Q.2 When photon of energy 4.0 eV strikes the surface of a metal A, the ejected photoelectrons have maximum kinetic energy $T_A$ eV and de-Broglie wavelength $\lambda_A$. The maximum kinetic energy of photoelectrons liberated from another metal B by photon of energy 4.50 eV is $T_B = (T_A - 1.5)eV$. If the de-Broglie wavelength of these photoelectrons $\lambda_B = 2\lambda_A$, then the work function of metal B is:

Options
1. 3 eV
2. 2 eV
3. 4 eV
4. 1.5 eV

Question Type: MCQ
Question ID: 4050361485
Option 1 ID: 4050365432
Option 2 ID: 4050365433
Option 3 ID: 4050365431
Option 4 ID: 4050365430
Status: Answered
Chosen Option: 3

Q.3 The length of a potentiometer wire is 1200 cm and it carries a current of 60 mA. For a cell of emf 5 V and internal resistance of 20 $\Omega$, the null point on it is found to be at 1000 cm. The resistance of whole wire is:

Options
1. 120 $\Omega$
2. 60 $\Omega$
3. 80 $\Omega$
4. 100 $\Omega$

Question Type: MCQ
Question ID: 4050361488
Option 1 ID: 4050365445
Option 2 ID: 4050365442
Option 3 ID: 4050365443
Option 4 ID: 4050365444
Status: Answered
Chosen Option: 4
Q.4 Proton with kinetic energy of 1 MeV moves from south to north. It gets an acceleration of $10^{12} \text{ m/s}^2$ by an applied magnetic field (west to east). The value of magnetic field:
(Rest mass of proton is $1.6 \times 10^{-27} \text{ kg}$)

Options
1. 71 mT
2. 7.1 mT
3. 0.071 mT
4. 0.71 mT
Q.5 The plot that depicts the behavior of the mean free time $\tau$ (time between two successive collisions) for the molecules of an ideal gas, as a function of temperature ($T$), qualitatively, is: (Graphs are schematic and not drawn to scale)

Options

1. $\tau$ vs $T$
2. $\tau$ vs $\frac{1}{T}$
3. $\tau$ vs $\sqrt{T}$
4. $\tau$ vs $\frac{1}{\sqrt{T}}$
Q.6  Consider a uniform rod of mass $M = 4m$ and length $l$ pivoted about its centre. A mass $m$ moving with velocity $v$ making an angle $\theta = \frac{\pi}{4}$ to the rod’s long axis collides with one end of the rod and sticks to it. The angular speed of the rod-mass system just after the collision is:

Options
1. $\frac{3}{7\sqrt{2}} \frac{v}{l}$
2. $\frac{3\sqrt{2}}{7} \frac{v}{l}$
3. $\frac{4}{7} \frac{v}{l}$
4. $\frac{3}{7} \frac{v}{l}$

Question Type: MCQ
Question ID: 4050361472
Option 1 ID: 4050365379
Option 2 ID: 4050365380
Option 3 ID: 4050365381
Option 4 ID: 4050365378
Status: Answered
Chosen Option: 2

Q.7 The dimension of stopping potential $V_0$ in photoelectric effect in units of Planck’s constant ‘$h$’, speed of light ‘$c$’ and Gravitational constant ‘$G$’ and ampere ‘$A$’ is:

Options
1. $h^2G^{3/2}c^{1/3}A^{-1}$
2. $h^{-2/3}c^{-1/3}G^{4/3}A^{-1}$
3. $h^{1/3}G^{2/3}c^{1/3}A^{-1}$
4. $h^{2/3}G^{5/3}A^{1/3}A^{-1}$

Question Type: MCQ
Question ID: 4050361469
Option 1 ID: 4050365366
Option 2 ID: 4050365369
Option 3 ID: 4050365367
Option 4 ID: 4050365368
Status: Marked For Review
Chosen Option: 4
Q.8 Consider two solid spheres of radii $R_1 = 1\text{m}$, $R_2 = 2\text{m}$ and masses $M_1$ and $M_2$, respectively. The gravitational field due to sphere ① and ② are shown. The value of $\frac{M_1}{M_2}$ is:

![Gravitational Field Graph]

Options

1. $\frac{1}{2}$
2. $\frac{2}{3}$
3. $\frac{1}{3}$
4. $\frac{1}{6}$
Q.9  In finding the electric field using Gauss law
the formula \( \frac{q_{\text{enc}}}{\epsilon_0|A|} \) is applicable. In
the formula \( \epsilon_0 \) is permittivity of free space,
\( A \) is the area of Gaussian surface and \( q_{\text{enc}} \)
is charge enclosed by the Gaussian surface.
This equation can be used in which of the
following situation?

