<table>
<thead>
<tr>
<th>Question Paper Name</th>
<th>B Tech 1st Sep 2021 Shift 2</th>
</tr>
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<tbody>
<tr>
<td>Subject Name</td>
<td>B TECH</td>
</tr>
<tr>
<td>Creation Date</td>
<td>2021-09-01 20:31:56</td>
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<td>Duration</td>
<td>180</td>
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<td>Total Marks</td>
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<td>Display Marks</td>
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<tr>
<th>B TECH</th>
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<tr>
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<table>
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<th>Physics Section A</th>
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<tr>
<td>Section Id</td>
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<tr>
<td>Section Number</td>
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<tr>
<td>Section type</td>
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The temperature of an ideal gas in 3-dimensions is 300 K. The corresponding de-Broglie wavelength of the electron approximately at 300 K, is:

\[ \lambda = \frac{h}{m_e v} \]

where:
- \( m_e = \) mass of electron \( = 9 \times 10^{-31} \text{ kg} \)
- \( h = \) Planck constant \( = 6.6 \times 10^{-34} \text{ J s} \)
- \( k_B = \) Boltzmann constant \( = 1.38 \times 10^{-23} \text{ JK}^{-1} \)

\[ \lambda = \frac{6.6 \times 10^{-34}}{9 \times 10^{-31} \times \sqrt{2 \times 300}} \]

\[ \lambda \approx 2.26 \text{ nm} \]

Options:

- 86435171141. 2.26 nm
- 86435171142. 3.25 nm
- 86435171143. 6.26 nm
- 86435171144. 8.46 nm
The half life period of a radioactive element $x$ is same as the mean life time of another radioactive element $y$. Initially they have the same number of atoms. Then:

Options:

- $x$ will decay faster than $y$.
- $y$ will decay faster than $x$.
- $x$ and $y$ have same decay rate initially and later on different decay rate.
- $x$ and $y$ decay at the same rate always.
In the given figure, each diode has a forward bias resistance of 30 Ω and infinite resistance in reverse bias. The current $I_1$ will be:

Options:

86435171149. $2$ A
86435171150. $2.35$ A
86435171151. $2.73$ A
86435171152. $3.75$ A
A square loop of side 20 cm and resistance 1 Ω is moved towards right with a constant speed \( v_0 \). The right arm of the loop is in a uniform magnetic field of 5 T. The field is perpendicular to the plane of the loop and is going into it. The loop is connected to a network of resistors each of value 4 Ω. What should be the value of \( v_0 \) so that a steady current of 2 mA flows in the loop?

**Options:**

86435171153. 1 cm/s
86435171154. 1 m/s
86435171155. \( 10^2 \) m/s
86435171156. \( 10^{-2} \) cm/s
For the given circuit the current $i$ through the battery when the key is closed and the steady state has been reached is _______.

[Diagram of an electrical circuit]

Options:

86435171157. 0 A
86435171158. 6 A
86435171159. 10 A
86435171160. 25 A

Electric field of a plane electromagnetic wave propagating through a non-magnetic medium is given by $E=20\cos(2\times10^9 t - 200x)$ V/m. The dielectric constant of the medium is equal to:

(Take $\varepsilon_r = 1$)
A glass tumbler having inner depth of 17.5 cm is kept on a table. A student starts pouring water ($\mu = 4/3$) into it while looking at the surface of water from the above. When he feels that the tumbler is half filled, he stops pouring water. Up to what height, the tumbler is actually filled?

**Options:**

86435171165. 8.75 cm

86435171166. 7.5 cm

86435171167. 11.7 cm

86435171168. 10 cm
A cube is placed inside an electric field, $\vec{E} = 150 \hat{j}$ N/C. The side of the cube is 0.5 m and is placed in the field as shown in the given figure. The charge inside the cube is:

Options:

- $8.3 \times 10^{-11}$ C
- $3.8 \times 10^{-11}$ C
- $8.3 \times 10^{-12}$ C
- $3.8 \times 10^{-12}$ C
Due to cold weather a 1 m water pipe of cross-sectional area 1 cm² is filled with ice at $-10^\circ$C. Resistive heating is used to melt the ice. Current of 0.5 A is passed through 4 kΩ resistance. Assuming that all the heat produced is used for melting, what is the minimum time required?

(Given latent heat of fusion for water/ice $= 3.33 \times 10^5$ J kg$^{-1}$,

specific heat of ice $= 2 \times 10^3$ J kg$^{-1}$ and

density of ice $= 10^3$ kg/m$^3$)

Options:

86435171173. 0.353 s

86435171174. 35.3 s

86435171175. 70.6 s

86435171176. 3.53 s

Question Number: 10 Question Id: 86435121529 Question Type: MCQ Option Shuffling: Yes Is Question Mandatory: No

Correct Marks: 4 Wrong Marks: 1
Following plots show Magnetization (M) vs Magnetising field (H) and Magnetic susceptibility (χ) vs Temperature (T) graph:

(a) \[ M \] vs \[ H \]
(b) \[ M \] vs \[ H \]
(c) \[ \chi \] vs \[ T \]
(d) \[ \chi \] vs \[ T \]

Which of the following combination will be represented by a diamagnetic material?

