Choose the correct waveform that can represent the voltage across R of the following circuit, assuming the diode is ideal one:

\[ V_i = 10 \sin \omega t \]

**Options:**

![Waveform Diagram]

86435170061.
In the following logic circuit the sequence of the inputs A, B are (0, 0), (0, 1), (1, 0) and (1, 1). The output Y for this sequence will be:

Options:
86435170065. 1, 1, 1, 0
86435170066. 1, 0, 1, 0
86435170067. 0, 1, 0, 1
86435170068. 0, 0, 1, 1
A sample of a radioactive nucleus A disintegrates to another radioactive nucleus B, which in turn disintegrates to some other stable nucleus C. Plot of a graph showing the variation of number of atoms of nucleus B versus time is:

(Assume that at $t = 0$, there are no B atoms in the sample)

Options:
A moving proton and electron have the same de-Broglie wavelength. If $K$ and $P$ denote the K.E. and momentum respectively. Then choose the correct option:

Options :

1. $K_p = K_e$ and $P_p = P_e$ 
2. $K_p > K_e$ and $P_p = P_e$
Two plane mirrors $M_1$ and $M_2$ are at right angle to each other shown. A point source ‘P’ is placed at ‘a’ and ‘2a’ meter away from $M_1$ and $M_2$ respectively. The shortest distance between the images thus formed is: (Take $\sqrt{5} = 2.3$)
Question Number : 6 Question Id : 86435121165 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1

An object is placed at the focus of concave lens having focal length \( f \). What is the magnification and distance of the image from the optical centre of the lens?

Options:

86435170081. Very high, \( \infty \)

86435170082. \( 1, \infty \)

86435170083. \( \frac{1}{2}, \frac{f}{2} \)

86435170084. \( \frac{1}{4}, \frac{f}{4} \)

Question Number : 7 Question Id : 86435121166 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1
A small square loop of side ‘a’ and one turn is placed inside a larger square loop of side b and one turn (b >> a). The two loops are coplanar with their centres coinciding. If a current I is passed in the square loop of side ‘b’, then the coefficient of mutual inductance between the two loops is:

Options:

\[\frac{\mu_0}{4\pi} 8\sqrt{2} \frac{a^2}{b}\]

86435170085.

\[\frac{\mu_0}{4\pi} 8\sqrt{2} \frac{b^2}{a}\]

86435170086.

\[\frac{\mu_0}{4\pi} 8\sqrt{2} \frac{8\sqrt{2}}{a}\]

86435170087.

\[\frac{\mu_0}{4\pi} 8\sqrt{2} \frac{8\sqrt{2}}{b}\]

86435170088.

In an ac circuit, an inductor, a capacitor and a resistor are connected in series with \(X_L = R = X_C\). Impedance of this circuit is:

Options:

86435170089. Zero
Consider a galvanometer shunted with 5 \( \Omega \) resistance and 2\% of current passes through it. What is the resistance of the given galvanometer?

Options:

1. 300 \( \Omega \)
2. 245 \( \Omega \)
3. 344 \( \Omega \)
4. 226 \( \Omega \)

A coil having \( N \) turns is wound tightly in the form of a spiral with inner and outer radii ‘a’ and ‘b’ respectively. Find the magnetic field at centre, when a current I passes through coil:
\[ \frac{\mu_0}{2(b - a)} \ln \left( \frac{b}{a} \right) \]

\[ \frac{\mu_0 I}{8} \left( \frac{a - b}{a + b} \right) \]

\[ \frac{\mu_0 I}{4(a - b)} \left[ \frac{1}{a} - \frac{1}{b} \right] \]

\[ \frac{\mu_0 I}{8} \left[ \frac{a + b}{a - b} \right] \]

**Question Number : 11 Question Id : 86435121170 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1**

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

<table>
<thead>
<tr>
<th>List - I</th>
<th>List - II</th>
</tr>
</thead>
<tbody>
<tr>
<td>Torque</td>
<td>MLT(^{-1})</td>
</tr>
<tr>
<td>Impulse</td>
<td>MT(^{-2})</td>
</tr>
<tr>
<td>Tension</td>
<td>ML(^2)T(^{-2})</td>
</tr>
<tr>
<td>Surface Tension</td>
<td>MLT(^{-2})</td>
</tr>
</tbody>
</table>

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

**Options :**
Question Number : 12
Question Id : 86435121171
Question Type : MCQ
Option Shuffling : Yes
Is Question Mandatory : No
Correct Marks : 4 Wrong Marks : 1

Two particles A and B having charges 20 \( \mu \text{C} \) and \(-5 \mu \text{C} \) respectively are held fixed with a separation of 5 cm. At what position a third charged particle should be placed so that it does not experience a net electric force?

\[ \begin{array}{ccc}
20 \mu \text{C} & -5 \mu \text{C} \\
A & 5 \text{ cm} & B
\end{array} \]

Options :

- At midpoint between two charges
- At 5 cm from \(-5 \mu \text{C} \) on the right side
- At 5 cm from \(20 \mu \text{C} \) on the left side of system
- At 1.25 cm from a \(-5 \mu \text{C} \) between two charges
Which of the following equations is dimensionally incorrect?

