JEE MAINS PAPER 1 2025

Test Date	28/01/2025
Test Time	9:00 AM - 12:00 PM
Subject	B. Tech

Section : **Mathematics Section A**

Q.1

If $f(x)=\frac{2^x}{2^x+\sqrt{2}}$, $x \in \mathbb{R}$, then

$\sum_{k=1}^{81} f\left(\frac{k}{82}\right)$ is equal to

Options

1. $\frac{81}{2}$
2. 41
3. 82
4. $81\sqrt{2}$

Question Type : **MCQ**
Question ID : **7364751502**
Option 1 ID : **7364755106**
Option 2 ID : **7364755105**
Option 3 ID : **7364755107**
Option 4 ID : **7364755108**

Q.2

If $\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} \frac{96x^2\cos^2 x}{(1+e^x)}dx=\pi(\alpha\pi^2+\beta),\ \alpha,\beta\in\mathbb{Z},$

then $(\alpha+\beta)^2$ equals

Options

1. 144
2. 100
3. 196
4. 64

Question Type : **MCQ**
Question ID : **7364751520**
Option 1 ID : **7364755179**
Option 2 ID : **7364755178**
Option 3 ID : **7364755180**
Option 4 ID : **7364755177**

Q.3 Let the equation of the circle, which touches x−axis at the point (a, 0), a > 0 and cuts off an intercept of length b on y−axis be $x^2 + y^2 - \alpha x + \beta y + \gamma = 0$. If the circle lies below x−axis, then the ordered pair $(2a, b^2)$ is equal to

Options

1. $(\alpha, \beta^2 - 4\gamma)$
2. $(\gamma, \beta^2 + 4\alpha)$
3. $(\gamma, \beta^2 - 4\alpha)$
4. $(\alpha, \beta^2 + 4\gamma)$

Question Type : **MCQ**
Question ID : **7364751512**
Option 1 ID : **7364755146**
Option 2 ID : **7364755147**
Option 3 ID : **7364755148**
Option 4 ID : **7364755145**

Q.4 Let for some function $y = f(x)$, $\int_0^x t\, f(t)\, dt = x^2 f(x), x > 0$ and $f(2) = 3$. Then $f(6)$ is equal to

Options

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

Question Type : **MCQ**
Question ID : **7364751518**
Option 1 ID : **7364755172**
Option 2 ID : **7364755169**
Option 3 ID : **7364755171**
Option 4 ID : **7364755170**

Q.5 Let A (x, y, z) be a point in xy- plane, which is equidistant from three points $(0, 3, 2)$, $(2, 0, 3)$ and $(0, 0, 1)$.
Let $B = (1, 4, -1)$ and $C = (2, 0, -2)$. Then among the statements
(S1) : ΔABC is an isosceles right angled triangle, and
(S2) : the area of ΔABC is $\frac{9\sqrt{2}}{2}$,

Options
1. both are true
2. only (S1) is true
3. only (S2) is true
4. both are false

Question Type : **MCQ**
Question ID : **7364751514**
Option 1 ID : **7364755153**
Option 2 ID : **7364755155**
Option 3 ID : **7364755156**
Option 4 ID : **7364755154**

Q.6 The relation $R = \{(x, y) : x, y \in \mathbb{Z} \text{ and } x + y \text{ is even}\}$ is:

Options
1. an equivalence relation
2. symmetric and transitive but not reflexive
3. reflexive and symmetric but not transitive
4. reflexive and transitive but not symmetric

Question Type : **MCQ**
Question ID : **7364751501**
Option 1 ID : **7364755104**
Option 2 ID : **7364755103**
Option 3 ID : **7364755102**
Option 4 ID : **7364755101**

Q.7 $\cos\left(\sin^{-1}\frac{3}{5}+\sin^{-1}\frac{5}{13}+\sin^{-1}\frac{33}{65}\right)$ is equal to:

Options
1. 1
2. $\frac{33}{65}$
3. 0
4. $\frac{32}{65}$

Question Type : **MCQ**
Question ID : **7364751513**
Option 1 ID : **7364755150**
Option 2 ID : **7364755152**
Option 3 ID : **7364755149**
Option 4 ID : **7364755151**

Q.8 The sum of all local minimum values of the function

$$f(x)=\begin{cases}1-2x, & x<-1\\ \frac{1}{3}(7+2|x|), & -1\le x\le 2\\ \frac{11}{18}(x-4)(x-5), & x>2\end{cases}$$

is

Options
1. $\frac{131}{72}$
2. $\frac{167}{72}$
3. $\frac{157}{72}$
4. $\frac{171}{72}$

Question Type : **MCQ**
Question ID : **7364751516**
Option 1 ID : **7364755162**
Option 2 ID : **7364755161**
Option 3 ID : **7364755163**
Option 4 ID : **7364755164**

Q.9 The sum, of the squares of all the roots of the equation $x^2 + |2x - 3| - 4 = 0$, is

Options

1. $3(2-\sqrt{2})$
2. $6(2-\sqrt{2})$
3. $6(3-\sqrt{2})$
4. $3(3-\sqrt{2})$

Question Type : **MCQ**
Question ID : **7364751504**
Option 1 ID : **7364755114**
Option 2 ID : **7364755113**
Option 3 ID : **7364755115**
Option 4 ID : **7364755116**

Q.10 Let ${}^nC_{r-1} = 28$, ${}^nC_r = 56$ and ${}^nC_{r+1} = 70$. Let A (4cost, 4sint), B (2sint, − 2cost) and C $(3r-n, r^2 - n - 1)$ be the vertices of a triangle ABC, where t is a parameter. If $(3x - 1)^2 + (3y)^2 = \alpha$, is the locus of the centroid of triangle ABC, then α equals

Options

1. 20
2. 8
3. 6
4. 18

Question Type : **MCQ**
Question ID : **7364751511**
Option 1 ID : **7364755141**
Option 2 ID : **7364755143**
Option 3 ID : **7364755144**
Option 4 ID : **7364755142**

Q.11 Three defective oranges are accidently mixed with seven good ones and on looking at them, it is not possible to differentiate between them. Two oranges are drawn at random from the lot. If x denote the number of defective oranges, then the variance of x is

Options

1. 14/25
2. 18/25
3. 26/75
4. 28/75

Question Type : **MCQ**
Question ID : **7364751508**
Option 1 ID : **7364755129**
Option 2 ID : **7364755132**
Option 3 ID : **7364755130**
Option 4 ID : **7364755131**

