JEE April 2024

Test Date	08/04/2024
Test Time	3:00 PM - 6:00 PM
Subject	B. Tech

Section : **Mathematics Section A**

Q.1 Let $y=y(x)$ be the solution curve of the differential equation $\sec y\frac{dy}{dx}+2x\sin y=x^3\cos y$, $y(1)=0$.

Then $y(\sqrt{3})$ is equal to :

Options

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

Question Type : **MCQ**
Question ID : **87827056070**
Option 1 ID : **878270220180**
Option 2 ID : **878270220181**
Option 3 ID : **878270220179**
Option 4 ID : **878270220182**

Q.2 If the function $f(x)=2x^3-9ax^2+12a^2x+1$, $a>0$ has a local maximum at $x=\alpha$ and a local minimum at $x=\alpha^2$, then α and α^2 are the roots of the equation :

Options

1. $x^2+6x+8=0$
2. $8x^2+6x-1=0$
3. $8x^2-6x+1=0$
4. $x^2-6x+8=0$

Question Type : **MCQ**
Question ID : **87827056067**
Option 1 ID : **878270220170**
Option 2 ID : **878270220168**
Option 3 ID : **878270220167**
Option 4 ID : **878270220169**

Q.3 If the image of the point $(-4, 5)$ in the line $x+2y=2$ lies on the circle $(x+4)^2+(y-3)^2=r^2$, then r is equal to :

Options

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

Question Type : **MCQ**
Question ID : **87827056072**
Option 1 ID : **878270220187**
Option 2 ID : **878270220190**
Option 3 ID : **878270220189**
Option 4 ID : **878270220188**

Q.4 For a, b > 0, let $f(x) = \begin{cases} \dfrac{\tan((a+1)x)+b\tan x}{x}, & x<0 \\ 3, & x=0 \\ \dfrac{\sqrt{ax+b^2x^2}-\sqrt{ax}}{b\sqrt{a}\,x\sqrt{x}}, & x>0 \end{cases}$

be a continous function at $x=0$. Then $\dfrac{b}{a}$ is equal to :

Options

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

Question Type : **MCQ**
Question ID : **87827056066**
Option 1 ID : **878270220165**
Option 2 ID : **878270220166**
Option 3 ID : **878270220164**
Option 4 ID : **878270220163**

Q.5 If $\alpha \neq a, \beta \neq b, \gamma \neq c$ and $\begin{vmatrix} \alpha & b & c \\ a & \beta & c \\ a & b & \gamma \end{vmatrix} = 0$, then $\frac{a}{\alpha - a} + \frac{b}{\beta - b} + \frac{\gamma}{\gamma - c}$ is equal to :

Options

1. 1
2. 2
3. 0
4. 3

Question Type : **MCQ**
Question ID : **87827056061**
Option 1 ID : **878270220145**
Option 2 ID : **878270220143**
Option 3 ID : **878270220144**
Option 4 ID : **878270220146**

Q.6 If the system of equations $x+4y-z=\lambda$, $7x+9y+\mu z=-3$, $5x+y+2z=-1$ has infinitely many solutions, then $(2\mu+3\lambda)$ is equal to :

Options

1. 3
2. -3
3. 2
4. -2

Question Type : **MCQ**
Question ID : **87827056060**
Option 1 ID : **878270220139**
Option 2 ID : **878270220140**
Option 3 ID : **878270220141**
Option 4 ID : **878270220142**

Q.7 If the value of $\frac{3\cos 36^\circ + 5\sin 18^\circ}{5\cos 36^\circ - 3\sin 18^\circ}$ is $\frac{a\sqrt{5}-b}{c}$, where a, b, c are natural numbers and gcd(a, c) = 1, then a + b + c is equal to :

Options

1. 52
2. 54
3. 50
4. 40

Question Type : **MCQ**
Question ID : **87827056077**
Option 1 ID : **878270220209**
Option 2 ID : **878270220210**
Option 3 ID : **878270220208**
Option 4 ID : **878270220207**

Q.8 Let $\vec{a} = \hat{i} + 2\hat{j} + 3\hat{k}$, $\vec{b} = 2\hat{i} + 3\hat{j} - 5\hat{k}$ and $\vec{c} = 3\hat{i} - \hat{j} + \lambda\hat{k}$ be three vectors. Let $\vec{r}$ be a unit vector along $\vec{b} + \vec{c}$. If $\vec{r} \cdot \vec{a} = 3$, then 3λ is equal to :

Options

1. 30
2. 27
3. 25
4. 21

Question Type : **MCQ**
Question ID : **87827056075**
Option 1 ID : **878270220201**
Option 2 ID : **878270220200**
Option 3 ID : **878270220199**
Option 4 ID : **878270220202**

Q.9

If the term independent of x in the expansion of $\left(\sqrt{a}x^2 + \frac{1}{2x^3}\right)^{10}$ is 105, then a^2 is equal to :

Options

1. 4
2. 2
3. 6
4. 9

Question Type : **MCQ**
Question ID : **87827056063**
Option 1 ID : **878270220152**
Option 2 ID : **878270220151**
Option 3 ID : **878270220153**
Option 4 ID : **878270220154**

Q.10

Let $\int_{\alpha}^{\log_e 4} \frac{dx}{\sqrt{e^x - 1}} = \frac{\pi}{6}$. Then e^{α} and $e^{-\alpha}$ are the roots of the equation :

Options

1. $x^2 + 2x - 8 = 0$
2. $2x^2 - 5x + 2 = 0$
3. $2x^2 - 5x - 2 = 0$
4. $x^2 - 2x - 8 = 0$

Question Type : **MCQ**
Question ID : **87827056068**
Option 1 ID : **878270220171**
Option 2 ID : **878270220173**
Option 3 ID : **878270220174**
Option 4 ID : **878270220172**

Q.11

Let $f(x)=\begin{cases}-a & \text{if } -a\le x\le 0\\ x+a & \text{if } 0<x\le a\end{cases}$ where $a>0$ and $g(x)=(f(|x|)-|f(x)|)/2$.

