1 - JEE Main Maths 21-Jan 2026 Shift -1

Q1. The value of cosec $10^{o} - \sqrt{3}$ sec 10° is equal to **[2026]**

1) 2
2) 4
3) 6
4) 8

Q2. Let $\vec{c}$ and $\vec{d}$ be vectors such that $\left|\vec{c} + \vec{d}\right| = \sqrt{29}$ and $\vec{c} \times \left(2\hat{i} + 3\hat{j} + 4\hat{k}\right) = \left(2\hat{i} + 3\hat{j} + 4\hat{k}\right) \times \vec{d}$. If $\lambda_1, \lambda_2\,(\lambda_1 > \lambda_2)$ are the possible values of $\left(\vec{c} + \vec{d}\right) \cdot \left(-7\hat{i} + 2\hat{j} + 3\hat{k}\right)$, then the equation $K^2x^2 + \left(K^2 - 5K + \lambda_1\right)xy + \left(3K + \frac{\lambda_2}{2}\right)y^2 - 8x + 12y + \lambda_2 = 0$ represents a circle, for k equal to: **[2026]**

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

Q3. Let (α, β, γ) be the co-ordinates of the foot of the perpendicular drawn from the point (5,4,2) on the line $\vec{r} = \left(-\hat{i} + 3\hat{j} + \hat{k}\right) + \lambda\left(2\hat{i} + 3\hat{j} - \hat{k}\right)$. Then the length of the projection of the vector $\alpha\hat{i} + \beta\hat{j} + \gamma\hat{k}$ on the vector $6\hat{i} + 2\hat{j} + 3\hat{k}$ is **[2026]**

1) 18/7
2) 15/7
3) 3
4) 4

Q4. The area of the region inside the ellipse $x^2 + 4y^2 = 4$ and outside the region bounded by the curves $y = |x| - 1$ and $y = 1 - |x|$ is **[2026]**

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

Q5. The number of relations, defined on the set {a, b, c, d}, which are both reflexive and symmetric, is equal to: **[2026]**

1) 64
2) 256
3) 16
4) 1024

Q6. If the domain of the function $f(x) = \cos^{-1}\left(\frac{2x - 5}{11 - 3x}\right) + \sin^{-1}\left(2x^2 - 3x + 1\right)$ is the interval $[\alpha, \beta]$ then $\alpha + 2\beta$ is equal to: **[2026]**

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

Q7. Let the foci of a hyperbola coincide with the foci of the ellipse $\frac{x^2}{36} + \frac{y^2}{16} = 1$. If the eccentricity of the hyperbola is 5 then the length of its latus rectum is: **[2026]**

1) $24\sqrt{5}$
2) $\frac{96}{\sqrt{5}}$
3) 12
4) 16

Q8. The sum of all the roots of the equation $(x - 1)^2 - 5|x - 1| + 6 = 0$ is **[2026]**

1) 1
2) 3

3) 5 4) 4

Q9. Let the mean and variance of 7 observations 2, 4, 10, x, 12, 14, y, $x > y$, be 8 and 16 respectively. Two numbers are chosen from {1, 2, 3, x - 4, y, 5} one after another without replacement, then the probability, that the smaller number among the two chosen numbers is less than 4, is: **[2026]**

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

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

Q10. Let $a_1, a_2, a_3,$ ... be a G.P. of increasing positive terms such that $a_2 \cdot a_3 \cdot a_4 = 64$ and $a_1 + a_3 + a_5 = \frac{813}{7}$. Then $a_3 + a_5 + a_7$ is equal to: **[2026]**

1) 3256 2) 3244

3) 3248 4) 3252

Q11. If $x^2 + x + 1 = 0$, then the value of $\left(x + \frac{1}{x}\right)^4 + \left(x^2 + \frac{1}{x^2}\right)^4 + \left(x^3 + \frac{1}{x^3}\right)^4 + \ldots + \left(x^{25} + \frac{1}{x^{25}}\right)^4$ is **[2026]**

1) 128 2) 162

3) 145 4) 175

Q12. Let $f: \mathbb{R} \to (0, \infty)$ be a twice differentiable function such that $f(3) = 18$, $f'(3) = 0$ and $f''(3) = 4$. Then $\lim\limits_{x \to 1} \left(log_e \left(\frac{f(2+x)}{f(3)} \right)^{\frac{18}{(x-1)^2}} \right)$ is equal to **[2026]**

1) 2 2) 9

3) 1 4) 18

Q13. If the coefficient of x in the expansion of $\left(ax^2 + bx + c\right)(1 - 2x)^{26}$ is - 56 and the coefficients of x^2 and x^3 are both zero, then $a + b + c$ is equal to : **[2026]**

1) 1300 2) 1500

3) 1403 4) 1483

Q14. The number of strictly increasing functions f from the set $\{1, 2, 3, 4, 5, 6\}$ to the set $\{1, 2, 3, \ldots, 9\}$ such that $f(i) \neq i$ for $1 \leq i \leq 6$, is equal to **[2026]**

1) 28 2) 22

3) 27 4) 21

Q15. Let $\vec{a} = -\hat{i} + 2\hat{j} + 2\hat{k}$, $\vec{b} = 8\hat{i} + 7\hat{j} - 3\hat{k}$ and $\vec{c}$ be a vector such that $\vec{a} \times \vec{c} = \vec{b}$. If $\vec{c} \cdot \left(\hat{i} + \hat{j} + \hat{k}\right) = 4$, *then* $|\vec{a} + \vec{c}|^2$ is equal to **[2026]**

1) 35 2) 30

3) 27 4) 33

Q16. Let a point A lie between the parallel lines L_1 and L_2 such that its distances from L_1 and L_2 are 6 and 3 units, respectively. Then the area (in sq. units) of the equilateral triangle ABC, where the points B and C lie on the lines L_1 and L_2, respectively, is: **[2026]**

1) 27

2) $15\sqrt{6}$

3) $21\sqrt{3}$

4) $12\sqrt{2}$

Q17. Let $y = y(x)$ be the solution curve of the differential equation $(1+x^2)\,dy + (y - \tan^{-1}x)\,dx = 0,\ y(0) = 1$. Then the value of $y(1)$ is: **[2026]**