Q.12 Let $f:\mathbb{R}\to\mathbb{R}$ be a function defined by

$$f(x)=(2+3a)x^2+\left(\frac{a+2}{a-1}\right)x+\mathrm{b},\ a\neq 1\ .\ \text{If}$$

$$f(x+\mathrm{y})=f(x)+f(\mathrm{y})+1-\frac{2}{7}x\mathrm{y}\ \text{, then the value of } 28\sum_{i=1}^{5}|f(i)| \text{ is}$$

Options

1. 545
2. 675
3. 715
4. 735

Question Type : **MCQ**
Question ID : **7364751519**
Option 1 ID : **7364755173**
Option 2 ID : **7364755174**
Option 3 ID : **7364755175**
Option 4 ID : **7364755176**

Q.13 Two number k_1 and k_2 are randomly chosen from the set of natural numbers. Then, the probability that the value of $i^{k_1}+i^{k_2}$, $(i=\sqrt{-1})$ is non-zero, equals

Options

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

Question Type : **MCQ**
Question ID : **7364751509**
Option 1 ID : **7364755135**
Option 2 ID : **7364755133**
Option 3 ID : **7364755134**
Option 4 ID : **7364755136**

Q.14 If the image of the point (4, 4, 3) in the line $\frac{x-1}{2}=\frac{y-2}{1}=\frac{z-1}{3}$ is (α, β, γ), then $\alpha+\beta+\gamma$ is equal to

Options

1. 9
2. 7
3. 12
4. 8

Question Type : **MCQ**
Question ID : **7364751515**
Option 1 ID : **7364755159**
Option 2 ID : **7364755157**
Option 3 ID : **7364755160**
Option 4 ID : **7364755158**

Q.15 The area (in sq. units) of the region $\{(x, y) : 0 \le y \le 2|x| + 1, 0 \le y \le x^2 + 1, |x| \le 3\}$ is

Options

1. $\frac{80}{3}$
2. $\frac{64}{3}$
3. $\frac{32}{3}$
4. $\frac{17}{3}$

Question Type : **MCQ**
Question ID : **7364751517**
Option 1 ID : **7364755166**
Option 2 ID : **7364755165**
Option 3 ID : **7364755167**
Option 4 ID : **7364755168**

Q.16 The number of different 5 digit numbers greater than 50000 that can be formed using the digits 0, 1, 2, 3, 4, 5, 6, 7, such that the sum of their first and last digits should not be more than 8, is

Options

1. 4608
2. 5719
3. 4607
4. 5720

Question Type : **MCQ**
Question ID : **7364751507**
Option 1 ID : **7364755126**
Option 2 ID : **7364755127**
Option 3 ID : **7364755125**
Option 4 ID : **7364755128**

Q.17

Let T_r be the r^{th} term of an A.P. If for some m, $T_m = \frac{1}{25}$, $T_{25} = \frac{1}{20}$, and $20\sum_{r=1}^{25} T_r = 13$, then

$5m\sum_{r=m}^{2m} T_r$ is equal to

Options

1. 126
2. 98
3. 142
4. 112

Question Type : **MCQ**
Question ID : **7364751506**
Option 1 ID : **7364755123**
Option 2 ID : **7364755121**
Option 3 ID : **7364755124**
Option 4 ID : **7364755122**

Q.18

Let $\langle a_n \rangle$ be a sequence such that $a_0 = 0$, $a_1 = \frac{1}{2}$ and $2a_{n+2} = 5a_{n+1} - 3a_n$, $n = 0, 1, 2, 3, \ldots$.

Then $\sum_{k=1}^{100} a_k$ is equal to

Options

1. $3a_{99} - 100$
2. $3a_{100} - 100$
3. $3a_{100} + 100$
4. $3a_{99} + 100$

Question Type : **MCQ**
Question ID : **7364751505**
Option 1 ID : **7364755118**
Option 2 ID : **7364755120**
Option 3 ID : **7364755119**
Option 4 ID : **7364755117**

Q.19 Let ABCD be a trapezium whose vertices lie on the parabola $y^2 = 4x$. Let the sides AD and BC of the trapezium be parallel to y-axis. If the diagonal AC is of length $\frac{25}{4}$ and it passes through the point (1, 0), then the area of ABCD is

Options

1. $\frac{75}{8}$
2. $\frac{25}{2}$
3. $\frac{125}{8}$
4. $\frac{75}{4}$

Question Type : **MCQ**
Question ID : **7364751510**
Option 1 ID : **7364755139**
Option 2 ID : **7364755137**
Option 3 ID : **7364755140**
Option 4 ID : **7364755138**

Q.20 Let O be the origin, the point A be $z_1 = \sqrt{3} + 2\sqrt{2}i$, the point B (z_2) be such that $\sqrt{3}|z_2| = |z_1|$ and $\arg(z_2) = \arg(z_1) + \frac{\pi}{6}$. Then

Options

1. area of triangle ABO is $\frac{11}{4}$
2. ABO is a scalene triangle
3. area of triangle ABO is $\frac{11}{\sqrt{3}}$
4. ABO is an obtuse angled isosceles triangle

Question Type : **MCQ**
Question ID : **7364751503**
Option 1 ID : **7364755112**
Option 2 ID : **7364755110**
Option 3 ID : **7364755111**
Option 4 ID : **7364755109**

Section : **Mathematics Section B**

Q.21 Let $f(x)=\begin{cases} 3x, & x<0 \\ \min\{1+x+[x],\ x+2[x]\}, & 0\le x\le 2 \\ 5, & x>2, \end{cases}$

where [.] denotes greatest integer function. If α and β are the number of points, where f is not continuous and is not differentiable, respectively, then α + β equals____.

Question Type : **SA**
Question ID : **7364751525**

Q.22 Let $\vec{a}=\hat{i}+\hat{j}+\hat{k}$, $\vec{b}=2\hat{i}+2\hat{j}+\hat{k}$ and $\vec{d}=\vec{a}\times\vec{b}$. If $\vec{c}$ is a vector such that $\vec{a}\cdot\vec{c}=|\vec{c}|$, $|\vec{c}-2\vec{a}|^2=8$ and the angle between $\vec{d}$ and $\vec{c}$ is $\frac{\pi}{4}$, then $|10-3\vec{b}\cdot\vec{c}|+|\vec{d}\times\vec{c}|^2$ is equal to _____.

