JEE MAINS PAPER 1 2025

Test Date	24/01/2025
Test Time	9:00 AM - 12:00 PM
Subject	B. Tech

Section : **Mathematics Section A**

Q.1 The area of the region $\{(x, y) : x^2 + 4x + 2 \le y \le |x + 2|\}$ is equal to

Options

1. 7
2. 20/3
3. 24/5
4. 5

Question Type : **MCQ**
Question ID : **7364751069**
Option 1 ID : **7364753646**
Option 2 ID : **7364753645**
Option 3 ID : **7364753644**
Option 4 ID : **7364753643**

Q.2 For some $n \neq 10$, let the coefficients of the 5th, 6th and 7th terms in the binomial expansion of $(1+x)^{n+4}$ be in A.P. Then the largest coefficient in the expansion of $(1+x)^{n+4}$ is:

Options

1. 35
2. 70
3. 10
4. 20

Question Type : **MCQ**
Question ID : **7364751056**
Option 1 ID : **7364753591**
Option 2 ID : **7364753592**
Option 3 ID : **7364753593**
Option 4 ID : **7364753594**

Q.3 If $I(m, n)=\int_0^1 x^{m-1}(1-x)^{n-1}dx,\ m, n>0$, then $I(9, 14) + I(10, 13)$ is

Options
1. $I(9, 13)$
2. $I(9, 1)$
3. $I(19, 27)$
4. $I(1, 13)$

Question Type : **MCQ**
Question ID : **7364751068**
Option 1 ID : **7364753641**
Option 2 ID : **7364753639**
Option 3 ID : **7364753642**
Option 4 ID : **7364753640**

Q.4 Let $y = y(x)$ be the solution of the differential equation $\left(xy-5x^2\sqrt{1+x^2}\right)dx+(1+x^2)dy=0$, $y(0) = 0$. Then $y(\sqrt{3})$ is equal to

Options
1. $2\sqrt{2}$
2. $\sqrt{\frac{15}{2}}$
3. $\frac{5\sqrt{3}}{2}$
4. $\sqrt{\frac{14}{3}}$

Question Type : **MCQ**
Question ID : **7364751070**
Option 1 ID : **7364753649**
Option 2 ID : **7364753650**
Option 3 ID : **7364753647**
Option 4 ID : **7364753648**

Q.5 Let the lines $3x - 4y - \alpha = 0$, $8x - 11y - 33 = 0$, and $2x - 3y + \lambda = 0$ be concurrent. If the image of the point

$(1, 2)$ in the line $2x - 3y + \lambda = 0$ is $\left(\frac{57}{13}, \frac{-40}{13}\right)$, then $|\alpha\lambda|$ is equal to

Options

1. 91
2. 101
3. 113
4. 84

Question Type : **MCQ**
Question ID : **7364751059**
Option 1 ID : **7364753605**
Option 2 ID : **7364753603**
Option 3 ID : **7364753606**
Option 4 ID : **7364753604**

Q.6 If α and β are the roots of the equation $2z^2 - 3z - 2i = 0$, where $i = \sqrt{-1}$, then

$16 \cdot \mathrm{Re}\left(\frac{\alpha^{19} + \beta^{19} + \alpha^{11} + \beta^{11}}{\alpha^{15} + \beta^{15}}\right) \cdot \mathrm{Im}\left(\frac{\alpha^{19} + \beta^{19} + \alpha^{11} + \beta^{11}}{\alpha^{15} + \beta^{15}}\right)$ is equal to

Options

1. 441
2. 312
3. 398
4. 409

Question Type : **MCQ**
Question ID : **7364751053**
Option 1 ID : **7364753582**
Option 2 ID : **7364753579**
Option 3 ID : **7364753580**
Option 4 ID : **7364753581**

Q.7 If the system of equations

$2x - y + z = 4$

$5x + \lambda y + 3z = 12$

$100x - 47y + \mu z = 212,$

has infinitely many solutions, then $\mu - 2\lambda$ is equal to

Options

1. 55
2. 59
3. 57
4. 56

Question Type : **MCQ**
Question ID : **7364751054**
Option 1 ID : **7364753583**
Option 2 ID : **7364753586**
Option 3 ID : **7364753585**
Option 4 ID : **7364753584**

Q.8 Let $\vec{a} = \hat{i} + 2\hat{j} + 3\hat{k}$, $\vec{b} = 3\hat{i} + \hat{j} - \hat{k}$ and $\vec{c}$ be three vectors such that $\vec{c}$ is coplanar with $\vec{a}$ and $\vec{b}$. If the vector $\vec{c}$ is perpendicular to $\vec{b}$ and $\vec{a} \cdot \vec{c} = 5$, then $|\vec{c}|$ is equal to

Options

1. 16
2. $\sqrt{\frac{11}{6}}$
3. 18
4. $\frac{1}{3\sqrt{2}}$

Question Type : **MCQ**
Question ID : **7364751063**
Option 1 ID : **7364753622**
Option 2 ID : **7364753619**
Option 3 ID : **7364753621**
Option 4 ID : **7364753620**

Q.9 For a statistical data $x_1, x_2, \ldots, x_{10}$ of 10 values, a student obtained the mean as 5.5 and $\sum_{i=1}^{10} x_i^2 = 371$. He later found that he had noted two values in the data incorrectly as 4 and 5, instead of the correct values 6 and 8, respectively. The variance of the corrected data is

Options

1. 9
2. 5
3. 4
4. 7

Question Type : **MCQ**
Question ID : **7364751057**
Option 1 ID : **7364753598**
Option 2 ID : **7364753596**
Option 3 ID : **7364753595**
Option 4 ID : **7364753597**

Q.10 Let the line passing through the points (–1, 2, 1) and parallel to the line $\frac{x-1}{2}=\frac{y+1}{3}=\frac{z}{4}$ intersect the line $\frac{x+2}{3}=\frac{y-3}{2}=\frac{z-4}{1}$ at the point P. Then the distance of P from the point Q (4, –5, 1) is

Options

1. 10
2. 5
3. $5\sqrt{6}$
4. $5\sqrt{5}$

Question Type : **MCQ**
Question ID : **7364751065**
Option 1 ID : **7364753628**
Option 2 ID : **7364753627**
Option 3 ID : **7364753630**
Option 4 ID : **7364753629**

Q.11 Let $f : \mathbb{R} - \{0\} \to \mathbb{R}$ be a function such that $f(x) - 6f\left(\frac{1}{x}\right) = \frac{35}{3x} - \frac{5}{2}$.

