A simple pendulum of mass \( m \), length \( l \) and charge \( +q \) suspended in the electric field produced by two conducting parallel plates as shown. The value of deflection of pendulum in equilibrium position will be:

\[
\tan^{-1} \left[ \frac{q}{mg} \times \frac{C_1(V_1 + V_2)}{(C_1 + C_2)(d - t)} \right]
\]

Options:

1. \( \tan^{-1} \left[ \frac{q}{mg} \times \frac{C_1(V_1 + V_2)}{(C_1 + C_2)(d - t)} \right] \)
\[\tan^{-1}\left[\frac{q}{mg} \times \frac{C_2(V_1 + V_2)}{(C_1 + C_2)(d-t)}\right]\]

2.

\[\tan^{-1}\left[\frac{q}{mg} \times \frac{C_1(V_2 - V_1)}{(C_1 + C_2)(d-t)}\right]\]

3.

\[\tan^{-1}\left[\frac{q}{mg} \times \frac{C_2(V_2 - V_1)}{(C_1 + C_2)(d-t)}\right]\]

4.

Question Type: MCQ Is Question Mandatory: No
Correct Marks: 4 Wrong Marks: 1

Options:
Find the truth table for the function $Y$ of $A$ and $B$ represented in the following figure.

Options:
<table>
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<th>Y</th>
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4.
Question Type: MCQ  Is Question Mandatory: No
Correct Marks: 4  Wrong Marks: 1

Options:

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2.
3. Table 1:

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4. Table 2:

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</tbody>
</table>

**Question Type:** MCQ  
**Is Question Mandatory:** No

**Correct Marks:** 4  
**Wrong Marks:** 1

A particle of mass $M$ originally at rest is subjected to a force whose direction is constant but magnitude varies with time according to the relation

$$F = F_0 \left[ 1 - \left( \frac{t - T}{T} \right)^2 \right]$$

Where $F_0$ and $T$ are constants. The force acts only for the time interval $2T$. The velocity $v$ of the particle after time $2T$ is:

**Options:**

1. $\frac{F_0 T}{3M}$
2. \( \frac{4F_0 T}{3M} \)

3. \( \frac{F_0 T}{2M} \)

4. \( \frac{2F_0 T}{M} \)

Question Type : MCQ Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

\[ F = F_0 \left[ 1 - \left( \frac{t - T}{T} \right)^2 \right] \]

\( F_0 \) এর আর তুলনায় হলো, এরপর \( F_0 \) এর তুলনায় হলো। তাহলে 2T চলাচল যে কি হলো তা হলো।

Options :

1. \( \frac{F_0 T}{3M} \)

2. \( \frac{4F_0 T}{3M} \)

3. \( \frac{F_0 T}{2M} \)

4. \( \frac{2F_0 T}{M} \)

Question Type : MCQ Is Question Mandatory : No
Match List I with List II.

<table>
<thead>
<tr>
<th>List I</th>
<th>List II</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Capacitance, C</td>
<td>(i) $M^1 L^1 T^{-3} A^{-1}$</td>
</tr>
<tr>
<td>(b) Permittivity of free space, $\varepsilon_0$</td>
<td>(ii) $M^{-1} L^{-3} T^4 A^2$</td>
</tr>
<tr>
<td>(c) Permeability of free space, $\mu_0$</td>
<td>(iii) $M^{-1} L^{-2} T^4 A^2$</td>
</tr>
<tr>
<td>(d) Electric field, E</td>
<td>(iv) $M^1 L^1 T^{-2} A^{-2}$</td>
</tr>
</tbody>
</table>

Choose the correct answer from the options given below:

Options:

1. (a) $\rightarrow$ (iii), (b) $\rightarrow$ (iv), (c) $\rightarrow$ (ii), (d) $\rightarrow$ (i)

2. (a) $\rightarrow$ (iv), (b) $\rightarrow$ (ii), (c) $\rightarrow$ (iii), (d) $\rightarrow$ (i)

3. (a) $\rightarrow$ (iii), (b) $\rightarrow$ (ii), (c) $\rightarrow$ (iv), (d) $\rightarrow$ (i)

4. (a) $\rightarrow$ (iv), (b) $\rightarrow$ (iii), (c) $\rightarrow$ (ii), (d) $\rightarrow$ (i)
Options :  

1. (a) → (iii), (b) → (iv), (c) → (ii), (d) → (i)

2. (a) → (iv), (b) → (ii), (c) → (iii), (d) → (i)

3. (a) → (iii), (b) → (ii), (c) → (iv), (d) → (i)

4. (a) → (iv), (b) → (iii), (c) → (ii), (d) → (i)

Question Type : MCQ Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

One mole of an ideal gas is taken through an adiabatic process where the temperature rises from 27°C to 37°C. If the ideal gas is composed of polyatomic molecule that has 4 vibrational modes, which of the following is true?

[ R = 8.314 J mol⁻¹ K⁻¹ ]

Options :

1. work done by the gas is close to 582 J
2. work done on the gas is close to 582 J

3. work done by the gas is close to 332 J

4. work done on the gas is close to 332 J

Question Type: MCQ  Is Question Mandatory: No
Correct Marks: 4 Wrong Marks: 1
Options:
1.
2.
3.
4.
Given below is the plot of a potential energy function $U(x)$ for a system, in which a particle is in one dimensional motion, while a conservative force $F(x)$ acts on it. Suppose that $E_{\text{mech}} = 8 \text{ J}$, the incorrect statement for this system is:

![Plot of potential energy function $U(x)$]

**Options:**

1. at $x=x_2$, K.E. is greatest and the particle is moving at the fastest speed.

2. at $x < x_1$, K.E. is smallest and the particle is moving at the slowest speed.