Question Type : **SA**
Question ID : **7364751524**

Q.23 Let $E_1:\frac{x^2}{9}+\frac{y^2}{4}=1$ be an ellipse. Ellipses E_i's are constructed such that their centres and eccentricities are same as that of E_1, and the length of minor axis of E_i is the length of major axis of E_{i+1} $(i\ge 1)$. If A_i is the area of the ellipse E_i, then $\frac{5}{\pi}\left(\sum_{i=1}^{\infty}A_i\right)$, is equal to ____.

Question Type : **SA**
Question ID : **7364751523**

Q.24 If $\alpha=1+\sum_{r=1}^{6}(-3)^{r-1}\ {}^{12}C_{2r-1}$,

then the distance of the point $(12,\sqrt{3})$ from the line $\alpha x-\sqrt{3}y+1=0$ is____.

Question Type : **SA**
Question ID : **7364751522**

Q.25 Let M denote the set of all real matrices of order 3 × 3 and let S = {−3, −2, −1, 1, 2}. Let

$S_1=\{A=[a_{ij}]\in M : A=A^T \text{ and } a_{ij}\in S, \forall\ i, j\}$,

$S_2=\{A=[a_{ij}]\in M : A=-A^T \text{ and } a_{ij}\in S, \forall\ i, j\}$,

$S_3=\{A=[a_{ij}]\in M : a_{11}+a_{22}+a_{33}=0 \text{ and } a_{ij}\in S, \forall\ i, j\}$.

If $n(S_1\cup S_2\cup S_3)=125\,\alpha$, then α equls ____.

Question Type : **SA**
Question ID : **7364751521**

Section : **Physics Section A**

Q.26 Due to presence of an em-wave whose electric component is given by $E = 100 \sin(\omega t - kx)\ NC^{-1}$, a cylinder of length 200 cm holds certain amount of em-energy inside it. If another cylinder of same length but half diameter than previous one holds same amount of em-energy, the magnitude of the electric field of the corresponding em-wave should be modified as

Options

1. $25 \sin(\omega t - kx)\ NC^{-1}$
2. $50 \sin(\omega t - kx)\ NC^{-1}$
3. $400 \sin(\omega t - kx)\ NC^{-1}$
4. $200 \sin(\omega t - kx)\ NC^{-1}$

Question Type : **MCQ**
Question ID : **7364751540**
Option 1 ID : **7364755244**
Option 2 ID : **7364755242**
Option 3 ID : **7364755245**
Option 4 ID : **7364755243**

Q.27 In the experiment for measurement of viscosity 'η' of given liquid with a ball having radius R, consider following statements.

A. Graph between terminal velocity V and R will be a parabola.

B. The terminal velocities of different diameter balls are constant for a given liquid.

C. Measurement of terminal velocity is dependent on the temperature.

D. This experiment can be utilized to assess the density of a given liquid.

E. If balls are dropped with some initial speed, the value of η will change.

Choose the correct answer from the options given below:

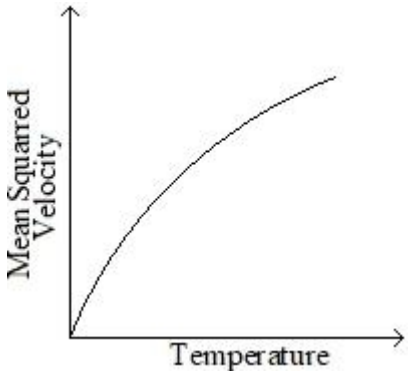
Options

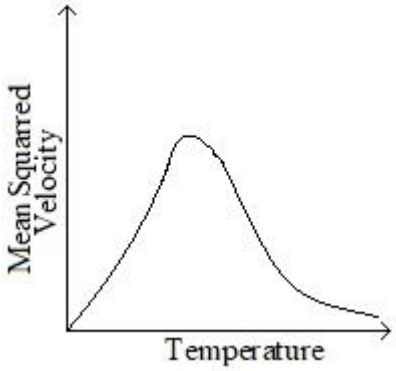
1. C, D and E Only
2. B, D and E Only
3. A, C and D Only
4. A, B and E Only

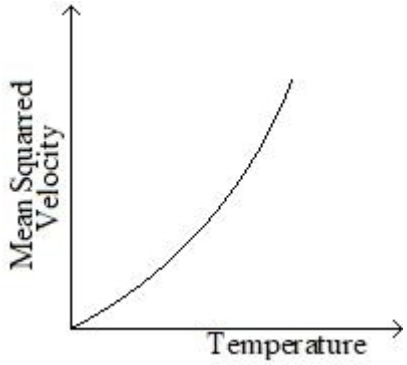
Question Type : **MCQ**
Question ID : **7364751530**
Option 1 ID : **7364755204**
Option 2 ID : **7364755203**
Option 3 ID : **7364755202**
Option 4 ID : **7364755205**

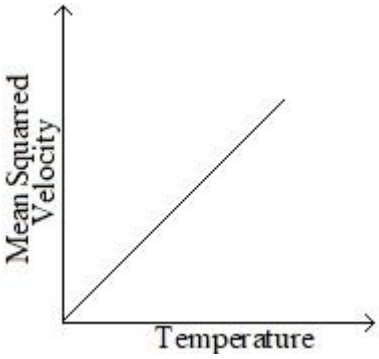
Q.28 For a particular ideal gas which of the following graphs represents the variation of mean squared velocity of the gas molecules with temperature?

Options

1. 

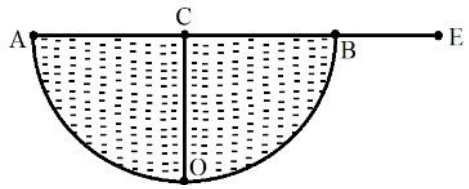
2. 

3. 

4. 

Question Type : **MCQ**
Question ID : **7364751531**
Option 1 ID : **7364755208**
Option 2 ID : **7364755207**
Option 3 ID : **7364755209**
Option 4 ID : **7364755206**

Q.29 A hemispherical vessel is completely filled with a liquid of refractive index μ. A small coin is kept at the lowest point (O) of the vessel as shown in figure. The minimum value of the refractive index of the liquid so that a person can see the coin from point E (at the level of the vessel) is _____.