Then the function $g:[-a,a]\to[-a,a]$ is

Options

1. onto.
2. neither one-one nor onto.
3. both one-one and onto.
4. one-one.

Question Type : **MCQ**
Question ID : **87827056059**
Option 1 ID : **878270220136**
Option 2 ID : **878270220138**
Option 3 ID : **878270220137**
Option 4 ID : **878270220135**

Q.12

If the line segment joining the points (5, 2) and (2, a) subtends an angle $\frac{\pi}{4}$ at the origin, then the absolute value of the product of all possible values of a is :

Options

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

Question Type : **MCQ**
Question ID : **87827056071**
Option 1 ID : **878270220183**
Option 2 ID : **878270220186**
Option 3 ID : **878270220185**
Option 4 ID : **878270220184**

Q.13 The number of ways five alphabets can be chosen from the alphabets of the word MATHEMATICS, where the chosen alphabets are not necessarily distinct, is equal to :

Options

1. 177
2. 179
3. 181
4. 175

Question Type : **MCQ**
Question ID : **87827056062**
Option 1 ID : **878270220148**
Option 2 ID : **878270220149**
Option 3 ID : **878270220150**
Option 4 ID : **878270220147**

Q.14 There are three bags X, Y and Z. Bag X contains 5 one-rupee coins and 4 five-rupee coins; Bag Y contains 4 one-rupee coins and 5 five-rupee coins and Bag Z contains 3 one-rupee coins and 6 five-rupee coins. A bag is selected at random and a coin drawn from it at random is found to be a one-rupee coin. Then the probability, that it came from bag Y, is :

Options

1. $\frac{5}{12}$
2. $\frac{1}{2}$
3. $\frac{1}{4}$
4. $\frac{1}{3}$

Question Type : **MCQ**
Question ID : **87827056076**
Option 1 ID : **878270220203**
Option 2 ID : **878270220206**
Option 3 ID : **878270220205**
Option 4 ID : **878270220204**

Q.15

If the shortest distance between the lines $\frac{x-\lambda}{2}=\frac{y-4}{3}=\frac{z-3}{4}$ and $\frac{x-2}{4}=\frac{y-4}{6}=\frac{z-7}{8}$ is $\frac{13}{\sqrt{29}}$, then a value of λ is :

Options

1. $\frac{13}{25}$
2. -1
3. 1
4. $-\frac{13}{25}$

Question Type : **MCQ**
Question ID : **87827056073**
Option 1 ID : **878270220192**
Option 2 ID : **878270220191**
Option 3 ID : **878270220193**
Option 4 ID : **878270220194**

Q.16

Let $\vec{a}=4\hat{i}-\hat{j}+\hat{k}$, $\vec{b}=11\hat{i}-\hat{j}+\hat{k}$ and $\vec{c}$ be a vector such that $\left(\vec{a}+\vec{b}\right)\times\vec{c}=\vec{c}\times\left(-2\vec{a}+3\vec{b}\right)$.

If $\left(2\vec{a}+3\vec{b}\right)\cdot\vec{c}=1670$, then $|\vec{c}|^2$ is equal to :

Options

1. 1609
2. 1627
3. 1618
4. 1600

Question Type : **MCQ**
Question ID : **87827056074**
Option 1 ID : **878270220195**
Option 2 ID : **878270220198**
Option 3 ID : **878270220197**
Option 4 ID : **878270220196**

Q.17 The area of the region in the first quadrant inside the circle $x^2+y^2=8$ and outside the parabola $y^2=2x$ is equal to :

Options

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

Question Type : **MCQ**
Question ID : **87827056069**
Option 1 ID : **878270220176**
Option 2 ID : **878270220177**
Option 3 ID : **878270220178**
Option 4 ID : **878270220175**

Q.18 The sum of all possible values of $\theta\in[-\pi, 2\pi]$, for which $\frac{1+i\cos\theta}{1-2i\cos\theta}$ is purely imaginary, is equal to :

Options

1. 4π
2. 2π
3. 5π
4. 3π

Question Type : **MCQ**
Question ID : **87827056064**
Option 1 ID : **878270220157**
Option 2 ID : **878270220155**
Option 3 ID : **878270220158**
Option 4 ID : **878270220156**

Q.19 In an increasing geometric progression of positive terms, the sum of the second and sixth terms is $\frac{70}{3}$ and the product of the third and fifth terms is 49. Then the sum of the 4^{th}, 6^{th} and 8^{th} terms is equal to :

Options

1. 96
2. 78
3. 84
4. 91

Question Type : **MCQ**
Question ID : **87827056065**
Option 1 ID : **878270220162**
Option 2 ID : **878270220159**
Option 3 ID : **878270220160**
Option 4 ID : **878270220161**

Q.20 Let $A=\{2, 3, 6, 8, 9, 11\}$ and $B=\{1, 4, 5, 10, 15\}$. Let R be a relation on $A \times B$ defined by $(a, b)R(c, d)$ if and only if $3ad-7bc$ is an even integer. Then the relation R is

Options

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

Question Type : **MCQ**
Question ID : **87827056058**
Option 1 ID : **878270220132**
Option 2 ID : **878270220133**
Option 3 ID : **878270220131**
Option 4 ID : **878270220134**

Section : **Mathematics Section B**

Q.21 Let $a, b, c \in \mathbf{N}$ and $a < b < c$. Let the mean, the mean deviation about the mean and the variance of the 5 observations 9, 25, a, b, c be 18, 4 and $\frac{136}{5}$, respectively. Then $2a+b-c$ is equal to

_____

Question Type : **SA**
Question ID : **87827056087**

Q.22 The number of distinct real roots of the equation $|x+1|\,|x+3|-4|x+2|+5=0$, is _____

Question Type : **SA**
Question ID : **87827056078**

Q.23 Let A be the region enclosed by the parabola $y^2=2x$ and the line $x=24$. Then the maximum area of the rectangle inscribed in the region A is _____.