If the $\lim_{x \to 0}\left(\frac{1}{\alpha x} + f(x)\right) = \beta$; $\alpha, \beta \in \mathbb{R}$, then $\alpha + 2\beta$ is equal to

Options

1. 6
2. 4
3. 5
4. 3

Question Type : **MCQ**
Question ID : **7364751066**
Option 1 ID : **7364753634**
Option 2 ID : **7364753632**
Option 3 ID : **7364753633**
Option 4 ID : **7364753631**

Q.12 Let $f(x)=\frac{2^{x+2}+16}{2^{2x+1}+2^{x+4}+32}$. Then the value of $8\left(f\left(\frac{1}{15}\right)+f\left(\frac{2}{15}\right)+\ldots+f\left(\frac{59}{15}\right)\right)$ is equal to

Options

1. 102
2. 92
3. 118
4. 108

Question Type : **MCQ**
Question ID : **7364751051**
Option 1 ID : **7364753573**
Option 2 ID : **7364753574**
Option 3 ID : **7364753571**
Option 4 ID : **7364753572**

Q.13 $\lim\limits_{x\to 0} \operatorname{cosec} x\left(\sqrt{2\cos^2 x+3\cos x}-\sqrt{\cos^2 x+\sin x+4}\right)$ is:

Options

1. $\frac{1}{2\sqrt{5}}$
2. $-\frac{1}{2\sqrt{5}}$
3. $\frac{1}{\sqrt{15}}$
4. 0

Question Type : **MCQ**
Question ID : **7364751062**
Option 1 ID : **7364753616**
Option 2 ID : **7364753617**
Option 3 ID : **7364753618**
Option 4 ID : **7364753615**

Q.14 Let circle C be the image of $x^2 + y^2 - 2x + 4y - 4 = 0$ in the line $2x - 3y + 5 = 0$ and A be the point on C such that OA is parallel to x-axis and A lies on the right hand side of the centre O of C. If $B(\alpha, \beta)$, with $\beta < 4$, lies on C such that the length of the arc AB is $(1/6)^{th}$ of the perimeter of C, then $\beta-\sqrt{3}\alpha$ is equal to

Options

1. $4-\sqrt{3}$
2. 3
3. 4
4. $3+\sqrt{3}$

Question Type : **MCQ**
Question ID : **7364751060**
Option 1 ID : **7364753608**
Option 2 ID : **7364753609**
Option 3 ID : **7364753610**
Option 4 ID : **7364753607**

Q.15 Consider the region $R=\left\{(x,y): x\le y\le 9-\frac{11}{3}x^2, x\ge 0\right\}$.

The area, of the largest rectangle of sides parallel to the coordinate axes and inscribed in R, is:

Options

1. $\frac{567}{121}$
2. $\frac{730}{119}$
3. $\frac{625}{111}$
4. $\frac{821}{123}$

Question Type : **MCQ**
Question ID : **7364751067**
Option 1 ID : **7364753635**
Option 2 ID : **7364753637**
Option 3 ID : **7364753636**
Option 4 ID : **7364753638**

Q.16 Let $S_n=\frac{1}{2}+\frac{1}{6}+\frac{1}{12}+\frac{1}{20}+\ldots$ upto n terms. If the sum of the first six terms of an A.P. with first term –p and common difference p is $\sqrt{2026\,S_{2025}}$, then the absolute difference betwen 20^{th} and 15^{th} terms of the A.P. is

Options

1. 20
2. 25
3. 45
4. 90

Question Type : **MCQ**
Question ID : **7364751055**
Option 1 ID : **7364753587**
Option 2 ID : **7364753588**
Option 3 ID : **7364753589**
Option 4 ID : **7364753590**

Q.17 A and B alternately throw a pair of dice. A wins if he throws a sum of 5 before B throws a sum of 8, and B wins if he throws a sum of 8 before A throws a sum of 5. The probability, that A wins if A makes the first throw, is

Options

1. $\frac{9}{17}$
2. $\frac{8}{19}$
3. $\frac{8}{17}$
4. $\frac{9}{19}$

Question Type : **MCQ**
Question ID : **7364751058**
Option 1 ID : **7364753599**
Option 2 ID : **7364753602**
Option 3 ID : **7364753601**
Option 4 ID : **7364753600**

Q.18 Let in a ΔABC, the length of the side AC be 6, the vertex B be (1, 2, 3) and the vertices A, C lie on the line $\frac{x-6}{3}=\frac{y-7}{2}=\frac{z-7}{-2}$. Then the area (in sq. units) of ΔABC is:

Options

1. 42
2. 21
3. 17
4. 56

Question Type : **MCQ**
Question ID : **7364751064**
Option 1 ID : **7364753625**
Option 2 ID : **7364753624**
Option 3 ID : **7364753623**
Option 4 ID : **7364753626**

Q.19 The product of all the rational roots of the equation $(x^2-9x+11)^2 - (x-4)(x-5) = 3$, is equal to

Options

1. 14
2. 28
3. 7
4. 21

Question Type : **MCQ**
Question ID : **7364751052**
Option 1 ID : **7364753576**
Option 2 ID : **7364753578**
Option 3 ID : **7364753575**
Option 4 ID : **7364753577**

Q.20 Let the product of the focal distances of the point $\left(\sqrt{3}, \frac{1}{2}\right)$ on the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$, $(a > b)$, be $\frac{7}{4}$. Then the absolute difference of the eccentricities of two such ellipses is

Options

1. $\frac{1-\sqrt{3}}{\sqrt{2}}$
2. $\frac{1-2\sqrt{2}}{\sqrt{3}}$
3. $\frac{3-2\sqrt{2}}{2\sqrt{3}}$
4. $\frac{3-2\sqrt{2}}{3\sqrt{2}}$

Question Type : **MCQ**
Question ID : **7364751061**
Option 1 ID : **7364753614**
Option 2 ID : **7364753613**
Option 3 ID : **7364753611**
Option 4 ID : **7364753612**

Section : **Mathematics Section B**

Q.21 Let A be a 3×3 matrix such that $X^TAX = O$ for all nonzero 3×1 matrices $X = \begin{bmatrix} x \\ y \\ z \end{bmatrix}$. If

$A\begin{bmatrix}1\\1\\1\end{bmatrix} = \begin{bmatrix}1\\4\\-5\end{bmatrix}$, $A\begin{bmatrix}1\\2\\1\end{bmatrix} = \begin{bmatrix}0\\4\\-8\end{bmatrix}$, and $\det(\text{adj}(2(A+I))) = 2^{\alpha}3^{\beta}5^{\gamma}$, $\alpha, \beta, \gamma \in N$, then $\alpha^2+\beta^2+\gamma^2$ is _____.