Where \( t = \text{time}, \ h = \text{height}, \ s = \text{surface tension}, \ \theta = \text{angle}, \ p = \text{density}, \ a, \ r = \text{radius}, \ g = \text{acceleration due to gravity}, \ v = \text{volume}, \ \rho = \text{pressure}, \ W = \text{work done}, \ \Gamma = \text{torque}, \ \epsilon = \text{permittivity}, \ E = \text{electric field}, \ J = \text{current density}, \ L = \text{length}.

Options:

1. \[ h = \frac{2s \cos \theta}{\rho rg} \]
2. \[ v = \frac{\pi \pa^4}{8 \eta L} \]
3. \[ W = \Gamma \theta \]
4. \[ J = \epsilon \frac{\partial E}{\partial t} \]
For an ideal gas the instantaneous change in pressure \( p \) with volume \( v \) is given by the equation \( \frac{dp}{dv} = -ap \). If \( p = p_0 \) at \( v = 0 \) is the given boundary condition, then the maximum temperature one mole of gas can attain is:

(Here \( R \) is the gas constant)

**Options:**

86435170113. \( 0^\circ \text{C} \)

86435170114. \( \frac{p_0}{a e R} \)

86435170115. \( \frac{ap_0}{e R} \)

86435170116. \( \text{infinity} \)

**Question Number : 15 Question Id : 86435121174 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1**

A reversible engine has an efficiency of \( \frac{1}{4} \). If the temperature of the sink is reduced by \( 58^\circ \text{C} \), its efficiency becomes double. Calculate the temperature of the sink:

**Options :**

86435170117. \( 280^\circ \text{C} \)
Question Number : 16 Question Id : 86435121175 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1

A uniform heavy rod of weight $10 \text{ kg m s}^{-2}$, cross-sectional area $100 \text{ cm}^2$ and length $20 \text{ cm}$ is hanging from a fixed support. Young modulus of the material of the rod is $2 \times 10^{11} \text{ N m}^{-2}$. Neglecting the lateral contraction, find the elongation of rod due to its own weight:

Options:

86435170121. $2 \times 10^{-9} \text{ m}$

86435170122. $5 \times 10^{-10} \text{ m}$

86435170123. $5 \times 10^{-8} \text{ m}$

86435170124. $4 \times 10^{-8} \text{ m}$

Question Number : 17 Question Id : 86435121176 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1
The masses and radii of the earth and moon are \((M_1, R_1)\) and \((M_2, R_2)\) respectively. Their centres are at a distance ‘r’ apart. Find the minimum escape velocity for a particle of mass ‘m’ to be projected from the middle of these two masses:

Options:

\[
V = \frac{\sqrt{2G(M_1 + M_2)}}{r}
\]

86435170125.

\[
V = \frac{1}{2} \sqrt{\frac{2G(M_1 + M_2)}{r}}
\]

86435170126.

\[
V = \sqrt{\frac{4G(M_1 + M_2)}{r}}
\]

86435170127.

\[
V = \frac{1}{2} \sqrt{\frac{4G(M_1 + M_2)}{r}}
\]

86435170128.

Question Number : 18 Question Id : 86435121177 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1

Angular momentum of a single particle moving with constant speed along circular path:

Options:

86435170129. is zero
remains same in magnitude but changes in the direction

changes in magnitude but remains same in the direction

remains same in magnitude and direction

A helicopter is flying horizontally with a speed \('v'\) at an altitude \('h'\) has to drop a food packet for a man on the ground. What is the distance of helicopter from the man when the food packet is dropped ?

