JEE April 2024

Test Date	06/04/2024
Test Time	9:00 AM - 12:00 PM
Subject	B. Tech

Section : **Mathematics Section A**

Q.1

For $\alpha, \beta \in \mathbb{R}$ and a natural number n, let $A_r = \begin{vmatrix} r & 1 & \frac{n^2}{2}+\alpha \\ 2r & 2 & n^2-\beta \\ 3r-2 & 3 & \frac{n(3n-1)}{2} \end{vmatrix}$. Then

$2A_{10}-A_8$ is

Options

1. $2\alpha+4\beta$
2. 0
3. $4\alpha+2\beta$
4. $2n$

Question Type : **MCQ**
Question ID : **68019114068**
Option 1 ID : **68019155199**
Option 2 ID : **68019155197**
Option 3 ID : **68019155200**
Option 4 ID : **68019155198**

Q.2 The interval in which the function $f(x) = x^x$, $x > 0$, is strictly increasing is

Options

1. $\left[\frac{1}{e^2}, 1\right)$
2. $\left[\frac{1}{e}, \infty\right)$
3. $(0, \infty)$
4. $\left(0, \frac{1}{e}\right]$

Question Type : **MCQ**
Question ID : **68019114072**
Option 1 ID : **68019155215**
Option 2 ID : **68019155213**
Option 3 ID : **68019155216**
Option 4 ID : **68019155214**

Q.3 If $f(x)=\begin{cases} x^3\sin\left(\frac{1}{x}\right), & x\neq 0 \\ 0, & x=0 \end{cases}$, then

Options

1. $f''(0)=1$
2. $f''(0)=0$
3. $f''\left(\frac{2}{\pi}\right)=\frac{12-\pi^2}{2\pi}$
4. $f''\left(\frac{2}{\pi}\right)=\frac{24-\pi^2}{2\pi}$

Question Type : **MCQ**
Question ID : **68019114071**
Option 1 ID : **68019155211**
Option 2 ID : **68019155209**
Option 3 ID : **68019155212**
Option 4 ID : **68019155210**

Q.4 The shortest distance between the lines $\frac{x-3}{2}=\frac{y+15}{-7}=\frac{z-9}{5}$ and $\frac{x+1}{2}=\frac{y-1}{1}=\frac{z-9}{-3}$ is

Options

1. $8\sqrt{3}$
2. $5\sqrt{3}$
3. $6\sqrt{3}$
4. $4\sqrt{3}$

Question Type : **MCQ**
Question ID : **68019114080**
Option 1 ID : **68019155248**
Option 2 ID : **68019155246**
Option 3 ID : **68019155245**
Option 4 ID : **68019155247**

Q.5 The mean and standard deviation of 20 observations are found to be 10 and 2, respectively. On rechecking, it was found that an observation by mistake was taken 8 instead of 12. The correct standard deviation is

Options

1. 1.8
2. $\sqrt{3.96}$
3. $\sqrt{3.86}$
4. 1.94

Question Type : **MCQ**
Question ID : **68019114081**
Option 1 ID : **68019155249**
Option 2 ID : **68019155250**
Option 3 ID : **68019155251**
Option 4 ID : **68019155252**

Q.6 Let $y = y(x)$ be the solution of the differential equation $\left(1+x^2\right)\frac{dy}{dx}+y=e^{\tan^{-1}x}$, $y(1) = 0$. Then $y(0)$ is

Options

1. $\frac{1}{2}\left(e^{\pi/2}-1\right)$
2. $\frac{1}{4}\left(e^{\pi/2}-1\right)$
3. $\frac{1}{2}\left(1-e^{\pi/2}\right)$
4. $\frac{1}{4}\left(1-e^{\pi/2}\right)$

Question Type : **MCQ**
Question ID : **68019114076**
Option 1 ID : **68019155229**
Option 2 ID : **68019155230**
Option 3 ID : **68019155231**
Option 4 ID : **68019155232**

Q.7 Let the area of the region enclosed by the curves $y = 3x$, $2y = 27 - 3x$ and $y = 3x - x\sqrt{x}$ be A. Then $10A$ is equal to

Options

1. 154
2. 162
3. 172
4. 184

Question Type : **MCQ**
Question ID : **68019114075**
Option 1 ID : **68019155225**
Option 2 ID : **68019155226**
Option 3 ID : **68019155227**
Option 4 ID : **68019155228**

Q.8 Let a variable line of slope $m > 0$ passing through the point $(4, -9)$ intersect the coordinate axes at the points A and B. The minimum value of the sum of the distances of A and B from the origin is

Options

1. 30
2. 10
3. 25
4. 15

Question Type : **MCQ**
Question ID : **68019114073**
Option 1 ID : **68019155220**
Option 2 ID : **68019155217**
Option 3 ID : **68019155218**
Option 4 ID : **68019155219**

Q.9 If $A(3,1,-1)$, $B\left(\frac{5}{3},\frac{7}{3},\frac{1}{3}\right)$, $C(2,2,1)$ and $D\left(\frac{10}{3},\frac{2}{3},\frac{-1}{3}\right)$ are the vertices of a quadrilateral $ABCD$, then its area is

Options

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

Question Type : **MCQ**
Question ID : **68019114082**
Option 1 ID : **68019155254**
Option 2 ID : **68019155253**
Option 3 ID : **68019155255**
Option 4 ID : **68019155256**

Q.10 Let C be the circle of minimum area touching the parabola $y = 6 - x^2$ and the lines $y = \sqrt{3}|x|$. Then, which one of the following points lies on the circle C?

Options

1. $(2, 4)$
2. $(2, 2)$
3. $(1, 2)$
4. $(1, 1)$

Question Type : **MCQ**
Question ID : **68019114079**
Option 1 ID : **68019155241**
Option 2 ID : **68019155243**
Option 3 ID : **68019155242**
Option 4 ID : **68019155244**

Q.11 Let $f:(-\infty,\infty)-\{0\}\to\mathbb{R}$ be a differentiable function such that $f'(1)=\lim\limits_{a\to\infty}a^2f\left(\frac{1}{a}\right)$.