Question Type : **SA**
Question ID : **7364751072**

Q.22 Let f be a differentiable function such that $2(x+2)^2 f(x) - 3(x+2)^2 = 10\int_0^x (t+2) f(t)\,dt$, $x \geq 0$.

Then f(2) is equal to _____.

Question Type : **SA**
Question ID : **7364751075**

Q.23 If for some α, β; $\alpha \leq \beta$, $\alpha + \beta = 8$ and $\sec^2(\tan^{-1}\alpha) + \text{cosec}^2(\cot^{-1}\beta) = 36$, then $\alpha^2 + \beta$ is _____.

Question Type : **SA**
Question ID : **7364751074**

Q.24 Let $S = \{p_1, p_2 \ldots, p_{10}\}$ be the set of first ten prime numbers. Let $A = S \cup P$, where P is the set of all possible products of distinct elements of S. Then the number of all ordered pairs (x, y), $x \in S$, $y \in A$, such that x divides y, is _____.

Question Type : **SA**
Question ID : **7364751071**

Q.25 The number of 3-digit numbers, that are divisible by 2 and 3, but not divisible by 4 and 9, is _____.

Question Type : **SA**
Question ID : **7364751073**

Section : **Physics Section A**

Q.26 For an experimental expression $y=\frac{32.3\times1125}{27.4}$, where all the digits are significant.Then to report the value of y we should write

Options
1. $y = 1326.19$
2. $y = 1326.2$
3. $y = 1326.186$
4. $y = 1330$

Question Type : **MCQ**
Question ID : **7364751076**
Option 1 ID : **7364753657**
Option 2 ID : **7364753658**
Option 3 ID : **7364753656**
Option 4 ID : **7364753659**

Q.27 A force $F = \alpha + \beta x^2$ acts on an object in the x–direction. The work done by the force is 5 J when the object is displaced by 1 m. If the constant $\alpha = 1N$ then β will be

Options
1. $12\ N/m^2$
2. $15\ N/m^2$
3. $8\ N/m^2$
4. $10\ N/m^2$

Question Type : **MCQ**
Question ID : **7364751079**
Option 1 ID : **7364753669**
Option 2 ID : **7364753670**
Option 3 ID : **7364753671**
Option 4 ID : **7364753668**

Q.28 An ideal gas goes from an initial state to final state. During the process, the pressure of gas increases linearly with temperature.

A. The work done by gas during the process is zero.

B. The heat added to gas is different from change in its internal energy.

C. The volume of the gas is increased.

D. The internal energy of the gas is increased.

E. The process is isochoric (constant volume process)

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

Options

1. A, B, C, D Only
2. E Only
3. A, C Only
4. A, D, E Only

Question Type : **MCQ**
Question ID : **7364751084**
Option 1 ID : **7364753689**
Option 2 ID : **7364753691**
Option 3 ID : **7364753688**
Option 4 ID : **7364753690**

Q.29 A uniform solid cylinder of mass 'm' and radius 'r' rolls along an inclined rough plane of inclination 45°. If it starts to roll from rest from the top of the plane then the linear acceleration of the cylinder's axis will be

Options

1. $\frac{1}{3\sqrt{2}}g$
2. $\frac{1}{\sqrt{2}}g$
3. $\sqrt{2}\,g$
4. $\frac{\sqrt{2}g}{3}$

Question Type : **MCQ**
Question ID : **7364751080**
Option 1 ID : **7364753674**
Option 2 ID : **7364753672**
Option 3 ID : **7364753673**
Option 4 ID : **7364753675**

Q.30 An air bubble of radius 0.1 cm lies at a depth of 20 cm below the free surface of a liquid of density 1000 kg/m^3 . If the pressure inside the bubble is 2100 N/m^2 greater than the atmospheric pressure, then the surface tension of the liquid in SI unit is (use $g = 10m/s^2$)

Options

1. 0.05
2. 0.25
3. 0.1
4. 0.02

Question Type : **MCQ**
Question ID : **7364751083**
Option 1 ID : **7364753684**
Option 2 ID : **7364753686**
Option 3 ID : **7364753685**
Option 4 ID : **7364753687**

Q.31 Consider the following statements:

A. The junction area of solar cell is made very narrow compared to a photo diode.

B. Solar cells are not connected with any external bias.

C. LED is made of lightly doped p-n junction.

D. Increase of forward current results in continuous increase of LED light intensity.

E. LEDs have to be connected in forward bias for emission of light.

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

Options

1. B, D, E Only
2. A, C, E Only
3. B, E Only
4. A, C Only

Question Type : **MCQ**
Question ID : **7364751095**
Option 1 ID : **7364753734**
Option 2 ID : **7364753735**
Option 3 ID : **7364753733**
Option 4 ID : **7364753732**

Q.32 A particle is executing simple harmonic motion with time period 2 s and amplitude 1 cm. If D and d are the total distance and displacement covered by the particle in 12.5 s, then $\frac{D}{d}$ is

Options

1. 10
2. 25
3. $\frac{16}{5}$
4. $\frac{15}{4}$

Question Type : **MCQ**
Question ID : **7364751085**
Option 1 ID : **7364753695**
Option 2 ID : **7364753693**
Option 3 ID : **7364753694**
Option 4 ID : **7364753692**

Q.33 A thin plano convex lens made of glass of refractive index 1.5 is immersed in a liquid of refractive index 1.2. When the plane side of the lens is silver coated for complete reflection, the lens immersed in the liquid behaves like a concave mirror of focal length 0.2 m. The radius of curvature of the curved surface of the lens is