Options:

86435171177. (a), (c)
86435171178. (a), (d)
86435171179. (b), (c)
86435171180. (b), (d)
There are two infinitely long straight current carrying conductors and they are held at right angles to each other so that their common ends meet at the origin as shown in the figure given below. The ratio of current in both conductors is 1:1. The magnetic field at point P is ________.

\[
\frac{\mu_0 I}{4\pi xy} \left[ \sqrt{x^2 + y^2} + (x + y) \right]
\]

\[
\frac{\mu_0 I xy}{4\pi} \left[ \sqrt{x^2 + y^2} + (x + y) \right]
\]

\[
\frac{\mu_0 I xy}{4\pi} \left[ \sqrt{x^2 + y^2} - (x + y) \right]
\]

\[
\frac{\mu_0 I}{4\pi xy} \left[ \sqrt{x^2 + y^2} - (x + y) \right]
\]
The ranges and heights for two projectiles projected with the same initial velocity at angles 42° and 48° with the horizontal are $R_1$, $R_2$ and $H_1$, $H_2$ respectively. Choose the correct option:

Options:

86435171185. $R_1 = R_2$ and $H_1 < H_2$

86435171186. $R_1 > R_2$ and $H_1 = H_2$

86435171187. $R_1 < R_2$ and $H_1 < H_2$

86435171188. $R_1 = R_2$ and $H_1 = H_2$
A block of mass $m$ slides on the wooden wedge, which in turn slides backward on the horizontal surface. The acceleration of the block with respect to the wedge is:

Given $m = 8 \text{ kg}$, $M = 16 \text{ kg}$

Assume all the surfaces shown in the figure to be frictionless.

Options:

1. $\frac{4}{3} g$
2. $\frac{2}{3} g$
3. $\frac{3}{5} g$
4. $\frac{6}{5} g$
An object of mass ‘m’ is being moved with a constant velocity under the action of an applied force of 2N along a frictionless surface with following surface profile.

The correct applied force vs distance graph will be:

Options:

- [Graph with forces 2N and -2N along the distance]

86435171193.
A body of mass ‘m’ dropped from a height ‘h’ reaches the ground with a speed of $0.8\sqrt{gh}$. The value of workdone by the air-friction is:

Options:

\[ mgh \]

\[ -0.68 \ mgh \]

\[ 0.64 \ mgh \]
Four particles each of mass $M$, move along a circle of radius $R$ under the action of their mutual gravitational attraction as shown in figure. The speed of each particle is:

\[ \frac{1}{2} \sqrt{\frac{GM}{R}} \left(2\sqrt{2} + 1\right) \]

Options:

86435171200.

1.64 mgh

86435171201.

\[ \frac{1}{2} \sqrt{\frac{GM}{R}} \left(2\sqrt{2} + 1\right) \]

86435171202.

\[ \frac{1}{2} \sqrt{\frac{GM}{R}} \left(2\sqrt{2} - 1\right) \]
\[ \frac{1}{2} \sqrt{\frac{GM}{R \left(2\sqrt{2} + 1\right)}} \]

\[ \sqrt{\frac{GM}{R}} \]

**Question Number : 17**  
**Question Id : 86435121536**  
**Question Type : MCQ**  
**Option Shuffling : Yes**  
**Is Question Mandatory : No**  
**Correct Marks : 4**  
**Wrong Marks : 1**

A mass of 5 kg is connected to a spring. The potential energy curve of the simple harmonic motion executed by the system is shown in the figure. A simple pendulum of length 4 m has the same period of oscillation as the spring system. What is the value of acceleration due to gravity on the planet where these experiments are performed?

**Options :**

\[ 9.8 \text{ m/s}^2 \]
86435171206.  10 m/s²

86435171207.  5 m/s²

86435171208.  4 m/s²

Question Number : 18  Question Id : 86435121537  Question Type : MCQ  Option Shuffling : Yes  Is Question Mandatory : No  Correct Marks : 4  Wrong Marks : 1

A capacitor is connected to a 20 V battery through a resistance of 10 Ω. It is found that the potential difference across the capacitor rises to 2 V in 1 μs. The capacitance of the capacitor is _______ μF.

Given \( \ln \left( \frac{10}{9} \right) = 0.105 \)

Options :
86435171209.  1.85

86435171210.  0.95

86435171211.  9.52

86435171212.  0.105

Question Number : 19  Question Id : 86435121538  Question Type : MCQ  Option Shuffling : Yes  Is Question Mandatory : No  Correct Marks : 4  Wrong Marks : 1
A student determined Young’s Modulus of elasticity using the formula \( Y = \frac{MgL^3}{4bd^3\delta} \). The value of \( \delta \) is taken to be 9.8 m/s\(^2\), without any significant error, his observation are as following.