1) $\frac{4}{e^{\pi/4}} - \frac{\pi}{2} - 1$

2) $\frac{2}{e^{\pi/4}} + \frac{\pi}{4} - 1$

3) $\frac{4}{e^{\pi/4}} + \frac{\pi}{2} - 1$

4) $\frac{2}{e^{\pi/4}} - \frac{\pi}{4} - 1$

Q18. The value of $\int_{-\pi/6}^{\pi/6} \left(\frac{\pi + 4x^{11}}{1 - \sin(|x| + \pi/6)} \right) dx$ is equal to: **[2026]**

1) 8π

2) 2π

3) 6π

4) 4π

Q19. Let PQ and MN be two straight lines touching the circle $x^2 + y^2 - 4x - 6y - 3 = 0$ at the points A and B respectively. Let O be the centre of the circle and angle $\angle AOB = \frac{\pi}{3}$ Then the locus of the point of intersection of the lines PQ and MN is: **[2026]**

1) $3(x^2 + y^2) - 12x - 18y - 25 = 0$

2) $3(x^2 + y^2) - 18x - 12y + 25 = 0$

3) $x^2 + y^2 - 12x - 18y - 25 = 0$

4) $x^2 + y^2 - 18x - 12y - 25 = 0$

Q20. Let O be the vertex of the parabola $x^2 = 4y$ and Q be any point on it. Let the locus of the point P, which divides the line segment OQ internally in the ratio 2 : 3 be the conic C. Then the equation of the chord of C, which is bisected at the point (1, 2), is: **[2026]**

1) $4x - 5y + 6 = 0$

2) $x - 2y + 3 = 0$

3) $5x - 4y + 3 = 0$

4) $5x - y - 3 = 0$

Q21. Let $S = \{(m,n) : m,n \in \{1,2,3,\ldots,50\}\}$. If the number of elements (m,n) in S such that $6^m + 9^n$ is a multiple of 5 is p and the number of elements (m,n) in S such that $m+n$ is a square of a prime number is q, then $p+q$ is equal to _____. **[2026]**

Q22. For some $\alpha, \beta \in \mathbb{R}$, let $A = \begin{bmatrix} \alpha & 2 \\ 1 & 2 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 1 \\ 1 & \beta \end{bmatrix}$ be such that $A^2 - 4A + 2I = B^2 - 3B + I = O$. Then $\left(\det\left(\text{adj}\left(A^3 - B^3\right)\right)\right)^2$ is equal to _____ **[2026]**

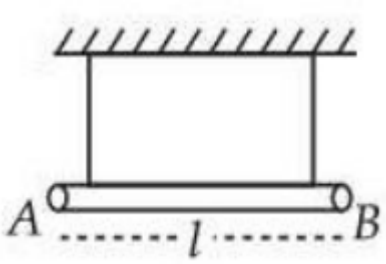
Q23. Let $a_1 = 1$ and for $n \geq 1$, $a_{n+1} = \frac{1}{2}\ a_n + \frac{n^2 - 2n - 1}{n^2(n+1)^2}$. Then $\left|\sum_{n=1}^{\infty}\left(a_n - \frac{2}{n^2}\right)\right|$ is equal to _____. **[2026]**

Q24. $6\int_0^{\pi} |(\sin 3x + \sin 2x + \sin x)|\,dx$ is equal to_____. **[2026]**

Q25. Let $f: R \to R$ be a twice differentiable function such that the quadratic equation $f(x)m^2 - 2f'(x)m + f''(x) = 0$ in m, has two equal roots for every $x \in R$. If $f(0) = 1, f'(0) = 2$ and $(\alpha,\ \beta)$ is the largest interval in which the function $f\left(\log_e x - x\right)$ is increasing, then $\alpha + \beta$ is equal to **[2026]**

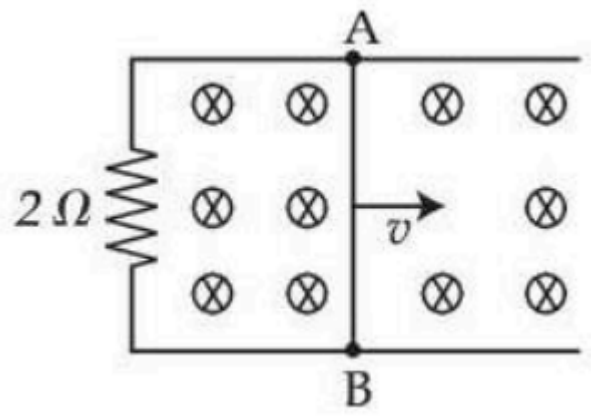
2 - JEE Main Physics 21-Jan 2026 Shift -1

Q26. A uniform rod of mass m and length l suspended by means of two identical inextensible light strings as shown in figure. Tension in one string immediately after the other string is cut, is _____. (g acceleration due to gravity) **[2026]**



1) mg/2
2) mg/4
3) mg
4) mg/3

Q27. A 1 m long metal rod AB completes the circuit as shown in figure. The area of circuit is perpendicular to the magnetic field of 0.10 T. If the resistance of the total circuit is 2Ω then the force needed to move the rod towards right with constant speed (v) of 1.5 m/s is_____ N. **[2026]**

