In Millikan’s oil drop experiment, what is viscous force acting on an uncharged drop of radius $2.0 \times 10^{-5}$ m and density $1.2 \times 10^3$ kgm$^{-3}$? Take viscosity of liquid $= 1.8 \times 10^{-5}$ Nsm$^{-2}$. (Neglect buoyancy due to air).

Options:

86435168171. $5.8 \times 10^{-10}$ N

86435168172. $1.8 \times 10^{-10}$ N

86435168173. $3.8 \times 10^{-11}$ N

86435168174. $3.9 \times 10^{-10}$ N

Moment of inertia of a square plate of side $l$ about the axis passing through one of the corner and perpendicular to the plane of square plate is given by:

Options:
A huge circular arc of length 4.4 ly subtends an angle ‘4s’ at the centre of the circle. How long it would take for a body to complete 4 revolution if its speed is 8 AU per second?

Given: 1 ly = 9.46 × 10^{15} m
1 AU = 1.5 × 10^{11} m

Options:

86435168179. 4.5 × 10^{10} s
86435168180. 4.1 × 10^{8} s
86435168181. 3.5 × 10^{6} s
86435168182. $7.2 \times 10^8$ s

Question Number : 4  Question Id : 86435120533  Question Type : MCQ  Option Shuffling : Yes  Is Question Mandatory : No  Correct Marks : 4  Wrong Marks : 1

The resultant of these forces $\mathbf{OP}, \mathbf{OQ}, \mathbf{OR}, \mathbf{OS}$ and $\mathbf{OT}$ is approximately __________ N.

[Take $\sqrt{3} = 1.7, \sqrt{2} = 1.4$ Given $\hat{i}$ and $\hat{j}$ unit vectors along x, y axis]

Options:

$3\hat{i} + 15\hat{j}$
\[ -1.5 \hat{i} - 15.5 \hat{j} \]

\[ 9.25 \hat{i} + 5 \hat{j} \]

\[ 2.5 \hat{i} - 14.5 \hat{j} \]

**Question Number : 5**  
**Question Id : 86435120534**  
**Question Type : MCQ**  
**Option Shuffling : Yes**  
**Is Question Mandatory : No**  
**Correct Marks : 4**  
**Wrong Marks : 1**

**Which of the following is not a dimensionless quantity?**

**Options:**

- Quality factor
- Power factor
- Relative magnetic permeability \((\mu_r)\)
- Permeability of free space \((\mu_0)\)

**Question Number : 6**  
**Question Id : 86435120535**  
**Question Type : MCQ**  
**Option Shuffling : Yes**  
**Is Question Mandatory : No**  
**Correct Marks : 4**  
**Wrong Marks : 1**

If \(E\) and \(H\) represents the intensity of electric field and magnetising field respectively, then the unit of \(E/H\) will be:
An ideal gas is expanding such that $PT^3 =$ constant. The coefficient of volume expansion of the gas is:

Options:

86435168191. $\frac{1}{T}$
86435168192. $\frac{2}{T}$
86435168193. $\frac{3}{T}$
A balloon carries a total load of 185 kg at normal pressure and temperature of 27°C. What load will the balloon carry on rising to a height at which the barometric pressure is 45 cm of Hg and the temperature is −7°C. Assuming the volume constant?

Options:

- 123.54 kg
- 214.15 kg
- 219.07 kg
- 181.46 kg
The variation of displacement with time of a particle executing free simple harmonic motion is shown in the figure.

The potential energy $U(x)$ versus time $(t)$ plot of the particle is correctly shown in figure:

Options:

1. $86435168203.$
2. $86435168204.$
3. $86435168205.$
Calculate the amount of charge on capacitor of 4 $\mu$F. The internal resistance of battery is 1 $\Omega$:

Options:
- zero
- 4 $\mu$C
- 8 $\mu$C
A uniformly charged disc of radius $R$ having surface charge density $\sigma$ is placed in the $xy$ plane with its center at the origin. Find the electric field intensity along the $z$-axis at a distance $Z$ from origin:

Options:

$$E = \frac{\sigma}{2\varepsilon_0} \left(1 + \frac{Z}{(Z^2 + R^2)^{1/2}}\right)$$

$$E = \frac{\sigma}{2\varepsilon_0} \left(1 - \frac{Z}{(Z^2 + R^2)^{1/2}}\right)$$

$$E = \frac{2\varepsilon_0}{\sigma} \left(\frac{1}{(Z^2 + R^2)^{1/2}} + Z\right)$$

$$E = \frac{\sigma}{2\varepsilon_0} \left(\frac{1}{(Z^2 + R^2)} + \frac{1}{Z^2}\right)$$

Question Number : 11 Question Id : 86435120540 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No
Correct Marks : 4 Wrong Marks : 1

Question Number : 12 Question Id : 86435120541 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No
Correct Marks : 4 Wrong Marks : 1
Five identical cells each of internal resistance 1 Ω and emf 5 V are connected in series and in parallel with an external resistance ‘R’. For what value of ‘R’, current in series and parallel combination will remain the same?