<table>
<thead>
<tr>
<th>Physical Quantity</th>
<th>Least count of the Equipment used for measurement</th>
<th>Observed Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mass (M)</td>
<td>1 g</td>
<td>2 kg</td>
</tr>
<tr>
<td>Length of bar (L)</td>
<td>1 mm</td>
<td>1 m</td>
</tr>
<tr>
<td>Breadth of bar (b)</td>
<td>0.1 mm</td>
<td>4 cm</td>
</tr>
<tr>
<td>Thickness of bar (d)</td>
<td>0.01 mm</td>
<td>0.4 cm</td>
</tr>
<tr>
<td>Depression ((\delta))</td>
<td>0.01 mm</td>
<td>5 mm</td>
</tr>
</tbody>
</table>

Then the fractional error in the measurement of \( Y \) is:

**Options:**

86435171213. 0.0083

86435171214. 0.083

86435171215. 0.155

86435171216. 0.155
Two resistors $R_1 = (4 \pm 0.8) \, \Omega$ and $R_2 = (4 \pm 0.4) \, \Omega$ are connected in parallel. The equivalent resistance of their parallel combination will be:

Options:

86435171217. $(4 \pm 0.4) \, \Omega$

86435171218. $(2 \pm 0.3) \, \Omega$

86435171219. $(2 \pm 0.4) \, \Omega$

86435171220. $(4 \pm 0.3) \, \Omega$
Question Number : 21 Question Id : 86435121540 Question Type : SA
Correct Marks : 4 Wrong Marks : 0

The temperature of 3.00 mol of an ideal diatomic gas is increased by 40.0°C without changing the pressure of the gas. The molecules in the gas rotate but do not oscillate. If the ratio of change in internal energy of the gas to the amount of work done by the gas is \( \frac{x}{10} \). Then the value of \( x \) (round off to the nearest integer) is ________.

(Given \( R = 8.31 \text{ J mol}^{-1} \text{ K}^{-1} \))

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

Question Number : 22 Question Id : 86435121541 Question Type : SA
Correct Marks : 4 Wrong Marks : 0

A uniform heating wire of resistance 36 Ω is connected across a potential difference of 240 V. The wire is then cut into half and a potential difference of 240 V is applied across each half separately. The ratio of power dissipation in first case to the total power dissipation in the second case would be 1 : \( x \), where \( x \) is ________.
The width of one of the two slits in a Young's double slit experiment is three times the other slit. If the amplitude of the light coming from a slit is proportional to the slit-width, the ratio of minimum to maximum intensity in the interference pattern is $x:4$ where $x$ is _______.

A carrier wave with amplitude of 250 V is amplitude modulated by a sinusoidal base band signal of amplitude 150 V. The ratio of minimum amplitude to maximum amplitude for the amplitude modulated wave is $50:x$, then value of $x$ is _______.

Question Number : 23 Question Id : 86435121542 Question Type : SA
Correct Marks : 4 Wrong Marks : 0

Question Number : 24 Question Id : 86435121543 Question Type : SA
Correct Marks : 4 Wrong Marks : 0
Two satellites revolve around a planet in coplanar circular orbits in anticlockwise direction. Their period of revolutions are 1 hour and 8 hours respectively. The radius of the orbit of nearer satellite is $2 \times 10^3$ km. The angular speed of the farther satellite as observed from the nearer satellite at the instant when both the satellites are closest is $\frac{\pi}{x}$ rad h$^{-1}$ where $x$ is 

Question Number : 25 Question Id : 86435121544 Question Type : SA
Correct Marks : 4 Wrong Marks : 0

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 : 86435121545 Question Type : SA
Correct Marks : 4 Wrong Marks : 0
When a body slides down from rest along a smooth inclined plane making an angle of 30° with the horizontal, it takes time T. When the same body slides down from the rest along a rough inclined plane making the same angle and through the same distance, it takes time αT, where α is a constant greater than 1. The co-efficient of friction between the body and the rough plane is \( \frac{1}{\sqrt{x}} \left( \frac{\alpha^2 - 1}{\alpha^2} \right) \) where \( x = \) ________.

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 : 86435121546 Question Type : SA Correct Marks : 4 Wrong Marks : 0
An engine is attached to a wagon through a shock absorber of length 1.5 m. The system with a total mass of 40,000 kg is moving with a speed of 72 kmh\(^{-1}\) when the brakes are applied to bring it to rest. In the process of the system being brought to rest, the spring of the shock absorber gets compressed by 1.0 m. If 90% of energy of the wagon is lost due to friction, the spring constant is \( \) ________ \( \times 10^5 \) N/m.

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

Answers :

1
Question Number : 28 Question Id : 86435121547 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

The average translational kinetic energy of N₂ gas molecules at _________ °C becomes equal to the K.E. of an electron accelerated from rest through a potential difference of 0.1 volt. (Given k_B = 1.38 × 10⁻²³ J/K) (Fill the nearest integer).

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal Text

Areas : PlainText Possible

Answers :

1

Question Number : 29 Question Id : 86435121548 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

A steel rod with γ = 2.0 × 10¹¹ N m⁻² and α = 10⁻⁵ °C⁻¹ of length 4 m and area of cross-section 10 cm² is heated from 0°C to 400°C without being allowed to extend. The tension produced in the rod is x × 10⁵ N where 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 : 30 Question Id : 86435121549 Question Type : SA

Correct Marks : 4 Wrong Marks : 0
A 2 kg steel rod of length 0.6 m is clamped on a table vertically at its lower end and is free to rotate in vertical plane. The upper end is pushed so that the rod falls under gravity. Ignoring the friction due to clamping at its lower end, the speed of the free end of rod when it passes through its lowest position is ________ ms\(^{-1}\).