3. at $x > x_4$, K.E. is constant throughout the region.

4. at $x = x_3$, K.E. = 4 \text{ J}.

**Question Type:** MCQ  
**Is Question Mandatory:** No  
**Correct Marks:** 4  
**Wrong Marks:** 1
Options:

1. $x = x_2$ ଓିଇଇ, ଇରିତ ଥିବି ଏହାବୁ ଜାବୋ ଇରିତ ଶେଷବାଳ ବଣିବାକୁ ବାହିଁ କରିବାରୁ ଲାଗିବାରୁ ଏହି କରିବାରୁ ଲାଗିବାରୁ ଲାଗିବାରୁ ଲାଗିବା

2. $x < x_1$ ଓିଇ, ଇରିତ ଥିବି ଏହାବୁ ଜାବୋ ଇରିତ ଶେଷବାଳ ବଣିବାକୁ ବାହିଁ କରିବାରୁ ଲାଗିବାରୁ ଲାଗିବା

3. $x > x_4$ ଓିଇ, ଇରିତ ଥିବି ଏହାବୁ ଜାବୋ ଇରିତ ଶେଷବାଳ ବଣିବାକୁ ବାହିଁ କରିବା

4. $x = x_3$ ଓିଇ, ଇରିତ ଥିବି = 4 J

[ଇହି K.E. = କରିତ ଥିବି]
Consider the following statements:

A. Atoms of each element emit characteristics spectrum.
B. According to Bohr’s Postulate, an electron in a hydrogen atom, revolves in a certain stationary orbit.
C. The density of nuclear matter depends on the size of the nucleus.
D. A free neutron is stable but a free proton decay is possible.
E. Radioactivity is an indication of the instability of nuclei.

Choose the correct answer from the options given below:

Options:

1. A, B and E only
2. A, C and E only
3. B and D only
4. A, B, C, D and E
A raindrop with radius \( R = 0.2 \) mm falls from a cloud at a height \( h = 2000 \) m above the ground. Assume that the drop is spherical throughout its fall and the force of buoyance may be neglected, then the terminal speed attained by the raindrop is:

\[
\text{[ Density of water } \rho_w = 1000 \text{ kg m}^{-3} \\
\text{and Density of air } \rho_a = 1.2 \text{ kg m}^{-3}, \\
g = 10 \text{ m/s}^2 \\
\text{Coefficient of viscosity of air } = 1.8 \times 10^{-5} \text{ Ns m}^{-2}\]

Question Type : MCQ  Is Question Mandatory : No
Correct Marks : 4  Wrong Marks : 1
Options:

1. 250.6 m s\(^{-1}\)
2. 4.94 m s\(^{-1}\)
3. 14.4 m s\(^{-1}\)
4. 43.56 m s\(^{-1}\)

Question Type: MCQ
Is Question Mandatory: No
Correct Marks: 4
Wrong Marks: 1

(একাডেমিক তথ্য আপনার মাধ্যমে প্রয়োজন হলে, এটি আপনার কাছে প্রদান করতে পারে)

Options:

1. 250.6 m s\(^{-1}\)
2. 4.94 m s\(^{-1}\)
3. 14.4 m s\(^{-1}\)
4. 43.56 m s\(^{-1}\)
A physical quantity 'y' is represented by the formula $y = m^2 r^{-4} g^{\frac{3}{2}}$.

If the percentage errors found in $y$, $m$, $r$, $l$ and $g$ are 18, 1, 0.5, 4 and $p$ respectively, then find the value of $x$ and $p$.

Options:
1. $4 \pm 3$
2. $5 \pm 2$
3. $8 \pm 2$
4. $\frac{16}{3} \pm \frac{3}{2}$

Question Type : MCQ Is Question Mandatory : No
Correct Marks : 4 Wrong Marks : 1
Options:
1. $4 \pm 3$
2. $5 \pm 2$
3. \(8 \, \text{min} \pm 2\)

\[
\frac{16}{3} \, \text{min} \pm \frac{3}{2}
\]

4. \(8 \, \text{min} \pm 2\)

**Question Type:** MCQ  **Is Question Mandatory:** No

**Correct Marks:** 4  **Wrong Marks:** 1

Two Carnot engines A and B operate in series such that engine A absorbs heat at \(T_1\) and rejects heat to a sink at temperature \(T\). Engine B absorbs half of the heat rejected by Engine A and rejects heat to the sink at \(T_3\). When work done in both the cases is equal, the value of \(T\) is:

**Options:**

1. \(\frac{2}{3} T_1 + \frac{1}{3} T_3\)

2. \(\frac{3}{2} T_1 + \frac{1}{3} T_3\)

3. \(\frac{2}{3} T_1 + \frac{3}{2} T_3\)

4. \(\frac{1}{3} T_1 + \frac{2}{3} T_3\)
The planet Mars has two moons, if one of them has a period 7 hours, 30 minutes and an orbital radius of 9.0 \times 10^3 \text{ km}. Find the mass of Mars.

\[ \left\{ \begin{array}{l}
\text{Given} \quad \frac{4\pi^2}{G} = 6 \times 10^{11} \text{ m}^{-2} \text{ kg}^2 \end{array} \right. \]

Options:

1. \( 5.96 \times 10^{19} \text{ kg} \)
2. \(3.25 \times 10^{21}\) kg

3. \(6.00 \times 10^{23}\) kg

4. \(7.02 \times 10^{25}\) kg

Question Type: MCQ Is Question Mandatory: No

Correct Marks: 4 Wrong Marks: 1

Options:

1. \(5.96 \times 10^{19}\) kg

2. \(3.25 \times 10^{21}\) kg

3. \(6.00 \times 10^{23}\) kg

4. \(7.02 \times 10^{25}\) kg

Question Type: MCQ Is Question Mandatory: No

Correct Marks: 4 Wrong Marks: 1
An object of mass 0.5 kg is executing simple harmonic motion. Its amplitude is 5 cm and time period (T) is 0.2 s. What will be the potential energy of the object at an instant \( t = \frac{T}{4} \) starting from mean position. Assume that the initial phase of the oscillation is zero.