Options:

1 Ω
25 Ω
10 Ω
5 Ω

Question Number : 13 Question Id : 86435120542 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No
Correct Marks : 4 Wrong Marks : 1
Two ions of masses 4 amu and 16 amu have charges +2e and +3e respectively. These ions pass through the region of constant perpendicular magnetic field. The kinetic energy of both ions is same. Then:

Options:

lighter ion will be deflected more than heavier ion
lighter ion will be deflected less than heavier ion
both ions will be deflected equally
no ion will be deflected
A bar magnet is passing through a conducting loop of radius R with velocity $v$. The radius of the bar magnet is such that it just passes through the loop. The induced e.m.f. in the loop can be represented by the approximate curve:

Options:
Electric field in a plane electromagnetic wave is given by

\[ E = 50 \sin(500x - 10 \times 10^{10}t) \text{ V/m} \]

The velocity of electromagnetic wave in this medium is:
(Given \( C = \) speed of light in vacuum)

Options:

1. \( \frac{2}{3} C \)
2. \( C \)
3. \( \frac{3}{2} C \)
An object is placed beyond the centre of curvature $C$ of the given concave mirror. If the distance of the object is $d_1$ from $C$ and the distance of the image formed is $d_2$ from $C$, the radius of curvature of this mirror is:

Options:

- $\frac{d_1 d_2}{d_1 - d_2}$
- $\frac{d_1 d_2}{d_1 + d_2}$
- $\frac{2d_1 d_2}{d_1 - d_2}$
- $\frac{2d_1 d_2}{d_1 + d_2}$
Find the distance of the image from object O, formed by the combination of lenses in the figure:

\[ f = +10 \text{ cm} \quad f = -10 \text{ cm} \quad f = +30 \text{ cm} \]

Options:

86435168235. 10 cm
86435168236. 20 cm
86435168237. 75 cm
86435168238. infinity

In a photoelectric experiment, increasing the intensity of incident light:
increases the number of photons incident and also increases the K.E. of the ejected electrons.

increases the number of photons incident and the K.E. of the ejected electrons remains unchanged.

increases the frequency of photons incident and increases the K.E. of the ejected electrons.

increases the frequency of photons incident and the K.E. of the ejected electrons remains unchanged.

There are $10^{10}$ radioactive nuclei in a given radioactive element. Its half-life time is 1 minute. How many nuclei will remain after 30 seconds?

$$\left(\sqrt{2} = 1.414\right)$$

Options:

86435168243. $10^5$

86435168244. $2 \times 10^{10}$
86435168245. \(7 \times 10^9\)

86435168246. \(4 \times 10^{10}\)

Question Number : 20 Question Id : 86435120549 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1

For a transistor in CE mode to be used as an amplifier, it must be operated in :

Options :

86435168247. Cut-off region only

86435168248. Saturation region only

86435168249. Both cut-off and Saturation

86435168250. The active region only

Physics Section B

Section Id : 864351939
Section Number : 2
Section type : Online
Mandatory or Optional : Mandatory
Number of Questions : 10
Number of Questions to be attempted : 5
Section Marks : 20
Enable Mark as Answered Mark for Review and Clear Response : Yes
A circuit is arranged as shown in figure. The output voltage $V_o$ is equal to _________V.

![Circuit Diagram]

Response Type: Numeric
Evaluation Required For SA: Yes
Show Word Count: Yes
Answers Type: Equal
Text Areas: PlainText
Possible Answers: 1
Two persons A and B perform same amount of work in moving a body through a certain distance d with application of forces acting at angles 45° and 60° with the direction of displacement respectively. The ratio of force applied by person A to the force applied by person B is \( \frac{1}{\sqrt{x}} \). The value of \( x \) is __________.

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

Question Number : 23 Question Id : 86435120552 Question Type : SA
Correct Marks : 4 Wrong Marks : 0

If the velocity of a body related to displacement \( x \) is given by \( v = \sqrt{5000 + 24x} \) m/s, then the acceleration of the body is __________ m/s\(^2\).