Options

1. 0.15 m
2. 0.25 m
3. 0.20 m
4. 0.10 m

Question Type : **MCQ**
Question ID : **7364751090**
Option 1 ID : **7364753713**
Option 2 ID : **7364753715**
Option 3 ID : **7364753714**
Option 4 ID : **7364753712**

Q.34 The amount of work done to break a big water drop of radius 'R' into 27 small drops of equal radius is 10 J. The work done required to break the same big drop into 64 small drops of equal radius will be

Options

1. 5 J
2. 15 J
3. 20 J
4. 10 J

Question Type : **MCQ**
Question ID : **7364751082**
Option 1 ID : **7364753680**
Option 2 ID : **7364753682**
Option 3 ID : **7364753683**
Option 4 ID : **7364753681**

Q.35 Consider a parallel plate capacitor of area A (of each plate) and separation 'd' between the plates. If E is the electric field and ε_0 is the permittivity of free space between the plates, then potential energy stored in the capacitor is

Options

1. $\frac{1}{2}\varepsilon_0 E^2 Ad$
2. $\frac{1}{4}\varepsilon_0 E^2 Ad$
3. $\varepsilon_0 E^2 Ad$
4. $\frac{3}{4}\varepsilon_0 E^2 Ad$

Question Type : **MCQ**
Question ID : **7364751088**
Option 1 ID : **7364753705**
Option 2 ID : **7364753704**
Option 3 ID : **7364753706**
Option 4 ID : **7364753707**

Q.36 An electron of mass 'm' with an initial velocity $\vec{v}=v_0\hat{i}(v_0>0)$ enters an electric field $\vec{E}=-E_0\hat{k}$. If the initial de Broglie wavelength is λ_0, the value after time t would be

Options

1. λ_0
2. $\frac{\lambda_o}{\sqrt{1-\frac{e^2E_o{}^2t^2}{m^2v_o{}^2}}}$
3. $\frac{\lambda_o}{\sqrt{1+\frac{e^2E_o{}^2t^2}{m^2v_o{}^2}}}$
4. $\lambda_o\sqrt{1+\frac{e^2E_o{}^2t^2}{m^2v_o{}^2}}$

Question Type : **MCQ**
Question ID : **7364751093**
Option 1 ID : **7364753724**
Option 2 ID : **7364753726**
Option 3 ID : **7364753727**
Option 4 ID : **7364753725**

Q.37 A car of mass 'm' moves on a banked road having radius 'r' and banking angle θ. To avoid slipping from banked road, the maximum permissible speed of the car is v_0. The coefficient of friction μ between the wheels of the car and the banked road is

Options

1. $\mu=\frac{v_o^2-rg\tan\theta}{rg+v_o^2\tan\theta}$
2. $\mu=\frac{v_o^2+rg\tan\theta}{rg-v_o^2\tan\theta}$
3. $\mu=\frac{v_o^2+rg\tan\theta}{rg+v_o^2\tan\theta}$
4. $\mu=\frac{v_o^2-rg\tan\theta}{rg-v_o^2\tan\theta}$

Question Type : **MCQ**
Question ID : **7364751078**
Option 1 ID : **7364753666**
Option 2 ID : **7364753665**
Option 3 ID : **7364753664**
Option 4 ID : **7364753667**

Q.38 An alternating current is given by $I = I_A \sin\omega t + I_B \cos\omega t$. The r.m.s current will be

Options

1. $\frac{|I_A+I_B|}{\sqrt{2}}$
2. $\sqrt{I_A^2+I_B^2}$
3. $\frac{\sqrt{I_A^2+I_B^2}}{2}$
4. $\sqrt{\frac{I_A^2+I_B^2}{2}}$

Question Type : **MCQ**
Question ID : **7364751086**
Option 1 ID : **7364753698**
Option 2 ID : **7364753699**
Option 3 ID : **7364753696**
Option 4 ID : **7364753697**

Q.39 A parallel plate capacitor was made with two rectangular plates, each with a length of $l = 3$ cm and breath of b = 1 cm. The distance between the plates is 3 μm. Out of the following, which are the ways to increase the capacitance by a factor of 10?

A. $l = 30$ cm, b = 1 cm, d = 1 μm

B. $l = 3$ cm, b = 1 cm, d = 30 μm

C. $l = 6$ cm, b = 5 cm, d = 3 μm

D. $l = 1$ cm, b = 1 cm, d = 10 μm

E. $l = 5$ cm, b = 2 cm, d = 1 μm

Choose the correct answer from the options given below:

Options

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

Question Type : **MCQ**
Question ID : **7364751087**
Option 1 ID : **7364753700**
Option 2 ID : **7364753701**
Option 3 ID : **7364753702**
Option 4 ID : **7364753703**

Q.40 What is the relative decrease in focal length of a lens for an increase in optical power by 0.1D from 2.5D ? ['D' stands for dioptre]

Options

1. 0.1
2. 0.01
3. 0.04
4. 0.40

Question Type : **MCQ**
Question ID : **7364751091**
Option 1 ID : **7364753717**
Option 2 ID : **7364753716**
Option 3 ID : **7364753718**
Option 4 ID : **7364753719**

Q.41 During the transition of electron from state A to state C of a Bohr atom, the wavelength of emitted radiation is 2000 Å and it becomes 6000 Å when the electron jumps from state B to state C. Then the wavelength of the radiation emitted during the transition of electrons from state A to state B is

Options

1. 4000 Å
2. 3000 Å
3. 6000 Å
4. 2000 Å

Question Type : **MCQ**
Question ID : **7364751094**
Option 1 ID : **7364753730**
Option 2 ID : **7364753729**
Option 3 ID : **7364753731**
Option 4 ID : **7364753728**

Q.42 An object of mass 'm' is projected from origin in a vertical xy plane at an angle 45° with the x–axis with an initial velocity v_0. The magnitude and direction of the angular momentum of the object with respect to origin, when it reaches at the maximum height, will be [g is acceleration due to gravity]