Options:
1. \( 6.2 \times 10^{-3} \) J
2. \( 1.2 \times 10^{3} \) J
3. 0.62 J
4. \( 6.2 \times 10^{3} \) J
3. $0.62 \, J$

4. $6.2 \times 10^3 \, J$

**Question Type:** MCQ  **Is Question Mandatory:** No  
**Correct Marks:** 4  **Wrong Marks:** 1

An automobile of mass $'m'$ accelerates starting from origin and initially at rest, while the engine supplies constant power $P$. The position is given as a function of time by:

**Options:**

1. \[
\left( \frac{9P}{8m} \right)^\frac{1}{2} \frac{3}{t^2}
\]

2. \[
\left( \frac{8P}{9m} \right)^\frac{1}{2} \frac{2}{t^3}
\]

3. \[
\left( \frac{8P}{9m} \right)^\frac{1}{2} \frac{3}{t^2}
\]

4. \[
\left( \frac{9m}{8P} \right)^\frac{1}{2} \frac{3}{t^2}
\]
Question Type: MCQ  Is Question Mandatory: No

Correct Marks: 4  Wrong Marks: 1

‘m’ ও চূড়া নিয়ে চল সূচকচিত তার (ক্রোমলয়) চড়টা চালে যেতি সূচক চিত্র রাখার, চল্লিরত্ন কর্তৃক বিদেশ পাব একটি অফিস। এরদের চল্লিরত্ন চিত্র চিত্র প্রেক্ষিত হয়?

Options:

1. \[
\left( \frac{9P}{8m} \right)^{1/2} \frac{3}{t^2}
\]

2. \[
\left( \frac{8P}{9m} \right)^{1/2} \frac{2}{t^3}
\]

3. \[
\left( \frac{8P}{9m} \right)^{1/2} \frac{3}{t^2}
\]

4. \[
\left( \frac{9m}{8P} \right)^{1/2} \frac{3}{t^2}
\]

Question Type: MCQ  Is Question Mandatory: No

Correct Marks: 4  Wrong Marks: 1
Figure A and B show two long straight wires of circular cross-section (a and b with a < b), carrying current I which is uniformly distributed across the cross-section. The magnitude of magnetic field B varies with radius r and can be represented as:

Options:

1. 

2. 

3. 
Question Type: MCQ  Is Question Mandatory: No

Correct Marks: 4 Wrong Marks: 1

The area $A$ is less than the area $B$ (i.e., $A < B$) when the radius $r$ is less than the radius $a$. Therefore, when the current $I$ flows through the ring, the magnetic field $B$ is directed as shown in Fig. A or Fig. B.

Options:

1. 

2.
Two identical particles of mass 1 kg each go round a circle of radius R, under the action of their mutual gravitational attraction. The angular speed of each particle is:

Options:

1. \( \sqrt{\frac{G}{2R^3}} \)
2. \( \frac{1}{2} \sqrt{\frac{G}{R^3}} \)

3. \( \frac{1}{2R} \sqrt{\frac{1}{G}} \)

4. \( \sqrt{\frac{2G}{R^3}} \)

Question Type: MCQ
Is Question Mandatory: No
Correct Marks: 4
Wrong Marks: 1

Options:

1. \( \sqrt{\frac{G}{2R^3}} \)

2. \( \frac{1}{2} \sqrt{\frac{G}{R^3}} \)

3. \( \frac{1}{2R} \sqrt{\frac{1}{G}} \)

4. \( \sqrt{\frac{2G}{R^3}} \)
4. \[ \sqrt{\frac{2G}{R^3}} \]

Question Type: MCQ  Is Question Mandatory: No

Correct Marks: 4 Wrong Marks: 1

An electron and proton are separated by a large distance. The electron starts approaching the proton with energy 3 eV. The proton captures the electron and forms a hydrogen atom in second excited state. The resulting photon is incident on a photosensitive metal of threshold wavelength 4000 Å. What is the maximum kinetic energy of the emitted photoelectron?

Options:

1. 3.3 eV
2. No photoelectron would be emitted
3. 7.61 eV
4. 1.41 eV

Question Type: MCQ  Is Question Mandatory: No

Correct Marks: 4 Wrong Marks: 1

Options:

1. 3.3 eV
Question Type: MCQ
Is Question Mandatory: No

Correct Marks: 4 Wrong Marks: 1

The expected graphical representation of the variation of angle of deviation ‘δ’ with angle of incidence ‘i’ in a prism is:

Options:

1. 

2. 
Question Type: MCQ Is Question Mandatory: No
Correct Marks: 4 Wrong Marks: 1
Options:

1. [Diagram]

2. [Diagram]
A 100 Ω resistance, a 0.1 μF capacitor and an inductor are connected in series across a 250 V supply at variable frequency. Calculate the value of inductance of inductor at which resonance will occur. Given that the resonant frequency is 60 Hz.