(Take \(g = 10\) ms\(^{-2}\))

**Response Type**: Numeric

**Evaluation Required For SA**: Yes

**Show Word Count**: Yes

**Answers Type**: Equal Text

**Areas**: PlainText Possible

**Answers**: 

1

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**Chemistry Section A**

**Section Id**: 8643511006

**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**

**Yes**

**Clear Response**: 

**Sub-Section Number**: 1

**Sub-Section Id**: 8643511233

**Question Shuffling Allowed**: Yes
Which one of the following given graphs represents the variation of rate constant (k) with temperature (T) for an endothermic reaction?

Options:

1. ![Graph 1](image1.png)
2. ![Graph 2](image2.png)
3. ![Graph 3](image3.png)
**Question Number : 32 Question Id : 86435121551 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>(Colloid Preparation Method)</td>
<td>(Chemical Reaction)</td>
</tr>
<tr>
<td>(a) Hydrolysis</td>
<td>(i) $2\text{AuCl}_3 + 3\text{HCHO} + 3\text{H}_2\text{O} \rightarrow 2\text{Au(sol)} + 3\text{HCOOH} + 6\text{HCl}$</td>
</tr>
<tr>
<td>(b) Reduction</td>
<td>(ii) $\text{As}_2\text{O}_3 + 3\text{H}_2\text{S} \rightarrow \text{As}_2\text{S}_3\text{(sol)} + 3\text{H}_2\text{O}$</td>
</tr>
<tr>
<td>(c) Oxidation</td>
<td>(iii) $\text{SO}_2 + 2\text{H}_2\text{S} \rightarrow 3\text{S(sol)} + 2\text{H}_2\text{O}$</td>
</tr>
<tr>
<td>(d) Double Decomposition</td>
<td>(iv) $\text{FeCl}_3 + 3\text{H}_2\text{O} \rightarrow \text{Fe(OH)}_3\text{(sol)} + 3\text{HCl}$</td>
</tr>
</tbody>
</table>

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

**Options :**

86435171235.  (a)-(i), (b)-(ii), (c)-(iv), (d)-(iii)

86435171236.  (a)-(i), (b)-(iii), (c)-(ii), (d)-(iv)

86435171237.  (a)-(iv), (b)-(ii), (c)-(iii), (d)-(i)
(a)-(iv), (b)-(i), (c)-(iii), (d)-(ii)

Question Number : 33 Question Id : 86435121552 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1

Identify the element for which electronic configuration in +3 oxidation state is [Ar]3d^5:

Options :

86435171239. Mn
86435171240. Fe
86435171241. Ru
86435171242. Co

Question Number : 34 Question Id : 86435121553 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1

Calamine and Malachite, respectively, are the ores of:

Options :

86435171243. Copper and Iron
86435171244. Zinc and Copper
86435171245. Aluminium and Zinc
Hydrogen peroxide reacts with iodine in basic medium to give:

Options:

\[ \text{IO}_3^- \]

\[ \text{I}^- \]

\[ \text{IO}^- \]

\[ \text{IO}_4^+ \]

---

Number of paramagnetic oxides among the following given oxides is ________.

\( \text{Li}_2\text{O}, \text{CaO}, \text{Na}_2\text{O}_2, \text{KO}_2, \text{MgO} \) and \( \text{K}_2\text{O} \)

Options:

3

2

1
Question Number : 37 Question Id : 86435121556 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1

The oxide without nitrogen-nitrogen bond is:

Options:

86435171255. \( N_2O \)

86435171256. \( N_2O_3 \)

86435171257. \( N_2O_4 \)

86435171258. \( N_2O_5 \)

Question Number : 38 Question Id : 86435121557 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1

In the given chemical reaction, colors of the \( Fe^{2+} \) and \( Fe^{3+} \) ions, are respectively:

\[ 5Fe^{2+} + MnO_4^- + 8H^+ \rightarrow Mn^{2+} + 4H_2O + 5Fe^{3+} \]

Options:

86435171259. Yellow, Orange

86435171260. Green, Yellow
Green, Orange

Yellow, Green

Question Number : 39 Question Id : 86435121558 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1

The Crystal Field Stabilization Energy (CFSE) and magnetic moment (spin-only) of an octahedral aqua complex of a metal ion (M²⁺) are -0.8 Δ₀ and 3.87 BM, respectively. Identify (M²⁺):

Options :
86435171263. Co²⁺
86435171264. V³⁺
86435171265. Mn⁴⁺
86435171266. Cr³⁺

Question Number : 40 Question Id : 86435121559 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1

Water sample is called cleanest on the basis of which one of the BOD values given below:

Options :
86435171267. ³ ppm
86435171268. 11 ppm

86435171269. 15 ppm

86435171270. 21 ppm

Question Number: 41 Question Id: 86435121560 Question Type: MCQ Option Shuffling: Yes Is Question Mandatory: No Correct Marks: 4 Wrong Marks: 1

Experimentally reducing a functional group cannot be done by which one of the following reagents?

Options:
- Pd-C/H₂
- Pt-C/H₂
- Zn/H₂O
- Na/H₂

Question Number: 42 Question Id: 86435121561 Question Type: MCQ Option Shuffling: Yes Is Question Mandatory: No

Correct Marks: 4 Wrong Marks: 1
The stereoisomers that are formed by electrophilic addition of bromine to trans-but-2-ene is/are:

Options:

86435171275. 2 identical mesomers

86435171276. 2 enantiomers

86435171277. 1 racemic and 2 enantiomers

86435171278. 2 enantiomers and 2 mesomers

Question Number : 43  Question Id : 86435121562  Question Type : MCQ  Option Shuffling : Yes  Is Question Mandatory : No  Correct Marks : 4  Wrong Marks : 1

Which one of the following compounds is aromatic in nature?

