell law
D.	$\oint \vec{B} \cdot \vec{dl} = \mu_0 I$	IV.	Gauss's law of electrostatics

Choose the correct answer from the options given below:

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

Q27. A small bob A of mass m is attached to a massless rigid rod of length 1 m pivoted at point P and kept at an angle of 60° with the vertical as shown in the figure. At a distance of 1 m below point P, an identical bob B is kept at rest on a smooth horizontal surface that extends to a circular track of radius R as shown in the figure. If bob B just manages to complete the circular path of radius R up to a point Q after being hit elastically by bob A, then the radius R is _____ m. **[2026]**



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

Q28. A 20 m long uniform copper wire held horizontally is allowed to fall under gravity $\left(g = 10\ \mathrm{m/s^2}\right)$ through a uniform horizontal magnetic field of 0.5 Gauss perpendicular to the length of the wire. The induced EMF across the wire when it travels a vertical distance of 200 m is _____ mV. **[2026]**

1) $20\sqrt{10}$
2) $0.2\sqrt{10}$
3) $200\sqrt{10}$
4) $2\sqrt{10}$

Q29. Given below are two statements: one is labelled as **Assertion (A)** and the other is labelled as **Reason (R)**.

Consider a ferromagnetic material:

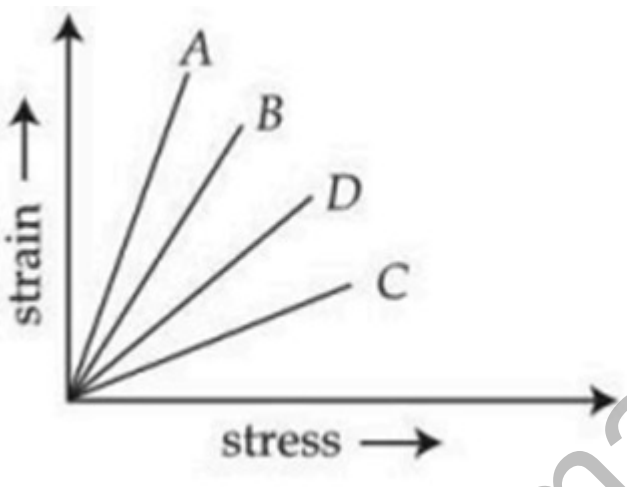
Assertion (A): The individual atoms in a ferromagnetic material possess a magnetic dipole moment and interact with one another in such a way that they spontaneously align themselves forming domains.

Reason (R): At high enough temperature, the domain structure of ferromagnetic material disintegrates. Thus, magnetization will disappear at high enough temperature known as Curie temperature.

In the light of the above statements, choose the **correct answer** from the options given below: **[2026]**

1) (A) is true but (R) is false
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) Both (A) and (R) are true and (R) is the correct explanation of (A)

Q30. The strain–stress plot for materials A, B, C, and D is shown in the figure. Which material has the largest Young's modulus? **[2026]**



1) B
2) A
3) D
4) C

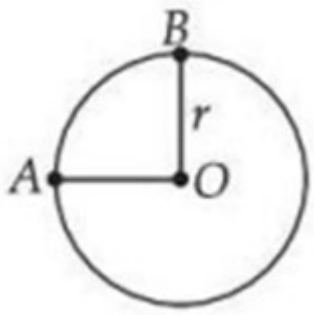
Q31. Four persons measure the length of a rod as 20.00 cm, 19.75 cm, 17.01 cm, and 18.25 cm. The relative error in the measurement of average length of the rod is: **[2026]**

1) 0.08
2) 0.18
3) 0.24
4) 0.06

Q32. A thin prism with angle 5° of refractive index 1.72 is combined with another prism of refractive index 1.9 to produce dispersion without deviation. The angle of the second prism is _____. **[2026]**

1) 4.5°
2) 6°
3) 5°
4) 4°

Q33. A wire of uniform resistance $\lambda\ \Omega$ / m is bent into a circle of radius r and another piece of wire with length $2r$ is connected between points A and B (AOB) as shown in the figure. The equivalent resistance between points A and B is _____ Ω. **[2026]**



1) $2\pi\lambda r$

2) $\frac{3\pi\lambda r}{8}$

3) $\frac{6\pi\lambda r}{3\pi+16}$

4) $(\pi+1)\,2r\lambda$

Q34. A simple pendulum of string length 30 cm performs 20 oscillations in 10 s. The length of the string required for the pendulum to perform 40 oscillations in the same time duration is _____ cm. [Assume that the mass of the pendulum remains same.] **[2026]**

1) 7.5

2) 0.75

3) 15

4) 120

Q35. The moment of inertia of a square loop made of four uniform solid cylinders, each having radius R and length L $(R<L)$ about an axis passing through the mid points of opposite sides, is _____. (Take the mass of the entire loop as M). **[2026]**

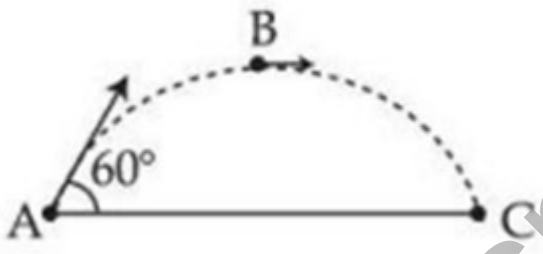
1) $\frac{3}{8}MR^2+\frac{1}{6}ML^2$

2) $\frac{3}{8}MR^2+\frac{7}{12}ML^2$

3) $\frac{3}{4}MR^2+\frac{7}{12}ML^2$

4) $\frac{3}{4}MR^2+\frac{1}{6}ML^2$

Q36. An object is projected with kinetic energy K from a point A at an angle 60° with the horizontal. The ratio of the difference in kinetic energies at points B and C to that at point A (see figure), in the absence of air friction, is: **[2026]**