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

Question Number : 24 Question Id : 86435120553 Question Type : SA
Correct Marks : 4 Wrong Marks : 0
A body of mass \(2M\) splits into four masses \(\{m, M-m, m, M-m\}\), which are rearranged to form a square as shown in the figure. The ratio of \(\frac{M}{m}\) for which, the gravitational potential energy of the system becomes maximum is \(x:1\). The value of \(x\) is \boxed{1}\.
Two cars X and Y are approaching each other with velocities 36 km/h and 72 km/h respectively. The frequency of a whistle sound as emitted by a passenger in car X, heard by the passenger in car Y is 1320 Hz. If the velocity of sound in air is 340 m/s, the actual frequency of the whistle sound produced is ________ Hz.

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

Question Number : 26 Question Id : 86435120555 Question Type : SA
Correct Marks : 4 Wrong Marks : 0

First, a set of n equal resistors of 10 Ω each are connected in series to a battery of emf 20 V and internal resistance 10 Ω. A current I is observed to flow. Then, the n resistors are connected in parallel to the same battery. It is observed that the current is increased 20 times, then the value of n is ________.

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

Question Number : 27 Question Id : 86435120556 Question Type : SA
Correct Marks : 4 Wrong Marks : 0
A uniform conducting wire of length is 24a, and resistance R is wound up as a current carrying coil in the shape of an equilateral triangle of side ‘a’ and then in the form of a square of side ‘a’. The coil is connected to a voltage source $V_0$. The ratio of magnetic moment of the coils in case of equilateral triangle to that for square is $1 : \sqrt{y}$ where $y$ is __________.

Question Number : 28 Question Id : 86435120557 Question Type : SA
Correct Marks : 4 Wrong Marks : 0
The alternating current is given by

$$i = \left\{ \sqrt{42} \sin \left( \frac{2\pi}{T} t \right) + 10 \right\} A$$

The r.m.s. value of this current is __________ A.

Question Number : 29 Question Id : 86435120558 Question Type : SA
A transmitting antenna has a height of 320 m and that of receiving antenna is 2000 m. The maximum distance between them for satisfactory communication in line of sight mode is ‘d’. The value of ‘d’ is ________ km.

A rod CD of thermal resistance 10.0 Kω^{-1} is joined at the middle of an identical rod AB as shown in figure. The ends A, B and D are maintained at 200°C, 100°C and 125°C respectively. The heat current in CD is P watt. The value of P is ________.
The unit of the van der Waals gas equation parameter ‘a’ in

\[
\left( P + \frac{an^2}{V^2} \right)(V - nb) = nRT
\]

is:

Options:

86435168261. \text{ kg m s}^{-2}

86435168262. \text{ atm dm}^6 \text{ mol}^{-2}
**Question Number : 32**  
**Question Id : 86435120561**  
**Question Type : MCQ**  
**Option Shuffling : Yes**  
**Is Question Mandatory : No**  
**Correct Marks : 4**  
**Wrong Marks : 1**

Match items of **List - I** with those of **List - II**:

<table>
<thead>
<tr>
<th>List - I (Property)</th>
<th>List - II (Example)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Diamagnetism</td>
<td>(i) MnO</td>
</tr>
<tr>
<td>(b) Ferrimagnetism</td>
<td>(ii) O₂</td>
</tr>
<tr>
<td>(c) Paramagnetism</td>
<td>(iii) NaCl</td>
</tr>
<tr>
<td>(d) Antiferromagnetism</td>
<td>(iv) Fe₃O₄</td>
</tr>
</tbody>
</table>

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

**Options :**

(a)-(iii), (b)-(iv), (c)-(ii), (d)-(i)  
86435168265.

(a)-(ii), (b)-(i), (c)-(iii), (d)-(iv)  
86435168266.

(a)-(i), (b)-(iii), (c)-(iv), (d)-(ii)  
86435168267.