Then $\lim\limits_{a\to\infty}\frac{a(a+1)}{2}\tan^{-1}\left(\frac{1}{a}\right)+a^2-2\log_e a$ is equal to

Options

1. $\frac{3}{8}+\frac{\pi}{4}$
2. $\frac{3}{2}+\frac{\pi}{4}$
3. $\frac{3}{4}+\frac{\pi}{8}$
4. $\frac{5}{2}+\frac{\pi}{8}$

Question Type : **MCQ**
Question ID : **68019114069**
Option 1 ID : **68019155203**
Option 2 ID : **68019155202**
Option 3 ID : **68019155204**
Option 4 ID : **68019155201**

Q.12 A circle is inscribed in an equilateral triangle of side of length 12. If the area and perimeter of any square inscribed in this circle are m and n, respectively, then $m+n^2$ is equal to

Options

1. 396
2. 408
3. 312
4. 414

Question Type : **MCQ**
Question ID : **68019114078**
Option 1 ID : **68019155240**
Option 2 ID : **68019155237**
Option 3 ID : **68019155238**
Option 4 ID : **68019155239**

Q.13 Let the relations R_1 and R_2 on the set $X=\{1, 2, 3, ..., 20\}$ be given by $R_1=\{(x, y): 2x-3y=2\}$ and $R_2=\{(x, y): -5x+4y=0\}$. If M and N be the minimum number of elements required to be added in R_1 and R_2, respectively, in order to make the relations symmetric, then $M+N$ equals

Options

1. 12
2. 10
3. 16
4. 8

Question Type : **MCQ**
Question ID : **68019114064**
Option 1 ID : **68019155183**
Option 2 ID : **68019155182**
Option 3 ID : **68019155184**
Option 4 ID : **68019155181**

Q.14 A company has two plants A and B to manufacture motorcycles. 60% motorcycles are manufactured at plant A and the remaining are manufactured at plant B. 80% of the motorcycles manufactured at plant A are rated of the standard quality, while 90% of the motorcycles manufactured at plant B are rated of the standard quality. A motorcycle picked up randomly from the total production is found to be of the standard quality. If p is the probability that it was manufactured at plant B, then $126p$ is

Options
1. 54
2. 56
3. 66
4. 64

Question Type : **MCQ**
Question ID : **68019114083**
Option 1 ID : **68019155260**
Option 2 ID : **68019155257**
Option 3 ID : **68019155259**
Option 4 ID : **68019155258**

Q.15 The function $f(x)=\frac{x^2+2x-15}{x^2-4x+9}$, $x \in \mathbb{R}$ is

Options
1. both one-one and onto.
2. onto but not one-one.
3. one-one but not onto.
4. neither one-one nor onto.

Question Type : **MCQ**
Question ID : **68019114065**
Option 1 ID : **68019155185**
Option 2 ID : **68019155187**
Option 3 ID : **68019155186**
Option 4 ID : **68019155188**

Q.16 The number of triangles whose vertices are at the vertices of a regular octagon but none of whose sides is a side of the octagon is

Options
1. 48
2. 16
3. 56
4. 24

Question Type : **MCQ**
Question ID : **68019114066**
Option 1 ID : **68019155192**
Option 2 ID : **68019155189**
Option 3 ID : **68019155191**
Option 4 ID : **68019155190**

Q.17 $\int_0^{\pi/4} \frac{\cos^2 x \sin^2 x}{\left(\cos^3 x + \sin^3 x\right)^2} dx$ is equal to

Options
1. $1/9$
2. $1/6$
3. $1/12$
4. $1/3$

Question Type : **MCQ**
Question ID : **68019114074**
Option 1 ID : **68019155223**
Option 2 ID : **68019155222**
Option 3 ID : **68019155224**
Option 4 ID : **68019155221**

Q.18 Let $y = y(x)$ be the solution of the differential equation $(2x \log_e x)\frac{dy}{dx} + 2y = \frac{3}{x}\log_e x$, $x > 0$ and $y(e^{-1}) = 0$. Then, $y(e)$ is equal to

Options
1. $-\frac{3}{e}$
2. $-\frac{3}{2e}$
3. $-\frac{2}{3e}$
4. $-\frac{2}{e}$

Question Type : **MCQ**
Question ID : **68019114077**
Option 1 ID : **68019155234**
Option 2 ID : **68019155235**
Option 3 ID : **68019155236**
Option 4 ID : **68019155233**

Q.19 Let $A = \{n \in [100, 700] \cap \mathbb{N}: n \text{ is neither a multiple of 3 nor a multiple of 4}\}$. Then the number of elements in A is

Options
1. 280
2. 300
3. 310
4. 290

Question Type : **MCQ**
Question ID : **68019114070**
Option 1 ID : **68019155205**
Option 2 ID : **68019155207**
Option 3 ID : **68019155208**
Option 4 ID : **68019155206**

Q.20 Let α, β be the distinct roots of the equation $x^2 - (t^2 - 5t + 6)x + 1 = 0, t \in \mathbb{R}$ and $a_n = \alpha^n + \beta^n$. Then the minimum value of $\frac{a_{2023} + a_{2025}}{a_{2024}}$ is

Options 1. $-1/4$
2. $1/4$
3. $1/2$
4. $-1/2$

Question Type : **MCQ**
Question ID : **68019114067**
Option 1 ID : **68019155193**
Option 2 ID : **68019155194**
Option 3 ID : **68019155196**
Option 4 ID : **68019155195**

Section : **Mathematics Section B**

Q.21 Let $\vec{a} = 2\hat{i} - 3\hat{j} + 4\hat{k}$, $\vec{b} = 3\hat{i} + 4\hat{j} - 5\hat{k}$ and a vector $\vec{c}$ be such that $\vec{a} \times (\vec{b} + \vec{c}) + \vec{b} \times \vec{c} = \hat{i} + 8\hat{j} + 13\hat{k}$. If $\vec{a} \cdot \vec{c} = 13$, then $(24 - \vec{b} \cdot \vec{c})$ is equal to _____.