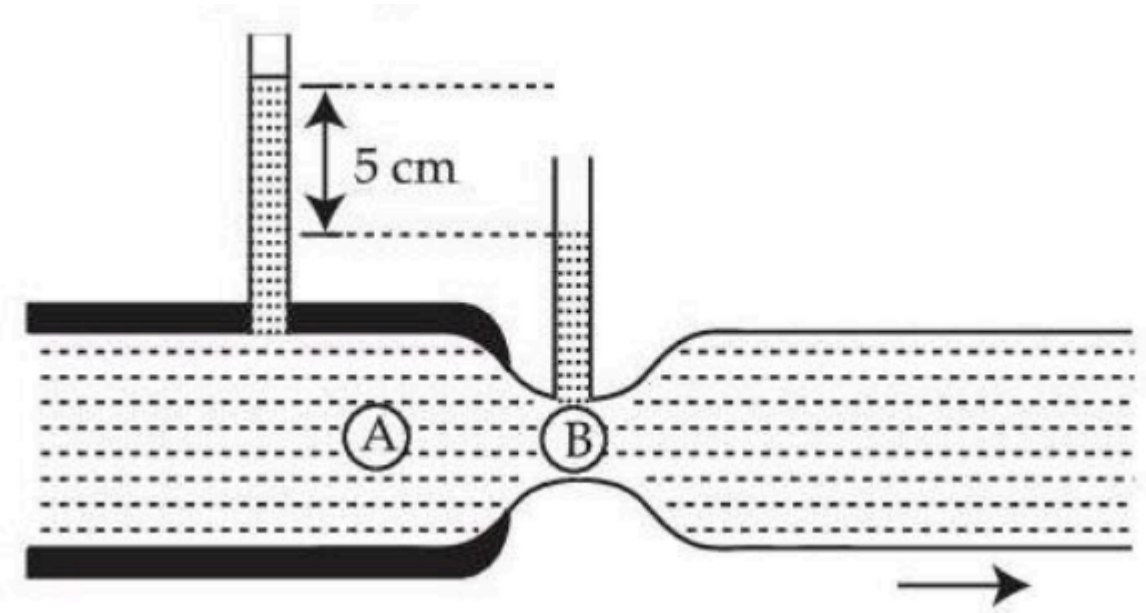


1) 5.7×10^{-2}
2) 7.5×10^{-2}
3) 5.7×10^{-3}
4) 7.5×10^{-3}

Q28. A gas based geyser heats water flowing at the rate of 5.0 litres per minute from $27°C$ to $87°C$. The rate of consumption of the gas is _____ g/s. (Take heat of combustion of gas = 5.0×10^4 J/g) specific heat capacity of water = 4200 J/kg. °C **[2026]**

1) 0.21
2) 2.1
3) 4.2
4) 0.42

Q29. Water flows through a horizontal tube as shown in the figure. The difference in height between the water columns in vertical tubes is 5 cm and the area of cross-sections at A and B are 6cm^2 and 3cm^2 respectively. The rate of flow will be _____ cm^3 / s. (take g = 10 m/s²) **[2026]**



1) $\frac{200}{\sqrt{3}}$
2) $100\sqrt{3}$

3) $200\sqrt{3}$ 4) $200\sqrt{6}$

Q30. A conducting circular loop of area $1.0\ m^2$ is placed perpendicular to a magnetic field which varies as $B = \sin(100t)$ Tesla. If the resistance of the loop is $100\ \Omega$, then the average thermal energy dissipated in the loop in one period is _____ J. **[2026]**

1) $\frac{\pi}{2}$ 2) π

3) π^2 4) 2π

Q31. If an alpha particle with energy 7.7 MeV is bombarded on a thin gold foil, the closest distance from nucleus it can reach is _____ m
(Atomic number of gold = 79 and $\frac{1}{4\pi\varepsilon_0} = 9\times10^9$ in SI units) **[2026]**

1) 3.85×10^{-16} 2) 2.95×10^{-14}

3) 3.85×10^{-14} 4) 2.95×10^{-16}

Q32. Initially a satellite of 100 kg is in a circular orbit of radius $1.5R_E$. This satellite can be moved to a circular orbit of radius $3R_E$ by supplying $\alpha\times10^6$ J of energy. The value of α is_____.

(Take Radius of Earth $R_E = 6\times10^6 m$ and $g = 10 m/s^2$) **[2026]**

1) 100 2) 500

3) 1000 4) 150

Q33. A light wave described by $E = 60\left[\sin\left(3\times10^{15}\right)t + \sin\left(12\times10^{15}\right)t\right]$ (in SI units) falls on a metal surface of work function **2.8 eV**. The maximum kinetic energy of ejected photoelectron is (approximately) _____ eV. $\left(h = 6.6\times10^{-34}\ \text{J·s and } e = 1.6\times10^{-19}\ \text{C}\right)$ **[2026]**

1) 7.8 2) 3.8

3) 5.1 4) 6.0

Q34. In an experiment the values of two spring constants were measured as $k_1 = (10\pm0.2)\ \text{N/m}$ and $k_2 = (20\pm0.3)\ \text{N/m}$. If these springs are connected in parallel, then the percentage error in the equivalent spring constant is: **[2026]**

1) 1.67% 2) 2.67%

3) 2.33% 4) 1.33%

Q35. A 4 kg mass moves under the influence of a force $\vec{F} = \left(4t^3\hat{i} - 3t\hat{j}\right)$ N where t is the time in seconds. If the mass starts from the origin at t = 0 the velocity and position after t = 2s will be. **[2026]**

1) $\vec{v} = 4\hat{i} - \frac{3}{2}\hat{j}$ $\vec{r} = \frac{8}{5}\hat{i} - \hat{j}$ 2) $\vec{v} = 4\hat{i} - \frac{3}{2}\hat{j}$ $\vec{r} = \frac{6}{5}\hat{i} - \hat{j}$

3) $\vec{v} = 3\hat{i} + \frac{3}{2}\hat{j}$ $\vec{r} = \frac{6}{5}\hat{i} + \hat{j}$ 4) $\vec{v} = 4\hat{i} + \frac{5}{2}\hat{j}$ $\vec{r} = \frac{8}{5}\hat{i} + 2\hat{j}$

Q36. A point charge of 10^{-8} C is placed at the origin. The work done in moving a point charge 2μC from point $A(4,4,2)$ to $B(2,2,1)$ is _____J. $\left(\frac{1}{4\pi\varepsilon_0} = 9\times10^9 \text{ in SI units}\right)$ **[2026]**

1) 0 2) 15×10^{-6}

3) 30×10^{-6} 4) 45×10^{-6}

Q37. In a double slit experiment the distance between the slits is 0.1 cm and the screen is placed at 50 cm from the slits plane. When one slit is covered with a transparent sheet having thickness t and refractive index n (= 1.5), the central fringe shifts by 0.2 cm. The value of t is _____ cm. **[2026]**