Options

1. $\frac{mv_o^3}{2\sqrt{2}g}$ along positive z–axis
2. $\frac{mv_o^3}{4\sqrt{2}g}$ along positive z–axis
3. $\frac{mv_o^3}{4\sqrt{2}g}$ along negative z–axis
4. $\frac{mv_o^3}{2\sqrt{2}g}$ along negative z–axis

Question Type : **MCQ**
Question ID : **7364751077**
Option 1 ID : **7364753661**
Option 2 ID : **7364753660**
Option 3 ID : **7364753662**
Option 4 ID : **7364753663**

Q.43 A plano-convex lens having radius of curvature of first surface 2 cm exhibits focal length of f_1 in air. Another plano-convex lens with first surface radius of curvature 3 cm has focal length of f_2 when it is immersed in a liquid of refractive index 1.2. If both the lenses are made of same glass of refractive index 1.5, the ratio of f_1 and f_2 will be

Options

1. $3 : 5$
2. $1 : 2$
3. $2 : 3$
4. $1 : 3$

Question Type : **MCQ**
Question ID : **7364751092**
Option 1 ID : **7364753722**
Option 2 ID : **7364753720**
Option 3 ID : **7364753721**
Option 4 ID : **7364753723**

Q.44 The Young's double slit interference experiment is performed using light consisting of 480 nm and 600 nm wavelengths to form interference patterns. The least number of the bright fringes of 480 nm light that are required for the first coincidence with the bright fringes formed by 600 nm light is

Options

1. 8
2. 5
3. 4
4. 6

Question Type : **MCQ**
Question ID : **7364751089**
Option 1 ID : **7364753711**
Option 2 ID : **7364753709**
Option 3 ID : **7364753708**
Option 4 ID : **7364753710**

Q.45 A satellite is launched into a circular orbit of radius 'R' around the earth. A second satellite is launched into an orbit of radius 1.03 R. The time period of revolution of the second satellite is larger than the first one approximately by

Options

1. 9%
2. 4.5%
3. 3%
4. 2.5%

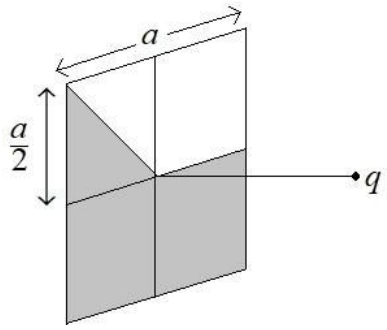
Question Type : **MCQ**
Question ID : **7364751081**
Option 1 ID : **7364753677**
Option 2 ID : **7364753679**
Option 3 ID : **7364753678**
Option 4 ID : **7364753676**

Section : **Physics Section B**

Q.46 A current of 5A exists in a square loop of side $\frac{1}{\sqrt{2}}$ m . Then the magnitude of the magnetic field B at the centre of the square loop will be $p \times 10^{-6}$ T. where, value of p is _____.
[Take $\mu_0 = 4\pi \times 10^{-7}$ T m A^{-1}].

Question Type : **SA**
Question ID : **7364751099**

Q.47 A square loop of sides $a = 1$ m is held normally in front of a point charge q = 1C. The flux of the electric field through the shaded region is $\frac{5}{p} \times \frac{1}{\varepsilon_0} \frac{Nm^2}{C}$, where the value of p is _____.



Question Type : **SA**
Question ID : **7364751100**

Q.48 A wire of resistance 9 Ω is bent to form an equilateral triangle. Then the equivalent resistance across any two vertices will be _____ohm.

Question Type : **SA**
Question ID : **7364751098**

Q.49 The temperature of 1 mole of an ideal monoatomic gas is increased by 50°C at constant pressure. The total heat added and change in internal energy are E_1 and E_2, respectively. If $\frac{E_1}{E_2} = \frac{x}{9}$ then the value of x is _____

Question Type : **SA**
Question ID : **7364751097**

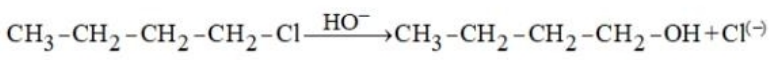
Q.50 The least count of a screw guage is 0.01 mm. If the pitch is increased by 75% and number of divisions on the circular scale is reduced by 50%, the new least count will be _____ $\times 10^{-3}$ mm

Question Type : **SA**
Question ID : **7364751096**

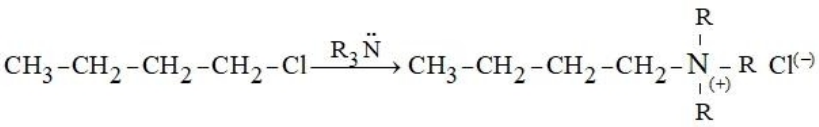
Section : **Chemistry Section A**

Q.51 Given below are two statements:

Statement I: The conversion proceeds well in the less polar medium .



Statement II: The conversion proceeds well in the more polar medium .



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

Options

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

Question Type : **MCQ**
Question ID : **7364751116**
Option 1 ID : **7364753801**
Option 2 ID : **7364753804**
Option 3 ID : **7364753802**
Option 4 ID : **7364753803**

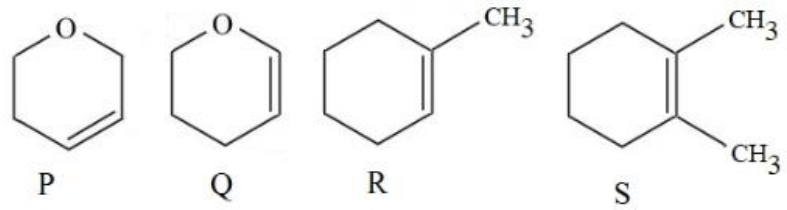
Q.52 Preparation of potassium permanganate from MnO_2 involves two step process in which the 1st step is a reaction with KOH and KNO_3 to produce

Options

1. K_3MnO_4
2. $KMnO_4$
3. K_2MnO_4
4. $K_4[Mn(OH)_6]$

Question Type : **MCQ**
Question ID : **7364751111**
Option 1 ID : **7364753782**
Option 2 ID : **7364753781**
Option 3 ID : **7364753784**
Option 4 ID : **7364753783**

Q.53 Following are the four molecules "P", "Q", "R" and "S".
Which one among the four molecules will react with $H\text{–}Br_{(aq)}$ at the fastest rate?