Question Type : **SA**
Question ID : **68019114092**

Q.22 Let $\alpha\beta\gamma = 45; \alpha, \beta, \gamma \in \mathbb{R}$. If $x(\alpha, 1, 2) + y(1, \beta, 2) + z(2, 3, \gamma) = (0, 0, 0)$ for some $x, y, z \in \mathbb{R}, xyz \neq 0$, then $6\alpha + 4\beta + \gamma$ is equal to _____

Question Type : **SA**
Question ID : **68019114085**

Q.23 If the second, third and fourth terms in the expansion of $(x + y)^n$ are 135, 30 and $\frac{10}{3}$, respectively, then $6(n^3 + x^2 + y)$ is equal to _____

Question Type : **SA**
Question ID : **68019114086**

Q.24 Let L_1, L_2 be the lines passing through the point $P(0, 1)$ and touching the parabola $9x^2 + 12x + 18y - 14 = 0$. Let Q and R be the points on the lines L_1 and L_2 such that the ΔPQR is an isosceles triangle with base QR. If the slopes of the lines QR are m_1 and m_2, then $16\left(m_1^2 + m_2^2\right)$ is equal to _____.

Question Type : **SA**
Question ID : **68019114089**

Q.25 For $n \in \mathbb{N}$, if $\cot^{-1}3 + \cot^{-1}4 + \cot^{-1}5 + \cot^{-1}n = \frac{\pi}{4}$, then n is equal to _____.

Question Type : **SA**
Question ID : **68019114093**

Q.26 Let P be the point $(10, -2, -1)$ and Q be the foot of the perpendicular drawn from the point $R(1, 7, 6)$ on the line passing through the points $(2, -5, 11)$ and $(-6, 7, -5)$. Then the length of the line segment PQ is equal to _____.

Question Type : **SA**
Question ID : **68019114091**

Q.27 Let the first term of a series be $T_1 = 6$ and its r^{th} term $T_r = 3\,T_{r-1} + 6^r$, $r = 2, 3,$ ....., n. If the sum of the first n terms of this series is $\frac{1}{5}\left(n^2 - 12n + 39\right)\left(4 \cdot 6^n - 5 \cdot 3^n + 1\right)$, then n is equal to _____.

Question Type : **SA**
Question ID : **68019114087**

Q.28 Let $r_k = \dfrac{\int_0^1 \left(1-x^7\right)^k dx}{\int_0^1 \left(1-x^7\right)^{k+1} dx}$, $k \in \mathbb{N}$. Then the value of $\sum_{k=1}^{10} \dfrac{1}{7\left(r_k - 1\right)}$ is equal to _____

Question Type : **SA**
Question ID : **68019114088**

Q.29 Let a conic C pass through the point $(4, -2)$ and $P(x, y)$, $x \geq 3$, be any point on C. Let the slope of the line touching the conic C only at a single point P be half the slope of the line joining the points P and $(3, -5)$. If the focal distance of the point $(7, 1)$ on C is d, then $12d$ equals _____.

Question Type : **SA**
Question ID : **68019114090**

Q.30 Let x_1, x_2, x_3, x_4 be the solution of the equation $4x^4 + 8x^3 - 17x^2 - 12x + 9 = 0$ and $\left(4 + x_1^2\right)\left(4 + x_2^2\right)\left(4 + x_3^2\right)\left(4 + x_4^2\right) = \dfrac{125}{16}m$. Then the value of m is _____

Question Type : **SA**
Question ID : **68019114084**

Section : **Physics Section A**

Q.31 σ is the uniform surface charge density of a thin spherical shell of radius R. The electric field at any point on the surface of the spherical shell is :

Options

1. $\sigma / 4\epsilon_o$
2. $\sigma / 2\epsilon_o$
3. σ/ϵ_o
4. $\sigma/\epsilon_o R$

Question Type : **MCQ**
Question ID : **68019114101**
Option 1 ID : **68019155302**
Option 2 ID : **68019155300**
Option 3 ID : **68019155299**
Option 4 ID : **68019155301**

Q.32 A sample contains mixture of helium and oxygen gas. The ratio of root mean square speed of helium and oxygen in the sample, is :

Options

1. $\frac{1}{2\sqrt{2}}$
2. $\frac{2\sqrt{2}}{1}$
3. $\frac{1}{32}$
4. $\frac{1}{4}$

Question Type : **MCQ**
Question ID : **68019114100**
Option 1 ID : **68019155296**
Option 2 ID : **68019155295**
Option 3 ID : **68019155297**
Option 4 ID : **68019155298**

Q.33 To find the spring constant (k) of a spring experimentally, a student commits 2% positive error in the measurement of time and 1% negative error in measurement of mass. The percentage error in determining value of k is :

Options

1. 3%
2. 1%
3. 5%
4. 4%

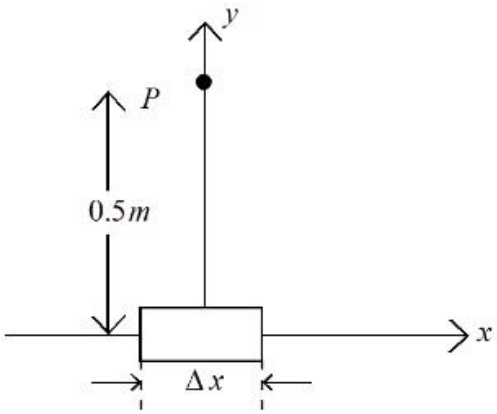
Question Type : **MCQ**
Question ID : **68019114108**
Option 1 ID : **68019155327**
Option 2 ID : **68019155329**
Option 3 ID : **68019155328**
Option 4 ID : **68019155330**

Q.34 While measuring diameter of wire using screw gauge the following readings were noted. Main scale reading is 1 mm and circular scale reading is equal to 42 divisions. Pitch of screw gauge is 1 mm and it has 100 divisions on circular scale. The diameter of the wire is $\frac{x}{50}$ mm. The value of x is :