Options:

1. $7.03 \times 10^{-5}$ H

2. 70.3 H
3. 0.70 H

4. 70.3 mH

Question Type: MCQ Is Question Mandatory: No
Correct Marks: 4 Wrong Marks: 1
Options:
1. $7.03 \times 10^{-5}$ H
2. 70.3 H
3. 0.70 H
4. 70.3 mH

Question Type: MCQ Is Question Mandatory: No
Correct Marks: 4 Wrong Marks: 1
The resistance of a conductor at 15°C is 16 Ω and at 100°C is 20 Ω. What will be the temperature coefficient of resistance of the conductor?
Options:
1. 0.003°C$^{-1}$
2. $0.010^\circ C^{-1}$

3. $0.033^\circ C^{-1}$

4. $0.042^\circ C^{-1}$

Question Type : MCQ Is Question Mandatory : No
Correct Marks : 4 Wrong Marks : 1

Options :
1. $0.003^\circ C^{-1}$
2. $0.010^\circ C^{-1}$
3. $0.033^\circ C^{-1}$
4. $0.042^\circ C^{-1}$

Question Type : MCQ Is Question Mandatory : No
Correct Marks : 4 Wrong Marks : 1
What will be the magnitude of electric field at point O as shown in figure? Each side of the figure is 1 and perpendicular to each other?

Options:

1. \( \frac{1}{4\pi \varepsilon_0} \frac{q}{l^2} \)
2. \( \frac{1}{4\pi \varepsilon_0} \frac{2q}{2l^2} (\sqrt{2}) \)
3. \( \frac{1}{4\pi \varepsilon_0} \frac{q}{(2l)^2} (2\sqrt{2} - 1) \)
4. \( \frac{q}{4\pi \varepsilon_0 (2l)^2} \)
Options:

1. \( \frac{1}{4\pi \varepsilon_0} \) \( \frac{q}{l^2} \) 

2. \( \frac{1}{4\pi \varepsilon_0} \) \( \frac{2q}{2l^2} (\sqrt{2}) \) 

3. \( \frac{1}{4\pi \varepsilon_0} \) \( \frac{q}{(2l^2)} (2\sqrt{2} - 1) \) 

4. \( \frac{q}{4\pi \varepsilon_0 (2l)^2} \)
The maximum amplitude for an amplitude modulated wave is found to be 12 V while the minimum amplitude is found to be 3 V. The modulation index is 0.6x where x is _________.

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

Answers:

1

Question Type: SA
Correct Marks: 4 Wrong Marks: 0
For the circuit shown, the value of current at time $t=3.2$ s will be ________ A.

![Voltage distribution V(t) is shown by Fig. (1) and the circuit is shown in Fig. (2)]
Answers Type: Equal

Text Areas: PlainText Possible

Answers:

1

Question Type: SA

Correct Marks: 4 Wrong Marks: 0

Current at t = 3.2 s in the circuit shown in Figure 2 is ________ A

![Figure 1](image1.png)

![Figure 2](image2.png)

(Option 1) 6.2 (Option 2) 5.0 (Option 3) 6.0 (Option 4) 3.6

Response Type: Numeric

Evaluation Required For SA: Yes

Show Word Count: Yes

Answers Type: Equal

Text Areas: PlainText Possible

Answers:

1
In the given figure the magnetic flux through the loop increases according to the relation \( \Phi_B(t) = 10t^2 + 20t \), where \( \Phi_B \) is in milliwebers and \( t \) is in seconds. The magnitude of current through \( R = 2 \, \Omega \) resistor at \( t = 5 \, s \) is _______ mA.
Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText Possible

Answers :

1

Question Type : SA

Correct Marks : 4 Wrong Marks : 0

The K\textsubscript{a} X-ray of molybdenum has wavelength 0.071 nm. If the energy of a molybdenum atom with a K electron knocked out is 27.5 keV, the energy of this atom when an L electron is knocked out will be ________ keV. (Round off to the nearest integer)

\[ h = 4.14 \times 10^{-15} \text{ eVs}, \ c = 3 \times 10^8 \text{ ms}^{-1} \]
The water is filled up to a height of 12 m in a tank having vertical sidewalls. A hole is made in one of the walls at a depth ‘h’ below the water level. The value of ‘h’ for which the emerging stream of water strikes the ground at the maximum range is _________ m.
1

Question Type: SA
Correct Marks: 4 Wrong Marks: 0

Response Type: Numeric
Evaluation Required For SA: Yes
Show Word Count: Yes
Answers Type: Equal

Answers:

1
In the given figure, two wheels P and Q are connected by a belt B. The radius of P is three times as that of Q. In case of same rotational kinetic energy, the ratio of rotational inertias \( \frac{I_1}{I_2} \) will be \( x : 1 \). The value of \( x \) will be ________.
Let \( P \) and \( Q \) be two current-carrying loops. Let \( B \) be the point of interest. If \( P \) and \( Q \) are current sources with currents \( I_1 \) and \( I_2 \), respectively, then the magnetic field \( B \) at point \( x \) is given by:

\[
\text{Answer: } 1
\]
A small block slides down from the top of hemisphere of radius \( R = 3 \) m as shown in the figure. The height ‘\( h \)’ at which the block will lose contact with the surface of the sphere is _______ m.

(Assume there is no friction between the block and the hemisphere)
ଜ଼ିଳେଦୁରୁ ଚୁଁତାଳି, ତାରିକା ତାପୁବାହନ ଅଭାଜା ରାଜତ୍ଯ୍ୟ R=3 m ଘନରେ ତାରିକା ଚିହନ୍ଦ୍ରଙ୍କାଳ ବାଗଙ୍କ ହୋଇ ହୋଇବାକୁ ଲାଗଭାବା ପାଇଁ। (ରାଜତ୍ୟ୍ୟ ଜିଲେଦୁରୁ) ଚିହନ୍ଦ୍ରଙ୍କାଳ ବାଗଙ୍କ ହୋଇଁ ଚାପାଶାଳା ବଛରଙ୍କ ବିଶେନା ଲେଖନି, ତାରିକା ରାଜତ୍ୟ ‘h’ ଏକ ଭୂଗୋଳାପତୀ ତାରିକା ହୋଇବାକୁ ଲାଗଭାବା ପାଇଁ _________ m ହୋଇବାକୁ ଲାଗଭାବା ପାଇଁ।

(ଜିଲେଦୁରୁ ଚୁଁ, ତାପୁବାହନ ଅଭାଜା ରାଜତ୍ୟ ବାଗଙ୍କାଳ ବଛର ବିଶେବି ତାରିକା, 

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

1

Question Type : SA
Correct Marks : 4 Wrong Marks : 0
A swimmer wants to cross a river from point A to point B. Line AB makes an angle of 30° with the flow of river. Magnitude of velocity of the swimmer is same as that of the river. The angle θ with the line AB should be _______°, so that the swimmer reaches point B.