(a)-(iv), (b)-(ii), (c)-(i), (d)-(iii)  
86435168268.
Match List - I with List - II:

<table>
<thead>
<tr>
<th>List - I</th>
<th>List - II</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Species)</td>
<td>(No. of lone pairs of electrons on the central atom)</td>
</tr>
<tr>
<td>(a) XeF₂</td>
<td>(i) 0</td>
</tr>
<tr>
<td>(b) XeO₂F₂</td>
<td>(ii) 1</td>
</tr>
<tr>
<td>(c) XeO₃F₂</td>
<td>(iii) 2</td>
</tr>
<tr>
<td>(d) XeF₄</td>
<td>(iv) 3</td>
</tr>
</tbody>
</table>

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

Options:

86435168269. (a)-(iii), (b)-(iv), (c)-(ii), (d)-(i)

86435168270. (a)-(iv), (b)-(ii), (c)-(i), (d)-(iii)

86435168271. (a)-(iv), (b)-(i), (c)-(ii), (d)-(iii)

86435168272. (a)-(iii), (b)-(ii), (c)-(iv), (d)-(i)
Tyndall effect is more effectively shown by:

**Options:**
- true solution
- lyophilic colloid
- lyophobic colloid
- suspension

In which one of the following molecules strongest back donation of an electron pair from halide to boron is expected?

**Options:**
- $\text{BI}_3$
- $\text{BBr}_3$
- $\text{BCl}_3$
- $\text{BF}_3$
Which refining process is generally used in the purification of low melting metals?

Options:

Electrolysis

Liquation

Zone refining

Chromatographic method

Deuterium resembles hydrogen in properties but:

Options:

reacts vigorously than hydrogen

emits $\beta^+$ particles

reacts slower than hydrogen

reacts just as hydrogen
Question Number : 38 Question Id : 86435120567 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1

The number of water molecules in gypsum, dead burnt plaster and plaster of Paris, respectively are:
Options:

86435168289.  2, 0 and 1

86435168290.  0.5, 0 and 2

86435168291.  5, 0 and 0.5

86435168292.  2, 0 and 0.5

Question Number : 39 Question Id : 86435120568 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1

In polythionic acid, \( \text{H}_2\text{S}_x\text{O}_6 \) \( (x = 3 \text{ to } 5) \) the oxidation state(s) of sulphur is/are:
Options:

86435168293.  +5 only

86435168294.  +3 and +5 only

86435168295.  0 and +5 only

86435168296.  +6 only
The nature of oxides $V_2O_3$ and CrO is indexed as ‘$X$’ and ‘$Y$’ type respectively. The correct set of $X$ and $Y$ is:

Options:

86435168297. $X = \text{amphoteric}$ $Y = \text{basic}$

86435168298. $X = \text{basic}$ $Y = \text{basic}$

86435168299. $X = \text{basic}$ $Y = \text{amphoteric}$

86435168300. $X = \text{acidic}$ $Y = \text{acidic}$

The gas ‘$A$’ is having very low reactivity reaches to stratosphere. It is non-toxic and non-flammable but dissociated by UV-radiations in stratosphere. The intermediates formed initially from the gas ‘$A$’ are:

Options:

86435168301. \[
\begin{array}{c}
\cdot \text{CH}_3 + \cdot \text{CF}_2\text{Cl} \\
\end{array}
\]

86435168302. \[
\begin{array}{c}
\cdot \text{ClO} + \cdot \text{CH}_3 \\
\end{array}
\]
In the following sequence of reactions, the final product D is:

\[
\text{CH}_3 - \text{C} = \text{C} - \text{H} + \text{NaNH}_2 \rightarrow \text{A} \xrightarrow{\text{Br}} \text{B} \xrightarrow{\text{H}_2/\text{Pd-C}} \text{C} \xrightarrow{\text{CrO}_3} \text{D}
\]

Options:

1. \(\text{H}_3\text{C} - \text{CH} = \text{CH} - \text{CH(OH)} - \text{CH}_2 - \text{CH}_2 - \text{CH}_3\)

2. \(\text{H}_3\text{C} - \text{CH}_2 - \text{CH}_2 - \text{CH}_2 - \text{CH}_2 - \text{CH}_2 - \text{CH} - \text{H}\)

3. \(\text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{CH}_2 - \text{C} - \text{CH}_3\)

4. \(\text{CH}_3 - \text{CH} = \text{CH} - \text{CH}_2 - \text{CH}_2 - \text{CH}_2 - \text{COOH}\)
In the following sequence of reactions the P is:

\[
\begin{align*}
\text{Cl} \quad \text{Mg} \quad \text{ether} \quad [A] \quad \text{ethanol} \\
\rightarrow & \quad \rightarrow \\
\end{align*}
\]

(Major Product)

Options:

1. O – CH₂CH₃
2. CH₂CH₃
3. O – CH₂CH₃
The structure of the starting compound $P$ used in the reaction given below is:

$$P \xrightarrow{1. \text{ NaOCl}} \xrightarrow{2. \text{ H}_3\text{O}^+}$$

Options:

86435168313.

86435168314.