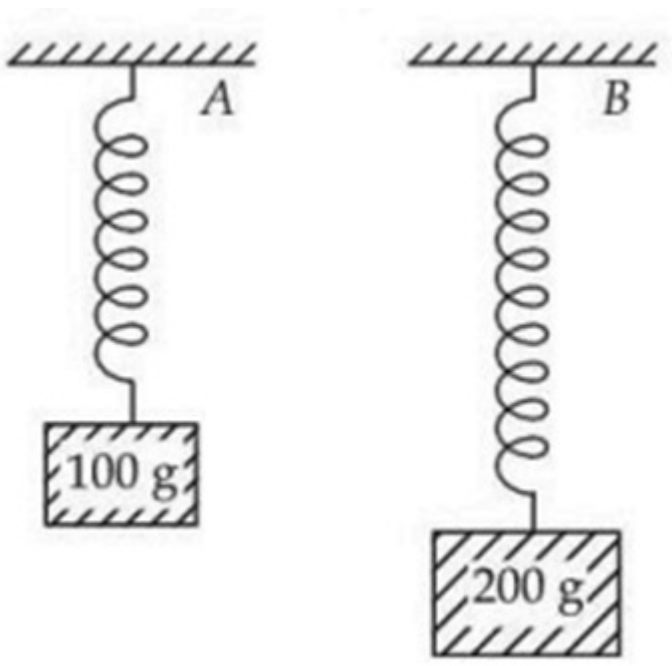
1) 1 : 4

2) 2 : 3

3) 3 : 4

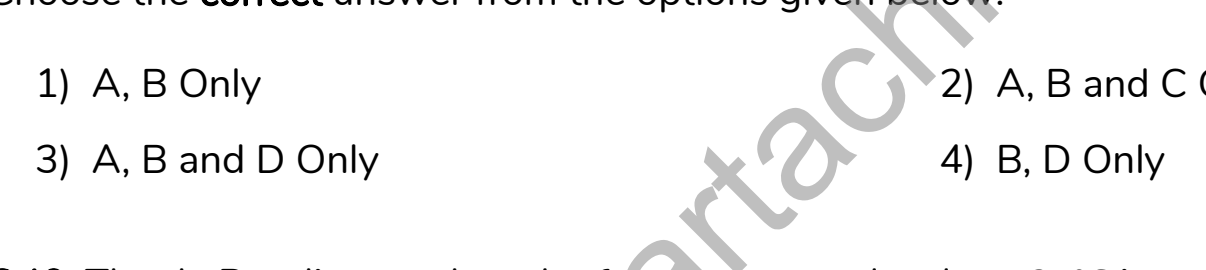
4) 1 : 2

Q37. Two blocks with masses 100 g and 200 g are attached to the ends of springs A and B as shown in the figure. The energy stored in A is E. The energy stored in B, when spring constants k_A and k_B of A and B, respectively satisfy the relation $4k_A=3k_B$ is: **[2026]**



1) $2E$
2) $4E$
3) $\frac{4}{3}E$
4) $3E$

Q38. The following diagram shows a Zener diode as a voltage regulator. The Zener diode is rated at $V_Z = 5\text{V}$ and the desired current in the load is 5mA. The unregulated voltage source can supply up to 25V. Considering the Zener diode can withstand four times of the load current, the value of resistor R_s (shown in circuit) should be ____ Ω. **[2026]**



1) 1000
2) 100
3) 4000
4) 10

Q39. In hydrogen atom spectrum, $(R \rightarrow \text{Rydberg's constant})$

A. the maximum wavelength of the radiation of Lyman series is $\frac{4}{3R}$
B. the Balmer series lies in the visible region of the spectrum
C. the minimum wavelength of the radiation of Paschen series is $\frac{9}{R}$
D. the minimum wavelength of Lyman series is $\frac{5}{4R}$

Choose the **correct** answer from the options given below: **[2026]**

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

Q40. The de Broglie wavelength of an oxygen molecule at $27°\text{C}$ is $x \times 10^{-12}\,\text{m}$. The value of x is (take Planck's constant $= 6.63 \times 10^{-34}\,\text{J.s}$, Boltzmann constant $= 1.38 \times 10^{-23}\,\text{J/K}$, mass of oxygen molecule $= 5.31 \times 10^{-26}\,\text{kg}$). **[2026]**

1) 20
2) 30
3) 26
4) 24

Q41. Two small balls with masses *m* and *2m* are attached to both ends of a rigid rod of length *d* and negligible mass. If angular momentum of this system is *L* about an axis *(A)* passing through its centre of mass and perpendicular to the rod then angular velocity of the system about *A* is: **[2026]**

1) $\frac{2L}{md^2}$
2) $\frac{3}{2}\frac{L}{md^2}$
3) $\frac{4}{3}\frac{L}{md^2}$
4) $\frac{2L}{5md^2}$

Q42. In a screw gauge, the zero of the circular scale lies 3 divisions above the horizontal pitch line when their metallic studs are brought in contact. Using this instrument, thickness of a sheet is measured. If pitch scale reading is 1 mm and the circular scale reading is 51, then the correct thickness of the sheet is _____ mm.

[Assume least count is 0.01 mm] **[2026]**

1) 1.54
2) 1.48

3) 1.50

4) 1.51

Q43. In a perfectly inelastic collision, two spheres made of the same material with masses 15 kg and 25 kg, moving in opposite directions with speeds 10 m/s and 30 m/s respectively, strike each other and stick together. The rise in temperature (in°C), if all the heat produced during the collision is retained by these spheres, is:

(specific heat of sphere material $31\,\text{cal/kg°C}$ and 1 cal = 4.2 J) **[2026]**

1) 1.95

2) 1.15

3) 1.75

4) 1.44

Q44. Consider light travelling from a medium A to medium B separated by a plane interface. If the light undergoes total internal reflection during its travel from medium A to B and the speed of light in medium A and B are $2.4\times10^8\,\text{m/s}$ and $2.7\times10^8\,\text{m/s}$ respectively, then the value of critical angle is:

[2026]