Options
1. 142
2. 71
3. 42
4. 21

Question Type : **MCQ**
Question ID : **68019114104**
Option 1 ID : **68019155314**
Option 2 ID : **68019155313**
Option 3 ID : **68019155311**
Option 4 ID : **68019155312**

Q.35 An element $\Delta l = \Delta x\hat{i}$ is placed at the origin and carries a large current $I = 10A$. The magnetic field on the y-axis at a distance of 0.5m from the elements Δx of 1cm length is :



Options
1. $4\times10^{-8}T$
2. $10\times10^{-8}T$
3. $12\times10^{-8}T$
4. $8\times10^{-8}T$

Question Type : **MCQ**
Question ID : **68019114106**
Option 1 ID : **68019155319**
Option 2 ID : **68019155321**
Option 3 ID : **68019155322**
Option 4 ID : **68019155320**

Q.36 Electromagnetic waves travel in a medium with speed of 1.5×10^8 m s^{-1}. The relative permeability of the medium is 2.0. The relative permittivity will be:

Options
1. 1
2. 5
3. 2
4. 4

Question Type : **MCQ**
Question ID : **68019114102**
Option 1 ID : **68019155303**
Option 2 ID : **68019155306**
Option 3 ID : **68019155304**
Option 4 ID : **68019155305**

Q.37 To project a body of mass m from earth's surface to infinity, the required kinetic energy is (assume, the radius of earth is R_E, g = acceleration due to gravity on the surface of earth):

Options
1. $1/2mgR_E$
2. mgR_E
3. $2mgR_E$
4. $4mgR_E$

Question Type : **MCQ**
Question ID : **68019114096**
Option 1 ID : **68019155281**
Option 2 ID : **68019155282**
Option 3 ID : **68019155279**
Option 4 ID : **68019155280**

Q.38 The specific heat at constant pressure of a real gas obeying $PV^2 = RT$ equation is:

Options
1. $C_V + \frac{R}{2V}$
2. $C_V + R$
3. $\frac{R}{3} + C_V$
4. R

Question Type : **MCQ**
Question ID : **68019114099**
Option 1 ID : **68019155291**
Option 2 ID : **68019155292**
Option 3 ID : **68019155294**
Option 4 ID : **68019155293**

Q.39 A train starting from rest first accelerates uniformly up to a speed of 80 *km/h* for time *t*, then it moves with a constant speed for time 3*t*. The average speed of the train for this duration of journey will be (in *km/h*) :

Options
1. 70
2. 40
3. 30
4. 80

Question Type : **MCQ**
Question ID : **68019114097**
Option 1 ID : **68019155283**
Option 2 ID : **68019155285**
Option 3 ID : **68019155284**
Option 4 ID : **68019155286**

Q.40 A light string passing over a smooth light pulley connects two blocks of masses m_1 and m_2 (where $m_2 > m_1$). If the acceleration of the system is $\frac{g}{\sqrt{2}}$, then the ratio of the masses $\frac{m_1}{m_2}$ is:

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

Question Type : **MCQ**
Question ID : **68019114095**
Option 1 ID : **68019155276**
Option 2 ID : **68019155278**
Option 3 ID : **68019155277**
Option 4 ID : **68019155275**

Q.41 A bullet of mass 50*g* is fired with a speed 100 m/s on a plywood and emerges with 40 m/s. The percentage loss of kinetic energy is :

Options
1. 16%
2. 84%
3. 32%
4. 44%

Question Type : **MCQ**
Question ID : **68019114113**
Option 1 ID : **68019155347**
Option 2 ID : **68019155348**
Option 3 ID : **68019155350**
Option 4 ID : **68019155349**

Q.42 Match **List I** with **List II**

LIST I		LIST II	
A.	Torque	I.	$[M^1L^1T^{-2}A^{-2}]$
B.	Magnetic field	II.	$[L^2A^1]$
C.	Magnetic moment	III.	$[M^1T^{-2}A^{-1}]$
D.	Permeability of free space	IV.	$[M^1L^2T^{-2}]$

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

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

Question Type : **MCQ**
Question ID : **68019114105**
Option 1 ID : **68019155316**
Option 2 ID : **68019155315**
Option 3 ID : **68019155317**
Option 4 ID : **68019155318**

Q.43 Given below are two statements :

Statement I : In an LCR series circuit, current is maximum at resonance.

Statement II : Current in a purely resistive circuit can never be less than that in a series LCR circuit when connected to same voltage source.

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

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

Question Type : **MCQ**
Question ID : **68019114107**
Option 1 ID : **68019155326**
Option 2 ID : **68019155325**
Option 3 ID : **68019155323**
Option 4 ID : **68019155324**

Q.44 A small ball of mass m and density ρ is dropped in a viscous liquid of density ρ_0. After sometime, the ball falls with constant velocity. The viscous force on the ball is :

Options

1. $mg\left(1-\frac{\rho_0}{\rho}\right)$
2. $mg\left(\frac{\rho_0}{\rho}-1\right)$
3. $mg(1-\rho\rho_0)$
4. $mg\left(1+\frac{\rho}{\rho_0}\right)$

Question Type : **MCQ**
Question ID : **68019114098**
Option 1 ID : **68019155287**
Option 2 ID : **68019155288**
Option 3 ID : **68019155289**
Option 4 ID : **68019155290**

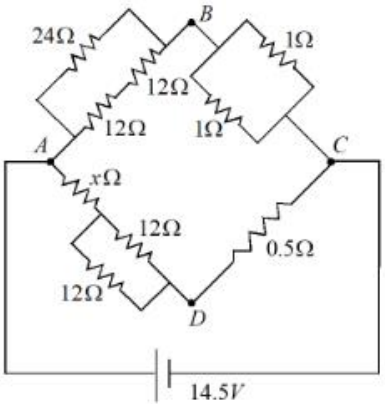
Q.45 Four particles A, B, C, D of mass $\frac{m}{2}, m, 2m, 4m$, have same momentum, respectively. The particle with maximum kinetic energy is :