86435168315.
Given below are two statements: one is labelled as **Assertion (A)** and the other is labelled as **Reason (R)**.

**Assertion (A)**: Synthesis of ethyl phenyl ether may be achieved by Williamson synthesis.

**Reason (R)**: Reaction of bromobenzene with sodium ethoxide yields ethyl phenyl ether.

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

**Options**:

86435168317. Both (A) and (R) are correct and (R) is the correct explanation of (A)

86435168318. Both (A) and (R) are correct but (R) is NOT the correct explanation of (A)

86435168319. (A) is correct but (R) is not correct

86435168320. (A) is not correct but (R) is correct
The major product of the following reaction is:

\[
\text{CH}_3-\text{CH}-\text{CH}_2-\text{CH}_2-\text{C}-\text{Cl} \xrightarrow{(i) \text{ alcoholic NH}_3, (ii) \text{NaOH, Br}_2, (iii) \text{NaNO}_2, \text{HCl}, (iv) \text{H}_2\text{O}} \text{Major Product}
\]

Options:

1. \[
\text{CH}_3-\text{CH}-\text{CH}_2-\text{CH}_2\text{OH} \quad 86435168321.
\]
2. \[
\text{Br} \quad \text{CH}_3-\text{CH}-\text{CH}_2-\text{CH}_2\text{OH} \quad 86435168322.
\]
3. \[
\text{CH}_3-\text{CH}-\text{CH}_2-\text{CH}_2-\text{Cl} \quad 86435168323.
\]
4. \[
\text{CH}_3-\text{CH}-\text{CH}_2-\text{CH}_2-\text{CH}_2\text{OH} \quad 86435168324.
\]
Which of the following is not a correct statement for primary aliphatic amines?

Options:

86435168325.
Primary amines can be prepared by the Gabriel phthalimide synthesis.

86435168326.
Primary amines are less basic than the secondary amines.

86435168327.
The intermolecular association in primary amines is less than the intermolecular association in secondary amines.

86435168328.
Primary amines on treating with nitrous acid solution form corresponding alcohols except methyl amine.
The correct statement about (A), (B), (C) and (D) is:

Options:

(A), (B) and (C) are narcotic analgesics

86435168329.
Out of following isomeric forms of uracil, which one is present in RNA?

Options:

1. (B), (C) and (D) are tranquillizers

2. (A) and (D) are tranquillizers

3. (B) and (C) are tranquillizers
Acidic ferric chloride solution on treatment with excess of potassium ferrocyanide gives a Prussian blue coloured colloidal species. It is:

Options:

- $\text{Fe}_4[\text{Fe(CN)}_6]_3$
- $\text{HFe}[\text{Fe(CN)}_6]$
- $\text{KFe}[\text{Fe(CN)}_6]$
- $\text{KFe}[\text{Fe(CN)}_6]$
The kinetic energy of an electron in the second Bohr orbit of a hydrogen atom is equal to $\frac{\hbar^2}{x m a_0^2}$. The value of 10 $x$ is _________. ($a_0$ is radius of Bohr’s orbit)

(Nearest integer)

[Given: $\pi = 3.14$]
200 mL of 0.2 M HCl is mixed with 300 mL of 0.1 M NaOH. The molar heat of neutralization of this reaction is $-57.1$ kJ. The increase in temperature in $^\circ$C of the system on mixing is $x \times 10^{-2}$. The value of $x$ is _________. (Nearest integer)

[Given: Specific heat of water $= 4.18$ J g$^{-1}$ K$^{-1}$
Density of water $= 1.00$ g cm$^{-3}$]

(Assume no volume change on mixing)

1 kg of 0.75 molal aqueous solution of sucrose can be cooled up to $-4^\circ$C before freezing. The amount of ice (in g) that will be separated out is _________. (Nearest integer)

[Given: $K_f$ (H$_2$O) $= 1.86$ K kg mol$^{-1}$]
Question Number : 54 Question Id : 86435120583 Question Type : SA
Correct Marks : 4 Wrong Marks : 0

The number of moles of NH₃, that must be added to 2 L of 0.80 M AgNO₃ in order to reduce the concentration of Ag⁺ ions to 5.0 × 10⁻⁸ M (K₉formation for [Ag(NH₃)₂]⁺ = 1.0 × 10⁸) is _________. (Nearest integer)

[Assume no volume change on adding NH₃]

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

1

Question Number : 55 Question Id : 86435120584 Question Type : SA
Correct Marks : 4 Wrong Marks : 0