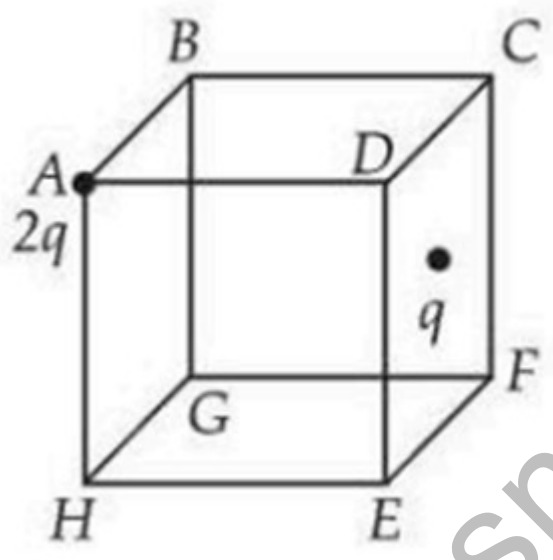
1) $\tan^{-1}\left(\frac{8}{\sqrt{17}}\right)$

2) $\cot^{-1}\left(\frac{3}{\sqrt{13}}\right)$

3) $\sin^{-1}\left(\frac{9}{8}\right)$

4) $\cos^{-1}\left(\frac{8}{9}\right)$

Q45. Two point charges $2q$ and q are placed at vertex A and centre of face CDEF of the cube as shown in the figure. The electric flux passing through the cube is: **[2026]**



1) $\frac{3q}{2\varepsilon_0}$

2) $\frac{q}{\varepsilon_0}$

3) $\frac{3q}{4\varepsilon_0}$

4) $\frac{3q}{\varepsilon_0}$

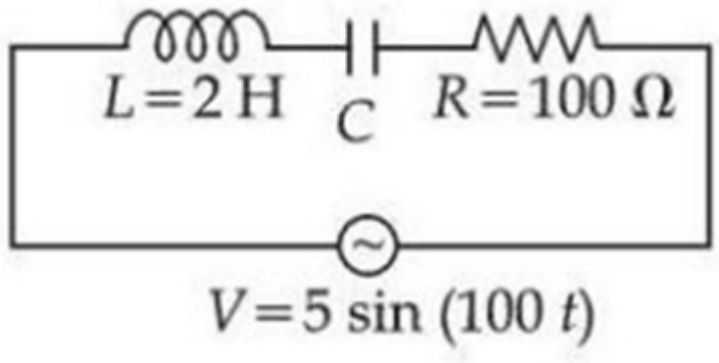
Q46. The equation of the electric field of an electromagnetic wave propagating through free space is given by:

$$E=\sqrt{377}\sin\left(6.27\times10^3 t - 2.09\times10^{-5}x\right)\ \text{N/C}$$

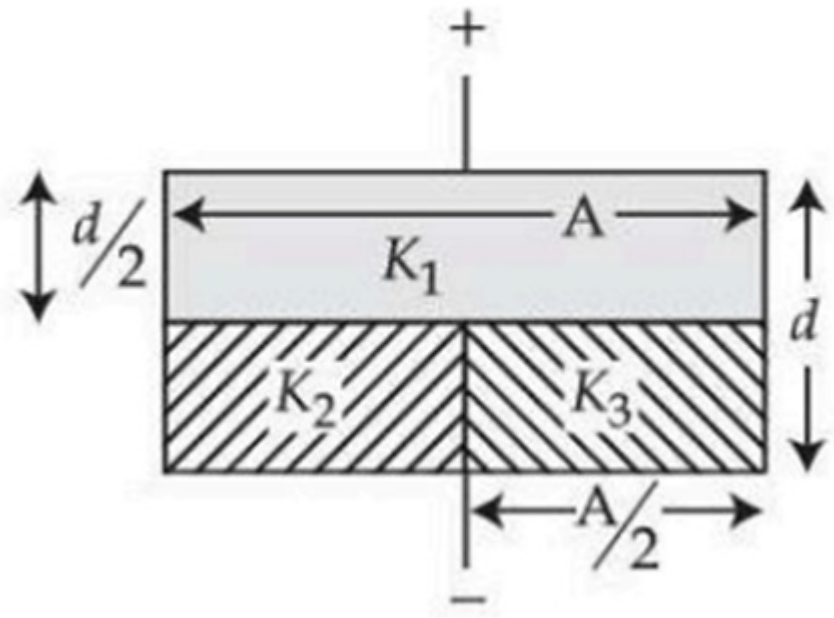
The average power of the electromagnetic wave is $\left(\frac{1}{\alpha}\right)\ \text{W/m}^2$. The value of α is _____.

$\left(\text{Take } \sqrt{\frac{\mu_0}{\varepsilon_0}} = 377 \text{ in SI units}\right)$ **[2026]**

Q47. Using a variable frequency a.c. voltage source the maximum current measured in the given LCR circuit is 50 mA for V = 5sin(100t). The values of L and R are shown in the figure. The capacitance of the capacitor (C) used is _____ μF. **[2026]**



Q48. The space between the plates of a parallel plate capacitor of capacitance C (without any dielectric) is now filled with three dielectric slabs of dielectric constants $K_1 = 2$, $K_2 = 3$, and $K_3 = 5$ (as shown in the figure). If the new capacitance is $\frac{n}{3}C$, then the value of n is _____. **[2026]**



Q49. In two separate Young's double-slit experimental set-ups, two monochromatic light sources of different wavelengths are used to get fringes of equal width. The ratios of the slit separations and that of the wavelengths of light used are 2 : 1 and 1 : 2 respectively. The corresponding ratio of the distances between the slits and the respective screens $\left(D_1 / D_2\right)$ is _____ . **[2026]**

Q50. A simple pendulum made of mass 10 g and a metallic wire of length 10 cm is suspended vertically in a uniform magnetic field of 2 T. The magnetic field direction is perpendicular to the plane of oscillations of the pendulum. If the pendulum is released from an angle of $60°$ with the vertical, then the maximum induced EMF between the point of suspension and the point of oscillation is _____ mV. (Take $g = 10\mathrm{m/s^2}$). **[2026]**

3 - JEE Main Chemistry 23-Jan 2026 Shift -1

Q51. Given below are two statements:

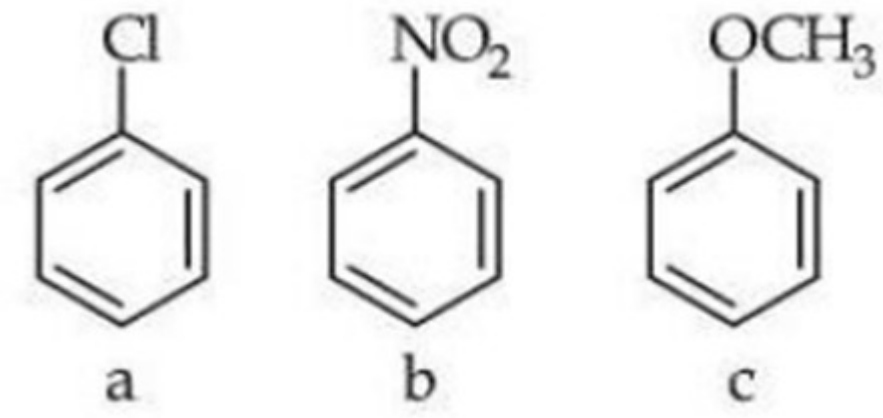
Statement I: $\left[\mathrm{CoBr_4}\right]^{2-}$ ion will absorb light of lower energy than $\left[\mathrm{CoCl_4}\right]^{2-}$ ion.

Statement II: In $\left[\mathrm{CoI_4}\right]^{2-}$ ion, the energy separation between the two sets of d-orbitals is more than $\left[\mathrm{CoCl_4}\right]^{2-}$ ion.

In the light of the above statements, choose the correct answer from the options given below: **[2026]**

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

Q52. Consider the following compounds.



Arrange these compounds in the increasing order of reactivity with nitrating mixture. **[2026]**

1) b < c < a
2) b < a < c
3) c < b < a
4) c < a < b

Q53. 'x' is the product which is obtained from propanenitrile and stannous chloride in the presence of hydrochloric acid followed by hydrolysis. 'y' is the product which is obtained from the but-2-ene by the ozonolysis followed by hydrolysis. From the following, which product is **not obtained** when one mole of 'x' and one mole of 'y' react with each other in the presence of alkali followed by heating? **[2026]**

1) 2-Methylbut-2-enal
2) Pent-2-enal
3) 2-Methylpent-2-enal
4) 3-Methylbut-2-enal

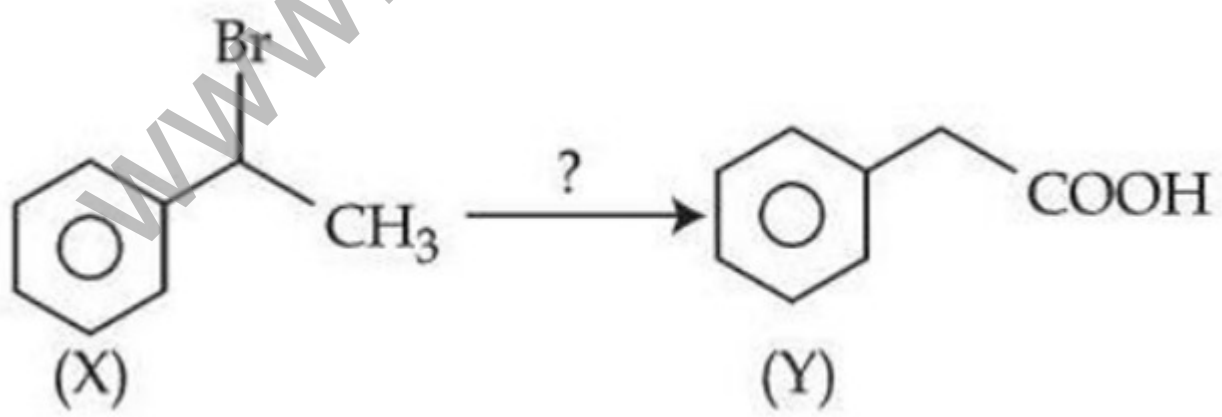
Q54. The correct statements from the following are: **[2026]**

A. Ionic radii of trivalent cations of group 13 elements decreases down the group.
B. Electronegativity of group 13 elements decreases down the group.
C. Among the group 13 elements, boron has the highest first ionisation enthalpy.
D. The trichloride and triiodide of group 13 elements are covalent in nature.

Choose the correct answer from the options given below:

1) A and D only
2) B and D only
3) A and C only
4) C and D only

Q55.



The correct sequence of reagents for the above conversion of X to Y is: **[2026]**

1) (i) Jones reagent (ii) NaOEt (iii) Hot $KMnO_4$ / KOH
2) (i) B_2H_6 / H_2O_2 (ii) NaOEt (iii) Jones reagent
3) (i) NaOH (aq) (ii) Jones reagent (iii) H_3O^+
4) (i) NaOEt (ii) B_2H_6 / H_2O_2 (iii) Jones reagent

Q56. Consider the general reaction given below at 400 K

$$xA(g) \rightleftharpoons yB(g)$$

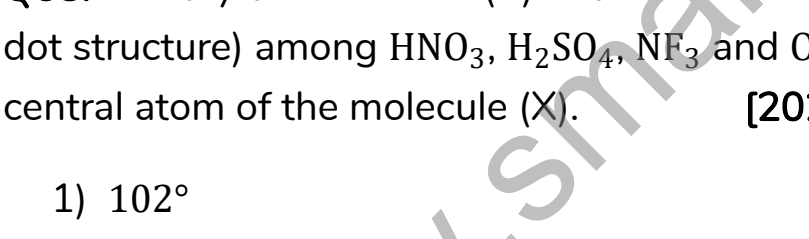
The values of K_p and K_c are studied under the same condition of temperature but variation in x and y.

(i) $K_p = 85.87$ and $K_c = 2.586$ (appropriate units)
(ii) $K_p = 0.862$ and $K_c = 28.62$ (appropriate units)

The values of x and y in (i) and (ii) respectively are: **[2026]**

1) (i) 1, 2 (ii) 2, 1
2) (i) 4, 1 (ii) 4, 1
3) (i) 3, 1 (ii) 3, 1
4) (i) 1, 3 (ii) 2, 1

Q57. But-2-yne and hydrogen (one mole each) are separately treated with (i) Pd/C and (ii) Na / liq. NH_3 to give the products X and Y respectively. **[2026]**



Identify the **incorrect statements**.