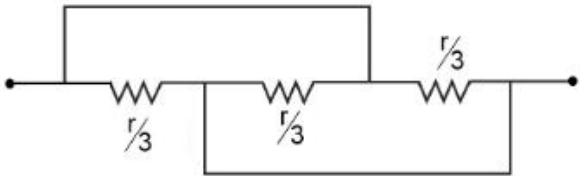


Options

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

Question Type : **MCQ**
Question ID : **7364751541**
Option 1 ID : **7364755247**
Option 2 ID : **7364755248**
Option 3 ID : **7364755246**
Option 4 ID : **7364755249**

Q.30 Find the equivalent resistance between two ends of the following circuit



Options

1. $\frac{r}{3}$
2. r
3. $\frac{r}{9}$
4. $\frac{r}{6}$

Question Type : **MCQ**
Question ID : **7364751536**
Option 1 ID : **7364755227**
Option 2 ID : **7364755228**
Option 3 ID : **7364755226**
Option 4 ID : **7364755229**

Q.31 The center of mass of a thin rectangular plate (fig - x) with sides of length a and b, whose mass per unit area (σ) varies as $\sigma=\frac{\sigma_0 x}{ab}$ (where σ_0 is a constant), would be _____

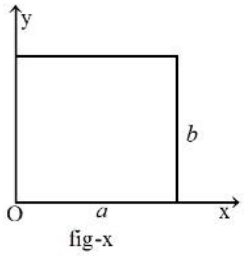


fig-x

Options

1. $\left(\frac{1}{3}a,\frac{b}{2}\right)$
2. $\left(\frac{2}{3}a,\frac{2}{3}b\right)$
3. $\left(\frac{a}{2},\frac{b}{2}\right)$
4. $\left(\frac{2}{3}a,\frac{b}{2}\right)$

Question Type : **MCQ**
Question ID : **7364751526**
Option 1 ID : **7364755189**
Option 2 ID : **7364755188**
Option 3 ID : **7364755186**
Option 4 ID : **7364755187**

Q.32 Choose the correct nuclear process from the below options
[p: proton, n: neutron, e^-: electron, e^+: positron, ν : neutrino, $\bar{\nu}$: antineutrino]

Options

1. $n \rightarrow p + e^+ + \bar{\nu}$
2. $n \rightarrow p + e^+ + \nu$
3. $n \rightarrow p + e^- + \bar{\nu}$
4. $n \rightarrow p + e^- + \nu$

Question Type : **MCQ**
Question ID : **7364751544**
Option 1 ID : **7364755259**
Option 2 ID : **7364755261**
Option 3 ID : **7364755260**
Option 4 ID : **7364755258**

Q.33 Three infinitely long wires with linear charge density λ are placed along the x–axis, y–axis and z–axis respectively. Which of the following denotes an equipotential surface?

Options

1. $(x + y)(y + z)(z + x) = \text{constant}$
2. $xyz = \text{constant}$
3. $xy + yz + zx = \text{constant}$
4. $(x^2 + y^2)(y^2 + z^2)(z^2 + x^2) = \text{constant}$

Question Type : **MCQ**
Question ID : **7364751539**
Option 1 ID : **7364755239**
Option 2 ID : **7364755238**
Option 3 ID : **7364755241**
Option 4 ID : **7364755240**

Q.34 A wire of resistance R is bent into an equilateral triangle and an identical wire is bent into *a* square. The ratio of resistance between the two end points of an edge of the triangle to that of the square is

Options

1. 32/27
2. 27/32
3. 9/8
4. 8/9

Question Type : **MCQ**
Question ID : **7364751534**
Option 1 ID : **7364755220**
Option 2 ID : **7364755221**
Option 3 ID : **7364755219**
Option 4 ID : **7364755218**

Q.35 Consider a long thin conducting wire carrying a uniform current I. A particle having mass "M" and charge "q" is released at a distance "a" from the wire with a speed v_0 along the direction of current in the wire. The particle gets attracted to the wire due to magnetic force. The particle turns round when it is at distance x from the wire. The value of x is
[μ_0 is vacuum permeability]

Options

1. $a\left[1-\frac{mv_o}{2q\mu_o I}\right]$
2. $\frac{a}{2}$
3. $ae^{-\frac{4\pi mv_o}{q\mu_o I}}$
4. $a\left[1-\frac{mv_o}{q\mu_o I}\right]$

Question Type : **MCQ**
Question ID : **7364751535**
Option 1 ID : **7364755225**
Option 2 ID : **7364755223**
Option 3 ID : **7364755222**
Option 4 ID : **7364755224**

Q.36 Given below are two statements: one is labelled as **Assertion A** and the other is labelled as **Reason R**

Assertion A: A sound wave has higher speed in solids than gases.

Reason R: Gases have higher value of Bulk modulus than solids.

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

Options

1. **A** is false but **R** is true
2. Both **A** and **R** are true and **R** is the correct explanation of **A**
3. **A** is true but **R** is false
4. Both **A** and **R** are true but **R** is **NOT** the correct explanation of **A**

Question Type : **MCQ**
Question ID : **7364751533**
Option 1 ID : **7364755217**
Option 2 ID : **7364755214**
Option 3 ID : **7364755216**
Option 4 ID : **7364755215**

Q.37 Given below are two statements: one is labelled as **Assertion A** and the other is labelled as **Reason R**

Assertion A: In a central force field, the work done is independent of the path chosen.

Reason R: Every force encountered in mechanics does not have an associated potential energy.

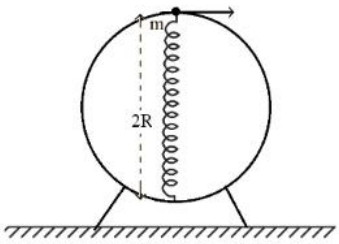
In the light of the above statements, choose the ***most appropriate*** answer from the options given below

Options

1. **A** is true but **R** is false
2. Both **A** and **R** are true and **R** is the correct explanation of **A**
3. Both **A** and **R** are true but **R** is **NOT** the correct explanation of **A**
4. **A** is false but **R** is true

Question Type : **MCQ**
Question ID : **7364751528**
Option 1 ID : **7364755196**
Option 2 ID : **7364755194**
Option 3 ID : **7364755195**
Option 4 ID : **7364755197**

Q.38 A bead of mass 'm' slides without friction on the wall of a vertical circular hoop of radius 'R' as shown in figure. The bead moves under the combined action of gravity and a massless spring (k) attached to the bottom of the hoop. The equilibrium length of the spring is 'R'. If the bead is released from top of the hoop with (negligible) zero initial speed, velocity of bead, when the length of spring becomes 'R', would be (spring constant is 'k', g is accleration due to gravity)