Question Type : **SA**
Question ID : **87827056081**

Q.24 If $\int \frac{1}{\sqrt[5]{(x-1)^4\,(x+3)^6}}\,dx = A\left(\frac{\alpha x-1}{\beta x+3}\right)^B + C$, where C is the constant of integration, then the value of $\alpha+\beta+20AB$ is _____.

Question Type : **SA**
Question ID : **87827056083**

Q.25 Let S be the focus of the hyperbola $\frac{x^2}{3}-\frac{y^2}{5}=1$, on the positive x-axis. Let C be the circle with its centre at $A\left(\sqrt{6},\sqrt{5}\right)$ and passing through the point S. If O is the origin and SAB is a diameter of C, then the square of the area of the triangle OSB is equal to _____

Question Type : **SA**
Question ID : **87827056085**

Q.26 If $\alpha = \lim\limits_{x\to 0^+}\left(\frac{e^{\sqrt{\tan x}}-e^{\sqrt{x}}}{\sqrt{\tan x}-\sqrt{x}}\right)$ and $\beta = \lim\limits_{x\to 0}(1+\sin x)^{2^{\cot x}}$ are the roots of the quadratic equation $ax^2+bx-\sqrt{e}=0$, then $12\log_e(a+b)$ is equal to _____.

Question Type : **SA**
Question ID : **87827056082**

Q.27 Let a ray of light passing through the point (3, 10) reflects on the line $2x+y=6$ and the reflected ray passes through the point (7, 2). If the equation of the incident ray is $ax+by+1=0$, then a^2+b^2+3ab is equal to _____.

Question Type : **SA**
Question ID : **87827056079**

Q.28 Let $\alpha|x| = |y|e^{xy-\beta}$, $\alpha, \beta \in \mathbf{N}$ be the solution of the differential equation $x\,dy-y\,dx+xy(x\,dy+y\,dx)=0$, $y(1)=2$. Then $\alpha+\beta$ is equal to _____

Question Type : **SA**
Question ID : **87827056084**

Q.29

An arithmetic progression is written in the following way

2

5 8

11 14 17

20 23 26 29

- -

- -

The sum of all the terms of the 10^{th} row is _____.

Question Type : **SA**
Question ID : **87827056080**

Q.30

Let $P(\alpha, \beta, \gamma)$ be the image of the point $Q(1, 6, 4)$ in the line $\frac{x}{1} = \frac{y-1}{2} = \frac{z-2}{3}$.

Then $2\alpha+\beta+\gamma$ is equal to _____

Question Type : **SA**
Question ID : **87827056086**

Section : **Physics Section A**

Q.31 A proton and an electron have the same de Broglie wavelength. If K_p and K_e be the kinetic energies of proton and electron respectively, then choose the correct relation :

Options

1. $K_p = K_e$
2. $K_p < K_e$
3. $K_p > K_e$
4. $K_p = K_e^2$

Question Type : **MCQ**
Question ID : **87827056103**
Option 1 ID : **878270220283**
Option 2 ID : **878270220282**
Option 3 ID : **878270220281**
Option 4 ID : **878270220284**

Q.32 A coil of negligible resistance is connected in series with 90 Ω resistor across 120 V, 60 Hz supply. A voltmeter reads 36 V across resistance. Inductance of the coil is :

Options

1. 0.91 H
2. 2.86 H
3. 0.76 H
4. 0.286 H

Question Type : **MCQ**
Question ID : **87827056100**
Option 1 ID : **878270220270**
Option 2 ID : **878270220269**
Option 3 ID : **878270220272**
Option 4 ID : **878270220271**

Q.33 A diatomic gas ($\gamma = 1.4$) does 100 J of work in an isobaric expansion. The heat given to the gas is :

Options

1. 350 J
2. 490 J
3. 150 J
4. 250 J

Question Type : **MCQ**
Question ID : **87827056095**
Option 1 ID : **878270220250**
Option 2 ID : **878270220252**
Option 3 ID : **878270220251**
Option 4 ID : **878270220249**

Q.34 A given object takes n times the time to slide down 45° rough inclined plane as it takes the time to slide down an identical perfectly smooth 45° inclined plane. The coefficient of kinetic friction between the object and the surface of inclined plane is :

Options

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

Question Type : **MCQ**
Question ID : **87827056090**
Option 1 ID : **878270220229**
Option 2 ID : **878270220230**
Option 3 ID : **878270220232**
Option 4 ID : **878270220231**

Q.35 Water boils in an electric kettle in 20 minutes after being switched on. Using the same main supply, the length of the heating element should be _____ to _____ times of its initial length if the water is to be boiled in 15 minutes.

Options

1. decreased, $3/4$
2. increased, $4/3$
3. decreased, $4/3$
4. increased, $3/4$

Question Type : **MCQ**
Question ID : **87827056098**
Option 1 ID : **878270220262**
Option 2 ID : **878270220264**
Option 3 ID : **878270220263**
Option 4 ID : **878270220261**

Q.36

In a hypothetical fission reaction

$$_{92}X^{236} \rightarrow {}_{56}Y^{141} + {}_{36}Z^{92} + 3R$$

The identity of emitted particles (R) is :

Options

1. γ-radiations
2. Electron
3. Neutron
4. Proton

Question Type : **MCQ**
Question ID : **87827056105**
Option 1 ID : **878270220292**
Option 2 ID : **878270220289**
Option 3 ID : **878270220291**
Option 4 ID : **878270220290**

Q.37 A plane progressive wave is given by $y = 2\cos 2\pi(330t - x)$ m. The frequency of the wave is :