A. X and Y are stereoisomers.
B. Dipole moment of X is zero.
C. Boiling point of X is higher than Y.
D. X and Y react with O_3 / $Zn + H_2O$ to give different products.

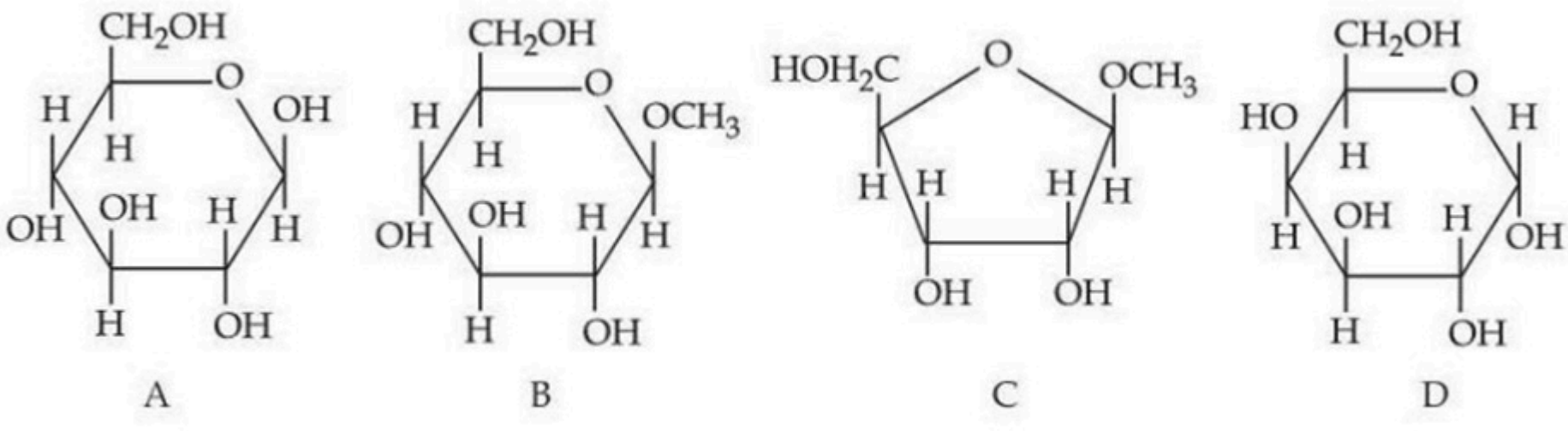
Choose the correct answer from the options given below:

1) B and D only
2) A and C only
3) A and B only
4) B and C only

Q58. Identify the molecule (X) with maximum number of lone pairs of electrons (obtained using Lewis dot structure) among HNO_3, H_2SO_4, NF_3 and O_3. Choose the correct bond angle made by the central atom of the molecule (X). **[2026]**

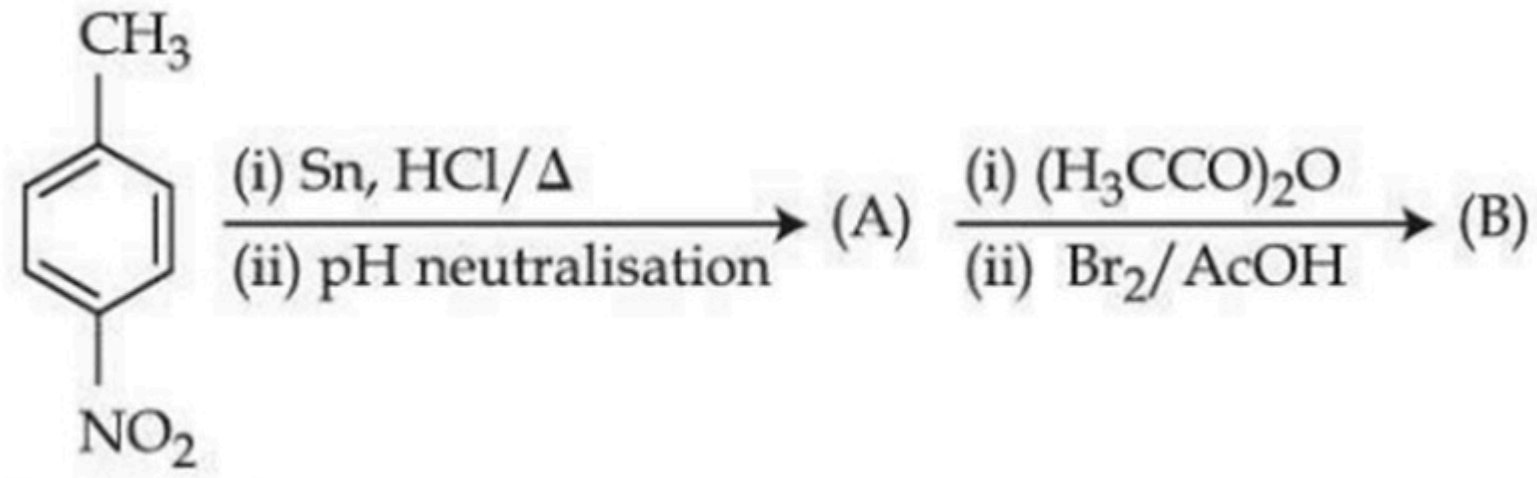
1) $102°$
2) $107°$
3) $116°$
4) $120°$

Q59. From the given following (A to D) cyclic structures, those which will **not** react with Tollen's reagent are: **[2026]**



1) B and D
2) A and B
3) B and C
4) A and D

Q60. Consider the following sequence of reactions.



4-Nitrotoluene

Assuming that the reaction proceeds to completion, then 137 mg of 4-nitrotoluene will produce _____ mg of B.