Options
1. Only when the Gaussian surface is an
equipotential surface.
2. Only when \( \frac{q_{\text{enc}}}{|E|} \) is constant on the
   surface.
3. For any choice of Gaussian surface.
   Only when the Gaussian surface is an
4. equipotential surface and \( \frac{q_{\text{enc}}}{|E|} \) is
   constant on the surface.
A thermodynamic cycle $xyzx$ is shown on a V-T diagram.

The P-V diagram that best describes this cycle is: (Diagrams are schematic and not to scale)

Options

1. 

2. 

3. 

4. 

Question Type: MCQ
Question ID: 4050361476
Option 1 ID: 4050365397
Option 2 ID: 4050365396
Option 3 ID: 4050365394
Option 4 ID: 4050365395
Status: Answered
Chosen Option: 4
Q.11 The coordinates of centre of mass of a uniform flag shaped lamina (thin flat plate) of mass 4 kg. (The coordinates of the same are shown in figure) are:

\[(0, 0)\quad (1, 0)\]

\[(1, 2)\]

\[(2, 2)\]

\[(0, 3)\quad (2, 3)\]

Options 1. (1.25 m, 1.50 m)
2. (1 m, 1.75 m)
3. (0.75 m, 0.75 m)
4. (0.75 m, 1.75 m)

Q.12 The magnifying power of a telescope with tube length 60 cm is 5. What is the focal length of its eye piece?

Options 1. 30 cm
2. 40 cm
3. 20 cm
4. 10 cm
Q.13

The graph which depicts the results of Rutherford gold foil experiment with α-particles is:

θ : Scattering angle
Y : Number of scattered α-particles detected

(Plots are schematic and not to scale)

Options

1. Y
   \[
   \begin{array}{c}
   \text{\textbf{Y}} \\
   0 \quad \theta \rightarrow \pi
   \end{array}
   \]

2. Y
   \[
   \begin{array}{c}
   \text{\textbf{Y}} \\
   0 \quad \theta \rightarrow \pi
   \end{array}
   \]

3. Y
   \[
   \begin{array}{c}
   \text{\textbf{Y}} \\
   0 \quad \theta \rightarrow \pi
   \end{array}
   \]

4. Y
   \[
   \begin{array}{c}
   \text{\textbf{Y}} \\
   0 \quad \theta \rightarrow \pi
   \end{array}
   \]
Q.14 A particle of mass $m$ is fixed to one end of a light spring having force constant $k$ and unstretched length $l$. The other end is fixed. The system is given an angular speed $\omega$ about the fixed end of the spring such that it rotates in a circle in gravity free space. Then the stretch in the spring is:

Options

1. $\frac{ml\omega^2}{k + m\omega^2}$
2. $\frac{ml\omega^2}{k - m\omega^2}$
3. $\frac{ml\omega^2}{k - \omega m}$
4. $\frac{ml\omega^2}{k + m\omega}$

Question Type: MCQ
Question ID: 4050361470
Option 1 ID: 4050365370
Option 2 ID: 4050365371
Option 3 ID: 4050365373
Option 4 ID: 4050365372
Status: Answered
Chosen Option: 2

Q.15 The critical angle of a medium for a specific wavelength, if the medium has relative permittivity $\kappa$ and relative permeability $\frac{4}{3}$ for this wavelength, will be:

Options

1. $60^\circ$
2. $15^\circ$
3. $45^\circ$
4. $30^\circ$

Question Type: MCQ
Question ID: 4050361483
Option 1 ID: 4050365424
Option 2 ID: 4050365425
Option 3 ID: 4050365423
Option 4 ID: 4050365422
Status: Answered
Chosen Option: 4
Q.16
A leak proof cylinder of length 1 m, made of a metal which has very low coefficient of expansion is floating vertically in water at 0°C such that its height above the water surface is 20 cm. When the temperature of water is increased to 4°C, the height of the cylinder above the water surface becomes 21 cm. The density of water at T = 4°C, relative to the density at T = 0°C is close to:

Options 1. 1.01
2. 1.04
3. 1.03
4. 1.26

---

Q.17
Boolean relation at the output stage-Y for the following circuit is:

Options 1. \( A + B \)
2. \( \overline{A} + \overline{B} \)
3. \( \overline{A} \cdot \overline{B} \)
4. \( A \cdot B \)
Q.18 Three charged particles A, B and C with charges $-4q$, $2q$ and $-2q$ are present on the circumference of a circle of radius $d$. The charged particles A, C and centre O of the circle formed an equilateral triangle as shown in figure. Electric field at O along $x$-direction is:

\[
\begin{align*}
\text{Options} & \quad 1. \quad \frac{2\sqrt{3}q}{\pi \epsilon_0 d^2} \\
               & \quad 2. \quad \frac{\sqrt{3}q}{4 \pi \epsilon_0 d^2} \\
               & \quad 3. \quad \frac{3\sqrt{3}q}{4 \pi \epsilon_0 d^2} \\
               & \quad 4. \quad \frac{\sqrt{3}q}{\pi \epsilon_0 d^2}
\end{align*}
\]

Question Type: MCQ
Question ID: 4050361478
Option 1 ID: 4050365404
Option 2 ID: 4050365402
Option 3 ID: 4050365403
Option 4 ID: 4050365405
Status: Answered
Chosen Option: 4
Q.19 At time $t = 0$ magnetic field of 1000 Gauss is passing perpendicularly through the area defined by the closed loop shown in the figure. If the magnetic field reduces linearly to 500 Gauss, in the next 5 s, then induced EMF in the loop is:

![Diagram](image)

Options:
1. 36 $\mu$V
2. 48 $\mu$V
3. 56 $\mu$V
4. 28 $\mu$V

Q.20 Effective capacitance of parallel combination of two capacitors $C_1$ and $C_2$ is 10 $\mu$F. When these capacitors are individually connected to a voltage source of 1 V, the energy stored in the capacitor $C_2$ is 4 times that of $C_1$. If these capacitors are connected in series, their effective capacitance will be:

Options:
1. 3.2 $\mu$F
2. 8.4 $\mu$F
3. 1.6 $\mu$F
4. 4.2 $\mu$F
Q.21
Four resistances of 15 Ω, 12 Ω, 4 Ω and 10 Ω respectively in cyclic order to form Wheatstone’s network. The resistance that is to be connected in parallel with the resistance of 10 Ω to balance the network is _______ Ω.

Given 10.00

Answer:

Q.22
A point object in air is in front of the curved surface of a plano-convex lens. The radius of curvature of the curved surface is 30 cm and the refractive index of the lens material is 1.5, then the focal length of the lens (in cm) is ________.

Given 60.00

Answer:

Q.23
A body A, of mass m = 0.1 kg has an initial velocity of $3 \hat{i} \text{ ms}^{-1}$. It collides elastically with another body, B of the same mass which has an initial velocity of $5 \hat{j} \text{ ms}^{-1}$. After collision, A moves with a velocity $\vec{v} = 4(\hat{i} + \hat{j})$. The energy of B after collision is written as $\frac{x}{10}$. The value of $x$ is ________.

Given 1.00

Answer:
Q.24 A particle is moving along the x-axis with its coordinate with time ‘t’ given by \( x(t) = 10 + 8t - 3t^2 \). Another particle is moving along the y-axis with its coordinate as a function of time given by \( y(t) = 5 - 8t^3 \). At \( t = 1 \) s, the speed of the second particle as measured in the frame of the first particle is given as \( \sqrt{v} \). Then \( v \) (in m/s) is \( \underline{\text{580.00}} \).

Q.25 A one metre long (both ends open) organ pipe is kept in a gas that has double the density of air at STP. Assuming the speed of sound in air at STP is 300 m/s, the frequency difference between the fundamental and second harmonic of this pipe is \( \underline{\text{106.05}} \) Hz.

Section: Chemistry
Q.1 A flask contains a mixture of isohexane and 3-methylpentane. One of the liquids boils at 63 °C while the other boils at 60 °C. What is the best way to separate the two liquids and which one will be distilled out first?