Options

1. 165 Hz
2. 340 Hz
3. 660 Hz
4. 330 Hz

Question Type : **MCQ**
Question ID : **87827056101**
Option 1 ID : **878270220276**
Option 2 ID : **878270220274**
Option 3 ID : **878270220273**
Option 4 ID : **878270220275**

Q.38 A long straight wire of radius a carries a steady current I. The current is uniformly distributed across its cross section. The ratio of the magnetic field at $\frac{a}{2}$ and 2a from axis of the wire is :

Options

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

Question Type : **MCQ**
Question ID : **87827056099**
Option 1 ID : **878270220268**
Option 2 ID : **878270220267**
Option 3 ID : **878270220266**
Option 4 ID : **878270220265**

Q.39 Least count of a vernier caliper is $\frac{1}{20N}$ cm. The value of one division on the main scale is 1 mm. Then the number of divisions of main scale that coincide with N divisions of vernier scale is :

Options

1. $(2N-1)$
2. $\left(\frac{2N-1}{2}\right)$
3. $\left(\frac{2N-1}{2N}\right)$
4. $\left(\frac{2N-1}{20N}\right)$

Question Type : **MCQ**
Question ID : **87827056107**
Option 1 ID : **878270220299**
Option 2 ID : **878270220298**
Option 3 ID : **878270220300**
Option 4 ID : **878270220297**

Q.40 Given below are two statements :

Statement (I) : The mean free path of gas molecules is inversely proportional to square of molecular diameter.

Statement (II) : Average kinetic energy of gas molecules is directly proportional to absolute temperature of gas.

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

Options

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

Question Type : **MCQ**
Question ID : **87827056096**
Option 1 ID : **878270220255**
Option 2 ID : **878270220253**
Option 3 ID : **878270220256**
Option 4 ID : **878270220254**

Q.41 Two satellite A and B go round a planet in circular orbits having radii 4R and R respectively. If the speed of A is $3v$, the speed of B will be :

Options

1. $12\,v$
2. $6\,v$
3. $\frac{4}{3}v$
4. $3\,v$

Question Type : **MCQ**
Question ID : **87827056093**
Option 1 ID : **878270220244**
Option 2 ID : **878270220243**
Option 3 ID : **878270220242**
Option 4 ID : **878270220241**

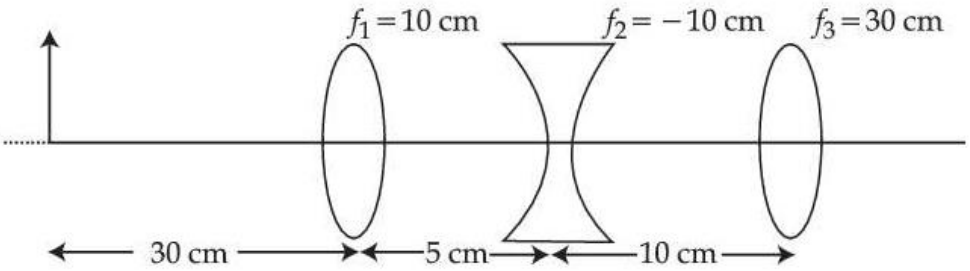
Q.42 The angle of projection for a projectile to have same horizontal range and maximum height is :

Options

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

Question Type : **MCQ**
Question ID : **87827056089**
Option 1 ID : **878270220225**
Option 2 ID : **878270220226**
Option 3 ID : **878270220228**
Option 4 ID : **878270220227**

Q.43 The position of the image formed by the combination of lenses is :



Options

1. 15 cm (left of second lens)
2. 15 cm (right of second lens)
3. 30 cm (left of third lens)
4. 30 cm (right of third lens)

Question Type : **MCQ**
Question ID : **87827056102**
Option 1 ID : **878270220277**
Option 2 ID : **878270220279**
Option 3 ID : **878270220278**
Option 4 ID : **878270220280**

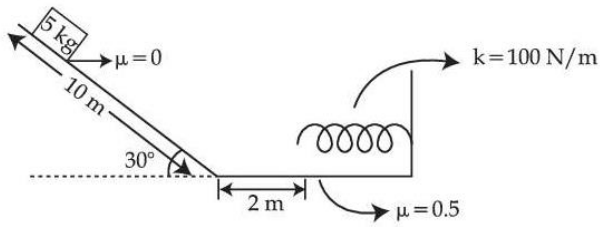
Q.44 A capacitor has air as dielectric medium and two conducting plates of area 12 cm^2 and they are 0.6 cm apart. When a slab of dielectric having area 12 cm^2 and 0.6 cm thickness is inserted between the plates, one of the conducting plates has to be moved by 0.2 cm to keep the capacitance same as in previous case. The dielectric constant of the slab is : (Given $\epsilon_0 = 8.834 \times 10^{-12}$ F/m)

Options

1. 1.50
2. 1.33
3. 1
4. 0.66

Question Type : **MCQ**
Question ID : **87827056097**
Option 1 ID : **878270220257**
Option 2 ID : **878270220260**
Option 3 ID : **878270220259**
Option 4 ID : **878270220258**

Q.45



A block is simply released from the top of an inclined plane as shown in the figure above. The maximum compression in the spring when the block hits the spring is :

Options

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

Question Type : **MCQ**
Question ID : **87827056091**
Option 1 ID : **878270220233**
Option 2 ID : **878270220236**
Option 3 ID : **878270220235**
Option 4 ID : **878270220234**

Q.46 A thin circular disc of mass M and radius R is rotating in a horizontal plane about an axis passing through its centre and perpendicular to its plane with angular velocity ω. If another disc of same dimensions but of mass $M/2$ is placed gently on the first disc co-axially, then the new angular velocity of the system is :

Options

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

Question Type : **MCQ**
Question ID : **87827056092**
Option 1 ID : **878270220239**
Option 2 ID : **878270220240**
Option 3 ID : **878270220238**
Option 4 ID : **878270220237**