Options:

Options:
In the following sequence of reactions,

\[ C_3H_6 \xrightarrow{H^+ / H_2O} A \xrightarrow{\text{KIO}} \text{B} + \text{C} \]

The compounds B and C respectively are:

Options:

86435171283. \[ \text{CH}_3\text{I}, \text{HCOOK} \]

86435171284. \[ \text{CH}_3\text{I}', \text{CH}_3\text{COOK} \]

86435171285. \[ \text{Cl}_3\text{COOK}, \text{CH}_3\text{I} \]

86435171286. \[ \text{Cl}_3\text{COOK}, \text{HCOOH} \]
Question Number : 45 Question Id : 86435121564 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No
Correct Marks : 4 Wrong Marks : 1

In the following sequence of reactions a compound A, (molecular formula C₆H₁₂O₂) with a straight chain structure gives a C₄ carboxylic acid. A is:

\[ A \xrightarrow{LiAlH₄, H₂O} B \xrightarrow{Oxidation} C₄ - \text{carboxylic acid} \]

Options:

86435171287.

\[
\text{CH}_3 - \text{CH}_2 - \text{CH} - \text{CH}_2 - \text{O} - \text{CH} = \text{CH}_2
\]

86435171288.

\[
\text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{O} - \text{CH} = \text{CH} - \text{CH}_2 - \text{OH}
\]

86435171289.

\[
\text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{COO} - \text{CH}_2 - \text{CH}_3
\]

86435171290.

\[
\text{CH}_3 - \text{CH}_2 - \text{COO} - \text{CH}_2 - \text{CH}_2 - \text{CH}_3
\]

Question Number : 46 Question Id : 86435121565 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1

Given below are two statements:

Statement I : The nucleophilic addition of sodium hydrogen sulphite to an aldehyde or a ketone involves proton transfer to form a stable ion.

Statement II : The nucleophilic addition of hydrogen cyanide to an aldehyde or a ketone yields amine as final product.

In the light of the above statements, choose the most appropriate answer from the options given below:
Identify A in the following reaction.

\[
\text{NH}_2 \quad \text{K}_2\text{Cr}_2\text{O}_7 \quad A
\]

Options:

86435171295.

86435171296.
Which one of the following gives the most stable Diazonium salt?

Options:

1. [Chemical structure of option A]
2. [Chemical structure of option B]
3. [Chemical structure of option C]
Monomer units of Dacron polymer are:

Options:

86435171303. glycerol and phthalic acid
86435171304. ethylene glycol and phthalic acid
86435171305. ethylene glycol and terephthalic acid
86435171306. glycerol and terephthalic acid

The potassium ferrocyanide solution gives a Prussian blue colour, when added to:

Options:

86435171307. FeCl₂
Chemistry Section B

Section Id : 8643511007
Section Number : 4
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 Response : Yes
Clear
Sub-Section Number : 1
Sub-Section Id : 8643511234
Question Shuffling Allowed : Yes

Question Number : 51 Question Id : 86435121570 Question Type : SA
Correct Marks : 4 Wrong Marks : 0
The number of atoms in 8 g of sodium is \( x \times 10^{23} \). The value of \( x \) is _________. (Nearest integer)

[Given: \( N_A = 6.02 \times 10^{23} \text{ mol}^{-1} \)]

Atomic mass of Na = 23.0 u

Response Type: Numeric

Evaluation Required For SA: Yes

Show Word Count: Yes

Answers Type: Equal Text

Areas: PlainText Possible

Answers:

1

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An empty LPG cylinder weighs 14.8 kg. When full, it weighs 29.0 kg and shows a pressure of 3.47 atm. In the course of use at ambient temperature, the mass of the cylinder is reduced to 23.0 kg. The final pressure inside the cylinder is ________ atm. (Nearest integer)

(Assume LPG to be an ideal gas)

Response Type: Numeric

Evaluation Required For SA: Yes

Show Word Count: Yes

Answers Type: Equal Text

Areas: PlainText Possible

Answers:

1
Correct Marks : 4 Wrong Marks : 0

A 50 watt bulb emits monochromatic red light of wavelength of 795 nm. The number of photons emitted per second by the bulb is \( x \times 10^{20} \). The value of \( x \) is \[ \ldots \text{(Nearest integer)} \]
\[ \text{[Given : } h=6.63 \times 10^{-34} \text{ Js and c=3.0} \times 10^8 \text{ ms}^{-1}] \]

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal Text

Areas : PlainText Possible

Answers :

1

Question Number : 54 Question Id : 86435121573 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

The spin-only magnetic moment value of \( B_{2}^{+} \) species is \[ \ldots \times 10^{-2} \text{ BM.} \]
(Nearest integer)
\[ \text{[Given : } \sqrt{3} = 1.73] \]

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 : 86435121574 Question Type : SA
For the reaction \(2\text{NO}_2(g) \rightleftharpoons \text{N}_2\text{O}_4(g)\), when \(\Delta S = -176.0 \text{ J K}^{-1}\) and \(\Delta H = -57.8 \text{ kJ mol}^{-1}\), the magnitude of \(\Delta G\) at 298 K for the reaction is \(_______\text{kJ mol}^{-1}\). (Nearest integer)

Response Type: Numeric

Evaluation Required For SA: Yes

Show Word Count: Yes

Answers Type: Equal Text

Areas: PlainText Possible

Answers:

1

If 80 g of copper sulphate \(\text{CuSO}_4 \cdot 5\text{H}_2\text{O}\) is dissolved in deionised water to make 5 L of solution. The concentration of the copper sulphate solution is \(x \times 10^{-3}\) mol L\(^{-1}\). The value of \(x\) is \(_______\).