Options 1. simple distillation, 3-methylpentane
2. simple distillation, isohexane
3. fractional distillation, isohexane
4. fractional distillation, 3-methylpentane

Q.2 The first ionization energy (in kJ/mol) of Na, Mg, Al and Si respectively, are:

Options 1. 496, 737, 577, 786
2. 786, 737, 577, 496
3. 496, 577, 737, 786
4. 496, 577, 786, 737
Q.3 The most suitable reagent for the given conversion is:

\[
\begin{align*}
\text{CONH}_2 & \quad \text{CH}_3 \\
\text{C} & \quad \text{O} \\
\text{HO}_2\text{C} & \quad \text{CN} \\
\text{CONH}_2 & \quad \text{COCH}_3 \\
\text{HO}_2\text{C} & \quad \text{CN}
\end{align*}
\]

Options 1. LiAlH\(_4\) 
2. NaBH\(_4\) 
3. H\(_2\)/Pd 
4. B\(_2\)H\(_6\)

Q.4 The third ionization enthalpy is minimum for:

Options 1. Fe 
2. Ni 
3. Co 
4. Mn
Q.5 The predominant intermolecular forces present in ethyl acetate, a liquid, are:

Options
1. hydrogen bonding and London dispersion
2. Dipole-dipole and hydrogen bonding
3. London dispersion and dipole-dipole
4. London dispersion, dipole-dipole and hydrogen bonding

Question Type: MCQ
Question ID: 4050361497
Option 1 ID: 4050365463
Option 2 ID: 4050365465
Option 3 ID: 4050365466
Option 4 ID: 4050365464
Status: Answered
Chosen Option: 3

Q.6 The strength of an aqueous NaOH solution is most accurately determined by titrating:
(Note: consider that an appropriate indicator is used)

Options
1. Aq. NaOH in a volumetric flask and concentrated H₂SO₄ in a conical flask
2. Aq. NaOH in a pipette and aqueous oxalic acid in a burette
3. Aq. NaOH in a burette and concentrated H₂SO₄ in a conical flask
4. Aq. NaOH in a burette and aqueous oxalic acid in a conical flask

Question Type: MCQ
Question ID: 4050361501
Option 1 ID: 4050365479
Option 2 ID: 4050365482
Option 3 ID: 4050365480
Option 4 ID: 4050365481
Status: Answered
Chosen Option: 1
Q.7  
The complex that can show fac- and mer- isomers is:

Options
1. [Pt(NH₃)₂Cl₂]
2. [Co(NH₃)₄Cl₂]⁺
3. [Co(NH₃)₃(NO₂)₂]
4. [CoCl₂(en)₂]

Q.8  
The stoichiometry and solubility product of a salt with the solubility curve given below is, respectively:

Options
1. $\text{X}_2\text{Y}$, $2 \times 10^{-9} \text{ M}^3$
2. $\text{XY}_2$, $1 \times 10^{-9} \text{ M}^3$
3. $\text{XY}_2$, $4 \times 10^{-9} \text{ M}^3$
4. $\text{XY}$, $2 \times 10^{-6} \text{ M}^3$
Q.9  The decreasing order of reactivity towards dehydrohalogenation (E1) reaction of the following compounds is:

(A) Cl

(B) Cl

(C) Cl

(D) Cl

Options 1. B > D > A > C

2. B > D > C > A

3. D > B > C > A

4. B > A > D > C

Q.10  The number of bonds between sulphur and oxygen atoms in $S_2O_8^{2-}$ and the number of bonds between sulphur and sulphur atoms in rhombic sulphur, respectively, are:

Options 1. 4 and 8

2. 4 and 6

3. 8 and 8

4. 8 and 6
Q.11 The rate of a certain biochemical reaction at physiological temperature (T) occurs $10^9$ times faster with enzyme than without. The change in the activation energy upon adding enzyme is:

Options
1. $-6RT$
2. $+6RT$
3. $+6(2.303)RT$
4. $-6(2.303)RT$

Q.12 Which of the following statement is not true for glucose?

Options
1. The pentaacetate of glucose does not react with hydroxylamine to give oxime
2. Glucose gives Schiff’s test for aldehyde
3. Glucose exists in two crystalline forms $\alpha$ and $\beta$
4. Glucose reacts with hydroxylamine to form oxime
Q.13 A graph of vapour pressure and temperature for three different liquids X, Y, and Z is shown below:

The following inferences are made:
(A) X has higher intermolecular interactions compared to Y.
(B) X has lower intermolecular interactions compared to Y.
(C) Z has lower intermolecular interactions compared to Y.