(Given molar mass in g mol^{-1}: H : 1, C : 12, N : 14, O : 16, Br : 80) **[2026]**

1) 301
2) 146
3) 208
4) 228

Q61. Given,

(A) $n = 5,\ m_\ell = -1$

(B) $n = 3,\ \ell = 2,\ m_\ell = -1,\ m_s = +\frac{1}{2}$

The maximum number of electron(s) in an atom that can have the quantum numbers as given in (A) and (B) respectively are: **[2026]**

1) 4 and 1
2) 26 and 1
3) 8 and 1
4) 2 and 4

Q62. A cup of water at 5°C (system) is placed in a microwave oven and the oven is turned on for one minute during which the water begins to boil. Which of the following option is true? **[2026]**

1) $q = +\text{ve},\ w = -\text{ve},\ \Delta U = -\text{ve}$
2) $q = +\text{ve},\ w = -\text{ve},\ \Delta U = +\text{ve}$
3) $q = -\text{ve},\ w = -\text{ve},\ \Delta U = -\text{ve}$
4) $q = +\text{ve},\ w = 0,\ \Delta U = -\text{ve}$

Q63. The correct trend in the first ionization enthalpies of the elements in the **3rd period** of the periodic table is: **[2026]**

1) S < Si < Al < P < Cl
2) Al < S < P < Si < Cl
3) Si < S < Al < P < Cl
4) Al < Si < S < P < Cl

Q64. Which of the following statements regarding the energy of the stationary state is **true** in the following one-electron systems? **[2026]**

1) -1.09×10^{-18} J for second orbit of H atom.
2) -2.18×10^{-18} J for third orbit of Li^{2+} ion.
3) $+8.72 \times 10^{-18}$ J for first orbit of He^{+} ion.
4) $+2.18 \times 10^{-18}$ J for second orbit of He^{+} ion.

Q65. The statements that are **incorrect** about the nickel(II) complex of dimethylglyoxime are: **[2026]**

A. It is red in colour.
B. It has a high solubility in water at pH = 9.
C. The Ni ion has two unpaired d-electrons.
D. The N–Ni–N bond angle is almost close to 90°.
E. The complex contains four five-membered metallacycles (metal-containing rings).

Choose the correct answer from the options given below:

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

Q66. In the given electrochemical cell, $\mathrm{Ag(s)} \mid \mathrm{AgCl(s)} \mid \mathrm{FeCl_2(aq)}, \mathrm{FeCl_3(aq)} \mid \mathrm{Pt(s)}$ at 298 K, the cell potential (E_{cell}) will increase when: **[2026]**

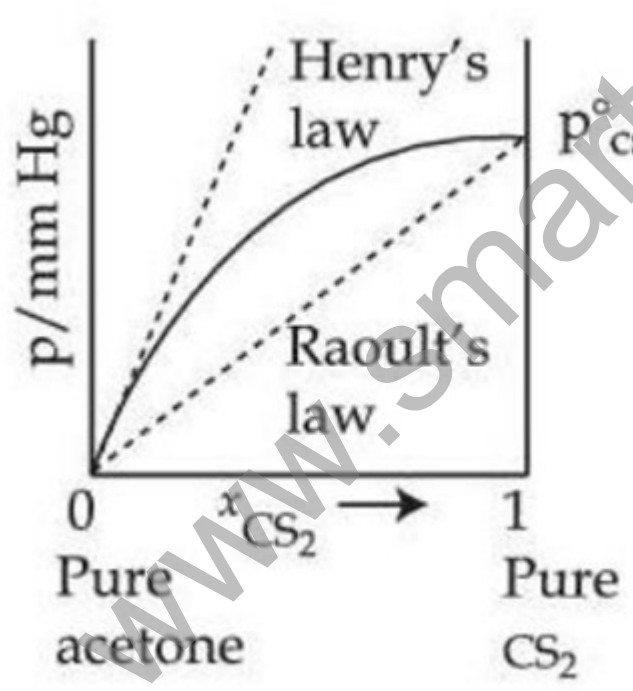
A. Concentration of $\mathrm{Fe^{2+}}$ is increased.
B. Concentration of $\mathrm{Fe^{3+}}$ is decreased.
C. Concentration of $\mathrm{Fe^{2+}}$ is decreased.
D. Concentration of $\mathrm{Fe^{3+}}$ is increased.
E. Concentration of $\mathrm{Cl^-}$ is increased.

Choose the correct answer from the options given below:

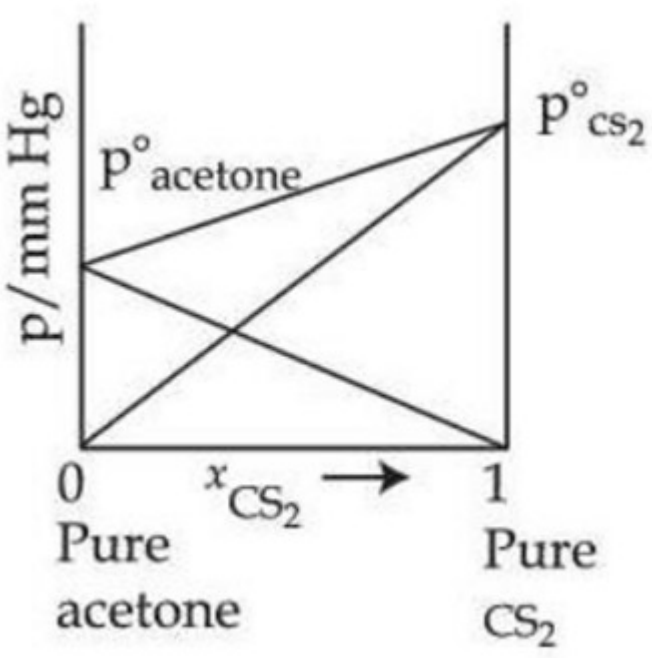
1) C, D and E only
2) B only
3) A and B only
4) A and E only

Q67. Which one of the following graphs accurately represents the plot of partial pressure of $\mathrm{CS_2}$ vs its mole fraction in a mixture of acetone and $\mathrm{CS_2}$ at constant temperature? **[2026]**