1) 6.0×10^{-3}
2) 5.6×10^{-4}
3) 8×10^{-4}
4) 8×10^{-4}

Q38. An aluminium and steel rods having same lengths and cross-sections are joined to make total length of 120 cm at 30°C. The coefficient of linear expansion of aluminium and steel are 24×10^{-6} / °C and 1.2×10^{-5} / °C respectively. The length of this composite rod when its temperature is raised to 100°C, is _____ cm. **[2026]**

1) 120.20
2) 120.06
3) 120.03
4) 120.15

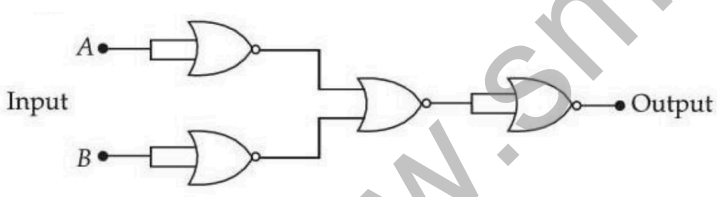
Q39. A current carrying solenoid is placed vertically and a particle of mass m with charge Q is released from rest. The particle moves along the axis of solenoid. If g is acceleration due to gravity then the acceleration (a) of the charged particle will satisfy : **[2026]**

1) a > g
2) a = g
3) 0 < a < g
4) a = 0

Q40. A parallel plate capacitor has capacitance C, when there is vacuum within the parallel plates. A sheet having thickness $(1/3)^{rd}$ of the separation between the plates and relative permittivity K is introduced between the plates. The new capacitance of the system is : **[2026]**

1) $\frac{CK}{2+K}$
2) $\frac{3CK^2}{(2K+1)^2}$
3) $\frac{3KC}{2K+1}$
4) $\frac{4KC}{3K-1}$

Q41. The given circuit works as : **[2026]**



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

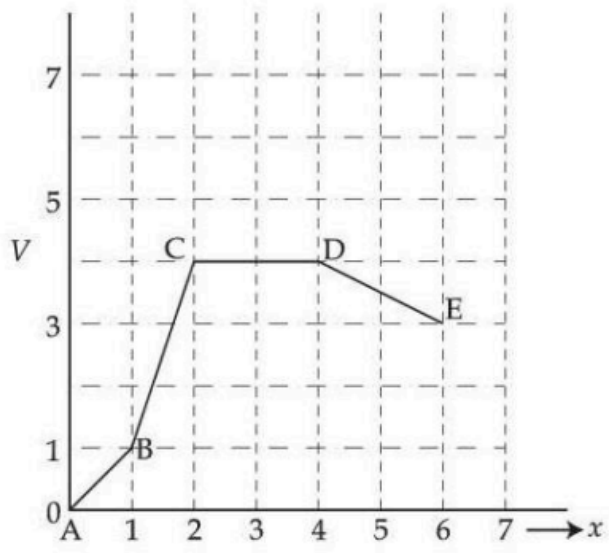
Q42. The electric field in a plane electromagnetic wave is given by :

$E_y = 69\sin\left[0.6 \times 10^3 x - 1.8 \times 10^{11} t\right] V/m$

The expression for magnetic field associated with this electromagnetic wave is _____ T. **[2026]**

1) $B_z = 2.3 \times 10^{-7}\sin\left[0.6 \times 10^3 x + 1.8 \times 10^{11} t\right]$
2) $B_z = 2.3 \times 10^{-7}\sin\left[0.6 \times 10^3 x - 1.8 \times 10^{11} t\right]$
3) $B_y = 69\sin\left[0.6 \times 10^3 x + 1.8 \times 10^{11} t\right]$
4) $B_y = 2.3 \times 10^{-7}\sin\left[0.6 \times 10^3 x - 1.8 \times 10^{11} t\right]$

Q43. Potential energy (V) versus distance (x) is given by the graph. Rank various regions as per the magnitudes of the force (F) acting on a particle from high to low. **[2026]**



1) $F_{BC} > F_{AB} > F_{DE} > F_{CD}$

2) $F_{CD} > F_{DE} > F_{AB} > F_{BC}$

3) $F_{BC} > F_{CD} > F_{DE} > F_{AB}$

4) $F_{CD} > F_{AB} > F_{BC} > F_{DE}$

Q44. Two strings (A, B) having linear densities $\mu_A = 2 \times 10^{-4}$ kg/m and $\mu_B = 4 \times 10^{-4}$ kg/m and lengths $L_A = 2.5$ m and $L_B = 1.5$ m respectively are joined. Free ends of A and B are tied to two rigid supports C and D, respectively creating a tension of 500 N in the wire. Two identical pulses, sent from C and D ends, take time t_1 and t_2 respectively to reach the joint. The ratio t_1 / t_2 is **[2026]**

1) 1.18

2) 1.90

3) 1.08

4) 1.67

Q45. Consider a modified Bernoulli equation.

$\left(P + \frac{A}{Bt^2}\right) + \rho g\left(h + Bt\right) + \frac{1}{2}\rho v^2 = \text{constant}.$

If t has the dimension of time then the dimensions of A and B are _____, _____ respectively. **[2026]**

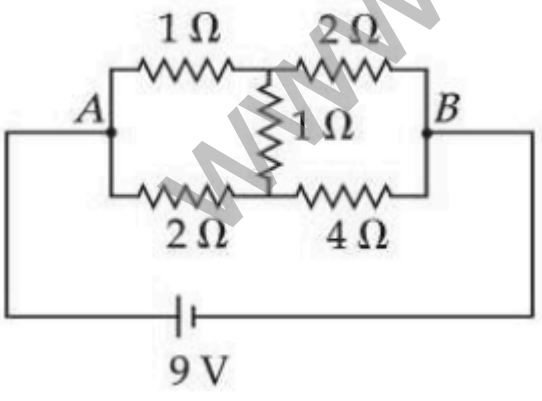
1) $\left[ML^0T^{-1}\right]$ and $\left[M^0LT^{-1}\right]$