P Q R S

Options

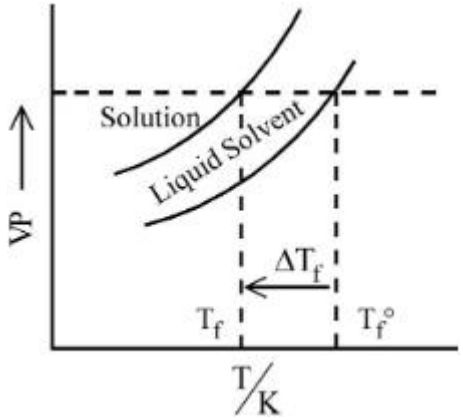
1. S
2. R
3. Q
4. P

Question Type : **MCQ**
Question ID : **7364751115**
Option 1 ID : **7364753800**
Option 2 ID : **7364753799**
Option 3 ID : **7364753798**
Option 4 ID : **7364753797**

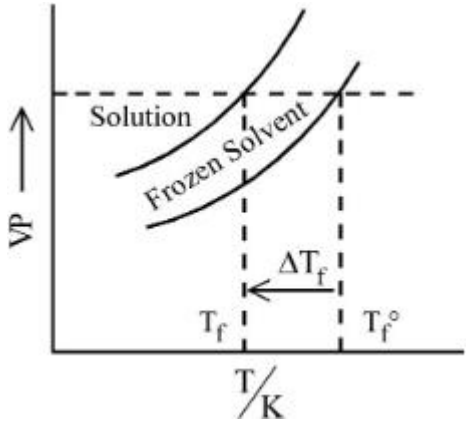
Q.54 Consider the given plots of vapour pressure (VP) vs temperature(T/K). Which amongst the following options is correct graphical representation showing ΔT_f, depression in the freezing point of a solvent in a solution?

Options

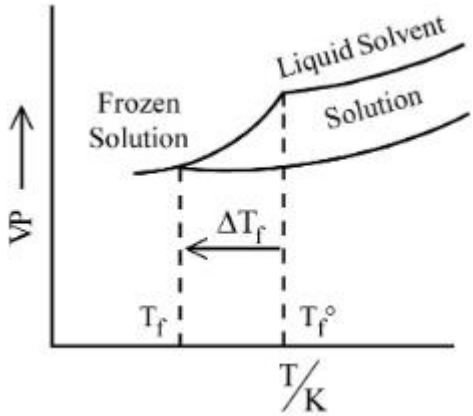
1.



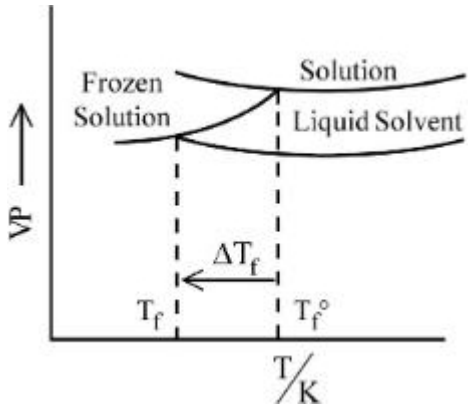
2.



3.



4.



Question Type : **MCQ**
Question ID : **7364751104**
Option 1 ID : **7364753754**
Option 2 ID : **7364753755**
Option 3 ID : **7364753756**
Option 4 ID : **7364753753**

Q.55 K_{sp} for $Cr(OH)_3$ is 1.6×10^{-30}. What is the molar solubility of this salt in water?

Options

1. $\sqrt[5]{1.8 \times 10^{-30}}$
2. $\frac{1.8 \times 10^{-30}}{27}$
3. $\sqrt[2]{1.6 \times 10^{-30}}$
4. $\sqrt[4]{\frac{1.6 \times 10^{-30}}{27}}$

Question Type : **MCQ**
Question ID : **7364751105**
Option 1 ID : **7364753758**
Option 2 ID : **7364753760**
Option 3 ID : **7364753757**
Option 4 ID : **7364753759**

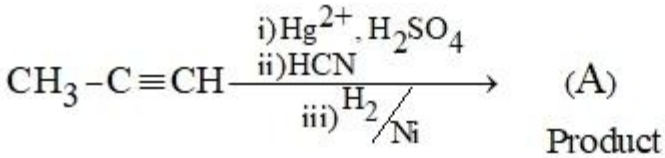
Q.56 One mole of the octahedral complex compound $Co(NH_3)_5\ Cl_3$ gives 3 moles of ions on dissolution in water. One mole of the same complex reacts with excess of $AgNO_3$ solution to yield two moles of $AgCl_{(s)}$. The structure of the complex is:

Options

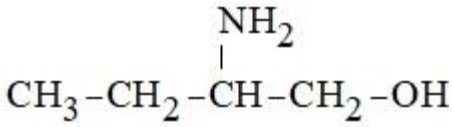
1. $[Co(NH_3)_3\ Cl_3].2NH_3$
2. $[Co(NH_3)_4\ Cl]\ .\ Cl_2.\ NH_3$
3. $[Co(NH_3)_5\ Cl]Cl_2$
4. $[Co(NH_3)_4\ Cl_2]\ .\ Cl\ .\ NH_3$

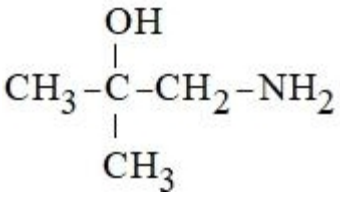
Question Type : **MCQ**
Question ID : **7364751112**
Option 1 ID : **7364753785**
Option 2 ID : **7364753787**
Option 3 ID : **7364753788**
Option 4 ID : **7364753786**

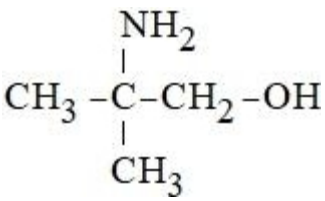
Q.57 The product (A) formed in the following reaction sequence is

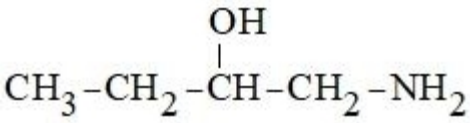


Options

1. 