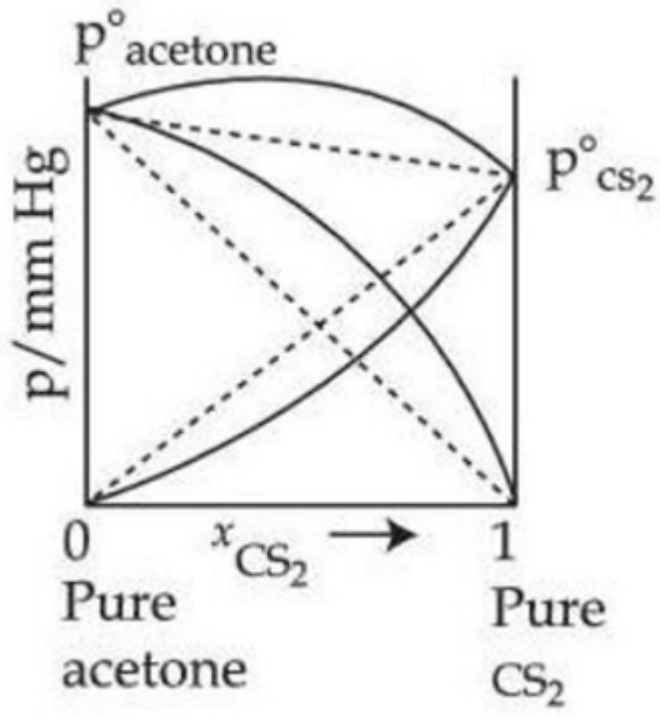
1)



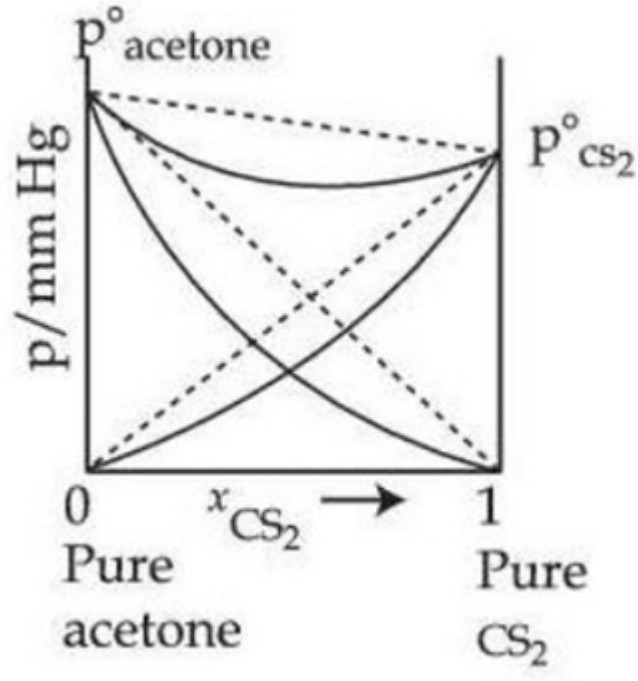
2)



3)



4)



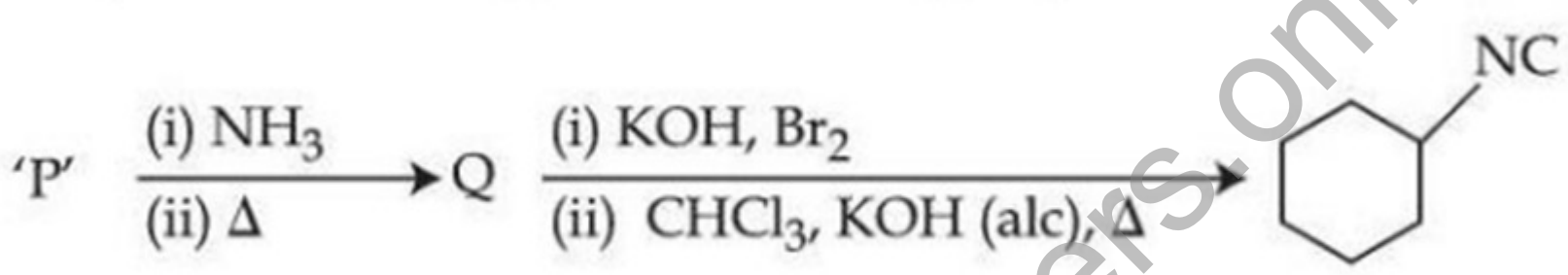
Q68. Match List-I with List-II. **[2026]**

	List-I		List-II
	(Functional group — detection)		**(Change observed during detection)**
A.	Unsaturation (Baeyer's test)	I.	Red colour appears
B.	Alcoholic group (Ceric ammonium nitrate test)	II.	Silver mirror appears
C.	Aldehyde group (Tollen's reagent)	III.	Violet colour appears
D.	Phenolic group ($FeCl_3$ test)	IV.	Discharge of pink colour

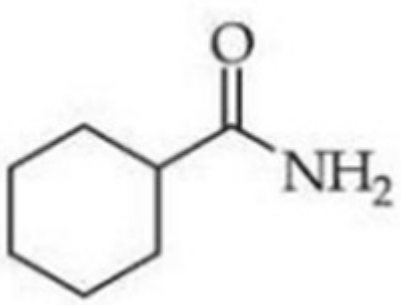
Choose the correct answer from the options given below:

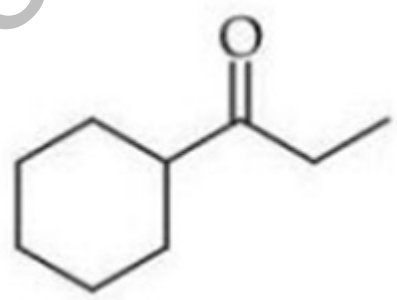
1) A–III, B–IV, C–I, D–II
2) A–III, B–IV, C–II, D–I
3) A–IV, B–I, C–II, D–III
4) A–IV, B–III, C–II, D–I

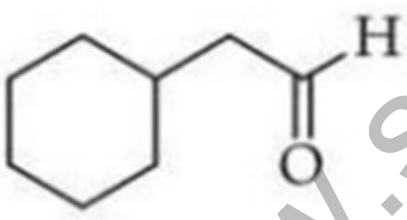
Q69. Compound 'P' undergoes the following sequence of reactions: **[2026]**

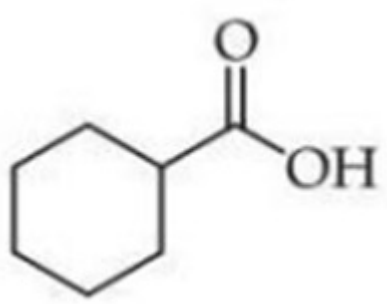


'P' is :

1) 

2) 

3) 

4) 

Q70. Given below are two statements:

Statement I: Sublimation is used for the separation and purification of compounds with low melting point.