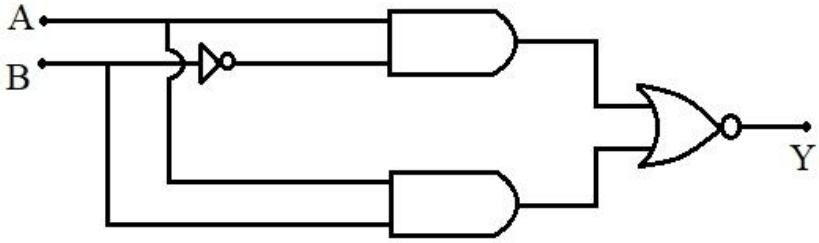


Options

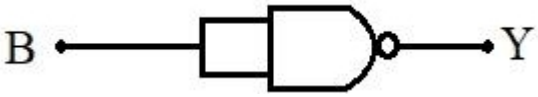
1. $2\sqrt{gR+\frac{kR^2}{m}}$
2. $\sqrt{2Rg+\frac{4kR^2}{m}}$
3. $\sqrt{2Rg+\frac{kR^2}{m}}$
4. $\sqrt{3Rg+\frac{kR^2}{m}}$

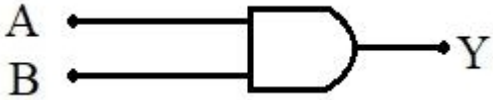
Question Type : **MCQ**
Question ID : **7364751527**
Option 1 ID : **7364755190**
Option 2 ID : **7364755191**
Option 3 ID : **7364755192**
Option 4 ID : **7364755193**

Q.39 Which of the following circuits has the same outpur as that of the given circuit?

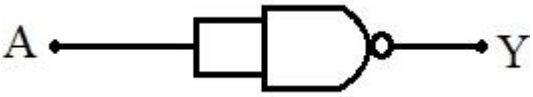


Options

1. 

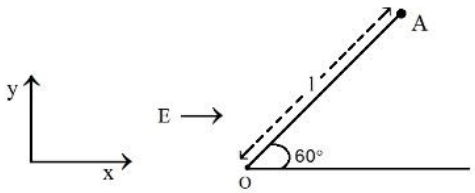
2. 

3. 

4. 

Question Type : **MCQ**
Question ID : **7364751545**
Option 1 ID : **7364755262**
Option 2 ID : **7364755264**
Option 3 ID : **7364755265**
Option 4 ID : **7364755263**

Q.40 A particle of mass 'm' and charge 'q' is fastened to one end 'A' of a massless string having equilibrium length *l*, whose other end is fixed at point 'O'. The whole system is placed on a frictionless horizontal plane and is initially at rest. If uniform electric field is switched on along the direction as shown in figure, then the speed of the particle when it crosses the x–axis is



Options

1. $\sqrt{\frac{qEl}{m}}$
2. $\sqrt{\frac{qEl}{2m}}$
3. $\sqrt{\frac{qEl}{4m}}$
4. $\sqrt{\frac{2qEl}{m}}$

Question Type : **MCQ**
Question ID : **7364751537**
Option 1 ID : **7364755231**
Option 2 ID : **7364755232**
Option 3 ID : **7364755233**
Option 4 ID : **7364755230**

Q.41 A proton of mass 'm_p' has same energy as that of a photon of wavelength 'λ'. If the proton is moving at non-relativistic speed, then ratio of its de Broglie wavelength to the wavelength of photon is.

Options

1. $\frac{1}{c}\sqrt{\frac{E}{2m_p}}$
2. $\frac{1}{c}\sqrt{\frac{2E}{m_p}}$
3. $\frac{1}{2c}\sqrt{\frac{E}{m_p}}$
4. $\frac{1}{c}\sqrt{\frac{E}{m_p}}$

Question Type : **MCQ**
Question ID : **7364751543**
Option 1 ID : **7364755255**
Option 2 ID : **7364755257**
Option 3 ID : **7364755256**
Option 4 ID : **7364755254**

Q.42 A thin prism P_1 with angle 4° made of glass having refractive index 1.54, is combined with another thin prism P_2 made of glass having refractive index 1.72 to get dispersion without deviation. The angle of the prism P_2 in degrees is

Options

1. 16/3
2. 1.5
3. 3
4. 4

Question Type : **MCQ**
Question ID : **7364751542**
Option 1 ID : **7364755251**
Option 2 ID : **7364755253**
Option 3 ID : **7364755250**
Option 4 ID : **7364755252**

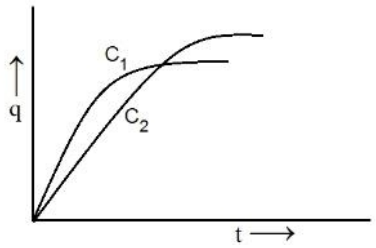
Q.43 A Carnot engine (E) is working between two temperatures 473K and 273K. In a new system two engines - engine E_1 works between 473K to 373K and engine E_2 works between 373K to 273K. If η_{12}, η_1 and η_2 are the efficiencies of the engines E, E_1 and E_2, respectively, then

Options

1. $\eta_{12} \geq \eta_1 + \eta_2$
2. $\eta_{12} = \eta_1 + \eta_2$
3. $\eta_{12} = \eta_1 \, \eta_2$
4. $\eta_{12} < \eta_1 + \eta_2$

Question Type : **MCQ**
Question ID : **7364751532**
Option 1 ID : **7364755211**
Option 2 ID : **7364755210**
Option 3 ID : **7364755212**
Option 4 ID : **7364755213**

Q.44 Two capacitors C_1 and C_2 are connected in parallel to a battery. Charge-time graph is shown below for the two capacitors. The energy stored with them are U_1 and U_2, respectively. Which of the given statements is true?



Options

1. $C_2 > C_1, U_2 < U_1$
2. $C_1 > C_2, U_1 < U_2$
3. $C_2 > C_1, U_2 > U_1$
4. $C_1 > C_2, U_1 > U_2$

Question Type : **MCQ**
Question ID : **7364751538**
Option 1 ID : **7364755237**
Option 2 ID : **7364755235**
Option 3 ID : **7364755236**
Option 4 ID : **7364755234**

Q.45 Consider following statements:

A. Surface tension arises due to extra energy of the molecules at the interior as compared to the molecules at the surface, of a liquid.