2) $\left[ML^0T^{-2}\right]$ and $\left[M^0LT^{-2}\right]$

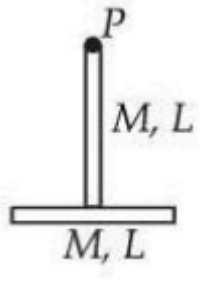
3) $\left[ML^0T^{-1}\right]$ and $\left[M^0LT\right]$

4) $\left[ML^0T^{-2}\right]$ and $\left[M^0LT^{-1}\right]$

Q46. The heat generated in 1 minute between points A and B in the given circuit, when a battery of 9 V with internal resistance of 1 Ω is connected across these points is _____ J. **[2026]**



Q47. Two identical thin rods of mass M kg and length L m are connected as shown in figure. Moment of inertia of the combined rod system about an axis passing through point P and perpendicular to the plane of the rods is $\frac{x}{12}ML^2\ kg\ m^2$. The value of x is _____. **[2026]**



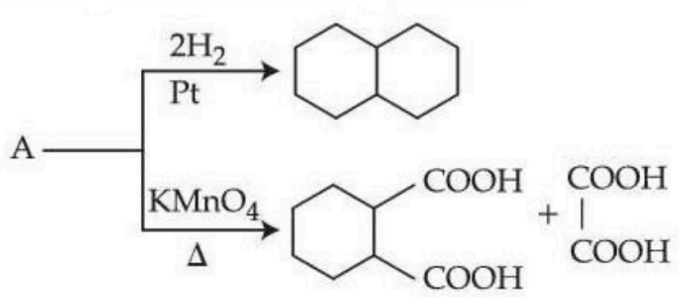
Q48. In a microscope the objective is having focal length $f_o = 2\ \text{cm}$ and eye-piece is having focal length $f_e = 4\ \text{cm}$. The tube length is 32 cm. The magnification produced by this microscope for normal adjustment is _____. **[2026]**

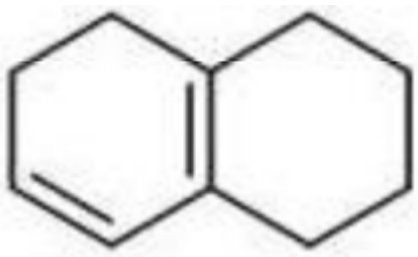
Q49. 10 mole of oxygen is heated at constant volume from 30°C to 40°C. The change in the internal energy of the gas is _____ cal. (The molecular specific heat of oxygen at constant pressure, $C_P = 7\ \text{cal./mol°C}$ and $\text{R}=2\ \text{cal./mol°C}$ **[2026]**

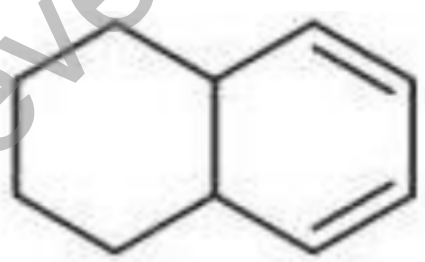
Q50. A collimated beam of light of diameter 2 mm is propagating along x-axis. The beam is required to be expanded in a collimated beam of diameter 14 mm using a system of two convex lenses. If first lens has focal length 40 mm, then the focal length of second lens is _____ mm. **[2026]**

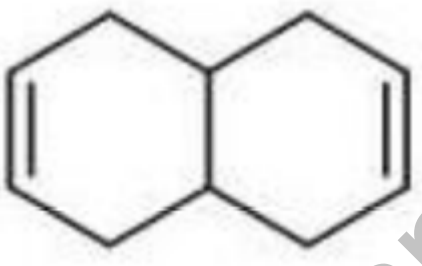
3 - JEE Main Chemistry 21-Jan 2026 Shift -1

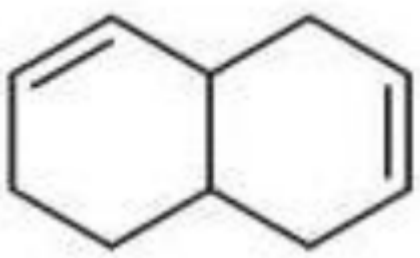
Q51. Identify A in the following reaction. **[2026]**



1) 

2) 

3) 

4) 

Q52. 14.0 g of calcium metal is allowed to react with excess HCl at 1.0 atm pressure and 273 K. Which of the following statements is incorrect ?

$[\text{Given : Molar mass in g mol}^{-1}\text{ of Ca} -40,\ \text{Cl} -35.5,\ \text{H} - 1]$ **[2026]**

1) 7.84 L of H_2 gas is evolved.
2) **0.35 mol** of H_2 gas is evolved.
3) The limiting reagent is calcium metal.
4) **33.3 g** of $CaCl_2$ is produced.

Q53. Consider the following reactions.

$\text{PbCl}_2 + \text{K}_2\text{CrO}_4 \rightarrow \text{A} + 2\text{KCl}$

(Hot solution)

$\text{A} + \text{NaOH} \rightleftharpoons \text{B} + \text{Na}_2\text{CrO}_4$

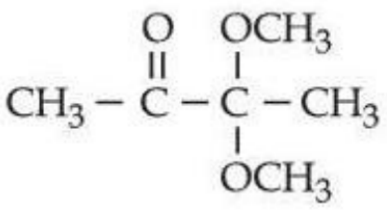
$\text{PbSO}_4 + 4\text{CH}_3\text{COONH}_4 \rightarrow \left(\text{NH}_4\right)_2\text{SO}_4 + \text{X}$

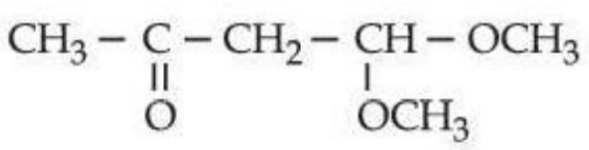
In the above reactions, A, B, and X are respectively. **[2026]**