Options

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

Question Type : **MCQ**
Question ID : **68019114094**
Option 1 ID : **68019155272**
Option 2 ID : **68019155271**
Option 3 ID : **68019155273**
Option 4 ID : **68019155274**

Q.46 The value of unknown resistance (x) for which the potential difference between B and D will be zero in the arrangement shown, is :



Options 1. $9\ \Omega$

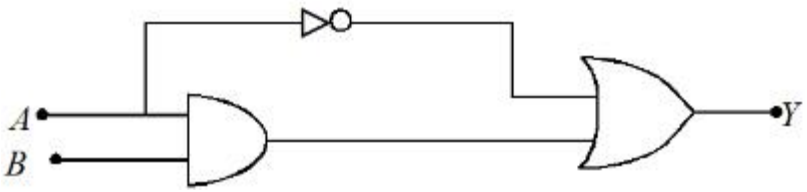
2. $42\ \Omega$

3. $3\ \Omega$

4. $6\ \Omega$

Question Type : **MCQ**
Question ID : **68019114103**
Option 1 ID : **68019155310**
Option 2 ID : **68019155307**
Option 3 ID : **68019155309**
Option 4 ID : **68019155308**

Q.47 The correct truth table for the following logic circuit is :



Options

1.

A	B	Y
0	0	1
0	1	1
1	0	0
1	1	1

2.

A	B	Y
0	0	1
0	1	1
1	0	0
1	1	0

3.

A	B	Y
0	0	0
0	1	1
1	0	0
1	1	1

4.

A	B	Y
0	0	0
0	1	0
1	0	0
1	1	1

Question Type : **MCQ**
Question ID : **68019114112**
Option 1 ID : **68019155344**
Option 2 ID : **68019155343**
Option 3 ID : **68019155345**
Option 4 ID : **68019155346**

Q.48 In photoelectric experiment energy of 2.48 eV irradiates a photo sensitive material. The stopping potential was measured to be 0.5 V. Work function of the photo sensitive material is :

Options
1. 2.48 eV
2. 1.98 eV
3. 1.68 eV
4. 0.5 eV

Question Type : **MCQ**
Question ID : **68019114110**
Option 1 ID : **68019155337**
Option 2 ID : **68019155335**
Option 3 ID : **68019155336**
Option 4 ID : **68019155338**

Q.49 Which of the following phenomena does not explain by wave nature of light.

A. reflection
B. diffraction
C. photoelectric effect
D. interference
E. polarization

Choose the **most appropriate** answer from the options given below:

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

Question Type : **MCQ**
Question ID : **68019114109**
Option 1 ID : **68019155333**
Option 2 ID : **68019155331**
Option 3 ID : **68019155332**
Option 4 ID : **68019155334**

Q.50 The ratio of the shortest wavelength of Balmer series to the shortest wavelength of Lyman series for hydrogen atom is :

Options
1. 1 : 2
2. 1 : 4
3. 4 : 1
4. 2 : 1

Question Type : **MCQ**
Question ID : **68019114111**
Option 1 ID : **68019155339**
Option 2 ID : **68019155341**
Option 3 ID : **68019155342**
Option 4 ID : **68019155340**

Section : **Physics Section B**

Q.51 For three vectors $\vec{A}=(-x\hat{i}-6\hat{j}-2\hat{k})$, $\vec{B}=(-\hat{i}+4\hat{j}+3\hat{k})$ and $\vec{C}=\left(-8\hat{i}-\hat{j}+3\hat{k}\right)$, if $\vec{A}\cdot(\vec{B}\times\vec{C})=0$, then value of x is _____.

Question Type : **SA**
Question ID : **68019114116**

Q.52 A particle is doing simple harmonic motion of amplitude 0.06 m and time period 3.14 s. The maximum velocity of the particle is _____ cm/s.

Question Type : **SA**
Question ID : **68019114115**

Q.53 The refractive index of prism is $\mu=\sqrt{3}$ and the ratio of the angle of minimum deviation to the angle of prism is one. The value of angle of prism is _____°.

Question Type : **SA**
Question ID : **68019114114**

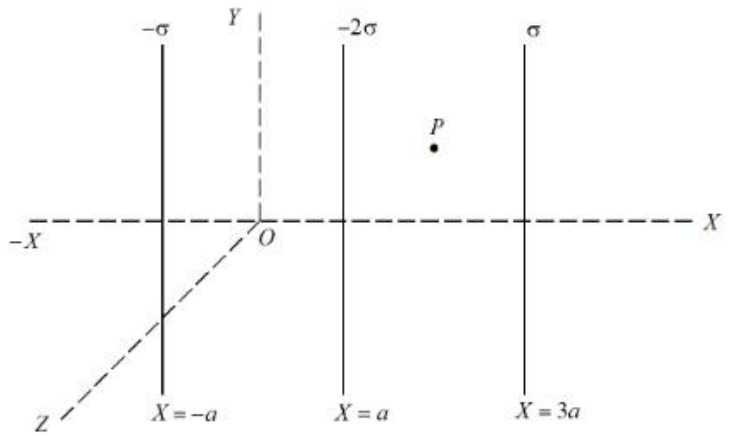
Q.54 A big drop is formed by coalescing 1000 small droplets of water. The ratio of surface energy of 1000 droplets to that of energy of big drop is $\frac{10}{x}$. The value of x is _____.

Question Type : **SA**
Question ID : **68019114117**

Q.55 If the radius of earth is reduced to three-fourth of its present value without change in its mass then value of duration of the day of earth will be _____ hours 30 minutes.

Question Type : **SA**
Question ID : **68019114119**

Q.56 Three infinitely long charged thin sheets are placed as shown in figure. The magnitude of electric field at the point P is $\frac{x\sigma}{\epsilon_o}$. The value of x is _____ (all quantities are measured in SI units).



Question Type : **SA**
Question ID : **68019114122**

Q.57 A wire of resistance R and radius r is stretched till its radius became $r/2$. If new resistance of the stretched wire is $x\,R$, then value of x is _____.