B. As the temperature of liquid rises, the coefficient of viscosity increases.

C. As the temperature of gas increases, the coefficient of viscosity increases

D. The onset of turbulence is determined by Reynold's number.

E. In a steady flow two stream lines never intersect.

Choose the correct answer from the options given below:

Options

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

Question Type : **MCQ**
Question ID : **7364751529**
Option 1 ID : **7364755200**
Option 2 ID : **7364755199**
Option 3 ID : **7364755201**
Option 4 ID : **7364755198**

Section : **Physics Section B**

Q.46 In a measurement, it is asked to find modulus of elasticity per unit torque applied on the system. The measured quantity has dimension of $[M^a L^b T^c]$. If b = 3, the value of c is _____

Question Type : **SA**
Question ID : **7364751546**

Q.47 A double slit interference experiment performed with a light of wavelength 600 nm forms an interference fringe pattern on a screen with 10th bright fringe having its centre at a distance of 10 mm from the central maximum. Distance of the centre of the same 10th bright fringe from the central maximum when the source of light is replaced by another source of wavelength 660 nm would be_____mm.

Question Type : **SA**
Question ID : **7364751550**

Q.48 A tiny metallic rectangular sheet has length and breadth of 5 mm and 2.5 mm, respectively. Using a specially designed screw gauge which has pitch of 0.75 mm and 15 divisions in the circular scale, you are asked to find the area of the sheet. In this measurement, the maximum fractional error will be $\frac{x}{100}$ where x is _____ .

Question Type : **SA**
Question ID : **7364751547**

Q.49 Two iron solid discs of negligible thickness have radii R_1 and R_2 and moment of intertia I_1 and I_2, respectively. For $R_2 = 2R_1$, the ratio of I_1 and I_2 would be 1/x, where x = _____.

Question Type : **SA**
Question ID : **7364751548**

Q.50 The moment of inertia of a solid disc rotating along its diameter is 2.5 times higher than the moment of inertia of a ring rotating in similar way. The moment of inertia of a solid sphere which has same radius as the disc and rotating in similar way, is n times higher than the moment of inertia of the given ring. Here, n = _____.
Consider all the bodies have equal masses.

Question Type : **SA**
Question ID : **7364751549**

Section : **Chemistry Section A**

Q.51 Given below are two statements:

Statement I: In the oxalic acid vs $KMnO_4$ (in the presence of dil H_2SO_4) titration the solution needs to be heated initially to 60°C, but no heating is required in Ferrous ammonium sulphate (FAS) vs $KMnO_4$ titration (in the presence of dil H_2SO_4)

Statement II: In oxalic acid vs $KMnO_4$ titration, the initial formation of $MnSO_4$ takes place at high temperature, which then acts as catalyst for further reaction. In the case of FAS vs $KMnO_4$, heating oxidizes Fe^{2+} into Fe^{3+} by oxygen of air and error may be introduced in the experiment.

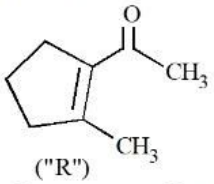
In the light of the above statements, choose the ***correct*** answer from the options given below

Options

1. Both Statement I and Statement II are true
2. Statement I is 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

Question Type : **MCQ**
Question ID : **7364751570**
Option 1 ID : **7364755347**
Option 2 ID : **7364755349**
Option 3 ID : **7364755348**
Option 4 ID : **7364755350**

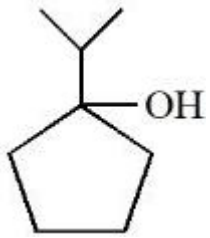
Q.52 A molecule ("P") on treatment with acid undergoes rearrangement and gives ("Q"). ("Q") on ozonolysis followed by reflux under alkaline condition gives ("R"). The structure of ("R") is given below.

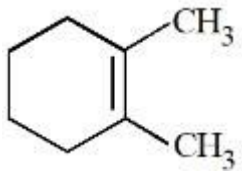


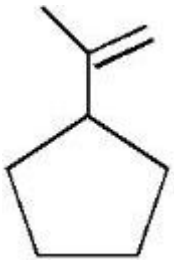
("R")

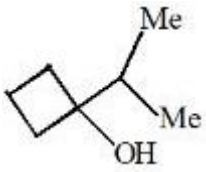
The structure of **("P")** is

Options

1. 

2. 

3. 

4. 

Question Type : **MCQ**
Question ID : **7364751565**
Option 1 ID : **7364755327**
Option 2 ID : **7364755329**
Option 3 ID : **7364755330**
Option 4 ID : **7364755328**

Q.53 Both acetaldehyde and acetone (individually) undergo which of the following reactions?

A. Iodoform Reaction
B. Cannizaro Reaction
C. Aldol Condensation
D. Tollen's Test
E. Clemmensen Reduction

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

Options

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

Question Type : **MCQ**
Question ID : **7364751567**
Option 1 ID : **7364755337**
Option 2 ID : **7364755335**
Option 3 ID : **7364755338**
Option 4 ID : **7364755336**

Q.54 Given below are two statements:

Statement I : D-glucose pentaacetate reacts with 2, 4 – dinitrophenylhydrazine

Statement II : Starch, on heating with concentrated sulfuric acid at 100°C and 2 - 3 atmosphere pressure produces glucose.

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

Question Type : **MCQ**
Question ID : **7364751569**
Option 1 ID : **7364755343**
Option 2 ID : **7364755345**
Option 3 ID : **7364755346**
Option 4 ID : **7364755344**

Q.55 The metal ion whose electronic configuration is not affected by the nature of the ligand and which gives a violet colour in non-luminous flame under hot condition in borax bead test is

Options

1. Ni^{2+}
2. Mn^{2+}
3. Cr^{3+}
4. Ti^{3+}

Question Type : **MCQ**
Question ID : **7364751562**
Option 1 ID : **7364755315**
Option 2 ID : **7364755318**
Option 3 ID : **7364755316**
Option 4 ID : **7364755317**

Q.56 Consider the following elements In, Tl, Al, Pb, Sn and Ge.

The most stable oxidation states of elements with highest and lowest first ionisation enthalpies, respectively, are

Options

1. +2 and +3
2. +4 and +1
3. +1 and +4
4. +4 and +3

Question Type : **MCQ**
Question ID : **7364751559**
Option 1 ID : **7364755304**
Option 2 ID : **7364755305**
Option 3 ID : **7364755303**
Option 4 ID : **7364755306**

Q.57 In a multielectron atom, which of the following orbitals described by three quantum numbers will have same energy in absence of electric and magnetic fields?