Options :

\[
\sqrt{\frac{2gh}{v^2}} + h^2
\]

\[
\sqrt{\frac{2v^2h}{g} + h^2}
\]
\[ \sqrt{\frac{2ghv^2 + 1}{h^2}} \]

Question Number : 20  Question Id : 86435121179  Question Type : MCQ  Option Shuffling : Yes  Is Question Mandatory : No  Correct Marks : 4  Wrong Marks : 1

A body of mass M moving at speed \( V_0 \) collides elastically with a mass ‘m’ at rest. After the collision, the two masses move at angles \( \theta_1 \) and \( \theta_2 \) with respect to the initial direction of motion of the body of mass M. The largest possible value of the ratio \( M/m \), for which the angles \( \theta_1 \) and \( \theta_2 \) will be equal, is:

Options:

86435170137. 2

86435170138. 3

86435170139. 1

86435170140. 4

Physics Section B

Section Id : 864351981
Section Number : 2
Section type : Online
Mandatory or Optional : Mandatory
Number of Questions : 10
The voltage drop across 15 Ω resistance in the given figure will be _______ V.
A particle of mass 1 kg is hanging from a spring of force constant 100 Nm\(^{-1}\). The mass is pulled slightly downward and released so that it executes free simple harmonic motion with time period \(T\). The time when the kinetic energy and potential energy of the system will become equal, is \(\frac{T}{x}\). The value of \(x\) is \___________.

A car is moving on a plane inclined at 30° to the horizontal with an acceleration of 10 ms\(^{-2}\) parallel to the plane upward. A bob is suspended by a string from the roof of the car. The angle in degrees which the string makes with the vertical is \___________.

(Take \(g = 10\) ms\(^{-2}\))
A block moving horizontally on a smooth surface with a speed of 40 ms\(^{-1}\) splits into two equal parts. If one of the parts moves at 60 ms\(^{-1}\) in the same direction, then the fractional change in the kinetic energy will be \(x : 4\) where \(x = \underline{\phantom{0}}\).

Response Type: Numeric
Evaluation Required For SA: Yes
Show Word Count: Yes
Answers Type: Equal
Text Areas: PlainText
Possible Answers:

When a rubber ball is taken to a depth of \(\underline{\phantom{0}}\) m in deep sea, its volume decreases by 0.5%.

(The bulk modulus of rubber = \(9.8 \times 10^8\) Nm\(^{-2}\)
Density of sea water = \(10^3\) kgm\(^{-3}\)
g = 9.8 m/s\(^2\))

Response Type: Numeric
Evaluation Required For SA: Yes
Show Word Count: Yes
Answers Type: Equal
Text Areas: PlainText
Possible Answers:
A wire having a linear mass density $9.0 \times 10^{-4}$ kg/m is stretched between two rigid supports with a tension of 900 N. The wire resonates at a frequency of 500 Hz. The next higher frequency at which the same wire resonates is 550 Hz. The length of the wire is __________m.

Response Type: Numeric
Evaluation Required For SA: Yes
Show Word Count: Yes
Answers Type: Equal
Text Areas: PlainText
Possible Answers:

1
A capacitor of 50 \( \mu F \) is connected in a circuit as shown in figure. The charge on the upper plate of the capacitor is \( \_\_\_\_\_\_ \mu C \).

![Circuit Diagram]

**Question Number : 28** Question Id : 86435121187 Question Type : SA
Correct Marks : 4 WrongMarks : 0

A square shaped wire with resistance of each side 3 \( \Omega \) is bent to form a complete circle. The resistance between two diametrically opposite points of the circle in unit of \( \Omega \) will be \( \_\_\_\_\_\_\_\_ \).
The electric field in an electromagnetic wave is given by
\[ E = (50 \text{ NC}^{-1}) \sin \omega (t - x/c) \]
The energy contained in a cylinder of volume \( V \) is \( 5.5 \times 10^{-12} \text{ J} \). The value of \( V \) is __________ cm\(^3\).
\( \text{(given} \quad \varepsilon_0 = 8.8 \times 10^{-12} \text{ C}^2\text{N}^{-1}\text{m}^{-2}\)\)
If the sum of the heights of transmitting and receiving antennas in the line of sight of communication is fixed at 160 m, then the maximum range of LOS communication is __________ km.

(Take radius of Earth = 6400 km)

Chemistry Section A

Section Id : 864351982
Section Number : 3
Section type : Online
Mandatory or Optional : Mandatory
Number of Questions : 20
Number of Questions to be attempted : 20
Section Marks : 80
Enable Mark as Answered Mark for Review and Clear Response : Yes
Sub-Section Number : 1
Sub-Section Id : 8643511209
Question Shuffling Allowed : Yes

Question Number : 31 Question Id : 86435121190 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1

Which one of the following is the correct PV vs P plot at constant temperature for an ideal gas? (P and V stand for pressure and volume of the gas respectively)
Question Number : 32 Question Id : 86435121191 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No
In the structure of the dichromate ion, there is a:

Options:

- linear symmetrical Cr−O−Cr bond.
- linear unsymmetrical Cr−O−Cr bond.
- non-linear symmetrical Cr−O−Cr bond.
- non-linear unsymmetrical Cr−O−Cr bond.