Question Type : **SA**
Question ID : **68019114121**

Q.58 When a *dc* voltage of 100V is applied to an inductor, a *dc* current of 5A flows through it. When an *ac* voltage of 200V peak value is connected to inductor, its inductive reactance is found to be $20\sqrt{3}\,\Omega$. The power dissipated in the circuit is _____W.

Question Type : **SA**
Question ID : **68019114118**

Q.59 Radius of a certain orbit of hydrogen atom is 8.48 Å. If energy of electron in this orbit is E/x. then x = _____.

(Given a_o = 0.529 Å, E = energy of electron in ground state).

Question Type : **SA**
Question ID : **68019114123**

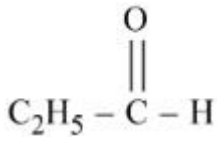
Q.60 A circular coil having 200 turns, 2.5×10^{-4} m^2 area and carrying 100 μA current is placed in a uniform magnetic field of 1T. Initially the magnetic dipole moment ($\vec{M}$) was directed along $\vec{B}$. Amount of work, required to rotate the coil through 90° from its initial orientation such that $\vec{M}$ becomes perpendicular to $\vec{B}$, is _____ μJ.

Question Type : **SA**
Question ID : **68019114120**

Section : **Chemistry Section A**

Q.61 Which among the following aldehydes is most reactive towards nucleophilic addition reactions?

Options

1. 
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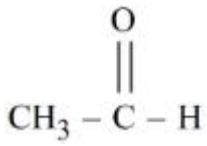
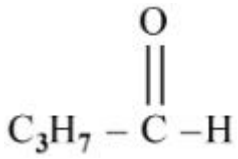
3. 
4. 

Question Type : **MCQ**
Question ID : **68019114142**
Option 1 ID : **68019155435**
Option 2 ID : **68019155433**
Option 3 ID : **68019155434**
Option 4 ID : **68019155436**

Q.62 The electron affinity value are negative for

A. $Be \rightarrow Be^{-}$
B. $N \rightarrow N^{-}$
C. $O \rightarrow O^{2-}$
D. $Na \rightarrow Na^{-}$
E. $Al \rightarrow Al^{-}$

Choose the most appropriate answer from the options given below :

Options

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

Question Type : **MCQ**
Question ID : **68019114129**
Option 1 ID : **68019155384**
Option 2 ID : **68019155382**
Option 3 ID : **68019155383**
Option 4 ID : **68019155381**

Q.63 Which of the following material is not a semiconductor.

Options
1. Germanium
2. Graphite
3. Copper oxide
4. Silicon

Question Type : **MCQ**
Question ID : **68019114127**
Option 1 ID : **68019155375**
Option 2 ID : **68019155374**
Option 3 ID : **68019155373**
Option 4 ID : **68019155376**

Q.64 The number of element from the following that do not belong to lanthanoids is

Eu, Cm, Er, Tb, Yb and Lu

Options
1. 4
2. 1
3. 5
4. 3

Question Type : **MCQ**
Question ID : **68019114132**
Option 1 ID : **68019155396**
Option 2 ID : **68019155394**
Option 3 ID : **68019155393**
Option 4 ID : **68019155395**

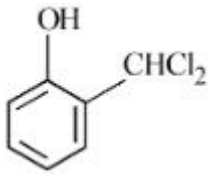
Q.65 Functional group present in sulphonic acids is :

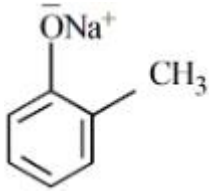
Options
1. $-\overset{\overset{O}{\|}}{S}-OH$
2. $-SO_2$
3. $-SO_3H$
4. $-SO_4H$

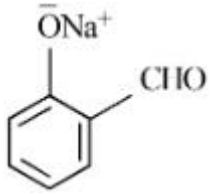
Question Type : **MCQ**
Question ID : **68019114138**
Option 1 ID : **68019155420**
Option 2 ID : **68019155417**
Option 3 ID : **68019155419**
Option 4 ID : **68019155418**

Q.66 In Reimer - Tiemann reaction, phenol is converted into salicylaldehyde through an intermediate. The structure of intermediate is _____.

Options

1. 

2. 

3. 

4. 

Question Type : **MCQ**
Question ID : **68019114141**
Option 1 ID : **68019155429**
Option 2 ID : **68019155431**
Option 3 ID : **68019155430**
Option 4 ID : **68019155432**

Q.67 At –20 °C and 1 atm pressure, a cylinder is filled with equal number of H_2, I_2 and HI molecules for the reaction

$H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$, the K_p for the process is $x \times 10^{-1}$.

x = _____.

[Given : R = 0.082 L atm K^{-1} mol^{-1}]

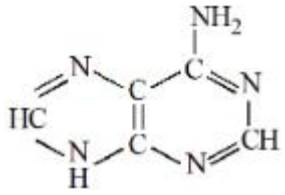
Options

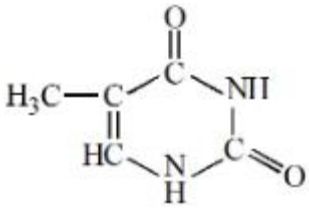
1. 0.01
2. 1
3. 2
4. 10

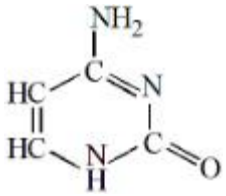
Question Type : **MCQ**
Question ID : **68019114126**
Option 1 ID : **68019155371**
Option 2 ID : **68019155369**
Option 3 ID : **68019155372**
Option 4 ID : **68019155370**

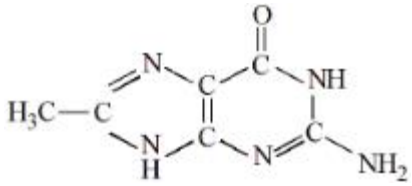
Q.68 DNA molecule contains 4 bases whose structure are shown below. One of the structures is not correct, identify the **incorrect** base structure.