Q.47 There are 100 divisions on the circular scale of a screw gauge of pitch 1 mm. With no measuring quantity in between the jaws, the zero of the circular scale lies 5 divisions below the reference line. The diameter of a wire is then measured using this screw gauge. It is found that 4 linear scale divisions are clearly visible while 60 divisions on circular scale coincide with the reference line. The diameter of the wire is :

Options

1. 4.60 mm
2. 4.65 mm
3. 4.55 mm
4. 3.35 mm

Question Type : **MCQ**
Question ID : **87827056106**
Option 1 ID : **878270220293**
Option 2 ID : **878270220294**
Option 3 ID : **878270220296**
Option 4 ID : **878270220295**

Q.48 If M_o is the mass of isotope $^{12}_{5}B$, M_P and M_n are the masses of proton and neutron, then nuclear binding energy of isotope is :

Options

1. $(M_o - 5M_p)C^2$
2. $(M_o - 12M_n)C^2$
3. $(M_o - 5M_p - 7M_n)C^2$
4. $(5M_p + 7M_n - M_o)C^2$

Question Type : **MCQ**
Question ID : **87827056104**
Option 1 ID : **878270220285**
Option 2 ID : **878270220286**
Option 3 ID : **878270220288**
Option 4 ID : **878270220287**

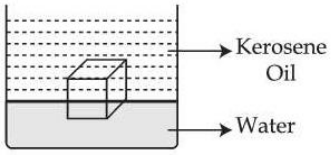
Q.49 If ϵ_o is the permittivity of free space and E is the electric field, then $\epsilon_o E^2$ has the dimensions :

Options

1. $[M^{-1} L^{-3} T^4 A^2]$
2. $[M L^{-1} T^{-2}]$
3. $[M L^2 T^{-2}]$
4. $[M^o L^{-2} T A]$

Question Type : **MCQ**
Question ID : **87827056088**
Option 1 ID : **878270220222**
Option 2 ID : **878270220224**
Option 3 ID : **878270220223**
Option 4 ID : **878270220221**

Q.50 A cube of ice floats partly in water and partly in kerosene oil. The ratio of volume of ice immersed in water to that in kerosene oil (specific gravity of Kerosene oil = 0.8, specific gravity of ice = 0.9) :



Options

1. $9:10$
2. $1:1$
3. $5:4$
4. $8:9$

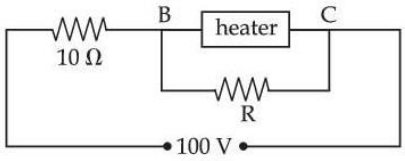
Question Type : **MCQ**
Question ID : **87827056094**
Option 1 ID : **878270220247**
Option 2 ID : **878270220248**
Option 3 ID : **878270220245**
Option 4 ID : **878270220246**

Section : **Physics Section B**

Q.51 The coercivity of a magnet is 5×10^3 A/m. The amount of current required to be passed in a solenoid of length 30 cm and the number of turns 150, so that the magnet gets demagnetised when inside the solenoid is _____A.

Question Type : **SA**
Question ID : **87827056114**

Q.52 A heater is designed to operate with a power of 1000 W in a 100 V line. It is connected in combination with a resistance of 10 Ω and a resistance R, to a 100 V mains as shown in figure. For the heater to operate at 62.5 W, the value of R should be _____ Ω.

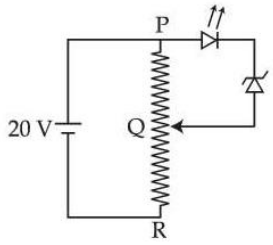


Question Type : **SA**
Question ID : **87827056113**

Q.53 Two slits are 1 mm apart and the screen is located 1 m away from the slits. A light of wavelength 500 nm is used. The width of each slit to obtain 10 maxima of the double slit pattern within the central maximum of the single slit pattern is _____ $\times10^{-4}$ m.

Question Type : **SA**
Question ID : **87827056116**

Q.54 A potential divider circuit is connected with a dc source of 20 V, a light emitting diode of glow in voltage 1.8 V and a zener diode of breakdown voltage of 3.2 V. The length (PR) of the resistive wire is 20 cm. The minimum length of PQ to just glow the LED is _____cm.



Question Type : **SA**
Question ID : **87827056117**

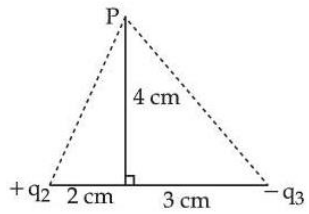
Q.55 An alternating emf $E = 110\sqrt{2}\ \sin 100t$ volt is applied to a capacitor of $2\mu F$, the rms value of current in the circuit is _____mA.

Question Type : **SA**
Question ID : **87827056115**

Q.56 An object of mass 0.2 kg executes simple harmonic motion along x axis with frequency of $\left(\frac{25}{\pi}\right)$Hz. At the position $x = 0.04$ m the object has kinetic energy 0.5 J and potential energy 0.4 J. The amplitude of oscillation is _____ cm.

Question Type : **SA**
Question ID : **87827056111**

Q.57 If the net electric field at point P along Y axis is zero, then the ratio of $\left|\frac{q_2}{q_3}\right|$ is $\frac{8}{5\sqrt{x}}$, where $x =$ _____.

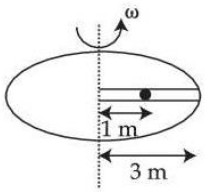


Question Type : **SA**
Question ID : **87827056112**

Q.58 Small water droplets of radius 0.01 mm are formed in the upper atmosphere and falling with a terminal velocity of 10 cm/s. Due to condensation, if 8 such droplets are coalesced and formed a larger drop, the new terminal velocity will be _____cm/s.