The correct inference(s) is/are:

Options 1. (A)
2. (C)
3. (B)
4. (A) and (C)
Q.14 Among the gases (a) – (e), the gases that cause greenhouse effect are:
(a) CO₂
(b) H₂O
(c) CFCs
(d) O₂
(e) O₃
Options 1. (a), (b), (c) and (d)
2. (a), (c), (d) and (e)
3. (a) and (d)
4. (a), (b), (c) and (e)

Q.15 As per Hardy-Schulze formulation, the flocculation values of the following for ferric hydroxide sol are in the order:
Options 1. AlCl₃ > K₃[Fe(CN)₆] > K₂CrO₄ > KBr = KNO₃
2. K₃[Fe(CN)₆] < K₂CrO₄ < AlCl₃ < KBr < KNO₃
3. K₃[Fe(CN)₆] > AlCl₃ > K₂CrO₄ > KBr > KNO₃
4. K₃[Fe(CN)₆] < K₂CrO₄ < KBr = KNO₃ = AlCl₃
Q.16 The major products A and B in the following reactions are:

\[ \text{CN} + \text{ Peroxide} \xrightarrow{\text{Heat}} [\text{A}] \]

\[ [\text{A}] + \text{CN} \xrightarrow{} \text{B} \]

Options
1. \( \text{A} = \text{CN} \) and \( \text{B} = \text{CN} \)
2. \( \text{A} = \text{CN} \) and \( \text{B} = \text{CN} \)
3. \( \text{A} = \text{CN} \) and \( \text{B} = \text{CN} \)
4. \( \text{A} = \text{CN} \) and \( \text{B} = \text{CN} \)

Q.17 For the Balmer series in the spectrum of H

atom, 

\[ \bar{\nu} = R_H \left( \frac{1}{n_1^2} - \frac{1}{n_2^2} \right) \]

the correct statements among (I) to (IV) are:

(I) As wavelength decreases, the lines in the series converge

(II) The integer \( n_1 \) is equal to 2

(III) The lines of longest wavelength corresponds to \( n_2 = 3 \)

(IV) The ionization energy of hydrogen can be calculated from wave number of these lines

Options
1. (II), (III), (IV)
2. (I), (II), (III)
3. (I), (III), (IV)
4. (I), (II), (IV)
Q.18 Arrange the following compounds in increasing order of C–OH bond length:
methanol, phenol, p-ethoxyphenol

Options
1. phenol < methanol < p-ethoxyphenol
2. phenol < p-ethoxyphenol < methanol
3. methanol < p-ethoxyphenol < phenol
4. methanol < phenol < p-ethoxyphenol
Q.19  The major product of the following reaction is:

\[ \text{H}_3\text{C} \quad \text{H}_3\text{C} \quad \text{H}_3\text{C} \quad \text{OH} \xrightarrow{\text{dil. H}_2\text{SO}_4} \]

Options

1. \[ \text{H}_3\text{C} \quad \text{H}_3\text{C} \quad \text{OH} \quad \text{CH}_3 \quad \text{CH}_3 \]

2. \[ \text{H}_3\text{C} \quad \text{CH}_3 \quad \text{OH} \]

3. \[ \text{CH}_3 \quad \text{H}_3\text{C} \quad \text{OH} \quad \text{CH}_3 \]

4. \[ \text{H}_3\text{C} \quad \text{HO} \quad \text{CH}_3 \quad \text{OH} \]

Q.20  When gypsum is heated to 393 K, it forms:

Options

1. Dead burnt plaster
2. Anhydrous \( \text{CaSO}_4 \)
3. \( \text{CaSO}_4 \cdot 5 \text{H}_2\text{O} \)
4. \( \text{CaSO}_4 \cdot 0.5 \text{H}_2\text{O} \)
Q.21 The number of chiral centres in penicillin is __________.

Given 3.00
Answer:

Q.22 The magnitude of work done by a gas that undergoes a reversible expansion along the path ABC shown in the figure is __________.