When 10 mL of an aqueous solution of KMnO₄ was titrated in acidic medium, equal volume of 0.1 M of an aqueous solution of ferrous sulphate was required for complete discharge of colour. The strength of KMnO₄ in grams per litre is ________ × 10⁻². (Nearest integer)

[Atomic mass of K = 39, Mn = 55, O = 16]

Response Type : Numeric
Evaluation Required For SA : Yes
Show Word Count : Yes
Answers Type : Equal
The reaction that occurs in a breath analyser, a device used to determine the alcohol level in a person’s blood stream is

$$2K_2Cr_2O_7 + 8H_2SO_4 + 3C_2H_6O \rightarrow 2Cr_2(SO_4)_3 + 3C_2H_4O_2 + 2K_2SO_4 + 11H_2O$$

If the rate of appearance of $Cr_2(SO_4)_3$ is $2.67 \text{ mol min}^{-1}$ at a particular time, the rate of disappearance of $C_2H_6O$ at the same time is ________ $\text{mol min}^{-1}$. (Nearest integer)

The number of $f$ electrons in the ground state electronic configuration of Np ($Z = 93$) is ________. (Integer answer)
1 mol of an octahedral metal complex with formula MCl₃·2L on reaction with excess of AgNO₃ gives 1 mol of AgCl. The denticity of Ligand L is _________. (Integer answer)

In Carius method for estimation of halogens, 0.2 g of an organic compound gave 0.188 g of AgBr. The percentage of bromine in the compound is _________. (Nearest integer) [Atomic mass : Ag = 108, Br = 80]
The number of moles of CuO, that will be utilized in Dumas method for estimating nitrogen in a sample of 57.5 g of N,N-dimethylaminopentane is \[ \underline{\text{_________}} \times 10^{-2}. \] (Nearest integer)

Mathematics Section A

Section Id : 864351942
Section Number : 5
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 : 8643511169
Question Shuffling Allowed : Yes

Question Number : 61 Question Id : 86435120590 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No
Correct Marks : 4 Wrong Marks : 1

If \( x^2 + 9y^2 - 4x + 3 = 0, x, y \in \mathbb{R} \), then \( x \) and \( y \) respectively lie in the intervals:

Options :
86435168351. \([1, 3]\) and \([1, 3]\)
If \( S = \left\{ z \in \mathbb{C} : \frac{z - i}{z + 2i} \in \mathbb{R} \right\} \), then:

Options:

86435168355. \( S \) contains only one element

86435168356. \( S \) contains exactly two elements

86435168357. \( S \) is a straight line in the complex plane

86435168358. \( S \) is a circle in the complex plane
If the matrix $A = \begin{pmatrix} 0 & 2 \\ K & -1 \end{pmatrix}$ satisfies $A(A^3 + 3I) = 2I$, then the value of $K$ is:

Options:

- $\frac{-1}{2}$
- $-1$
- $\frac{1}{2}$
- $1$

If for $x, y \in \mathbb{R}, x > 0$, $y = \log_{10} x + \log_{10} x^{1/3} + \log_{10} x^{1/9} + \ldots$ up to $\infty$ terms and $\frac{2 + 4 + 6 + \ldots + 2y}{3 + 6 + 9 + \ldots + 3y} = \frac{4}{\log_{10} x}$, then the ordered pair $(x, y)$ is equal to:

Options:

- $(10^6, 6)$
- $(10^2, 3)$
If \( \alpha, \beta \) are the distinct roots of \( x^2 + bx + c = 0 \), then \( \lim_{x \to \beta} \frac{e^{2(x^2 + bx + c)} - 1 - 2(x^2+bx+c)}{(x - \beta)^2} \) is equal to:

Options:

86435168367. \( b^2 - 4c \)

86435168368. \( b^2 + 4c \)

86435168369. \( 2(b^2 + 4c) \)

86435168370. \( 2(b^2 - 4c) \)
A wire of length 20 m is to be cut into two pieces. One of the pieces is to be made into a square and the other into a regular hexagon. Then the length of the side (in meters) of the hexagon, so that the combined area of the square and the hexagon is minimum, is:

Options:

\[
\frac{5}{2 + \sqrt{3}}
\]

86435168371.

\[
\frac{5}{3 + \sqrt{3}}
\]

86435168372.

\[
\frac{10}{3 + 2\sqrt{3}}
\]

86435168373.

\[
\frac{10}{2 + 3\sqrt{3}}
\]

86435168374.