Question Type : **SA**
Question ID : **87827056110**

Q.59 A circular table is rotating with an angular velocity of ω rad/s about its axis (see figure). There is a smooth groove along a radial direction on the table. A steel ball is gently placed at a distance of 1 m on the groove. All the surfaces are smooth. If the radius of the table is 3 m, the radial velocity of the ball w.r.t. the table at the time ball leaves the table is $x\sqrt{2}\,\omega$ m/s, where the value of x is _____.



Question Type : **SA**
Question ID : **87827056109**

Q.60 A body of mass M thrown horizontally with velocity v from the top of the tower of height H touches the ground at a distance of 100 m from the foot of the tower. A body of mass 2M thrown at a velocity $\frac{v}{2}$ from the top of the tower of height 4H will touch the ground at a distance of _____m.

Question Type : **SA**
Question ID : **87827056108**

Section : **Chemistry Section A**

Q.61 Given below are two statements :

Statement (I) : A Buffer solution is the mixture of a salt and an acid or a base mixed in any particular quantities.

Statement (II) : Blood is naturally occurring buffer solution whose pH is maintained by $H_2CO_3/HCO_3^{\ominus}$ concentrations.

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

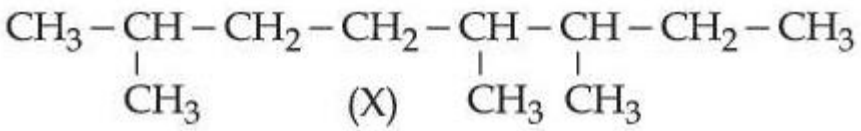
Options

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 : **87827056119**
Option 1 ID : **878270220315**
Option 2 ID : **878270220317**
Option 3 ID : **878270220318**
Option 4 ID : **878270220316**

Q.62

IUPAC name of following hydrocarbon(X) is :



Options

1. 2,5,6-Trimethyloctane
2. 2-Ethyl-2,6-diethylheptane
3. 3,4,7-Trimethyloctane
4. 2-Ethyl-3,6-dimethylheptane

Question Type : **MCQ**
Question ID : **87827056131**
Option 1 ID : **878270220365**
Option 2 ID : **878270220366**
Option 3 ID : **878270220363**
Option 4 ID : **878270220364**

Q.63

Identify the **incorrect** statements about group 15 elements :

(A) Dinitrogen is a diatomic gas which acts like an inert gas at room temperature.
(B) The common oxidation states of these elements are -3, $+3$ and $+5$.
(C) Nitrogen has unique ability to form $p\pi - p\pi$ multiple bonds.
(D) The stability of $+5$ oxidation states increases down the group.
(E) Nitrogen shows a maximum covalency of 6.

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

Options

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

Question Type : **MCQ**
Question ID : **87827056124**
Option 1 ID : **878270220338**
Option 2 ID : **878270220337**
Option 3 ID : **878270220335**
Option 4 ID : **878270220336**

Q.64

The emf of cell $Tl\left|\underset{(0.001M)}{Tl^{+}}\right\|\left|\underset{(0.01M)}{Cu^{2+}}\right|Cu$ is 0.83 V at 298 K. It could be increased by :

Options

1. increasing concentration of Cu^{2+} ions

2. increasing concentration of Tl^{+} ions

3. increasing concentration of both Tl^{+} and Cu^{2+} ions

4. decreasing concentration of both Tl^{+} and Cu^{2+} ions

Question Type : **MCQ**
Question ID : **87827056120**
Option 1 ID : **878270220320**
Option 2 ID : **878270220319**
Option 3 ID : **878270220321**
Option 4 ID : **878270220322**

Q.65

Match **List - I** with **List - II**.

List - I (Test)		**List - II (Identification)**
(A)	Bayer's test	(I) Phenol
(B)	Ceric ammonium nitrate test	(II) Aldehyde
(C)	Phthalein dye test	(III) Alcoholic-OH group
(D)	Schiff's test	(IV) Unsaturation

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

Options

1. (A)-(II), (B)-(III), (C)-(IV), (D)-(I)

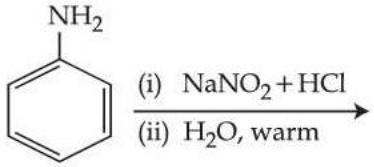
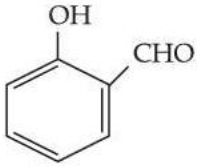
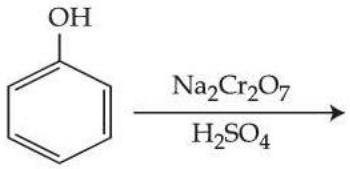
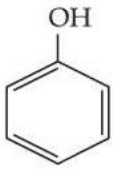
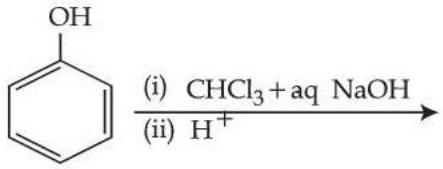
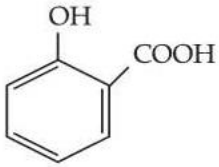
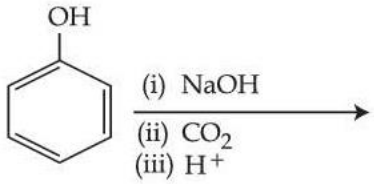
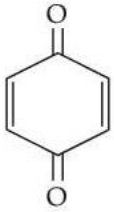
2. (A)-(IV), (B)-(I), (C)-(II), (D)-(III)

3. (A)-(III), (B)-(I), (C)-(IV), (D)-(II)

4. (A)-(IV), (B)-(III), (C)-(I), (D)-(II)

Question Type : **MCQ**
Question ID : **87827056137**
Option 1 ID : **878270220389**
Option 2 ID : **878270220388**
Option 3 ID : **878270220390**
Option 4 ID : **878270220387**

Q.66 Match **List - I** with **List - II**.