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

Question Type: SA
Correct Marks: 4 Wrong Marks: 0
A particle executes simple harmonic motion represented by displacement function as 
$x(t) = A \sin(\omega t + \phi)$

If the position and velocity of the particle at $t=0$ s are $2 \text{ cm}$ and $2\omega \text{ cm/s}$ respectively, then its amplitude is $x\sqrt{2} \text{ cm}$ where the value of $x$ is _____.

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
The difference in the number of waves when yellow light propagates through air and vacuum columns of the same thickness is one. The thickness of the air column is ________ mm.

[Refractive index of air = 1.0003, wavelength of yellow light in vacuum = 6000 Å]
(1) The radius of the atom of sodium is ________ mm. (Given that the diameter of the atom is 6000 Å)

**Response Type**: Numeric

**Evaluation Required For SA**: Yes

**Show Word Count**: Yes

**Answers Type**: Equal Text

**Areas**: PlainText Possible

**Answers**: 1

---

**Chemistry Section A**

<table>
<thead>
<tr>
<th>Section Id</th>
<th>864351850</th>
</tr>
</thead>
<tbody>
<tr>
<td>Section Number</td>
<td>3</td>
</tr>
<tr>
<td>Section type</td>
<td>Online</td>
</tr>
<tr>
<td>Mandatory or Optional</td>
<td>Mandatory</td>
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<td>Number of Questions</td>
<td>20</td>
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<tr>
<td>Number of Questions to be attempted</td>
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<td>Section Marks</td>
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<tr>
<td>Enable Mark as Answered Mark for Review and Clear</td>
<td>Yes</td>
</tr>
<tr>
<td>Response</td>
<td></td>
</tr>
<tr>
<td>Sub-Section Number</td>
<td>1</td>
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<tr>
<td>Sub-Section Id</td>
<td>8643511077</td>
</tr>
<tr>
<td>Question Shuffling Allowed</td>
<td>Yes</td>
</tr>
</tbody>
</table>

**Question Type**: MCQ Is Question Mandatory: No
Select the correct statements.

(A) Crystalline solids have long range order.
(B) Crystalline solids are isotropic.
(C) Amorphous solids are sometimes called pseudo solids.
(D) Amorphous solids soften over a range of temperatures.
(E) Amorphous solids have a definite heat of fusion.

Choose the most appropriate answer from the options given below:

Options:

1. (A), (C), (D) only

2. (A), (B), (E) only

3. (C), (D) only

4. (B), (D) only
Question Type: MCQ Is Question Mandatory: No
Correct Marks: 4 Wrong Marks: 1

If the Thompson model of the atom was correct, then the result of Rutherford’s gold foil experiment would have been:

Options:

1. All of the $\alpha$-particles pass through the gold foil without decrease in speed.

2. $\alpha$-Particles pass through the gold foil deflected by small angles and with reduced speed.
3. α-Particles are deflected over a wide range of angles.

4. All α-particles get bounced back by 180°.
Given below are two statements: one is labelled as Assertion A and the other is labelled as Reason R.

**Assertion A**: $\text{SO}_2(g)$ is adsorbed to a larger extent than $\text{H}_2(g)$ on activated charcoal.

**Reason R**: $\text{SO}_2(g)$ has a higher critical temperature than $\text{H}_2(g)$.

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

**Options**:

1. Both A and R are correct and R is the correct explanation of A.

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

3. A is correct but R is not correct.

4. A is not correct but R is correct.
2. Which element R has a higher first ionisation energy than A?

3. Which element R has the highest first ionisation energy?

4. Which element R has a lower first ionisation energy?

**Question Type : MCQ Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

The correct order of first ionisation enthalpy is:

**Options :**

1. Mg < Al < P < S
2. Mg < Al < S < P
3. Mg < S < Al < P
4. Al < Mg < S < P

**Question Type : MCQ Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

Among the elements Mg, Al, P, and S, which order has the correct ionisation enthalpy? 

**Options :**

1. Mg < Al < P < S
2. \( \text{Mg} < \text{Al} < \text{S} < \text{P} \)

3. \( \text{Mg} < \text{S} < \text{Al} < \text{P} \)

4. \( \text{Al} < \text{Mg} < \text{S} < \text{P} \)

**Question Type : MCQ Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

The addition of silica during the extraction of copper from its sulphide ore

**Options :**

1. converts copper sulphide into copper silicate

2. reduces copper sulphide into metallic copper

3. converts iron oxide into iron silicate

4. reduces the melting point of the reaction mixture

**Question Type : MCQ Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

印度的最大的学生评论平台

**Options :**

1. 印度的最大的学生评论平台
2. The number of neutrons and electrons, respectively, present in the radioactive isotope of hydrogen is:

Options:
1. 2 and 1
2. 3 and 1
3. 2 and 2
4. 1 and 1

3. The number of neutrons and electrons, respectively, present in the radioactive isotope of hydrogen is:

Options:
1. 2 and 1
Match List - I with List - II:

<table>
<thead>
<tr>
<th>List - I</th>
<th>List - II</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Li</td>
<td>(i) photoelectric cell</td>
</tr>
<tr>
<td>(b) Na</td>
<td>(ii) absorbent of CO₂</td>
</tr>
<tr>
<td>(c) K</td>
<td>(iii) coolant in fast breeder nuclear reactor</td>
</tr>
<tr>
<td>(d) Cs</td>
<td>(iv) treatment of cancer</td>
</tr>
<tr>
<td></td>
<td>(v) bearings for motor engines</td>
</tr>
</tbody>
</table>

Choose the correct answer from the options given below:

Options:

1. (a) - (iv), (b) - (iii), (c) - (i), (d) - (ii)
2. (a) - (v), (b) - (i), (c) - (ii), (d) - (iv)
3. (a) - (v), (b) - (ii), (c) - (iv), (d) - (i)
4. (a) - (v), (b) - (iii), (c) - (ii), (d) - (i)
Question Type: MCQ Is Question Mandatory: No

Correct Marks: 4 Wrong Marks: 1

Options:

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

2. (a) - (v), (b) - (i), (c) - (ii), (d) - (iv)

3. (a) - (v), (b) - (ii), (c) - (iv), (d) - (i)

4. (a) - (v), (b) - (iii), (c) - (ii), (d) - (i)

Question Type: MCQ Is Question Mandatory: No

Correct Marks: 4 Wrong Marks: 1

Number of Cl=O bonds in chlorous acid, chloric acid and perchloric acid respectively are:

Options:
1. 1, 1 and 3

2. 3, 1 and 1

3. 1, 2 and 3

4. 4, 1 and 0

Question Type: MCQ Is Question Mandatory: No
Correct Marks: 4 Wrong Marks: 1

Options:
1. 1, 1 and 3
2. 3, 1 and 1
3. 1, 2 and 3
4. 4, 1 and 0

Question Type: MCQ Is Question Mandatory: No
Correct Marks: 4 Wrong Marks: 1

To an aqueous solution containing ions such as Al$^{3+}$, Zn$^{2+}$, Ca$^{2+}$, Fe$^{3+}$, Ni$^{2+}$, Ba$^{2+}$ and Cu$^{2+}$ was added conc. HCl, followed by H$_2$S.
The total number of cations precipitated during this reaction is/are:
Options:
1. 3
2. 2
3. 1
4. 4

Question Type: MCQ Is Question Mandatory: No
Correct Marks: 4 Wrong Marks: 1

Options:
1. 3
2. 2
3. 1
4. 4

Question Type: MCQ Is Question Mandatory: No
Correct Marks: 4 Wrong Marks: 1
Given below are two statements:

Statement I: \([\text{Mn(CN)}_6]^{3-}\), \([\text{Fe(CN)}_6]^{3-}\) and \([\text{Co(C}_2\text{O}_4)_3]^{3-}\) are d\(^2\)sp\(^3\) hybridised.

Statement II: \([\text{MnCl}_4]^{3-}\) and \([\text{FeF}_6]^{3-}\) are paramagnetic and have 4 and 5 unpaired electrons, respectively.

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

Options:

1. Both statement I and statement II are true
2. Both statement I and statement II are false
3. Statement I is correct but statement II is false
4. Statement I is incorrect but statement II is true

Question Type: MCQ Is Question Mandatory: No
Correct Marks: 4 Wrong Marks: 1
2. লিটেল লিটেল ই জেল লিটেল ই হিয়া শুধু ম।

3. লিটেল ই জেল, লিটেল লিটেল ই হিয়া শুধু ম।

4. লিটেল ই হিয়া লিটেল লিটেল ই শুধু ম।

**Question Type :** MCQ  
**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>(compound)</td>
<td>(effect/affected species)</td>
</tr>
<tr>
<td>(a) Carbon monoxide</td>
<td>(i) Carcinogenic</td>
</tr>
<tr>
<td>(b) Sulphur dioxide</td>
<td>(ii) Metabolized by pyrus plants</td>
</tr>
<tr>
<td>(c) Polychlorinated biphenyls</td>
<td>(iii) Haemoglobin</td>
</tr>
<tr>
<td>(d) Oxides of nitrogen</td>
<td>(iv) Stiffness of flower buds</td>
</tr>
</tbody>
</table>

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

**Options :**

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

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

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

Question Type : MCQ Is Question Mandatory : No
Correct Marks : 4 Wrong Marks : 1

Options:
1. (a) - (iii), (b) - (iv), (c) - (i), (d) - (ii)

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

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

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

Question Type : MCQ Is Question Mandatory : No
Correct Marks : 4 Wrong Marks : 1
Which one of the following set of elements can be detected using sodium fusion extract?

Options:
1. Nitrogen, Phosphorous, Carbon, Sulfur
2. Sulfur, Nitrogen, Phosphorous, Halogens
3. Phosphorous, Oxygen, Nitrogen, Halogens
4. Halogens, Nitrogen, Oxygen, Sulfur

Question Type: MCQ Is Question Mandatory: No
Correct Marks: 4 Wrong Marks: 1
Given below are two statements:

**Statement I:** Hyperconjugation is a permanent effect.

**Statement II:** Hyperconjugation in ethyl cation \((\text{CH}_3^+ - \text{CH}_2^-)\) involves the overlapping of \(C_{sp^2} - H_{1s}\) bond with empty 2p orbital of other carbon.