Statement II: The boiling point of a liquid increases as the external pressure is reduced.

In the light of the above statements, choose the correct answer from the options given below: **[2026]**

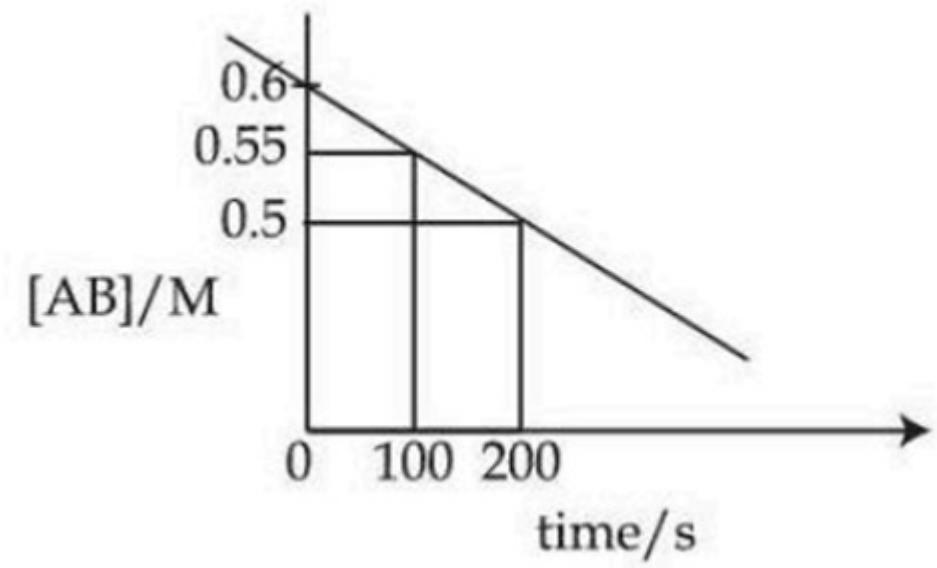
1) Both Statement I and Statement II are false
2) Statement I is false but Statement II is true
3) Both Statement I and Statement II are true
4) Statement I is true but Statement II is false

Q71. x mg of pure HCl was used to make an aqueous solution. 25.0 mL of 0.1 M $Ba(OH)_2$ solution is used when the HCl solution was titrated against it. The numerical value of x is _____ $\times 10^{-1}$ (Nearest integer).

Given: Molar mass of HCl and $\mathrm{Ba(OH)_2}$ are 36.5 and $171.0\,\mathrm{g\,mol^{-1}}$ respectively. **[2026]**

Q72. The crystal field splitting energy of $\left[\mathrm{Co(oxalate)_3}\right]^{3-}$ complex is 'n' times that of the $\left[\mathrm{Cr(oxalate)_3}\right]^{3-}$ complex. Here 'n' is _____. (Assume $\Delta_o \gg P$) **[2026]**

Q73. For the thermal decomposition of reactant AB(g), the following plot is constructed.



The half-life of the reaction is 'x' min.

$x =$ _____ min. (Nearest integer) **[2026]**

Q74. For the following gas phase equilibrium reaction at constant temperature,

$\mathrm{NH_3(g)} \rightleftharpoons \frac{1}{2}\mathrm{N_2(g)} + \frac{3}{2}\mathrm{H_2(g)}$

if the total pressure is $\sqrt{3}$ atm and the pressure equilibrium constant $\left(K_p\right)$ is 9 atm, then the degree of dissociation is given as $\left(x \times 10^{-2}\right)^{-1/2}$. The value of x is _____.(nearest integer)
[2026]

Q75. Consider all the structural isomers with molecular formula $\mathrm{C_5H_{11}Br}$ are separately treated with KOH(aq) to give respective substitution products, without any rearrangement. The number of products which can exhibit optical isomerism from these is _____. **[2026]**

Answer Key

Q1 : 1 Q2 : 1 Q3 : 3 Q4 : 2 Q5 : 3 Q6 : 4 Q7 : 4 Q8 : 3 Q9 : 1

Q10 : 3 Q11 : 4 Q12 : 3 Q13 : 1 Q14 : 4 Q15 : 1 Q16 : 2 Q17 : 2

Q18 : 2 Q19 : 1 Q20 : 2 Q21 : 62 Q22 : 311 Q23 : 12 Q24 : 1565

Q25 : 1422 Q26 : 2 Q27 : 1 Q28 : 1 Q29 : 3 Q30 : 4 Q31 : 4 Q32 : 4

Q33 : 3 Q34 : 1 Q35 : 1 Q36 : 3 Q37 : 4 Q38 : 1 Q39 : 2 Q40 : 3

Q41 : 2 Q42 : 1 Q43 : 4 Q44 : 1 Q45 : 3 Q46 : 2 Q47 : 50 Q48 : 8

Q49 : 4 Q50 : 100 Q51 : 2 Q52 : 2 Q53 : 4 Q54 : 4 Q55 : 4 Q56 : 1

Q57 : 1 Q58 : 1 Q59 : 3 Q60 : 4 Q61 : 3 Q62 : 2 Q63 : 4 Q64 : 2

Q65 : 4 Q66 : 1 Q67 : 1 Q68 : 3 Q69 : 4 Q70 : 1 Q71 : 1825 Q72 : 2