Let A be a fixed point (0, 6) and B be a moving point (2t, 0). Let M be the mid-point of AB and the perpendicular bisector of AB meets the y-axis at C. The locus of the mid-point P of MC is:

Options:

\[
2x^2 - 3y + 9 = 0
\]

86435168375.
If \( U_n = \left(1 + \frac{1}{n^2}\right) \left(1 + \frac{2^2}{n^2}\right)^2 \ldots \left(1 + \frac{n^2}{n^2}\right)^n \), then \( \lim_{x \to \infty} \left(U_n^{\frac{-4}{n^2}}\right) \) is equal to:

Options:

\[
\begin{align*}
86435168379. & \quad \frac{4}{e} \\
86435168380. & \quad \frac{4}{e^2} \\
86435168381. & \quad \frac{16}{e^2} \\
86435168382. & \quad \frac{e^2}{16}
\end{align*}
\]
Let \( y = y(x) \) be the solution of the differential equation \( \frac{dy}{dx} = 2(y + 2\sin x - 5) x - 2\cos x \) such that \( y(0) = 7 \). Then \( y(\pi) \) is equal to:

Options:

86435168383. \( e^{\pi^2} + 5 \)

86435168384. \( 2e^{\pi^2} + 5 \)

86435168385. \( 7e^{\pi^2} + 5 \)

86435168386. \( 3e^{\pi^2} + 5 \)

A tangent and a normal are drawn at the point P(2, -4) on the parabola \( y^2 = 8x \), which meet the directrix of the parabola at the points A and B respectively. If Q(a, b) is a point such that AQBP is a square, then \( 2a + b \) is equal to:

Options:

86435168387. \( -12 \)
Let us consider a curve, \( y = f(x) \) passing through the point \((-2, 2)\) and the slope of the tangent to the curve at any point \((x, f(x))\) is given by \( f(x) + xf'(x) = x^2 \). Then:

Options:

1. \( x^3 - 3xf(x) - 4 = 0 \)
2. \( x^2 + 2xf(x) - 12 = 0 \)
3. \( x^3 + xf(x) + 12 = 0 \)
4. \( x^2 + 2xf(x) + 4 = 0 \)
Equation of a plane at a distance $\sqrt{\frac{2}{21}}$ from the origin, which contains the line of intersection of the planes $x-y-z-1=0$ and $2x+y-3z+4=0$, is:

Options:

86435168395. $3x - 4z + 3 = 0$

86435168396. $-x + 2y + 2z - 3 = 0$

86435168397. $3x - y - 5z + 2 = 0$

86435168398. $4x - y - 5z + 2 = 0$

The distance of the point $(1, -2, 3)$ from the plane $x-y+z=5$ measured parallel to a line, whose direction ratios are $2, 3, -6$ is:

Options:

86435168399. $2$

86435168400. $3$

86435168401. $1$

86435168402. $5$
Let \( \frac{\sin A}{\sin B} = \frac{\sin (A - C)}{\sin (C - B)} \), where \( A, B, C \) are angles of a triangle \( ABC \). If the lengths of the sides opposite these angles are \( a, b, c \) respectively, then:

Options:

86435168403. \( a^2, b^2, c^2 \) are in A.P.

86435168404. \( b^2, c^2, a^2 \) are in A.P.

86435168405. \( c^2, a^2, b^2 \) are in A.P.

86435168406. \( b^2 - a^2 = a^2 + c^2 \)
When a certain biased die is rolled, a particular face occurs with probability \( \frac{1}{6} - x \) and its opposite face occurs with probability \( \frac{1}{6} + x \). All other faces occur with probability \( \frac{1}{6} \).

Note that opposite faces sum to 7 in any die. If \( 0 < x < \frac{1}{6} \), and the probability of obtaining total sum = 7, when such a die is rolled twice, is \( \frac{13}{96} \), then the value of \( x \) is:

Options:

- \( \frac{1}{9} \)
- \( \frac{1}{16} \)
- \( \frac{1}{12} \)
- \( \frac{1}{8} \)

Question Number : 76 Question Id : 86435120605 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1
If \((\sin^{-1} x)^2 - (\cos^{-1} x)^2 = a; 0 < x < 1, a \neq 0\), then the value of \(2x^2 - 1\) is:

Options:

\[
\cos \left( \frac{2a}{\pi} \right)
\]

86435168411.

\[
\sin \left( \frac{2a}{\pi} \right)
\]

86435168412.

\[
\sin \left( \frac{4a}{\pi} \right)
\]

86435168413.

\[
\cos \left( \frac{4a}{\pi} \right)
\]

86435168414.