A. $n = 1, l = 0, m_l = 0$

B. $n = 2, l = 0, m_l = 0$

C. $n = 2, l = 1, m_l = 1$

D. $n = 3, l = 2, m_l = 1$

E. $n = 3, l = 2, m_l = 0$

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

Options

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

Question Type : **MCQ**
Question ID : **7364751551**
Option 1 ID : **7364755273**
Option 2 ID : **7364755274**
Option 3 ID : **7364755271**
Option 4 ID : **7364755272**

Q.58 A weak acid HA has degree of dissociation x. Which option gives the correct expression of $(pH - pK_a)$?

Options

1. $\log(1 + 2x)$
2. $\log\left(\frac{1-x}{x}\right)$
3. $\log\left(\frac{x}{1-x}\right)$
4. 0

Question Type : **MCQ**
Question ID : **7364751555**
Option 1 ID : **7364755287**
Option 2 ID : **7364755288**
Option 3 ID : **7364755290**
Option 4 ID : **7364755289**

Q.59 The products A and B in the following reactions, respectively are

$$A \xleftarrow{Ag-NO_2} CH_3-CH_2-CH_2-Br \xrightarrow{AgCN} B$$

Options

1. $CH_3-CH_2-CH_2-NO_2$, $CH_3-CH_2-CH_2-NC$
2. $CH_3-CH_2-CH_2-NO_2$, $CH_3-CH_2-CH_2-CN$
3. $CH_3-CH_2-CH_2-ONO$, $CH_3-CH_2-CH_2-CN$
4. $CH_3-CH_2-CH_2-ONO$, $CH_3-CH_2-CH_2-NC$

Question Type : **MCQ**
Question ID : **7364751566**
Option 1 ID : **7364755334**
Option 2 ID : **7364755331**
Option 3 ID : **7364755332**
Option 4 ID : **7364755333**

Q.60 Which of the following oxidation reactions are carried out by both $K_2Cr_2O_7$ and $KMnO_4$ in acidic medium?

A. $I^- \rightarrow I_2$

B. $S^{2-} \rightarrow S$

C. $Fe^{2+} \rightarrow Fe^{3+}$

D. $I^- \rightarrow IO_3^-$

E. $S_2O_3^{2-} \rightarrow SO_4^{2-}$

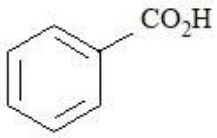
Choose the ***correct*** answer from the options given below:

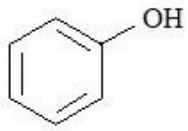
Options

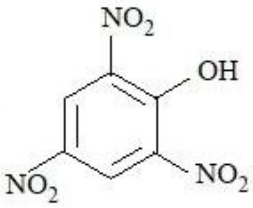
1. A, B and C Only
2. C, D and E Only
3. B, C and D Only
4. A, D and E Only

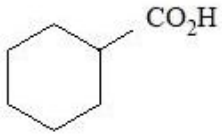
Question Type : **MCQ**
Question ID : **7364751560**
Option 1 ID : **7364755307**
Option 2 ID : **7364755309**
Option 3 ID : **7364755308**
Option 4 ID : **7364755310**

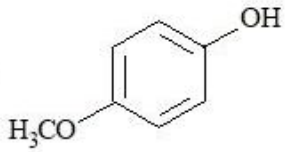
Q.61 The compounds that produce CO_2 with aqueous $NaHCO_3$ solution are:

A. 

B. 

C. 

D. 

E. 

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

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

Question Type : **MCQ**
Question ID : **7364751568**
Option 1 ID : **7364755340**
Option 2 ID : **7364755341**
Option 3 ID : **7364755339**
Option 4 ID : **7364755342**

Q.62 Consider 'n' is the number of lone pair of electrons present in the equatorial position of the most stable structure of ClF_3. The ions from the following with 'n' number of unpaired electrons are

A. V^{3+}
B. Ti^{3+}
C. Cu^{2+}
D. Ni^{2+}
E. Ti^{2+}

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

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

Question Type : **MCQ**
Question ID : **7364751561**
Option 1 ID : **7364755314**
Option 2 ID : **7364755312**
Option 3 ID : **7364755311**
Option 4 ID : **7364755313**

Q.63 The molecules having square pyramidal geometry are

Options
1. SbF_5 & PCl_5
2. SbF_5 & $XeOF_4$
3. BrF_5 & PCl_5
4. BrF_5 & $XeOF_4$

Question Type : **MCQ**
Question ID : **7364751552**
Option 1 ID : **7364755278**
Option 2 ID : **7364755276**
Option 3 ID : **7364755275**
Option 4 ID : **7364755277**

Q.64 Match the **LIST-I** with **LIST-II**

	LIST-I (Redox Reaction)		**LIST-II (Type of Redox Reaction)**
A.	$CH_{4(g)} + 2O_{2(g)} \xrightarrow{\Delta} CO_{2(g)} + 2H_2O_{(l)}$	I.	Disproportionation reaction
B.	$2NaH_{(s)} \xrightarrow{\Delta} 2Na_{(s)} + H_{2(g)}$	II.	Combination reaction
C.	$V_2O_{5(s)} + 5Ca_{(s)} \xrightarrow{\Delta} 2V_{(s)} + 5CaO_{(s)}$	III.	Decomposition reaction
D.	$2H_2O_{2(aq)} \xrightarrow{\Delta} 2H_2O_{(l)} + O_{2(g)}$	IV.	Displacement reaction

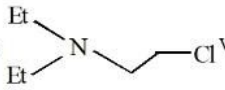
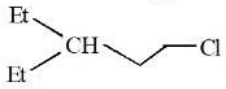
Choose the ***correct*** answer from the options given below:

Options

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

Question Type : **MCQ**
Question ID : **7364751556**
Option 1 ID : **7364755294**
Option 2 ID : **7364755291**
Option 3 ID : **7364755293**
Option 4 ID : **7364755292**

Q.65 Given below are two statements:

Statement I:  will undergo alkaline hydrolysis at a faster rate than 

Statement II: In  , intramolecular substitution takes place first by involving lone pair of electrons on nitrogen.

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

Options

1. Both Statement I and Statement II are incorrect
2. Both Statement I and Statement II are correct
3. Statement I is incorrect but Statement II is correct
4. Statement I is correct but Statement II is incorrect

Question Type : **MCQ**
Question ID : **7364751563**
Option 1 ID : **7364755320**
Option 2 ID : **7364755319**
Option 3 ID : **7364755322**
Option 4 ID : **7364755321**

Q.66 Ice and water are placed in a closed container at a pressure of 1 atm and temperature 273.15K. If pressure of the system is increased 2 times, keeping temperature constant, then identify correct observation from following

Options

1. The amount of ice decreases.
2. The solid phase (ice) disappears completely.
3. Volume of system increases .
4. Liquid phase disappears completely.