Choose the correct option:

- **Options:**
  1. Both **statement I** and **statement II** are true
  2. Both **statement I** and **statement II** are false
  3. **Statement I** is correct but **statement II** is false
  4. **Statement I** is incorrect but **statement II** is true

*Question Type: MCQ Is Question Mandatory: No*

*Correct Marks: 4 Wrong Marks: 1*
Consider the above reaction, the major product “P” formed is:

Options:
Question Type: MCQ  Is Question Mandatory: No  Correct Marks: 4  Wrong Marks: 1

Options:
Question Type: MCQ  Is Question Mandatory: No
Correct Marks: 4  Wrong Marks: 1
Consider the above reaction, and choose the correct statement:

Options:

1. Compound A will be the major product

2. Compound B will be the major product

3. Both compounds A and B are formed equally

4. The reaction is not possible in acidic medium
Consider the above reaction and identify “Y”.

Options:

1. $-\text{COOH}$

2. $-\text{CH}_2\text{NH}_2$

3. $-\text{CHO}$

4. $-\text{CONH}_2$
The correct sequence of correct reagents for the following transformation is:

Options:

1. (i) Cl₂, FeCl₃  (ii) Fe, HCl  (iii) NaNO₂, HCl, 0°C  (iv) H₂O/H⁺

2. (i) Fe, HCl  (ii) NaNO₂, HCl, 0°C  (iii) H₂O/H⁺  (iv) Cl₂, FeCl₃
3. (i) Fe, HCl  
   (ii) Cl₂, HCl  
   (iii) NaNO₂, HCl, 0°C  
   (iv) H₂O/H⁺

4. (i) Cl₂, FeCl₃  
   (ii) NaNO₂, HCl, 0°C  
   (iii) Fe, HCl  
   (iv) H₂O/H⁺

Question Type: MCQ  Is Question Mandatory: No
Correct Marks: 4 Wrong Marks: 1
What is A in the following reaction?

Options:

1. 

2. 

3. 

4. 

(Major Product)
Question Type : MCQ Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

What is the product 'A'? 

\[ \begin{align*}
\text{(i) } & \quad \text{Reagent} \\
\text{(ii) } & \quad \text{Product: A (Major Product)}
\end{align*} \]

Options:

1. 

2. \[ \text{CH}_2\text{NH}_2 \]
Question Type : MCQ Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

Given below are two statements:

Statement I : Penicillin is a bacteriostatic type antibiotic.

Statement II : The general structure of Penicillin is:

Choose the correct option:

Options:

1. Both statement I and statement II are true

2. Both statement I and statement II are false
3. **Statement I** is correct but **statement II** is false

4. **Statement I** is incorrect but **statement II** is true

**Question Type**: MCQ  
**Is Question Mandatory**: No

**Correct Marks**: 4  
**Wrong Marks**: 1

**Options**:

1.  
2.  
3.  

![Chemical Structure](image-url)
4. The I and II are related.

**Question Type: MCQ Is Question Mandatory: No**

**Correct Marks: 4 Wrong Marks: 1**

Compounds A gives D-Galactose and D-Glucose on hydrolysis. The compound A is:

**Options:**

1. Maltose
2. Lactose
3. Sucrose
4. Amylose

**Question Type: MCQ Is Question Mandatory: No**

**Correct Marks: 4 Wrong Marks: 1**

Compound A gives D-Galactose and D-Glucose on hydrolysis. The compound A is:

**Options:**

1. Maltose
2. Lactose
3. Sucrose
4. Amylose
The above reaction is carried out in a vessel starting with partial pressures $P_{SO_2} = 250 \text{ m bar}$, $P_{O_2} = 750 \text{ m bar}$ and $P_{SO_3} = 0 \text{ bar}$. When the reaction is complete, the total pressure in the reaction vessel is ________ m bar. (Round off to the Nearest Integer).
Question Type : SA

Correct Marks : 4 Wrong Marks : 0

The total number of electrons in all bonding molecular orbitals of $O_2^{2-}$ is ________.

(Round off to the Nearest Integer).

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText Possible

Answers :

1
When 400 mL of 0.2 M $\text{H}_2\text{SO}_4$ solution is mixed with 600 mL of 0.1 M NaOH solution, the increase in temperature of the final solution is $\text{ } \times 10^{-2}$ K. (Round off to the Nearest Integer).

[Use: $\text{H}^+(\text{aq}) + \text{OH}^-(\text{aq}) \rightarrow \text{H}_2\text{O} : \Delta_{\text{f}}H = -57.1 \text{ kJ mol}^{-1}$

Specific heat of $\text{H}_2\text{O} = 4.18 \text{ J K}^{-1} \text{ g}^{-1}$

density of $\text{H}_2\text{O} = 1.0 \text{ g cm}^{-3}$

Assume no change in volume of solution on mixing.]
ঋণক্রমে ৬০০ ml ও ০.১ M NaOH ত্বকা জোল ৪০০ ml ও ০.২ M H₂SO₄ ত্বকা কিন্তু, ত্বকা মেরে জোল অর্থাৎ ত্বকা \( \frac{4}{10^{-2}} \) K ।

(ত্বকা মেরে জোল অর্থাৎ ত্বকা)

জোলটি হ'ল: \( H^+(aq) + OH^-(aq) \rightarrow H_2O \): \( \Delta H = -57.1 \text{kJ mol}^{-1} \)

ত্বকা জোলের \( H_2O = 4.18 \text{J K}^{-1} \text{g}^{-1} \)

ত্বকা জোলে \( H_2O = 1.0 \text{g cm}^{-3} \)

(ত্বকা জোল জোল কীভাবে ত্বকা ত্বকা ত্বকা ত্বকা ত্বকা)

Response Type: Numeric

Evaluation Required For SA: Yes

Show Word Count: Yes

Answers Type: Equal

Text Areas: PlainText Possible

Answers:

1
In a solvent 50% of an acid HA dimerizes and the rest dissociates. The van’t Hoff factor of the acid is \( \_\_\_\_\_ \times 10^{-2} \). (Round off to 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 Type: SA