List - I (Reactions)		**List - II (Products)**	
(A)		(I)	
(B)		(II)	
(C)		(III)	
(D)		(IV)	

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

Options

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

Question Type : **MCQ**
Question ID : **87827056134**
Option 1 ID : **878270220375**
Option 2 ID : **878270220376**
Option 3 ID : **878270220377**
Option 4 ID : **878270220378**

Q.67 Which one the following compounds will readily react with dilute NaOH ?

Options

1. C_2H_5OH
2. $(CH_3)_3COH$
3. $C_6H_5CH_2OH$
4. C_6H_5OH

Question Type : **MCQ**
Question ID : **87827056135**
Option 1 ID : **878270220382**
Option 2 ID : **878270220381**
Option 3 ID : **878270220380**
Option 4 ID : **878270220379**

Q.68 Given below are two statements :

Statement (I) : S_N2 reactions are 'stereospecific', indicating that they result in the formation of only one stereo-isomer as the product.

Statement (II) : S_N1 reactions generally result in formation of product as racemic mixtures.

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

Question Type : **MCQ**
Question ID : **87827056132**
Option 1 ID : **878270220367**
Option 2 ID : **878270220368**
Option 3 ID : **878270220369**
Option 4 ID : **878270220370**

Q.69 In qualitative test for identification of presence of phosphorous, the compound is heated with an oxidising agent. Which is further treated with nitric acid and ammonium molybdate respectively. The yellow coloured precipitate obtained is :

Options

1. $MoPO_4.\ 21\,NH_4NO_3$
2. $Na_3PO_4.12MoO_3$
3. $(NH_4)_3PO_4.12MoO_3$
4. $(NH_4)_3PO_4.12(NH_4)_2MoO_4$

Question Type : **MCQ**
Question ID : **87827056128**
Option 1 ID : **878270220354**
Option 2 ID : **878270220351**
Option 3 ID : **878270220352**
Option 4 ID : **878270220353**

Q.70 For a reaction $A \xrightarrow{K_1} B \xrightarrow{K_2} C$
If the rate of formation of B is set to be zero then the concentration of B is given by :

Options

1. $(K_1/K_2)[A]$
2. $K_1K_2[A]$
3. $(K_1+K_2)[A]$
4. $(K_1-K_2)[A]$

Question Type : **MCQ**
Question ID : **87827056122**
Option 1 ID : **878270220330**
Option 2 ID : **878270220328**
Option 3 ID : **878270220329**
Option 4 ID : **878270220327**

Q.71 Given below are two statements :

Statement (I) : Kjeldahl method is applicable to estimate nitrogen in pyridine.

Statement (II) : The nitrogen present in pyridine can easily be converted into ammonium sulphate in Kjeldahl method.

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

Options

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

Question Type : **MCQ**
Question ID : **87827056129**
Option 1 ID : **878270220358**
Option 2 ID : **878270220356**
Option 3 ID : **878270220355**
Option 4 ID : **878270220357**

Q.72 When ψ_A and ψ_B are the wave functions of atomic orbitals, then σ^* is represented by :

Options

1. $\psi_A - 2\psi_B$
2. $\psi_A - \psi_B$
3. $\psi_A + 2\psi_B$
4. $\psi_A + \psi_B$

Question Type : **MCQ**
Question ID : **87827056118**
Option 1 ID : **878270220314**
Option 2 ID : **878270220312**
Option 3 ID : **878270220313**
Option 4 ID : **878270220311**

Q.73 Given below are two statements :

Statement (I) : Fusion of MnO_2 with KOH and an oxidising agent gives dark green K_2MnO_4.

Statement (II) : Manganate ion on electrolytic oxidation in alkaline medium gives permanganate ion.

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

Options

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

Question Type : **MCQ**
Question ID : **87827056126**
Option 1 ID : **878270220346**
Option 2 ID : **878270220344**
Option 3 ID : **878270220343**
Option 4 ID : **878270220345**

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

List - I (Complex ion)		**List - II (Spin only magnetic moment in B.M.)**	
(A)	$[Cr(NH_3)_6]^{3+}$	(I)	4.90
(B)	$[NiCl_4]^{2-}$	(II)	3.87
(C)	$[CoF_6]^{3-}$	(III)	0.0
(D)	$[Ni(CN)_4]^{2-}$	(IV)	2.83

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

Options

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

Question Type : **MCQ**
Question ID : **87827056127**
Option 1 ID : **878270220348**
Option 2 ID : **878270220349**
Option 3 ID : **878270220350**
Option 4 ID : **878270220347**

Q.75 The correct sequence of acidic strength of the following aliphatic acids in their decreasing order is :

CH_3CH_2COOH, CH_3COOH, $CH_3CH_2CH_2COOH$, HCOOH

Options 1.

$HCOOH > CH_3COOH > CH_3CH_2COOH > CH_3CH_2CH_2COOH$

2.

$HCOOH > CH_3CH_2CH_2COOH > CH_3CH_2COOH > CH_3COOH$

3.

$CH_3CH_2CH_2COOH > CH_3CH_2COOH > CH_3COOH > HCOOH$

4.

$CH_3COOH > CH_3CH_2COOH > CH_3CH_2CH_2COOH > HCOOH$

Question Type : **MCQ**
Question ID : **87827056133**
Option 1 ID : **878270220372**
Option 2 ID : **878270220373**
Option 3 ID : **878270220371**
Option 4 ID : **878270220374**

Q.76 Given below are two statements :

Statement (I) : All the following compounds react with p-toluenesulfonyl chloride.

$C_6H_5NH_2$ $(C_6H_5)_2NH$ $(C_6H_5)_3N$

Statement (II) : Their products in the above reaction are soluble is aqueous NaOH.