Options

1. 

2. 

3. 

4. 

Question Type : **MCQ**
Question ID : **68019114143**
Option 1 ID : **68019155437**
Option 2 ID : **68019155440**
Option 3 ID : **68019155439**
Option 4 ID : **68019155438**

Q.69 Match **List I** with **List II**

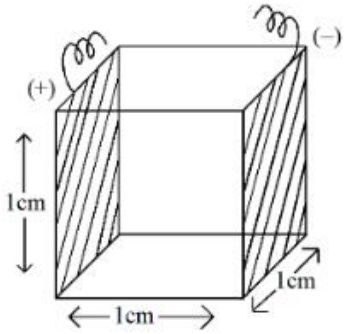
	LIST I (Compound/Species)		LIST II (Shape/Geometry)
A.	SF_4	I.	Tetrahedral
B.	BrF_3	II.	Pyramidal
C.	BrO_3^-	III.	See saw
D.	NH_4^+	IV.	Bent T-Shape

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

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

Question Type : **MCQ**
Question ID : **68019114131**
Option 1 ID : **68019155389**
Option 2 ID : **68019155390**
Option 3 ID : **68019155392**
Option 4 ID : **68019155391**

Q.70 A conductivity cell with two electrodes (dark side) are half filled with infinitely dilute aqueous solution of a weak electrolyte. If volume is doubled by adding more water at constant temperature, the molar conductivity of the cell will -



Options
1. decrease sharply
2. increase sharply
3. remain same or can not be measured accurately
4. depend upon type of electrolyte

Question Type : **MCQ**
Question ID : **68019114128**
Option 1 ID : **68019155378**
Option 2 ID : **68019155377**
Option 3 ID : **68019155379**
Option 4 ID : **68019155380**

Q.71 Given below are two statements :

Statement I : Gallium is used in the manufacturing of thermometers.

Statement II : A thermometer containing gallium is useful for measuring the freezing point (256 K) of brine solution.

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

Question Type : **MCQ**
Question ID : **68019114130**
Option 1 ID : **68019155386**
Option 2 ID : **68019155385**
Option 3 ID : **68019155388**
Option 4 ID : **68019155387**

Q.72 Consider the following complexes

$[CoCl(NH_3)_5]^{2+}$, $[Co(CN)_6]^{3-}$, $[Co(NH_3)_5\,(H_2O)]^{3+}$, $[Cu(H_2O)_4]^{2+}$

(A) (B) (C) (D)

The correct order of A, B, C and D in terms of *wavenumber* of light absorbed is :

Options
1. $D < A < C < B$
2. $B < C < A < D$
3. $A < C < B < D$
4. $C < D < A < B$

Question Type : **MCQ**
Question ID : **68019114134**
Option 1 ID : **68019155401**
Option 2 ID : **68019155402**
Option 3 ID : **68019155404**
Option 4 ID : **68019155403**

Q.73 The density of 'x' M solution ('x' molar) of NaOH is 1.12 g mL^{-1}, while in molality, the concentration of the solution is 3 m (3 molal). Then x is

(Given : Molar mass of NaOH is 40 g/mol)

Options
1. 3.8
2. 2.8
3. 3.0
4. 3.5

Question Type : **MCQ**
Question ID : **68019114124**
Option 1 ID : **68019155362**
Option 2 ID : **68019155364**
Option 3 ID : **68019155363**
Option 4 ID : **68019155361**

Q.74 Match **List I** with **List II**

	LIST I (Compound)		**LIST II (Uses)**
A.	Iodoform	I.	Fire extinguisher
B.	Carbon tetrachloride	II.	Insecticide
C.	CFC	III.	Antiseptic
D.	DDT	IV.	Refrigerants

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

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

Question Type : **MCQ**
Question ID : **68019114139**
Option 1 ID : **68019155424**
Option 2 ID : **68019155421**
Option 3 ID : **68019155423**
Option 4 ID : **68019155422**

Q.75 Match **List I** with **List II**

	LIST I (Hybridization)		**LIST II (Orientation in Space)**
A.	sp^3	I.	Trigonal bipyramidal
B.	dsp^2	II.	Octahedral
C.	sp^3d	III.	Tetrahedral
D.	sp^3d^2	IV.	Square planar

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

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

Question Type : **MCQ**
Question ID : **68019114133**
Option 1 ID : **68019155399**
Option 2 ID : **68019155400**
Option 3 ID : **68019155398**
Option 4 ID : **68019155397**

Q.76 Match **List I** with **List II**

	LIST I (Precipitating reagent and conditions)		**LIST II (Cation)**
A.	$NH_4Cl + NH_4OH$	I.	Mn^{2+}
B.	$NH_4OH + Na_2CO_3$	II.	Pb^{2+}
C.	$NH_4OH + NH_4Cl + H_2S$ gas	III.	Al^{3+}
D.	dilute HCl	IV.	Sr^{2+}

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

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

Question Type : **MCQ**
Question ID : **68019114135**
Option 1 ID : **68019155408**
Option 2 ID : **68019155405**
Option 3 ID : **68019155406**
Option 4 ID : **68019155407**

Q.77 Which of the following statements are correct?

A. Glycerol is purified by vacuum distillation because it decomposes at its normal boiling point.
B. Aniline can be purified by steam distillation as aniline is miscible in water.
C. Ethanol can be separated from ethanol water mixture by azeotropic distillation because it forms azeotrope.
D. An organic compound is pure, if mixed M.P. is remained same.

Choose the **most appropriate** answer from the options given below :

Options
1. A, B, D only
2. B, C, D only
3. A, B, C only
4. A, C, D only

Question Type : **MCQ**
Question ID : **68019114136**
Option 1 ID : **68019155410**
Option 2 ID : **68019155412**
Option 3 ID : **68019155409**
Option 4 ID : **68019155411**

Q.78 Given below are two statements :

Statement I : Piciric acid is 2,4,6 - trinitrotoluene.