2. 

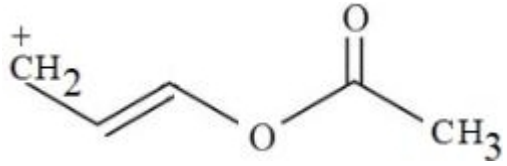
3. 

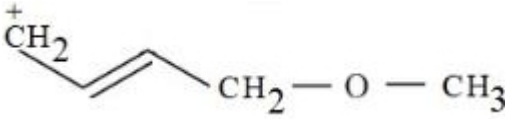
4. 

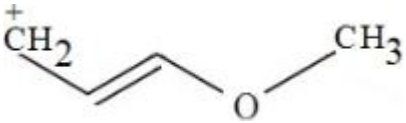
Question Type : **MCQ**
Question ID : **7364751119**
Option 1 ID : **7364753816**
Option 2 ID : **7364753814**
Option 3 ID : **7364753815**
Option 4 ID : **7364753813**

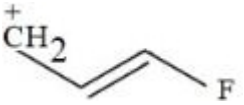
Q.58 Which one of the carbocations from the following is most stable?

Options

1. 

2. 

3. 

4. 

Question Type : **MCQ**
Question ID : **7364751114**
Option 1 ID : **7364753793**
Option 2 ID : **7364753795**
Option 3 ID : **7364753794**
Option 4 ID : **7364753796**

Q.59 Which of the following ions is the strongest oxidizing agent?
(Atomic Number of Ce = 58, Eu = 63, Tb = 65, Lu = 71)

Options

1. Eu^{2+}
2. Lu^{3+}
3. Tb^{4+}
4. Ce^{3+}

Question Type : **MCQ**
Question ID : **7364751110**
Option 1 ID : **7364753778**
Option 2 ID : **7364753780**
Option 3 ID : **7364753779**
Option 4 ID : **7364753777**

Q.60 Let us consider an endothermic reaction which is non-spontaneous at the freezing point of water. However, the reaction is spontaneous at boiling point of water. Choose the correct option.

Options

1. Both ΔH and ΔS are (–ve)
2. ΔH is (–ve) but ΔS is (+ve)
3. Both ΔH and ΔS are (+ve)
4. ΔH is (+ve) but ΔS is (–ve)

Question Type : **MCQ**
Question ID : **7364751103**
Option 1 ID : **7364753751**
Option 2 ID : **7364753749**
Option 3 ID : **7364753750**
Option 4 ID : **7364753752**

Q.61 For a reaction, $N_2O_{5(g)} \rightarrow 2NO_{2(g)} + \frac{1}{2} O_{2(g)}$ in a constant volume container, no products were present initially. The final pressure of the system when 50% of reaction gets completed is

Options

1. 7/2 times of initial pressure
2. 5/2 times of initial pressure
3. 5 times of initial pressure
4. 7/4 times of initial pressure

Question Type : **MCQ**
Question ID : **7364751107**
Option 1 ID : **7364753767**
Option 2 ID : **7364753766**
Option 3 ID : **7364753768**
Option 4 ID : **7364753765**

Q.62 For the given cell

$Fe^{2+}_{(aq)} + Ag^{+}_{(aq)} \rightarrow Fe^{3+}_{(aq)} + Ag_{(s)}$

The standard cell potential of the above reaction is

Given:

$Ag^{+} + e^{-} \rightarrow Ag$ $\quad E^{\theta} = x\ V$

$Fe^{2+} + 2e^{-} \rightarrow Fe$ $\quad E^{\theta} = y\ V$

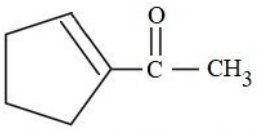
$Fe^{3+} + 3e^{-} \rightarrow Fe$ $\quad E^{\theta} = z\ V$

Options

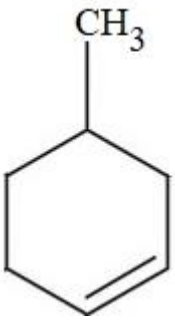
1. $x + 2y$
2. $x + y - z$
3. $x + 2y - 3z$
4. $y - 2x$

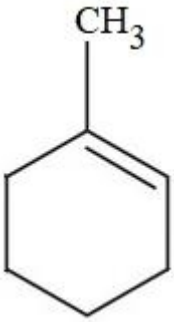
Question Type : **MCQ**
Question ID : **7364751106**
Option 1 ID : **7364753761**
Option 2 ID : **7364753762**
Option 3 ID : **7364753763**
Option 4 ID : **7364753764**

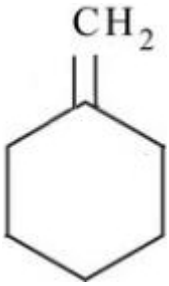
Q.63

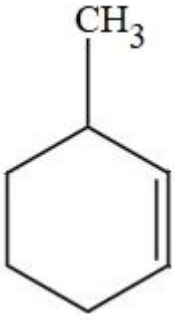
Aman has been asked to synthesise the molecule  (x). He thought of preparing the molecule using an aldol condensation reaction. He found a few cyclic alkenes in his laboratory. He thought of performing ozonolysis reaction on alkene to produce a dicarbonyl compound followed by aldol reaction to prepare "x". Predict the suitable alkene that can lead to the formation of "x".

Options

1. 

2. 

3. 

4. 

Question Type : **MCQ**
Question ID : **7364751117**
Option 1 ID : **7364753807**
Option 2 ID : **7364753805**
Option 3 ID : **7364753808**
Option 4 ID : **7364753806**

Q.64 The large difference between the melting and boiling points of oxygen and sulphur may be explained on the basis of

Options

1. Atomicity
2. Atomic size
3. Electron gain enthalpy
4. Electronegativity

Question Type : **MCQ**
Question ID : **7364751109**
Option 1 ID : **7364753775**
Option 2 ID : **7364753773**
Option 3 ID : **7364753776**
Option 4 ID : **7364753774**

Q.65 Which of the following statement is true with respect to H_2O, NH_3 and CH_4 ?