Which one of the following 0.10 M aqueous solutions will exhibit the largest freezing point depression?

Options:

- glycine
- glucose
- KHSO₄
- hydrazine
Select the graph that correctly describes the adsorption isotherms at two temperatures $T_1$ and $T_2$ ($T_1 > T_2$) for a gas:

- $x$ – mass of the gas adsorbed
- $m$ – mass of adsorbent
- $P$ – pressure

Options:

![Graph 1]

$86435170163.$

![Graph 2]

$86435170164.$
Given below are two statements: one is labelled as **Assertion (A)** and the other is labelled as **Reason (R)**.

**Assertion (A)**: Metallic character decreases and non-metallic character increases on moving from left to right in a period.

**Reason (R)**: It is due to increase in ionisation enthalpy and decrease in electron gain enthalpy, when one moves from left to right in a period.

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

**Options:**
Both (A) and (R) are correct and (R) is the correct explanation of (A).

Both (A) and (R) are correct but (R) is not the correct explanation of (A).

(A) is true but (R) is false.

(A) is false but (R) is true.

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

**Assertion (A)**: Aluminium is extracted from bauxite by the electrolysis of molten mixture of Al₂O₃ with cryolite.

**Reason (R)**: The oxidation state of Al in cryolite is +3.

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

**Options**:

- Both (A) and (R) are correct and (R) is the correct explanation of (A).
- Both (A) and (R) are correct but (R) is not the correct explanation of (A).
- (A) is true but (R) is false.
(A) is false but (R) is true.

Question Number : 37 Question Id : 86435121196 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1
Given below are two statements :

Statement I : The process of producing syn-gas is called gasification of coal.
Statement II : The composition of syn-gas is \( \text{CO} + \text{CO}_2 + \text{H}_2 \ (1 : 1 : 1) \).

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

Options :

86435170175. Both Statement I and Statement II are true.
86435170176. Both Statement I and Statement II are false.
86435170177. Statement I is true but Statement II is false.
86435170178. Statement I is false but Statement II is true.

Question Number : 38 Question Id : 86435121197 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1
The major component/ingredient of Portland Cement is :

Options :

86435170179. tricalcium aluminate
86435170180. dicalcium aluminate

86435170181. tricalcium silicate

86435170182. dicalcium silicate

Question Number : 39 Question Id : 86435121198 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1

Which one of the following lanthanides exhibits +2 oxidation state with diamagnetic nature? (Given Z for Nd = 60, Yb = 70, La = 57, Ce = 58)

Options :

86435170183. Nd

86435170184. Yb

86435170185. La

86435170186. Ce

Question Number : 40 Question Id : 86435121199 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1

The denticity of an organic ligand, biuret is :

Options :

86435170187. 2
Question Number : 41 Question Id : 86435121200 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1

BOD values (in ppm) for clean water (A) and polluted water (B) are expected respectively as :

Options :

86435170191. A > 15, B > 47
86435170192. A < 5 , B > 17
86435170193. A > 50, B < 27
86435170194. A > 25, B < 17

Question Number : 42 Question Id : 86435121201 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1
Given below are two statements: one is labelled as **Assertion (A)** and the other is labelled as **Reason (R)**.

**Assertion (A):** A simple distillation can be used to separate a mixture of propanol and propanone.

**Reason (R):** Two liquids with a difference of more than 20°C in their boiling points can be separated by simple distillations.

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

**Options:**

- Both (A) and (R) are correct and (R) is the correct explanation of (A).
- Both (A) and (R) are correct but (R) is not the correct explanation of (A).
- (A) is true but (R) is false.
- (A) is false but (R) is true.

**Choose the correct name for compound given below:**

```markdown
\[ \text{Br} \]
```
Given below are two statements: one is labelled as **Assertion (A)** and the other is labelled as **Reason (R)**.