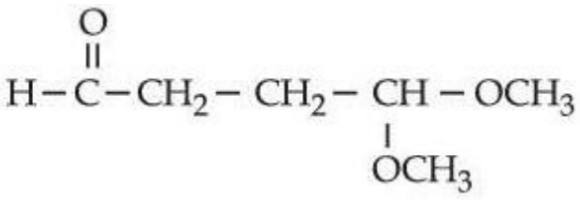
1) $\text{Na}_2\left[\text{Pb}\left(\text{OH}\right)_2\right]$, PbCrO_4 and $\left(\text{NH}_4\right)_2\left[\text{Pb}\left(\text{CH}_3\text{COO}\right)_4\right]$
2) $\left(\text{NH}_4\right)_2\text{PbCrO}_4$, $\text{Na}_2\left[\text{Pb}\left(\text{OH}\right)_4\right]$ and $\left[\text{Pb}\left(\text{NH}_3\right)_4\right]\text{SO}_4$

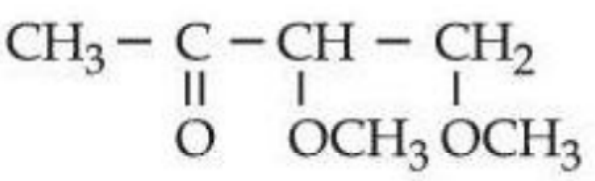
3) $Na_2[Pb(OH)_2]$, $PbCrO_4$ and $[Pb(NH_3)_4]SO_4$ 4) $PbCrO_4$, $Na_2[Pb(OH)_4]$ and $(NH_4)_2[Pb(CH_3COO$

Q54. An organic compound "P" of molecular formula $C_6H_{12}O_3$ gives positive Iodoform test but negative Tollen's test. When "P" is treated with dilute acid, it produces "Q". "Q" gives positive Tollen's test and also iodoform test. The structure of "P" is **[2026]**

1) 

2) 

3) 

4) 

Q55. Given below are two statements:

Statement I : When an electric discharge is passed through gaseous hydrogen, the hydrogen molecules dissociate and the energetically excited hydrogen atoms produce electromagnetic radiation of discrete frequencies.

Statement II : The frequency of second line of Balmer series obtained from He^+ is equal to that of first line of Lyman series obtained from hydrogen atom.

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

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 false
4) Both Statement I and Statement II are true

Q56. Given below are two statements :

Statement I : The number of species among
SF_4, NH_4^+, $[NiCl_4]^{2-}$, XeF_4, $[PtCl_4]^{2-}$, SeF_4 and $[Ni(CN)_4]^{2-}$, that have tetrahedral geometry is 3.

Statement II : In the set $[NO_2, BeH_2, BF_3, AlCl_3]$ all the molecules have incomplete octet around central atom.

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

Q57. In Carius method, 0.75 g of an organic compound gave 1.2 g of barium sulphate, find percentage of sulphur (molar mass 32 g mol^{-1}). Molar mass of barium sulphate is 233 g mol^{-1}.
[2026]

1) 4.55%
2) 21.97%
3) 16.48%
4) 10.30%

Q58. Given below are two statements:

Statement I: Among $[Cu(NH_3)_4]^{2+}$, $[Ni(en)_3]^{2+}$, $[Ni(NH_3)_6]^{2+}$ and $[Mn(H_2O)_6]^{2+}$, $[Mn(H_2O)_6]^{2+}$ has the maximum number of unpaired electrons.

Statement II: The number of pairs among $\left\{\left[NiCl_4\right]^{2-}, \left[Ni(CO)_4\right]\right\}$, $\left\{\left[NiCl_4\right]^{2-}, \left[Ni(CN)_4\right]^{2-}\right\}$ and $\left\{\left[Ni(CO)_4\right], \left[Ni(CN)_4\right]^{2-}\right\}$ that contain only diamagnetic species is two.

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

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

Q59. Identify the correct statements.

A. Arginine and Tryptophan are essential amino acids.
B. Histidine does not contain heterocyclic ring in its structure.
C. Proline is a six membered cyclic ring amino acid.
D. Glycine does not have chiral centre.
E. Cysteine has characteristic feature of side chain as $MeS-CH_2-CH_2-$.

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

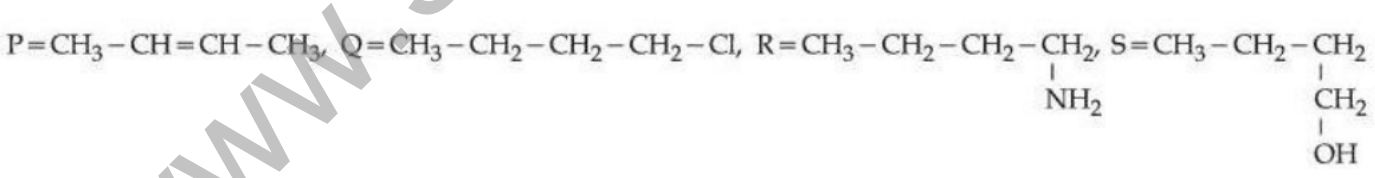
1) C and D Only
2) A and D Only
3) B and E Only
4) C and E Only

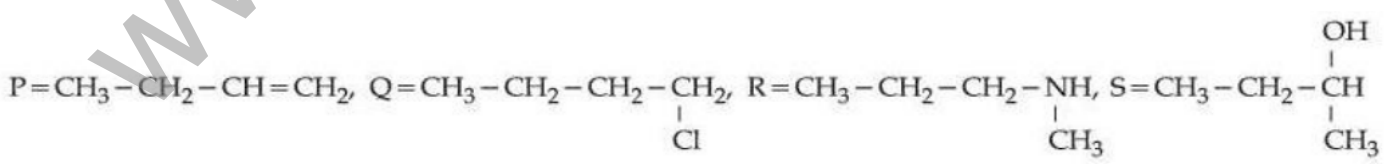
Q60. MnO_4^{2-}, in acidic medium, disproportionates to: **[2026]**

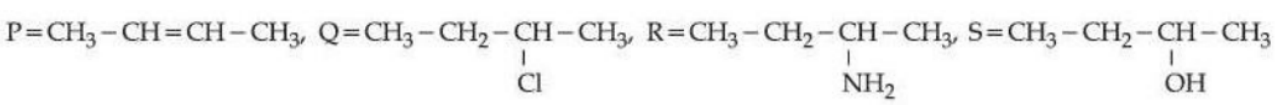
1) Mn_2O_7 and MnO
2) MnO_4^- and MnO
3) Mn_2O_7 and MnO_2
4) MnO_4^- and MnO_2