[Atomic masses Cu: 63.54 u, S: 32 u, O: 16 u, H: 1 u]

Response Type: Numeric

Evaluation Required For SA: Yes

Show Word Count: Yes

Answers Type: Equal Text

Areas: PlainText Possible

Answers:

1

Question Number: 57 Question Id: 86435121576 Question Type: SA

Correct Marks: 4 Wrong Marks: 0
The molar solubility of Zn(OH)₂ in 0.1 M NaOH solution is \( x \times 10^{-18} \) M. The value of \( x \) is ________. (Nearest integer)

(Given: The solubility product of Zn(OH)₂ is \( 2 \times 10^{-20} \))

Question Number: 58  Question Id: 86435121577  Question Type: SA
Correct Marks: 4  Wrong Marks: 0

If the conductivity of mercury at 0°C is \( 1.07 \times 10^6 \) S m⁻¹ and the resistance of a cell containing mercury is 0.243 Ω, then the cell constant of the cell is \( x \times 10^4 \) m⁻¹. The value of \( x \) is ________. (Nearest integer)

Question Number: 59  Question Id: 86435121578  Question Type: SA
Correct Marks: 4  Wrong Marks: 0

The sum of oxidation states of two silver ions in \([\text{Ag(NH}_3\text{)}_2]^- [\text{Ag(CN)}_2]^-\) complex is ________.
A peptide synthesized by the reactions of one molecule each of Glycine, Leucine, Aspartic acid and Histidine will have _______ peptide linkages.
The range of the function 
\[ f(x) = \log_{\sqrt{5}} \left( 3 \cos \left( \frac{3\pi}{4} + x \right) + \cos \left( \frac{\pi}{4} + x \right) + \cos \left( \frac{\pi}{4} - x \right) - \cos \left( \frac{3\pi}{4} - x \right) \right) \] is:

Options:

86435171321. \((0, \sqrt{5})\)

86435171322. \(\left[ \frac{1}{\sqrt{5}}, \sqrt{5} \right]\)

86435171323. \([0, 2]\)

86435171324. \([-2, 2]\)
The number of pairs \((a, b)\) of real numbers, such that whenever \(a\) is a root of the equation \(x^2 + ax + b = 0\), \(a^2 - 2\) is also a root of this equation, is:

Options:

86435171325. 2

86435171326. 4

86435171327. 6

86435171328. 8

Question Number: 63 Question Id: 86435121582 Question Type: MCQ Option Shuffling: Yes Is Question Mandatory: No Correct Marks: 4 Wrong Marks: 1

Consider the system of linear equations

\[-x + y + 2z = 0\]
\[3x - ay + 5z = 1\]
\[2x - 2y - az = 7\]

Let \(S_1\) be the set of all \(a \in \mathbb{R}\) for which the system is inconsistent and \(S_2\) be the set of all \(a \in \mathbb{R}\) for which the system has infinitely many solutions. If \(n(S_1)\) and \(n(S_2)\) denote the number of elements in \(S_1\) and \(S_2\) respectively, then

Options:

\[86435171329. \quad n(S_1) = 1, \quad n(S_2) = 0\]

\[86435171330. \quad n(S_1) = 0, \quad n(S_2) = 2\]

\[86435171331. \quad n(S_1) = 2, \quad n(S_2) = 2\]

\[ n(S_1) = 2, \quad n(S_2) = 0 \]

**Question Number : 64**

**Question Id : 86435121583**

**Question Type : MCQ**

**Option Shuffling : Yes**

**Is Question Mandatory : No**

**Correct Marks : 4**

**Wrong Marks : 1**

**Options :**

86435171333. \( (105)^2 \times 2^{38} \)

86435171334. \( (105)^2 \times 2^{36} \)

86435171335. \( (15)^2 \times 2^{34} \)

86435171336. \( (15)^2 \times 2^{42} \)

**Question Number : 65**

**Question Id : 86435121584**

**Question Type : MCQ**

**Option Shuffling : Yes**

**Is Question Mandatory : No**

**Correct Marks : 4**

**Wrong Marks : 1**
Let \( P_1, P_2, ..., P_{15} \) be 15 points on a circle. The number of distinct triangles formed by points \( P_i, P_j, P_k \) such that \( i+j+k \neq 15 \), is:

**Options:**

86435171337. 12

86435171338. 443

86435171339. 455

86435171340. 419

Let \( S_n = 1 \cdot (n-1) + 2 \cdot (n-2) + 3 \cdot (n-3) + ... + (n-1) \cdot 1, \ n \geq 4. \)

The sum \( \sum_{n=4}^{\infty} \left( \frac{2S_n}{n!} - \frac{1}{(n-2)!} \right) \) is equal to:

**Options:**

86435171341. \( \frac{e}{3} \)

86435171342. \( \frac{e}{6} \)

86435171343. \( \frac{e - 1}{3} \)
Question Number : 67 Question Id : 86435121586  Question Type : MCQ  Option Shuffling : Yes  Is Question Mandatory : No  Correct Marks : 4  Wrong Marks : 1

The function \( f(x) = x^3 - 6x^2 + ax + b \) is such that \( f(2) = f(4) = 0 \). Consider two statements.