\[
\int_{6}^{16} \frac{\log_e x^2}{\log_e x^2 + \log_e (x^2 - 44x + 484)} \, dx
\]

is equal to:

Options:

86435168415. 10

86435168416. 8
If $0 < x < 1$, then $\frac{3}{2} x^2 + \frac{5}{3} x^3 + \frac{7}{4} x^4 + ..., $ is equal to:

Options:

86435168419. $x \left( \frac{1 + x}{1 - x} \right) + \log_e (1-x)$

86435168420. $\frac{1 + x}{1 - x} + \log_e (1-x)$

86435168421. $x \left( \frac{1 - x}{1 + x} \right) + \log_e (1-x)$

86435168422. $\frac{1 - x}{1 + x} + \log_e (1-x)$
The statement \((p \land (p \rightarrow q) \land (q \rightarrow r)) \rightarrow r\) is:

Options:

86435168423. a tautology
86435168424. a fallacy
86435168425. equivalent to \(p \rightarrow \sim r\)
86435168426. equivalent to \(q \rightarrow \sim r\)

\[\sum_{k=0}^{20} \left( \binom{20}{k} \right)^2 \quad \text{is equal to}: \]

Options:

86435168427. \(\binom{41}{20}\)
86435168428. \(\binom{40}{19}\)
86435168429. \(\binom{40}{20}\)
86435168430. \(\binom{40}{21}\)
If \( A = \{x \in \mathbb{R} : |x - 2| > 1\}, \quad B = \{x \in \mathbb{R} : \sqrt{x^2 - 3} > 1\}, \quad C = \{x \in \mathbb{R} : |x - 4| \geq 2\} \) and \( Z \) is the set of all integers, then the number of subsets of the set \((A \cap B \cap C)^c \cap Z\) is ________.
If the system of linear equations
\[2x + y - z = 3\]
\[x - y - z = \alpha\]
\[3x + 3y + \beta z = 3\]
has infinitely many solution, then \(\alpha + \beta - \alpha\beta\) is equal to \___________.

A number is called a palindrome if it reads the same backward as well as forward. For example, 285582 is a six digit palindrome. The number of six digit palindromes, which are divisible by 55, is \___________.

Question Number : 83 Question Id : 86435120612 Question Type : SA
Correct Marks : 4 Wrong Marks : 0

Question Number : 84 Question Id : 86435120613 Question Type : SA
Correct Marks : 4 Wrong Marks : 0
If \( y^{1/4} + y^{-1/4} = 2x \), and \( (x^2 - 1) \frac{d^2 y}{dx^2} + \alpha \frac{dy}{dx} + \beta y = 0 \), then \( |\alpha - \beta| \) is equal to 

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

The number of distinct real roots of the equation \( 3x^4 + 4x^3 - 12x^2 + 4 = 0 \) is 

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

Let the equation \( x^2 + y^2 + px + (1 - p)y + 5 = 0 \) represent circles of varying radius \( r \in (0, 5] \). Then the number of elements in the set \( S = \{q : q = p^2 \text{ and } q \text{ is an integer}\} \) is 

Response Type: Numeric
Evaluation Required For SA: Yes
Show Word Count: Yes
Answers Type: Equal
If the minimum area of the triangle formed by a tangent to the ellipse \( \frac{x^2}{b^2} + \frac{y^2}{4a^2} = 1 \) and the co-ordinate axis is \( kab \), then \( k \) is equal to \( \underline{} \).

Let \( n \) be an odd natural number such that the variance of \( 1, 2, 3, 4, \ldots, n \) is 14. Then \( n \) is equal to \( \underline{} \).
Let \( \vec{a} = \hat{i} + 5 \hat{j} + \alpha \hat{k} \), \( \vec{b} = \hat{i} + 3 \hat{j} + \beta \hat{k} \) and \( \vec{c} = -\hat{i} + 2 \hat{j} - 3 \hat{k} \) be three vectors such that, 

\[ |\vec{b} \times \vec{c}| = 5\sqrt{3} \text{ and } \vec{a} \text{ is perpendicular to } \vec{b}. \]

Then the greatest amongst the values of \( |\vec{a}|^2 \) is ___________.

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

If \[ \int \frac{dx}{(x^2 + x + 1)^2} = a \tan^{-1} \left( \frac{2x + 1}{\sqrt{3}} \right) + b \left( \frac{2x + 1}{x^2 + x + 1} \right) + C, \ x > 0 \]

where \( C \) is the constant of integration, then the value of \( 9(\sqrt{3} \ a + b) \) is equal to ___________.

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