Q61. A hydrocarbon 'P' (C_4H_8) on reaction with HCl gives an optically active compound 'Q' (C_4H_9Cl) which on reaction with one mole of ammonia gives compound 'R' $(C_4H_{11}N)$. 'R' on diazotization followed by hydrolysis gives 'S'. Identify P, Q, R and S. **[2026]**

1) 

2) 

3) 

4) 

Q62. An organic compound (P) on treatment with aqueous ammonia under hot condition forms compound (Q) which on heating with Br_2 and KOH forms compound (R) having molecular formula C_6H_7N. Names of P, Q and R respectively are. **[2026]**

1) Benzoic acid, benzamide, aniline
2) Phenylethanoic acid, phenylethanamide, benzamin
3) Toluic acid, methylbenzamide, 2-methylaniline
4) Benzoic acid, 4-methylbenzamide, 4-methylaniline

Q63. Given below are two statements :

Statement I: The number of pairs among $[SiO_2, CO_2]$, $[SnO, SnO_2]$, $[PbO, PbO_2]$ and $[GeO, GeO_2]$ which contain oxides that are both amphoteric is 2.

Statement II: BF_3 is an electron deficient molecule, can act as a Lewis acid, forms adduct with NH_3 and has a trigonal planar geometry.

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

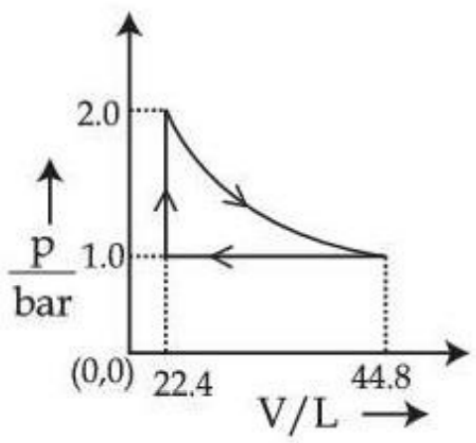
1) Statement I is false but Statement II is true
2) Both Statement I and Statement II are false
3) Statement I is true but Statement II is false
4) Both Statement I and Statement II are true

Q64. Elements P and Q form two types of non-volatile, non-ionizable compounds PQ and PQ_2. When 1 g of PQ is dissolved in 50 g of solvent 'A', ΔT_b was 1.176 K while when 1 g of PQ_2 is dissolved in 50 g of solvent 'A', ΔT_b was 0.689 K. $\left(K_b \text{ of 'A'} = 5\ \text{K kg mol}^{-1}\right)$. The molar masses of elements P and Q (in g mol^{-1}) respectively, are: **[2026]**

1) 65, 145
2) 70, 110
3) 60, 25
4) 25, 60

Q65. Which of the following graphs between pressure 'p' versus volume 'V' represents the maximum work done ? **[2026]**

1)



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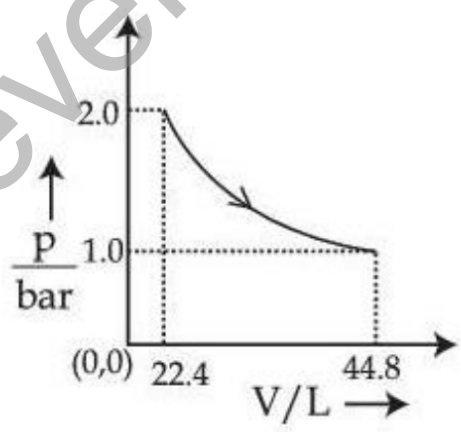

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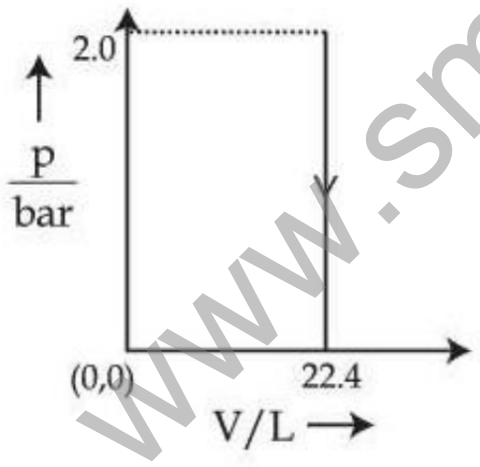

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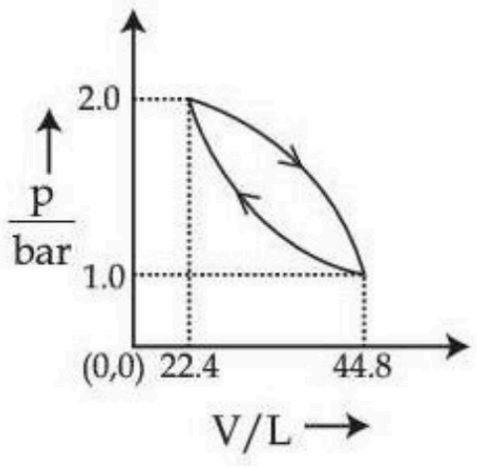


Q66. Identify correct statements from the following :

A. Propanal and propanone are functional isomers.
B. Ethoxyethane and methoxypropane are metamers.
C. But-2-ene shows optical isomerism.
D. But-1-ene and but-2-ene are functional isomers.
E. Pentane and 2,2-dimethyl propane are chain isomers.