Question Type : **MCQ**
Question ID : **7364751554**
Option 1 ID : **7364755284**
Option 2 ID : **7364755285**
Option 3 ID : **7364755286**
Option 4 ID : **7364755283**

Q.67

$[A]_o / mol\,L^{-1}$	$t_{1/2} / min$
0.100	200
0.025	100

For a given reaction R → P, $t_{1/2}$ is related to $[A]_0$ as given in table.

Given: log 2 = 0.30

Which of the following is true?

A. The order of the reaction is $1/2$.

B. If $[A]_o$ is 1M, then $t_{1/2}$ is $200\sqrt{10}$ min

C. The order of the reaction changes to 1 if the concentration of reactant changes from 0.100 M to 0.500 M.

D. $t_{1/2}$ is 800 min for $[A]_o$ = 1.6 M

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

Options

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

Question Type : **MCQ**
Question ID : **7364751557**
Option 1 ID : **7364755298**
Option 2 ID : **7364755297**
Option 3 ID : **7364755296**
Option 4 ID : **7364755295**

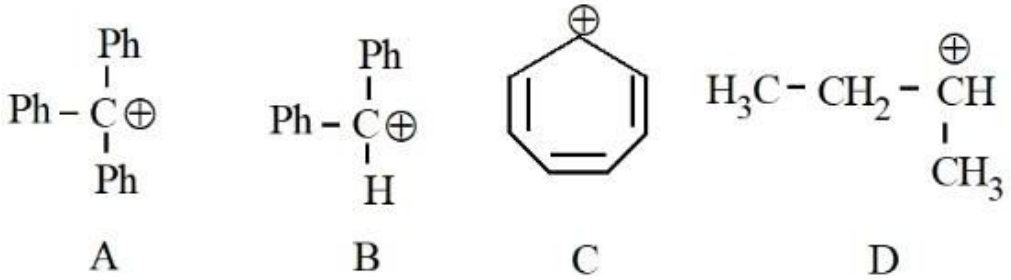
Q.68 What is the freezing point depression constant of a solvent, 50 g of which contain 1 g non volatile solute (molar mass 256 g mol^{-1}) and the decrease in freezing point is 0.40 K ?

Options

1. 5.12 K kg mol^{-1}
2. 3.72 K kg mol^{-1}
3. 1.86 K kg mol^{-1}
4. 4.43 K kg mol^{-1}

Question Type : **MCQ**
Question ID : **7364751553**
Option 1 ID : **7364755281**
Option 2 ID : **7364755280**
Option 3 ID : **7364755279**
Option 4 ID : **7364755282**

Q.69 The correct order of stability of following carbocations is :



A B C D

Options

1. C > B > A > D
2. A > B > C > D
3. C > A > B > D
4. B > C > A > D

Question Type : **MCQ**
Question ID : **7364751564**
Option 1 ID : **7364755325**
Option 2 ID : **7364755324**
Option 3 ID : **7364755323**
Option 4 ID : **7364755326**

Q.70 The incorrect decreasing order of atomic radii is

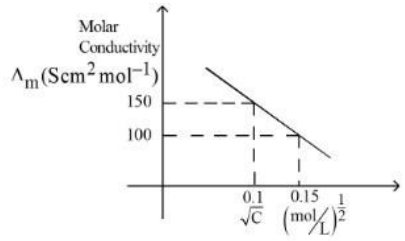
Options

1. Mg > Al > C > O
2. Si > P > Cl > F
3. Al > B > N > F
4. Be > Mg > Al > Si

Question Type : **MCQ**
Question ID : **7364751558**
Option 1 ID : **7364755300**
Option 2 ID : **7364755302**
Option 3 ID : **7364755299**
Option 4 ID : **7364755301**

Section : **Chemistry Section B**

Q.71 Given below is the plot of the molar conductivity vs $\sqrt{\text{concentration}}$ for KCl in aqueous solution.



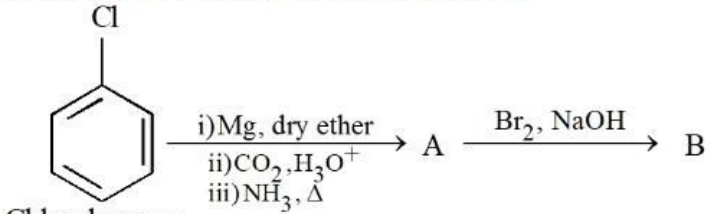
If, for the higher concentration of KCl solution, the resistance of the conductivity cell is 100 Ω, then the resistance of the same cell with the dilute solution is 'x' Ω
The value of x is _____ (Nearest integer)

Question Type : **SA**
Question ID : **7364751573**

Q.72 The formation enthalpies, $\Delta H_f^{\ominus}$ for $H_{(g)}$ and $O_{(g)}$ are 220.0 and 250.0 kJ mol^{-1}, respectively, at 298.15 K, and $\Delta H_f^{\ominus}$ for $H_2O_{(g)}$ is −242.0 kJ mol^{-1} at the same temperature. The average bond enthalpy of the O−H bond in water at 298.15 K is_____ kJ mol^{-1} (nearest integer).

Question Type : **SA**
Question ID : **7364751572**

Q.73 Consider the following sequence of reactions:



Chlorobenzene

11.25 mg of chlorobenzene will produce ---- $x10^{-1}$ mg of product B.
(Consider the reactions result in complete conversion.)

[Given molar mass of C, H, O, N and Cl as 12, 1, 16, 14 and 35.5 g mol^{-1} respectively]

Question Type : **SA**
Question ID : **7364751575**

Q.74 The molarity of a 70% (mass/mass) aqueous solution of a monobasic acid (X) is _____ × 10^{-1} M(Nearest integer)
[Given: Density of aqueous solution of (X) is 1.25 g mL^{-1}
Molar mass of the acid is 70 g mol^{-1}]

Question Type : **SA**
Question ID : **7364751571**

Q.75 Quantitative analysis of an organic compound (X) shows following % composition.

C : 14.5 % Cl : 64.46%

H : 1.8 %

(Empirical formula mass of the compound (X) is ____ $x10^{-1}$

(Given molar mass in g mol^{-1} of C : 12, H : 1, O : 16, Cl : 35.5)

Question Type : **SA**

Question ID : **7364751574**