A. The central atoms of all the molecules are sp^3 hybridized.

B. The H–O–H, H–N–H and H–C–H angles in the above molecules are 104.5°, 107.5° and 109.5°, respectively.

C. The increasing order of dipole moment is $CH_4 < NH_3 < H_2O$.

D. Both H_2O and NH_3 are Lewis acids and CH_4 is a Lewis base.

E. A solution of NH_3 in H_2O is basic. In this solution NH_3 and H_2O act as Lowry-Bronsted acid and base respectively.

Choose the correct answer from the options given below:

Options

1. A, D and E Only
2. A, B, C and E Only
3. A, B and C Only
4. C, D and E Only

Question Type : **MCQ**
Question ID : **7364751102**
Option 1 ID : **7364753748**
Option 2 ID : **7364753747**
Option 3 ID : **7364753745**
Option 4 ID : **7364753746**

Q.66 Which of the following statements are NOT true about the periodic table?

A. The properties of elements are function of atomic weights.

B. The properties of elements are function of atomic numbers.

C. Elements having similar outer electronic configurations are arranged in same period.

D. An element's location reflects the quantum numbers of the last filled orbital.

E. The number of elements in a period is same as the number of atomic orbitals available in energy level that is being filled.

Choose the correct answer from the options given below:

Options

1. A, C and E Only
2. A and E Only
3. D and E Only
4. B, C and E Only

Question Type : **MCQ**
Question ID : **7364751108**
Option 1 ID : **7364753769**
Option 2 ID : **7364753770**
Option 3 ID : **7364753772**
Option 4 ID : **7364753771**

Q.67 Which of the following linear combination of atomic orbitals will lead to formation of molecular orbitals in homonuclear diatomic molecules [internuclear axis in z- direction] ?

A. $2p_z$ and $2p_x$

B. 2s and $2p_x$

C. $3d_{xy}$ and $3d_{x^2-y^2}$

D. 2s and $2p_z$

E. $2p_z$ and $3d_{x^2-y^2}$

Choose the correct answer from the options given below:

Options

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

Question Type : **MCQ**
Question ID : **7364751101**
Option 1 ID : **7364753743**
Option 2 ID : **7364753741**
Option 3 ID : **7364753744**
Option 4 ID : **7364753742**

Q.68 Given below are two statements I and II.

Statement I: Dumas method is used for estimation of "Nitrogen" in an organic compound.

Statement II: Dumas method involves the formation of ammonium sulphate by heating the organic compound with conc H_2SO_4.

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

Options

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

Question Type : **MCQ**
Question ID : **7364751113**
Option 1 ID : **7364753790**
Option 2 ID : **7364753791**
Option 3 ID : **7364753789**
Option 4 ID : **7364753792**

Q.69 Which of the following arrangements with respect to their reactivity in nucleophilic addition reaction is correct?

Options

1.
p- nitrobenzaldehyde < benzaldehyde < p-tolualdehyde < acetophenone

2.
acetophenone < benzaldehyde < p-tolualdehyde < p- nitrobenzaldehyde

3.
benzaldehyde < acetophenone < p- nitrobenzaldehyde < p-tolualdehyde

4.
acetophenone < p-tolualdehyde < benzaldehyde < p- nitrobenzaldehyde

Question Type : **MCQ**
Question ID : **7364751118**
Option 1 ID : **7364753812**
Option 2 ID : **7364753811**
Option 3 ID : **7364753809**
Option 4 ID : **7364753810**

Q.70 The carbohydrate "Ribose" present in DNA, is

A. A pentose sugar

B. present in pyranose from

C. in "D" configuration

D. a reducing sugar, when free

E. in ∝–anomeric form

Choose the correct answer from the options given below:

Options

1. A, C and D Only
2. B, D and E Only
3. A, D and E Only
4. A, B and E Only

Question Type : **MCQ**
Question ID : **7364751120**
Option 1 ID : **7364753817**
Option 2 ID : **7364753819**
Option 3 ID : **7364753820**
Option 4 ID : **7364753818**

Section : **Chemistry Section B**

Q.71 37.8 g N_2O_5 was taken in a 1 L reaction vessel and allowed to undergo the following reaction at 500 K

$2N_2O_{5(g)} \rightleftharpoons 2N_2O_{4(g)} + O_{2(g)}$

The total pressure at equilibrium was found to be 18.65 bar.

Then, Kp = _____ $\times 10^{-2}$ [nearest integer]

Assume N_2O_5 to behave ideally under these conditions.

Given: R = 0.082 bar L mol^{-1} K^{-1}

Question Type : **SA**
Question ID : **7364751123**

Q.72 Consider the following reaction occurring in the blast furnace:

$Fe_3O_{4(s)} + 4CO_{(g)} \rightarrow 3Fe_{(l)} + 4CO_{2\,(g)}$

'x' kg of iron is produced when 2.32×10^3 kg Fe_3O_4 and 2.8×10^2 kg CO are brought together in the furnace. The value of 'x' is _____. (nearest integer)

{Given:

molar mass of Fe_3O_4 = 232 g mol^{-1}

molar mass of CO = 28 g mol^{-1}

molar mass of Fe = 56 g mol^{-1}}

Question Type : **SA**
Question ID : **7364751121**

Q.73 Xg of benzoic acid on reaction with aq $NaHCO_3$ released CO_2 that occupied 11.2 L volume at STP.
X is _____ g.

Question Type : **SA**
Question ID : **7364751124**

Q.74 Among the following cations, the number of cations which will give characteristic precipitate in their identification tests with $K_4[Fe(CN)_6]$ is _____.
Cu^{2+}, Fe^{3+}, Ba^{2+}, Ca^{2+}, NH_4^+, Mg^{2+}, Zn^{2+}

Question Type : **SA**
Question ID : **7364751125**

Q.75 Standard entropies of X_2, Y_2 and XY_5 are 70, 50 and 110 $J\,K^{-1}$ mol^{-1} respectively. The temperature in Kelvin at which the reaction

$$\frac{1}{2}X_2+\frac{5}{2}Y_2 \rightleftharpoons XY_5 \quad \Delta H^{\Theta}=-35\,kJ\,mol^{-1}$$

will be at equilibrium is _____ (Nearest integer)

Question Type : **SA**
Question ID : **7364751122**