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

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

Q67. For the reaction $N_2O_4 \rightleftharpoons 2NO_2$ graph is plotted as shown below. Identify correct statements:

A. Standard free energy change for the reaction is $-5.40 \quad kJ \quad mol^{-1}$.

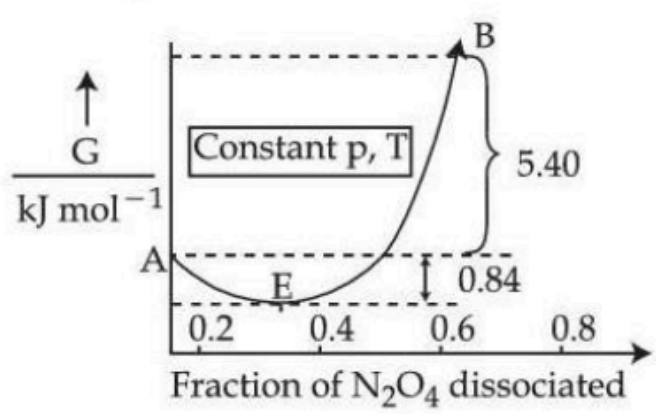
B. As $\Delta G°$ in graph is positive, N_2O_4 will not dissociate into NO_2 at all.

C. Reverse reaction will go to completion.

D. When 1 mole of N_2O_4 changes into equilibrium mixture, value of $\Delta G° = -0.84 \quad kJ \quad mol^{-1}$.

E. When 2 mole of NO_2 changes into equilibrium mixture, $\Delta G°$ for equilibrium mixture is $-6.24 \quad kJ \quad mol^{-1}$.

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



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

Q68. 80 mL of a hydrocarbon on mixing with 264 mL of oxygen in a closed U-tube undergoes complete combustion. The residual gases after cooling to 273 K occupy 224 mL. When the system is treated with KOH solution, the volume decreases to 64 mL. The formula of the hydrocarbon is: **[2026]**

1) C_4H_{10}
2) C_2H_6
3) C_2H_2
4) C_2H_4

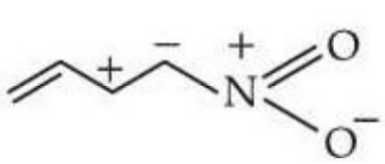
Q69. Which of the following represents the correct trend for the mentioned property ?

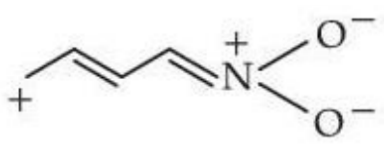
A. F > P > S > B	– First Ionization Energy
B. Cl > F > S > P	– Electron Affinity
C. K > Al > Mg > B	– Metallic character
D. $K_2O > Na_2O > MgO > Al_2O_3$	- Basic character

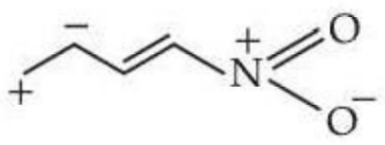
Choose the correct answer from the options given below : **[2026]**

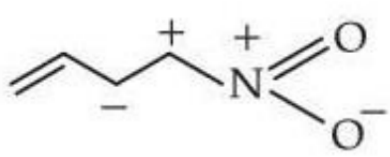
1) A and B only
2) B and C only
3) A, B and D only
4) A, B, C and D

Q70. From the following, the least stable structure is: **[2026]**

1) 

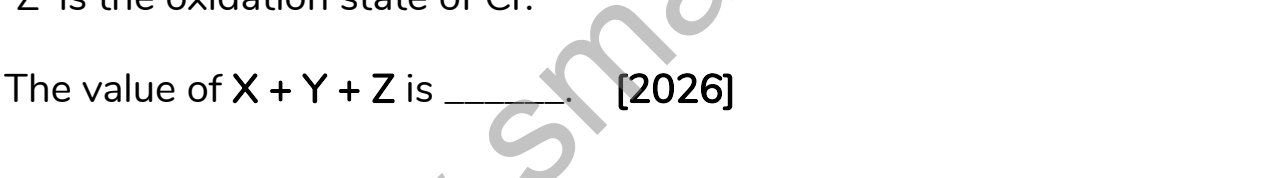
2) 

3) 

4) 

Q71. The pH and conductance of a weak acid (HX) was found to be 5 and 4×10^{-5} S respectively. The conductance was measured under standard condition using a cell where the electrode plates having a surface area of 1 cm^2 were at a distance of 15 cm apart. The value of the limiting molar conductivity is _____ $S \ m^2 \ mol^{-1}$. (nearest integer)
(Given : degree of dissociation of the weak acid $(\alpha) \ll 1$) **[2026]**

Q72. Consider the following reaction sequence



The percentage of nitrogen in product **'T'** formed is _____ %. (Nearest integer)
(Given molar mass in g mol^{-1} : H : 1, C : 12, N : 14, O : 16) **[2026]**

Q73. Consider the following reactions $NaCl + K_2Cr_2O_7 + H_2SO_4 \rightarrow A + KHSO_4 + NaHSO_4 + H_2O$

$A + NaOH \rightarrow B + NaCl + H_2O$

$B + H_2SO_4 + H_2O_2 \rightarrow C + Na_2SO_4 + H_2O$

In the product `C',

`X' is the number of O_2^{2-} units,

`Y' is the total number oxygen atoms present and

`Z' is the oxidation state of Cr.

The value of **X + Y + Z** is _____. **[2026]**

Q74. Use the following data :

Substance	$\frac{\Delta_f H^\circ \ (500 \ K)}{kJ \ mol^{-1}}$	$\frac{S^\circ \ (500 \ K)}{J \ K^{-1} \ mol^{-1}}$
AB(g)	32	222
A_2(g)	6	146
B_2(g)	x	280

One mole each of $A_2(g)$ and $B_2(g)$ are taken in a 1 L closed flask and allowed to establish the equilibrium at 500 K.

$A_2(g) + B_2(g) \rightleftharpoons 2AB(g)$

The value of **x** $(in \ kJ \ mol^{-1})$ is _____. (Nearest integer)

(Given : log K = 2.2 $R = 8.3 \ J \ K^{-1} \ mol^{-1}$) **[2026]**

Q75. Pre-exponential factors of two different reactions of same order are identical. Let activation energy of first reaction exceeds the activation energy of second reaction by 20 kJ mol^{-1}. If k_1 and k_2 are the rate constants of first and second reaction respectively at 300 K, then ln

$(k_2 \ / \ k_1)$ will be _____.

(nearest integer) $[R = 8.3 \ J \ K^{-1} \ mol^{-1}]$ [2026]