Pressure (Pa) 10

\[ \begin{array}{c}
A \quad B \\
8 \quad 6 \\
6 \quad 4 \\
(2, 2) \quad 4 \quad 6 \quad 8 \quad 10 \quad 12 \\
\text{Volume (m}^3) \\
\end{array} \]

Given 48.00
Answer:

Q.23 The volume (in mL) of 0.125 M AgNO\textsubscript{3} required to quantitatively precipitate chloride ions in 0.3 g of [Co(NH\textsubscript{3})\textsubscript{6}]Cl\textsubscript{3} is __________.

M$[^{\text{M}[\text{Co(NH}_3)_\text{6}]\text{Cl}_3}$ = 267.46 g/mol
M$[^{\text{M}\text{AgNO}_3}$ = 169.87 g/mol

Given 26.92
Answer:
Q.24
What would be the electrode potential for the given half cell reaction at pH = 5?

\[ 2\text{H}_2\text{O} \rightarrow \text{O}_2 + 4\text{H}^+ + 4\text{e}^-; E_{\text{red}}^0 = 1.23 \text{ V} \]

\((R = 8.314 \text{ J mol}^{-1} \text{ K}^{-1}; \text{Temp} = 298 \text{ K}; \text{oxygen under std. atm. pressure of 1 bar})\

Given: -0.935
Answer: 

Q.25
Ferrous sulphate heptahydrate is used to fortify foods with iron. The amount (in grams) of the salt required to achieve 10 ppm of iron in 100 kg of wheat is

Atomic weight: Fe = 55.85; S = 32.00; O = 16.00

Given: 4.98
Answer: 

Section: Mathematics
Q.1 Let the line \( y = mx \) and the ellipse \( 2x^2 + y^2 = 1 \) intersect at a point \( P \) in the first quadrant. If the normal to this ellipse at \( P \) meets the co-ordinate axes at \( \left( -\frac{1}{3\sqrt{2}}, 0 \right) \) and \( (0, \beta) \), then \( \beta \) is equal to:

Options:
1. \( \frac{2}{\sqrt{3}} \)
2. \( \frac{2\sqrt{2}}{3} \)
3. \( \frac{2}{3} \)
4. \( \frac{\sqrt{2}}{3} \)

Q.2 Let \( f : \mathbb{R} \rightarrow \mathbb{R} \) be such that for all \( x \in \mathbb{R} \), \( (2^x + 2^{-x}), f(x) \) and \( (3^x + 3^{-x}) \) are in A.P., then the minimum value of \( f(x) \) is:

Options:
1. 0
2. 3
3. 2
4. 4
Q.3 Let the volume of a parallelepiped whose coterminal edges are given by 
\[ \mathbf{u} = \mathbf{i} + \mathbf{j} + \mathbf{k}, \quad \mathbf{v} = \mathbf{i} + \mathbf{j} + 3\mathbf{k} \] and 
\[ \mathbf{w} = 2\mathbf{i} + \mathbf{j} + \mathbf{k} \] be 1 cu. unit. If \( \theta \) be the angle between the edges \( \mathbf{u} \) and \( \mathbf{w} \), then \( \cos \theta \) can be:

Options

1. \( \frac{7}{6\sqrt{3}} \)
2. \( \frac{5}{7} \)
3. \( \frac{7}{6\sqrt{6}} \)
4. \( \frac{5}{3\sqrt{3}} \)
Q.5 Let 

\[ f(x) = \left( \sin(\tan^{-1} x) + \sin(\cot^{-1} x) \right)^2 - 1 \]

\(|x| > 1\). If 

\[ \frac{dy}{dx} = \frac{1}{2} \frac{d}{dx} \left( \sin^{-1} f(x) \right) \]

and 

\[ y(\sqrt{3}) = \frac{\pi}{6}, \text{ then } y(-\sqrt{3}) \text{ is equal to:} \]

Options

1. \( \frac{5\pi}{6} \)
2. \( -\frac{\pi}{6} \)
3. \( \frac{\pi}{3} \)
4. \( \frac{2\pi}{3} \)

Q.6 

\[ \lim_{x \to 0} \left( \frac{3x^2 + 2}{7x^2 + 2} \right)^{\frac{1}{2}} \]

is equal to:

Options

1. \( \frac{1}{e} \)
2. \( e^2 \)
3. \( e \)
4. \( \frac{1}{e^2} \)
Q.7 Let two points be A(1, -1) and B(0, 2). If a point P(x', y') be such that the area of ΔPAB = 5 sq. units and it lies on the line, 3x + y - 4λ = 0, then a value of λ is:

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

Q.8 The mean and the standard deviation (s.d.) of 10 observations are 20 and 2 respectively. Each of these 10 observations is multiplied by p and then reduced by q, where p ≠ 0 and q ≠ 0. If the new mean and new s.d. become half of their original values, then q is equal to:

Options 1. -20  
2. 10  
3. -10  
4. -5
Q.9  
Let \( y = y(x) \) be a solution of the differential equation,
\[
\sqrt{1 - x^2} \frac{dy}{dx} + \sqrt{1 - y^2} = 0, \quad |x| < 1.
\]

If \( y \left( \frac{1}{2} \right) = \frac{\sqrt{3}}{2} \), then \( y \left( \frac{-1}{\sqrt{2}} \right) \) is equal to:

Options
1. \( -\frac{\sqrt{3}}{2} \)
2. \( \frac{1}{\sqrt{2}} \)
3. \( \frac{\sqrt{3}}{2} \)
4. \( -\frac{1}{\sqrt{2}} \)

Question Type: MCQ
Question ID: 4050361530
Option 1 ID: 4050365583
Option 2 ID: 4050365581
Option 3 ID: 4050365582
Option 4 ID: 4050365580
Status: Answered
Chosen Option: 2

Q.10  
If the equation, \( x^2 + bx + 45 = 0 \) (\( b \in \mathbb{R} \)) has conjugate complex roots and they satisfy
\( |z + 1| = 2\sqrt{10} \), then:

Options
1. \( b^2 - b = 42 \)
2. \( b^2 + b = 12 \)
3. \( b^2 + b = 72 \)
4. \( b^2 - b = 30 \)

Question Type: MCQ
Question ID: 4050361520
Option 1 ID: 4050365541
Option 2 ID: 4050365540
Option 3 ID: 4050365543
Option 4 ID: 4050365542
Status: Answered
Chosen Option: 4
Q.11 For a > 0, let the curves \( C_1 : y^2 = ax \) and \( C_2 : x^2 = ay \) intersect at origin \( O \) and a point \( P \). Let the line \( x = b \) (\( 0 < b < a \)) intersect the chord \( OP \) and the \( x \)-axis at points \( Q \) and \( R \), respectively. If the line \( x = b \) bisects the area bounded by the curves, \( C_1 \) and \( C_2 \), and the area of \( \triangle OQR = \frac{1}{2} \), then ‘\( a \)’ satisfies the equation:

Options
1. \( x^6 - 12x^3 + 4 = 0 \)
2. \( x^6 - 12x^3 - 4 = 0 \)
3. \( x^6 + 6x^3 - 4 = 0 \)
4. \( x^6 - 6x^3 + 4 = 0 \)

Q.12 Which one of the following is a tautology?

Options
1. \( P \land (P \lor Q) \)
2. \( P \lor (P \land Q) \)
3. \( Q \rightarrow (P \land (P \rightarrow Q)) \)
4. \( (P \land (P \rightarrow Q)) \rightarrow Q \)
Q. 13 The locus of a point which divides the line segment joining the point $(0, -1)$ and a point on the parabola, $x^2 = 4y$, internally in the ratio $1 : 2$, is:

Options 1. $9x^2 - 3y = 2$
2. $9x^2 - 12y = 8$
3. $x^2 - 3y = 2$
4. $4x^2 - 3y = 2$

Q. 14 If $c$ is a point at which Rolle’s theorem holds for the function,

\[ f(x) = \log_e \left( \frac{x^2 + \alpha}{7x} \right) \]

in the interval $[3, 4]$, where $\alpha \in \mathbb{R}$, then $f''(c)$ is equal to:

Options 1. $\frac{\sqrt{3}}{7}$
2. $\frac{1}{12}$
3. $-\frac{1}{24}$
4. $-\frac{1}{12}$
Q.15 For which of the following ordered pairs 
($\mu, \delta$), the system of linear equations

\[x + 2y + 3z = 1\]
\[3x + 4y + 5z = \mu\]
\[4x + 4y + 4z = \delta\]

is inconsistent?