**Assertion (A):** Treatment of bromine water with propene yields 1-bromopropan-2-ol.

**Reason (R):** Attack of water on bromonium ion follows Markovnikov rule and results in 1-bromopropan-2-ol.

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

**Options:**

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

The correct order of reactivity of the given chlorides with acetate in acetic acid is:

Options:
The major product formed in the following reaction is:

\[
\begin{align*}
&\text{CH}_3 \\
&\text{CH}_3 \quad \text{C} \quad \text{CH} \quad \text{CH}_3 \quad \text{CH}_3 \\
&\text{CH}_3 \quad \text{OH} \quad \text{conc. H}_2\text{SO}_4 \quad \text{a few drops} \quad \text{Major Product}
\end{align*}
\]

Options:

1. \[
\begin{align*}
&\text{CH}_3 \\
&\text{CH}_3 \quad \text{C} \quad \text{CH} \quad \text{===} \quad \text{CH}_2 \\
&\text{CH}_3
\end{align*}
\]

2. \[
\begin{align*}
&\text{CH}_3 \\
&\text{CH}_3 \quad \text{C} \quad \text{===} \quad \text{CH} \quad \text{===} \quad \text{CH}_3
\end{align*}
\]

3. \[
\begin{align*}
&\text{CH}_3 \\
&\text{CH}_3 \quad \text{===} \quad \text{CH} \quad \text{===} \quad \text{CH}_3
\end{align*}
\]
The structure of product C, formed by the following sequence of reactions is:

\[
\text{CH}_3\text{COOH} + \text{SOCl}_2 \rightarrow A \xrightarrow{\text{Benzene, AlCl}_3} B \xrightarrow{\text{KCN, OH}} C
\]

Options:
The major products A and B in the following set of reactions are:

\[ A \xrightleftharpoons{\text{LiAlH}_4, \text{H}_3\text{O}^+} \text{OH} \xrightarrow{\text{H}_3\text{O}^+, \text{H}_2\text{SO}_4} B \]

Options:

\[ A = \text{OH} \quad , \quad B = \text{CO}_2\text{H} \]
Question Number: 49  Question Id: 86435121208  Question Type: MCQ  Option Shuffling: Yes  Is Question Mandatory: No
Correct Marks: 4  Wrong Marks: 1

Monomer of Novolac is:

Options:

- o-Hydroxymethylphenol.
- Phenol and melamine.
- 1,3-Butadiene and styrene.
- 3-Hydroxybutanoic acid.
Which one of the following compounds contains $\beta$-C$_1$-C$_4$ glycosidic linkage?

Options:

86435170227. Lactose

86435170228. Amylose

86435170229. Sucrose

86435170230. Maltose
The molarity of the solution prepared by dissolving 6.3 g of oxalic acid \(\text{H}_2\text{C}_2\text{O}_4 \cdot 2\text{H}_2\text{O}\) in 250 mL of water in \(\text{mol L}^{-1}\) is \(x \times 10^{-2}\). The value of \(x\) is \[\text{__________}.\] (Nearest integer)

[Atomic mass : \(\text{H} : 1.0, \text{C} : 12.0, \text{O} : 16.0\)]

Question Number : 52 Question Id : 86435121211 Question Type : SA
Correct Marks : 4 Wrong Marks : 0

\(\text{Ge (Z=32)}\) in its ground state electronic configuration has \(x\) completely filled orbitals with \(m_l = 0\). The value of \(x\) is \[\text{__________}\].

Question Number : 53 Question Id : 86435121212 Question Type : SA
Correct Marks : 4 Wrong Marks : 0
According to the following figure, the magnitude of the enthalpy change of the reaction
\[ A + B \rightarrow M + N \ \text{kJ mol}^{-1} \]
is equal to \[ \_\_\_\_\_\_\_. \] (Integer answer)

\[ \text{Energy} \]
\[ \text{Reaction Coordinate} \]

\[ x = 20 \ \text{kJ mol}^{-1} \]
\[ y = 45 \ \text{kJ mol}^{-1} \]
\[ z = 15 \ \text{kJ mol}^{-1} \]

\[ A_3B_2 \text{ is a sparingly soluble salt of molar mass } M \ (\text{g mol}^{-1}) \text{ and solubility } x \ \text{g L}^{-1}. \text{ The solubility product satisfies } K_{sp} = a \left( \frac{x}{M} \right)^5. \text{ The value of } a \text{ is } \_\_\_\_\_\_. \] (Integer answer)
Consider the following cell reaction

\[
\text{Cd} (s) + \text{Hg}_2\text{SO}_4 (s) + \frac{9}{5} \text{H}_2\text{O} (l) \rightleftharpoons \text{CdSO}_4 \cdot \frac{9}{5} \text{H}_2\text{O} (s) + 2\text{Hg} (l).
\]

The value of \( E^{0}_{\text{cell}} \) is 4.315 V at 25°C. If \( \Delta H^\circ = -825.2 \text{ kJ mol}^{-1} \), the standard entropy change \( \Delta S^\circ \) in J K\(^{-1}\) is \( \underline{300} \). (Nearest integer)

[Given: Faraday constant = 96487 C mol\(^{-1}\)]

Response Type: Numeric
Evaluation Required For SA: Yes
Show Word Count: Yes
Answers Type: Equal
Text Areas: PlainText
Possible Answers:
1

For a first order reaction, the ratio of the time for 75% completion of a reaction to the time for 50% completion is \( \underline{1.7} \). (Integer answer)
Question Number : 57 Question Id : 86435121216 Question Type : SA
Correct Marks : 4 Wrong Marks : 0

The number of halogen(s) forming halic (V) acid is ________.