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

Options

1. **Statement I** is false but **Statement II** is true
2. Both **Statement I** and **Statement II** are 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 : **87827056136**
Option 1 ID : **878270220386**
Option 2 ID : **878270220383**
Option 3 ID : **878270220384**
Option 4 ID : **878270220385**

Q.77

The equilibrium $Cr_2O_7^{2-} \rightleftharpoons 2CrO_4^{2-}$ is shifted to the right in :

Options

1. a basic medium
2. a weakly acidic medium
3. a neutral medium
4. an acidic medium

Question Type : **MCQ**
Question ID : **87827056125**
Option 1 ID : **878270220340**
Option 2 ID : **878270220342**
Option 3 ID : **878270220341**
Option 4 ID : **878270220339**

Q.78

The reaction ;

$$\frac{1}{2}H_{2(g)} + AgCl_{(s)} \rightarrow H^+_{(aq)} + Cl^-_{(aq)} + Ag_{(s)}$$

occurs in which of the following galvanic cell :

Options

1. $Pt\left|H_{2(g)}\right|KCl_{(soln.)}\left|AgCl_{(s)}\right|Ag$
2. $Pt\left|H_{2(g)}\right|HCl_{(soln.)}\left|AgNO_{3(aq)}\right|Ag$
3. $Pt\left|H_{2(g)}\right|HCl_{(soln.)}\left|AgCl_{(s)}\right|Ag$
4. $Ag\left|AgCl_{(s)}\right|KCl_{(soln.)}\left|AgNO_{3(aq.)}\right|Ag$

Question Type : **MCQ**
Question ID : **87827056121**
Option 1 ID : **878270220324**
Option 2 ID : **878270220326**
Option 3 ID : **878270220325**
Option 4 ID : **878270220323**

Q.79 Identify the correct statements about p-block elements and their compounds.

(A) Non metals have higher electronegativity than metals.

(B) Non metals have lower ionisation enthalpy than metals.

(C) Compounds formed between highly reactive nonmetals and highly reactive metals are generally ionic.

(D) The non-metal oxides are generally basic in nature.

(E) The metal oxides are generally acidic or neutral in nature.

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

Options

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

Question Type : **MCQ**
Question ID : **87827056123**
Option 1 ID : **878270220334**
Option 2 ID : **878270220333**
Option 3 ID : **878270220331**
Option 4 ID : **878270220332**

Q.80 The shape of carbocation is :

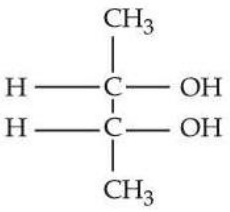
Options

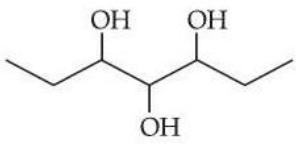
1. tetrahedral
2. diagonal pyramidal
3. trigonal planar
4. diagonal

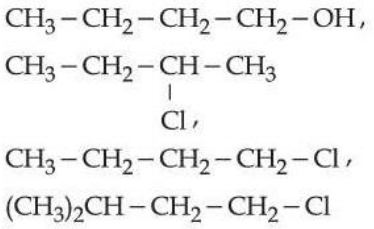
Question Type : **MCQ**
Question ID : **87827056130**
Option 1 ID : **878270220359**
Option 2 ID : **878270220362**
Option 3 ID : **878270220360**
Option 4 ID : **878270220361**

Section : **Chemistry Section B**

Q.81 Total number of optically active compounds from the following is _____.





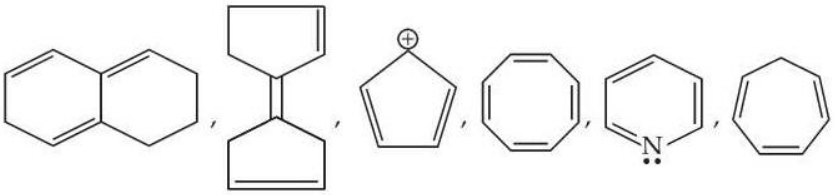


Question Type : **SA**
Question ID : **87827056146**

Q.82 The total number of carbon atoms present in tyrosine, an amino acid, is _____.

Question Type : **SA**
Question ID : **87827056147**

Q.83 Total number of aromatic compounds among the following compounds is _____.



Question Type : **SA**
Question ID : **87827056145**

Q.84 Total number of unpaired electrons in the complex ions $[Co(NH_3)_6]^{3+}$ and $[NiCl_4]^{2-}$ is _____.

Question Type : **SA**
Question ID : **87827056144**

Q.85 A solution is prepared by adding 1 mole ethyl alcohol in 9 mole water. The mass percent of solute in the solution is _____ (Integer answer) (Given : Molar mass in g mol^{-1} Ethyl alcohol : 46 water : 18)

Question Type : **SA**
Question ID : **87827056138**

Q.86 Two moles of benzaldehyde and one mole of acetone under alkaline conditions using aqueous NaOH after heating gives x as the major product. The number of π bonds in the product x is _____.

Question Type : **SA**
Question ID : **87827056143**

Q.87 Molality of an aqueous solution of urea is 4.44 m. Mole fraction of urea in solution is $x \times 10^{-3}$. Value of x is _____. (Integer answer)

Question Type : **SA**
Question ID : **87827056142**

Q.88 Number of molecules having bond order 2 from the following molecules is _____.
C_2, O_2, Be_2, Li_2, Ne_2, N_2, He_2

Question Type : **SA**
Question ID : **87827056140**

Q.89 $\Delta_{vap}H^{\ominus}$ for water is $+40.79$ kJ mol^{-1} at 1 bar and 100 °C. Change in internal energy for this vapourisation under same condition is _____ kJ mol^{-1}. (Integer answer)
(Given R = 8.3 JK^{-1} mol^{-1})

Question Type : **SA**
Question ID : **87827056141**

Q.90 Wavenumber for a radiation having 5800 Å wavelength is $x \times 10$ cm^{-1}. The value of x is _____. (Integer answer)

Question Type : **SA**
Question ID : **87827056139**