Options
1. (1, 0)
2. (4, 6)
3. (3, 4)
4. (4, 3)

Q.16 Let A and B be two independent events

such that $P(A) = \frac{1}{3}$ and $P(B) = \frac{1}{6}$. Then,

which of the following is TRUE?

Options
1. $P(A/B) = \frac{2}{3}$
2. $P(A/(A \cup B)) = \frac{1}{4}$
3. $P(A/B') = \frac{1}{3}$
4. $P(A'/B') = \frac{1}{3}$
Q.17 The inverse function of
\[ f(x) = \frac{8^{2x} - 8^{-2x}}{8^{2x} + 8^{-2x}}, x \in (-1, 1), \] is

\[
\frac{1}{4} \log_8 e \log_e \left( \frac{1 - x}{1 + x} \right)
\]

1. \[ \frac{1}{4} \log_8 e \log_e \left( \frac{1 - x}{1 + x} \right) \]
2. \[ \frac{1}{4} \log_e \left( \frac{1 - x}{1 + x} \right) \]
3. \[ \frac{1}{4} \log_8 e \log_e \left( \frac{1 + x}{1 - x} \right) \]
4. \[ \frac{1}{4} \log_e \left( \frac{1 + x}{1 - x} \right) \]

Q.18 If
\[
\int \frac{\cos x \, dx}{\sin^3 x \left( 1 + \sin^6 x \right)^{\frac{2}{3}}} = f(x) \left( 1 + \sin^6 x \right)^{\frac{1}{3}} + c
\]

where \( c \) is a constant of integration, then

\[ \lambda f\left( \frac{\pi}{3} \right) \] is equal to:

1. \[ -2 \]
2. \[ \frac{9}{8} \]
3. \[ 2 \]
4. \[ \frac{9}{8} \]
Q.19 The shortest distance between the lines
\[
\frac{x - 3}{3} = \frac{y - 8}{-1} = \frac{z - 3}{1} \quad \text{and} \quad \frac{x + 3}{-3} = \frac{y + 7}{2} = \frac{z - 6}{4}
\]
is:

Options
1. \(\frac{7}{2\sqrt{30}}\)
2. \(3\sqrt{30}\)
3. \(3\)
4. \(2\sqrt{30}\)

Q.20 Let \(f(x) = x\cos^{-1}(-\sin|x|), x \in \left[-\frac{\pi}{2}, \frac{\pi}{2}\right]\),
then which of the following is true?

Options
1. \(f'\) is decreasing in \((-\frac{\pi}{2}, 0)\) and increasing in \((0, \frac{\pi}{2})\)
2. \(f\) is not differentiable at \(x = 0\)
3. \(f'(0) = -\frac{\pi}{2}\)
4. \(f'\) is increasing in \((-\frac{\pi}{2}, 0)\) and decreasing in \((0, \frac{\pi}{2})\)
Q.21  The number of all 3 \times 3 matrices A, with entries from the set \{-1, 0, 1\} such that the sum of the diagonal elements of AA^T is 3, is \[\_\_\_\_\_\_\_.\]

Given 672.00
Answer:

Question Type: SA
Question ID: 4050361540
Status: Answered

Q.22  The least positive value of ‘a’ for which the equation, \[2x^2 + (a - 10)x + \frac{33}{2} = 2a\] has real roots is \[\_\_\_\_\_\_\_.\]

Given 8.00
Answer:

Question Type: SA
Question ID: 4050361539
Status: Answered

Q.23  Let the normal at a point P on the curve \(y^2 - 3x^2 + y + 10 = 0\) intersect the y-axis at \((0, \frac{3}{2})\). If \(m\) is the slope of the tangent at P to the curve, then \(|m|\) is equal to \[\_\_\_\_\_\_\_.\]

Given 4.00
Answer:

Question Type: SA
Question ID: 4050361542
Status: Answered

Q.24  The sum \[\sum_{k=1}^{20} (1 + 2 + 3 + \ldots + k)\] is \[\_\_\_\_\_\_.\]

Given 1540.00
Answer:

Question Type: SA
Question ID: 4050361541
Status: Answered
Q.25 An urn contains 5 red marbles, 4 black marbles and 3 white marbles. Then the number of ways in which 4 marbles can be drawn so that at the most three of them are red is _________.

Given 13.00
Answer :