Statement II : Phenol - 2,4 - disulphonic acid is treated with Conc. HNO_3 to get picric acid.

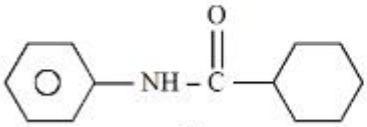
In the light of the above statements, choose the **most appropriate** answer from the options given below :

Options

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

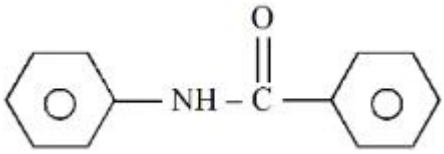
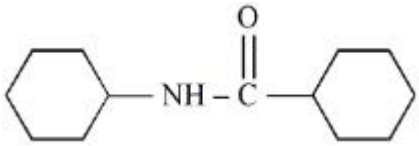
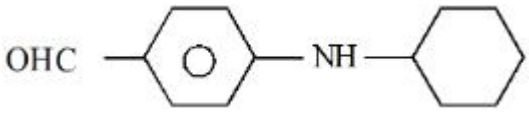
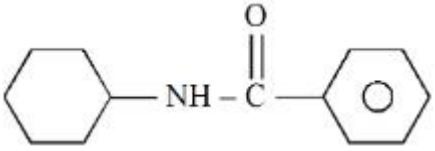
Question Type : **MCQ**
Question ID : **68019114140**
Option 1 ID : **68019155426**
Option 2 ID : **68019155428**
Option 3 ID : **68019155425**
Option 4 ID : **68019155427**

Q.79 Which of the following is metamer of the given compound (X)?



(X)

Options

1. 
2. 
3. 
4. 

Question Type : **MCQ**
Question ID : **68019114137**
Option 1 ID : **68019155415**
Option 2 ID : **68019155414**
Option 3 ID : **68019155416**
Option 4 ID : **68019155413**

Q.80 Match List I with List II

LIST I (Molecule / Species)		LIST II (Property / Shape)	
A.	SO_2Cl_2	I.	Paramagnetic
B.	NO	II.	Diamagnetic
C.	NO_2^-	III.	Tetrahedral
D.	I_3^-	IV.	Linear

Choose the correct answer from the options given below:

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

Question Type : **MCQ**
Question ID : **68019114125**
Option 1 ID : **68019155365**
Option 2 ID : **68019155366**
Option 3 ID : **68019155368**
Option 4 ID : **68019155367**

Section : **Chemistry Section B**

Q.81 Time required for 99.9% completion of a first order reaction is _____ times the time required for completion of 90% reaction.(nearest integer)

Question Type : **SA**
Question ID : **68019114148**

Q.82 Frequency of the de-Broglie wave of electron in Bohr's first orbit of hydrogen atom is _____ $\times 10^{13}$ Hz (nearest integer).

[Given : R_H (Rydberg constant) = 2.18×10^{-18} J, h (Plank's constant) = 6.6×10^{-34} J.s.]

Question Type : **SA**
Question ID : **68019114144**

Q.83 The difference in the 'spin-only' magnetic moment values of $KMnO_4$ and the manganese product formed during titration of $KMnO_4$ against oxalic acid in acidic medium is _____ BM. (nearest integer)

Question Type : **SA**
Question ID : **68019114150**

Q.84 Consider the dissociation of the weak acid HX as given below

$HX\,(aq) \rightleftharpoons H^+\,(aq) + X^-\,(aq)$, $Ka = 1.2 \times 10^{-5}$

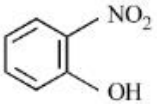
[K_a : dissociation constant]

The osmotic pressure of 0.03 M aqueous solution of HX at 300 K is _____ $\times 10^{-2}$ bar (nearest integer).

[Given : R = 0.083 L bar mol^{-1} K^{-1}]

Question Type : **SA**
Question ID : **68019114147**

Q.85 Number of molecules from the following which can exhibit hydrogen bonding is _____. (nearest integer)

CH_3OH, H_2O, C_2H_6, C_6H_6, 

, HF, NH_3

Question Type : **SA**
Question ID : **68019114145**

Q.86 9.3 g of pure aniline upon diazotisation followed by coupling with phenol gives an orange dye. The mass of orange dye produced (assume 100% yield/conversion) is _____ g. (nearest integer)

Question Type : **SA**
Question ID : **68019114153**

Q.87 An ideal gas, $\bar{C}_v = \frac{5}{2}R$, is expanded adiabatically against a constant pressure of 1 atm untill it doubles in volume. If the initial temperature and pressure is 298 K and 5 atm, respectively then the final temperature is _____ K (nearest integer).

[$\bar{C}_v$ is the molar heat capacity at constant volume]

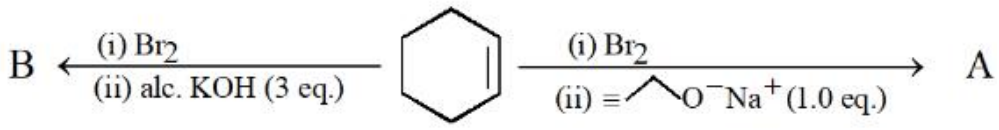
Question Type : **SA**
Question ID : **68019114146**

Q.88 Among CrO, Cr_2O_3 and CrO_3, the sum of spin-only magnetic moment values of basic and amphoteric oxides is _____ 10^{-2} BM (nearest integer).

(Given atomic number of Cr is 24)

Question Type : **SA**
Question ID : **68019114149**

Q.89 The major products from the following reaction sequence are product A and product B.



The total sum of π electrons in product A and product B are _____
(nearest integer)

Question Type : **SA**
Question ID : **68019114152**

Q.90 The major product of the following reaction is P.

$$CH_3C \equiv C - CH_3 \xrightarrow[\text{(ii) dil. } KMnO_4,\ 273\ K]{\text{(i) } Na/liq.\ NH_3} \text{'P'}$$

Number of oxygen atoms present in product 'P' is _____.
(nearest integer)

Question Type : **SA**
Question ID : **68019114151**