(S1) there exists \( x_1, x_2 \in (2, 4), x_1 < x_2 \), such that \( f'(x_1) = -1 \) and \( f'(x_2) = 0 \).

(S2) there exists \( x_3, x_4 \in (2, 4), x_3 < x_4 \), such that \( f \) is decreasing in \((2, x_4)\), increasing in \((x_4, 4)\) and \( 2f'(x_3) = \sqrt{3} f(x_4) \).

Then

Options :

86435171345. (S1) is true and (S2) is false

86435171346. (S1) is false and (S2) is true

86435171347. both (S1) and (S2) are false

86435171348. both (S1) and (S2) are true

Question Number : 68 Question Id : 86435121587  Question Type : MCQ  Option Shuffling : Yes  Is Question Mandatory : No

Correct Marks : 4  Wrong Marks : 1
Let $f : \mathbb{R} \to \mathbb{R}$ be a continuous function. Then

$$\lim_{x \to \pi/4} \frac{\sec^2 x}{2} \int_{2}^{\pi} f(x) \, dx$$

is equal to:

Options:

86435171349. $f(2)$

86435171350. $2f(2)$

86435171351. $4f(2)$

86435171352. $2f(\sqrt{2})$

The function $f(x)$, that satisfies the condition $f(x) = x + \int_{0}^{\pi/2} \sin x \cdot \cos f(y) \, dy$, is:

Options:

86435171353. $x + \frac{\pi}{2} \sin x$

86435171354. $x + (\pi + 2) \sin x$
\[ x + (\pi - 2)\sin x \]

\[ x + \frac{2}{3} (\pi - 2) \sin x \]

Question Number : 70 Question Id : 86435121589 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1

The area, enclosed by the curves \( y = \sin x + \cos x \) and \( y = |\cos x - \sin x| \) and the lines \( x = 0, \ x = \frac{\pi}{2} \)

is:

Options:

- 86435171357. \( 4(\sqrt{2} - 1) \)
- 86435171358. \( 2\sqrt{2}(\sqrt{2} - 1) \)
- 86435171359. \( 2(\sqrt{2} + 1) \)
- 86435171360. \( 2\sqrt{2}(\sqrt{2} + 1) \)

Question Number : 71 Question Id : 86435121590 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1

If \( y = y(x) \) is the solution curve of the differential equation

\[ x^2 \frac{dy}{dx} + \left( y - \frac{1}{x} \right) dx = 0; \ x > 0, \ \text{and} \ y(1) = 1, \ \text{then} \ y \left( \frac{1}{2} \right) \]

is equal to:
Consider the parabola with vertex \( \left( \frac{1}{2}, \frac{3}{4} \right) \) and the directrix \( y = \frac{1}{2} \). Let \( P \) be the point where the parabola meets the line \( x = -\frac{1}{2} \). If the normal to the parabola at \( P \) intersects the parabola again at the point \( Q \), then \( (PQ)^2 \) is equal to:

Options:

86435171365. \( \frac{125}{16} \)

86435171366. \( \frac{25}{2} \)
Which of the following is equivalent to the Boolean expression $p \land \neg q$?

Options:

1. $\neg p \rightarrow \neg q$
2. $\neg (p \rightarrow \neg q)$
3. $\neg (q \rightarrow p)$
4. $\neg (p \rightarrow q)$

Let the acute angle bisector of the two planes $x - 2y - 2z + 1 = 0$ and $2x - 3y - 6z + 1 = 0$ be the plane $P$. Then which of the following points lies on $P$?

Options:

1. $(4, 0, -2)$
(0, 2, -4)

(3, 1, -\frac{1}{2})

(-2, 0, -\frac{1}{2})

Question Number : 75 Question Id : 86435121594 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1

The distance of line $3y - 2z - 1 = 0 = 3x - z + 4$ from the point $(2, -1, 6)$ is :

Options :

$4\sqrt{2}$

$2\sqrt{6}$

$\sqrt{26}$

$2\sqrt{5}$

Question Number : 76 Question Id : 86435121595 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1
Let $a_1, a_2, ..., a_{21}$ be an AP such that \( \sum_{n=1}^{20} \frac{1}{a_n a_{n+1}} = \frac{4}{9} \). If the sum of this AP is 189, then $a_6 a_{16}$ is equal to:

**Options:**

- 86435171381. 57
- 86435171382. 72
- 86435171383. 48
- 86435171384. 36

Two squares are chosen at random on a chessboard (see figure). The probability that they have a side in common is:

![Chessboard Diagram]

**Options:**
Let $\theta$ be the acute angle between the tangents to the ellipse $\frac{x^2}{9} + \frac{y^2}{1} = 1$ and the circle $x^2 + y^2 = 3$ at their point of intersection in the first quadrant. Then $\tan \theta$ is equal to:

**Options:**

86435171389. $2$

86435171390. $\frac{5}{2\sqrt{3}}$
If \( n \) is the number of solutions of the equation \( 2 \cos x \left( 4 \sin \left( \frac{\pi}{4} + x \right) \sin \left( \frac{\pi}{4} - x \right) - 1 \right) = 1 \),

\( x \in [0, \pi] \) and \( S \) is the sum of all these solutions, then the ordered pair \( (n, S) \) is:

Options:

1. \( (2, \frac{2\pi}{3}) \)
2. \( (3, \frac{13\pi}{9}) \)
3. \( (3, \frac{5\pi}{3}) \)
4. \( (2, \frac{8\pi}{9}) \)
\[
\cos^{-1}(\cos(-5)) + \sin^{-1}(\sin(6)) - \tan^{-1}(\tan(12)) \text{ is equal to:} \\
\text{(The inverse trigonometric functions take the principal values)}
\]

Options:

86435171397. \(4\pi - 9\)

86435171398. \(3\pi + 1\)

86435171399. \(3\pi - 11\)

86435171400. \(4\pi - 11\)
Question Number : 81 Question Id : 86435121600 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

If for the complex numbers $z$ satisfying $|z - 2 - 2i| \leq 1$, the maximum value of $|3z + 6|$ is attained at $a + ib$, then $a + b$ is equal to ________.

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal Text

Areas : PlainText Possible

Answers :

1

Question Number : 82 Question Id : 86435121601 Question Type : SA

Correct Marks : 4 Wrong Marks : 0

Let $f(x) = x^6 + 2x^4 + x^3 + 2x + 3$, $x \in \mathbb{R}$. Then the natural number $n$ for which

$$\lim_{x \to 1} \frac{x^n f(1) - f(x)}{x - 1} = 44$$

is ________.

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 : 86435121602 Question Type : SA

Correct Marks : 4 Wrong Marks : 0
Let the points of intersections of the lines $x-y+1=0$, $x-2y+3=0$ and $2x-5y+11=0$ are the mid points of the sides of a triangle ABC. Then the area of the triangle ABC is ________.

**Question Number**: 84  **Question Id**: 86435121603  **Question Type**: SA

**Correct Marks**: 4  **Wrong Marks**: 0

Let $f(x)$ be a polynomial of degree 3 such that $f(k) = -\frac{2}{k}$ for $k=2, 3, 4, 5$. Then the value of $52 - 10f(10)$ is equal to ________.

**Question Number**: 85  **Question Id**: 86435121604  **Question Type**: SA

**Correct Marks**: 4  **Wrong Marks**: 0

A man starts walking from the point $P(-3, 4)$, touches the x-axis at R, and then turns to reach at the point $Q(0, 2)$. The man is walking at a constant speed. If the man reaches the point $Q$ in the minimum time, then $50((PR)^2 + (RQ)^2)$ is equal to ________. 
Question Number : 86 Question Id : 86435121605 Question Type : SA
Correct Marks : 4 Wrong Marks : 0
If the sum of the coefficients in the expansion of \((x+y)^n\) is 4096, then the greatest coefficient in the expansion is ________.

Question Number : 87 Question Id : 86435121606 Question Type : SA
Correct Marks : 4 Wrong Marks : 0
Let \([t]\) denote the greatest integer \(\leq t\). The number of points where the function \(f(x) = [x] |x^2 - 1| + \sin \left( \frac{\pi}{[x]+3} \right) - [x+1], x \in (-2, 2)\) is not continuous is ________.
Let $X$ be a random variable with distribution.

<table>
<thead>
<tr>
<th>$x$</th>
<th>$-2$</th>
<th>$-1$</th>
<th>$3$</th>
<th>$4$</th>
<th>$6$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$P(X=x)$</td>
<td>$\frac{1}{5}$</td>
<td>$a$</td>
<td>$\frac{1}{3}$</td>
<td>$\frac{1}{5}$</td>
<td>$b$</td>
</tr>
</tbody>
</table>

If the mean of $X$ is 2.3 and variance of $X$ is $\sigma^2$, then $100 \sigma^2$ is equal to:

Question Number: 89 Question Id: 86435121608 Question Type: SA
Correct Marks: 4 Wrong Marks: 0
Let \( \vec{a} = 2\hat{i} - \hat{j} + 2\hat{k} \) and \( \vec{b} = \hat{i} + 2\hat{j} - \hat{k} \). Let a vector \( \vec{v} \) be in the plane containing \( \vec{a} \) and \( \vec{b} \). If \( \vec{v} \) is perpendicular to the vector \( 3\hat{i} + 2\hat{j} - \hat{k} \) and its projection on \( \vec{a} \) is 19 units, then \( \| \vec{v} \| \) 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**: 90 **Question Id**: 86435121609 **Question Type**: SA

**Correct Marks**: 4 **Wrong Marks**: 0

All the arrangements, with or without meaning, of the word FARMER are written excluding any word that has two R appearing together. The arrangements are listed serially in the alphabetic order as in the English dictionary. Then the serial number of the word FARMER in this list is ________.

**Response Type**: Numeric

**Evaluation Required For SA**: Yes

**Show Word Count**: Yes

**Answers Type**: Equal Text

**Areas**: PlainText Possible

**Answers**:

1