Question Number : 58 Question Id : 86435121217 Question Type : SA
Correct Marks : 4 Wrong Marks : 0

The number of hydrogen bonded water molecule(s) associated with stoichiometry CuSO₄·5H₂O is ________.
The total number of reagents from those given below, that can convert nitrobenzene into aniline is _________. (Integer answer)

I. Sn – HCl
II. Sn – NH₄OH
III. Fe – HCl
IV. Zn – HCl
V. H₂ – Pd
VI. H₂ – Raney Nickel

Consider the sulphides HgS, PbS, CuS, Sb₂S₃, As₂S₃ and CdS. Number of these sulphides soluble in 50% HNO₃ is _________.

1
Which of the following is not correct for relation R on the set of real numbers?

Options:

86435170241. \((x, y) \in R \iff |x - y| \leq 1\) is reflexive and symmetric.

86435170242. \((x, y) \in R \iff |x| - |y| \leq 1\) is reflexive but not symmetric.

86435170243. \((x, y) \in R \iff 0 < |x| - |y| \leq 1\) is neither transitive nor symmetric.

86435170244. \((x, y) \in R \iff 0 < |x - y| \leq 1\) is symmetric and transitive.
The number of real roots of the equation $e^{4x} + 2e^{3x} - e^x - 6 = 0$ is:

Options:
86435170245. 0
86435170246. 1
86435170247. 2
86435170248. 4

If $a_r = \cos \frac{2r \pi}{9} + i \sin \frac{2r \pi}{9}, \ r = 1, 2, 3, \ldots, \ i = \sqrt{-1}$, then the determinant

$$\begin{vmatrix} a_1 & a_2 & a_3 \\ a_4 & a_5 & a_6 \\ a_7 & a_8 & a_9 \end{vmatrix}$$

is equal to:

Options:
86435170249. $a_9$
86435170250. $a_1 a_9 - a_3 a_7$
If the following system of linear equations
\[ \begin{align*}
2x + y + z &= 5 \\
x - y + z &= 3 \\
x + y + az &= b
\end{align*} \]
has no solution, then:

Options:

1. \( a = \frac{1}{3}, \quad b \neq \frac{7}{3} \)

2. \( a \neq \frac{1}{3}, \quad b = \frac{7}{3} \)

3. \( a = -\frac{1}{3}, \quad b \neq \frac{7}{3} \)
a ≠ \frac{-1}{3}, \ b = \frac{7}{3}

Three numbers are in an increasing geometric progression with common ratio r. If the middle number is doubled, then the new numbers are in an arithmetic progression with common difference d. If the fourth term of GP is 3 r^2, then r^2 – d is equal to:

Options:

\begin{align*}
86435170257. & \quad 7 - 7\sqrt{3} \\
86435170258. & \quad 7 + \sqrt{3} \\
86435170259. & \quad 7 - \sqrt{3} \\
86435170260. & \quad 7 + 3\sqrt{3}
\end{align*}

The sum of 10 terms of the series

\[ \frac{3}{1^2 \times 2^2} + \frac{5}{2^2 \times 3^2} + \frac{7}{3^2 \times 4^2} + \ldots \] is:

Options:
\[
\lim_{x \to 0} \frac{\sin^2(\pi \cos^4 x)}{x^4}
\]
is equal to:

Options:

86435170265. \(2\pi^2\)

86435170266. \(\pi^2\)

86435170267. \(4\pi^2\)

86435170268. \(4\pi\)

Question Number: 67

Question Id: 86435121226

Question Type: MCQ

Option Shuffling: Yes

Is Question Mandatory: No

Correct Marks: 4

Wrong Marks: 1
If the function \( f(x) = \begin{cases} \frac{1}{x} \log_e \left( \frac{1 + \frac{x}{a}}{1 - \frac{x}{b}} \right) & , \quad x < 0 \\ k & , \quad x = 0 \\ \frac{\cos^2 x - \sin^2 x - 1}{\sqrt{x^2 + 1} - 1} & , \quad x > 0 \end{cases} \)

is continuous at \( x = 0 \), then \( \frac{1}{a} + \frac{1}{b} + \frac{4}{k} \) is equal to:

Options:

- 5

- 5

- 4

- 4

The function \( f(x) = |x^2 - 2x - 3| \cdot e^{9x^2 - 12x + 4} \) is not differentiable at exactly:
The integral \( \int \frac{1}{4(x-1)^3(x+2)^5} \, dx \) is equal to:

(\text{where } C \text{ is a constant of integration})

Options:

\[
\frac{4}{3} \left( \frac{x - 1}{x + 2} \right)^\frac{1}{4} + C
\]

\[
\frac{3}{4} \left( \frac{x + 2}{x - 1} \right)^\frac{1}{4} + C
\]
\[ \frac{4}{3} \left( \frac{x - 1}{x + 2} \right)^{\frac{5}{4}} + C \]

\[ \frac{3}{4} \left( \frac{x + 2}{x - 1} \right)^{\frac{5}{4}} + C \]

Question Number : 71 Question Id : 86435121230 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1

If \( \frac{dy}{dx} = \frac{2^{x+y} - 2^x}{2^y} \), \( y(0) = 1 \), then \( y(1) \) is equal to :

Options :

86435170281. \( \log_2(2 + e) \)

86435170282. \( \log_2(2e) \)

86435170283. \( \log_2(1 + e^2) \)

86435170284. \( \log_2(1 + e) \)

Question Number : 72 Question Id : 86435121231 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1
Let \( f \) be a non-negative function in \([0, 1]\) and twice differentiable in \((0, 1)\). If
\[
\int_0^x \sqrt{1 - (f'(t))^2} \, dt = \int_0^x f(t) \, dt, \quad 0 \leq x \leq 1 \quad \text{and} \quad f(0) = 0,
\]
then
\[
\lim_{x \to 0} \frac{1}{x^2} \int_0^x f(t) \, dt :\]
Options:
- equals 0
- equals \( \frac{1}{2} \)
- equals 1
- does not exist

If \( p \) and \( q \) are the lengths of the perpendiculars from the origin on the lines,
\( x \cosec \alpha - y \sec \alpha = k \cot 2\alpha \) and \( x \sin \alpha + y \cos \alpha = k \sin 2\alpha \) respectively, then \( k^2 \) is equal to :
Options:
- \( p^2 + 2q^2 \)
- \( p^2 + 4q^2 \)
- \( 2p^2 + q^2 \)
The length of the latus rectum of a parabola, whose vertex and focus are on the positive x-axis at a distance R and S (> R) respectively from the origin, is:

Options:
1. $2(S + R)$
2. $2(S - R)$
3. $4(S + R)$
4. $4(S - R)$

The line $12x \cos \theta + 5y \sin \theta = 60$ is tangent to which of the following curves?

Options:
1. $x^2 + y^2 = 60$
2. $x^2 + y^2 = 169$
\[144x^2 + 25y^2 = 3600\]

\[25x^2 + 12y^2 = 3600\]

Question Number : 76 Question Id : 86435121235 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1

Let the equation of the plane, that passes through the point \((1, 4, -3)\) and contains the line of intersection of the planes \(3x - 2y + 4z - 7 = 0\) and \(x + 5y - 2z + 9 = 0\), be \(\alpha x + \beta y + \gamma z + 3 = 0\), then \(\alpha + \beta + \gamma\) is equal to :

Options :
86435170301. 23
86435170302. 15
86435170303. -15
86435170304. -23

Question Number : 77 Question Id : 86435121236 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1

cosec\(18^\circ\) is a root of the equation :

Options :
86435170305. \(x^2 - 2x - 4 = 0\)
86435170306. \( x^2 - 2x + 4 = 0 \)

86435170307. \( x^2 + 2x - 4 = 0 \)

86435170308. \( 4x^2 + 2x - 1 = 0 \)

Question Number : 78 Question Id : 86435121237 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No
Correct Marks : 4 Wrong Marks : 1

Let \( \vec{a} \) and \( \vec{b} \) be two vectors such that \( \left| 2 \vec{a} + 3 \vec{b} \right| = \left| 3 \vec{a} + \vec{b} \right| \) and the angle between \( \vec{a} \) and \( \vec{b} \) is 60°. If \( \frac{1}{8} \vec{a} \) is a unit vector, then \( \left| \vec{b} \right| \) is equal to:

Options :

86435170309. 4

86435170310. 5

86435170311. 6

86435170312. 8

Question Number : 79 Question Id : 86435121238 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No
Correct Marks : 4 Wrong Marks : 1
A vertical pole fixed to the horizontal ground is divided in the ratio 3 : 7 by a mark on it with lower part shorter than the upper part. If the two parts subtend equal angles at a point on the ground 18 m away from the base of the pole, then the height of the pole (in meters) is:

Options:

- $12\sqrt{10}$
- $8\sqrt{10}$
- $6\sqrt{10}$
- $12\sqrt{15}$

Let $*, \Box \in \{\land, \lor\}$ be such that the Boolean expression $(p * \neg q) \Rightarrow (p \Box q)$ is a tautology. Then:

Options:

- $*, \Box = \land, \land$
- $*, \Box = \land, \lor$
- $*, \Box = \lor, \land$
- $*, \Box = \lor, \lor$
If \( \left( \frac{3^6}{4^4} \right)^k \) is the term, independent of \( x \), in the binomial expansion of \( \left( \frac{x}{4} - \frac{12}{x^2} \right)^{12} \), then \( k \) is equal to \___________.

Response Type: Numeric
Evaluation Required For SA: Yes
Show Word Count: Yes
Answers Type: Equal
Text Areas: PlainText
Possible Answers:
1
A point $z$ moves in the complex plane such that $\arg\left(\frac{z - 2}{z + 2}\right) = \frac{\pi}{4}$, then the minimum value of $|z - 9\sqrt{2} - 2i|^2$ is equal to __________.

Response Type: Numeric
Evaluation Required For SA: Yes
Show Word Count: Yes
Answers Type: Equal
Text Areas: PlainText
Possible Answers: 1

Question Number: 83 Question Id: 86435121242 Question Type: SA
Correct Marks: 4 Wrong Marks: 0

If ‘$R$’ is the least value of ‘$a$’ such that the function $f(x)=x^2+ax+1$ is increasing on $[1, 2]$ and ‘$S$’ is the greatest value of ‘$a$’ such that the function $f(x)=x^2+ax+1$ is decreasing on $[1, 2]$, then the value of $|R-S|$ is __________.

Response Type: Numeric
Evaluation Required For SA: Yes
Show Word Count: Yes
Answers Type: Equal
Text Areas: PlainText
Possible Answers: 1

Question Number: 84 Question Id: 86435121243 Question Type: SA
Correct Marks: 4 Wrong Marks: 0
Let \([t]\) denote the greatest integer \(\leq t\). Then the value of \(8 \cdot \int_{-\frac{1}{2}}^{1} \left( \lfloor 2x \rfloor + |x| \right) \, dx\) is \___________.

Response Type: Numeric
Evaluation Required For SA: Yes
Show Word Count: Yes
Answers Type: Equal
Text Areas: PlainText
Possible Answers:
1

Question Number: 85 Question Id: 86435121244 Question Type: SA
Correct Marks: 4 Wrong Marks: 0

If \(x \phi(x) = \int_{0}^{x} \left( 3t^2 - 2\phi'(t) \right) \, dt\), \(x > -2\), and \(\phi(0) = 4\), then \(\phi(2)\) is \___________.

Response Type: Numeric
Evaluation Required For SA: Yes
Show Word Count: Yes
Answers Type: Equal
Text Areas: PlainText
Possible Answers:
1

Question Number: 86 Question Id: 86435121245 Question Type: SA
Correct Marks: 4 Wrong Marks: 0

If the variable line \(3x + 4y = \alpha\) lies between the two circles \((x-1)^2 + (y-1)^2 = 1\) and \((x-9)^2 + (y-1)^2 = 4\), without intercepting a chord on either circle, then the sum of all the integral values of \(\alpha\) is \___________.

Response Type: Numeric
Evaluation Required For SA: Yes
Show Word Count: Yes
Answers Type: Equal
Text Areas: PlainText
Possible Answers:
1
The square of the distance of the point of intersection of the line \( \frac{x - 1}{2} = \frac{y - 2}{3} = \frac{z + 1}{6} \)
and the plane \( 2x - y + z = 6 \) from the point \((-1, -1, 2)\) is \( \text{__________} \).

An electric instrument consists of two units. Each unit must function independently for the instrument to operate. The probability that the first unit functions is 0.9 and that of the second unit is 0.8. The instrument is switched on and it fails to operate. If the probability that only the first unit failed and second unit is functioning is \( p \), then 98 \( p \) is equal to \( \text{__________} \).

Response Type: Numeric
The number of six letter words (with or without meaning), formed using all the letters of the word ‘VOWELS’, so that all the consonants never come together, is _______.

The mean of 10 numbers

\[7 \times 8, 10 \times 10, 13 \times 12, 16 \times 14, \ldots\] is _______.