Correct Marks: 4 Wrong Marks: 0

HA }): 50% \( \text{dimerizes} \) \( \text{and} \) \( \text{rest} \) \( \text{dissociates} \). \( \text{The} \) \( \text{van't} \) \( \text{Hoff} \) \( \text{factor} \) \( \text{of} \) \( \text{the} \) \( \text{acid} \) \( \text{is} \) \( \_\_\_\_\_ \times 10^{-2} \). (Round off to 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 Type: SA

Correct Marks: 4 Wrong Marks: 0
The equilibrium constant for the reaction

\[ A(s) \rightleftharpoons M(s) + \frac{1}{2} O_2(g) \]

is \( K_p = 4 \). At equilibrium, the partial pressure of \( O_2 \) is ________ atm. (Round off to 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 Type: SA
Correct Marks: 4 Wrong Marks: 0

\( \text{প্রতিদ্বন্দ্বিতা} A(s) \rightleftharpoons M(s) + \frac{1}{2} O_2(g) \) তে \( K_p = 4 \) হলে, \( O_2 \) এর পার্শ্বিক সরবরাহ সম্পূর্নতা হলে তা হলো ________ atm।

(প্রতিদ্বন্দ্বিতা পূর্ণস্থিতি হলো দেখুন)

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

1
For the cell Cu(s) | Cu^{2+}(aq) (0.1 M) || Ag^+(aq) (0.01 M) | Ag(s)
the cell potential $E_1 = 0.3095$ V

For the cell Cu(s) | Cu^{2+}(aq) (0.01 M) || Ag^+(aq) (0.001 M) | Ag(s)
the cell potential = \( \frac{2.303 \times 10^{-2}}{F} \) V. (Round off to the Nearest Integer).

[Use: \( \frac{2.303 \times 10^{-2}}{F} = 0.059 \)]

Response Type: Numeric

Evaluation Required For SA: Yes

Show Word Count: Yes

Answers Type: Equal

Text Areas: PlainText Possible

Answers: 1
\[
Cu(s) | Cu^{2+} (aq) \ (0.1 \text{ M}) \ || \ Ag^+ (aq) \ (0.01 \text{ M}) | Ag(s) \text{ electrode}
\]
E_1 = 0.3095 V

\[
Cu(s) | Cu^{2+} (aq) \ (0.01 \text{ M}) \ || \ Ag^+ (aq) \ (0.001 \text{ M}) | Ag(s) \text{ electrode}
\]
E_2 = \frac{2.303 \text{ RT}}{F} = 0.059 \times 10^{-2} V

(Use \frac{2.303 \text{ RT}}{F} = 0.059)

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

Question Type: SA
Correct Marks: 4 Wrong Marks: 0
For the first order reaction \( A \rightarrow 2B \), 1 mole of reactant \( A \) gives 0.2 moles of \( B \) after 100 minutes. The half-life of the reaction is \( \text{_______} \) min. (Round off to the Nearest Integer).

[Use: \ln 2 = 0.69, \ln 10 = 2.3]

Properties of logarithms: \( \ln x^y = y \ln x \);

\[
\ln\left(\frac{x}{y}\right) = \ln x - \ln y
\]

Response Type: Numeric
Evaluation Required For SA: Yes
Question Type: SA

Correct Marks: 4 Wrong Marks: 0

\( \ln 2 = 0.69, \ln 10 = 2.3, \text{ then } x^y = y^x \)

\[
\ln \left( \frac{x}{y} \right) = \ln x - \ln y
\]

Response Type: Numeric

Evaluation Required For SA: Yes
3 moles of metal complex with formula $\text{Co(en)}_2\text{Cl}_3$ gives 3 moles of silver chloride on treatment with excess of silver nitrate. The secondary valency of Co in the complex is \_\_\_. (Round off to 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 Type : SA
Correct Marks : 4 Wrong Marks : 0
3 মোলের মেটাল কমপ্লেক্স এর সূত্র $\text{Co(en)}_2\text{Cl}_3$ জ্বলন্ত সাদা নাচে চারজন হিলনের দলসহ চার মুটি হিলের ৩ মোল হিলনের চূড়ায় হয়। Co এর দ্বীতীয় তাপতা দীর্ঘদূর তাপতা \_\_\_।

(চূর্ণ নূর্ধ্বরূপে নূর্ধ্বরূপ)

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

1

Question Type : SA
Correct Marks : 4 Wrong Marks : 0
The dihedral angle in staggered form of Newman projection of 1,1,1-Trichloro ethane is ______ degree. (Round off to the Nearest Integer).

**Question Type : SA**

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

1,1,1- トリクロエタンの Newman 表面投影における二面角を近似した場合、その値は ______ 度である。（四捨五入）

(トリクロエタンの Newman 表面投影 で)

**Question Type : SA**

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

1
10.0 mL of 0.05 M KMnO₄ solution was consumed in a titration with 10.0 mL of given oxalic acid dihydrate solution. The strength of given oxalic acid solution is ______ × 10⁻² g/L. (Round off to the Nearest Integer).

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

10.0 mL of 0.05 M KMnO₄ সোলিউশন করা হয়েছে । 10.0 mL ওকসিকেটিন কণা তিত্রাশীলে দুইবার তেলার পর যে কণা । এই কণার দুই তৃতীয় ভাগের মেটারা যে কণা ______ × 10⁻² g/L হয়।

Response Type: Numeric
Evaluation Required For SA: Yes
Show Word Count: Yes
Answers Type: Equal Text
Areas: PlainText Possible
Answers:
1
Let $f: \mathbb{R} \to \mathbb{R}$ be defined as

$$f(x + y) + f(x - y) = 2f(x)f(y), \quad f\left(\frac{1}{2}\right) = -1.$$ Then, the value of

$$\sum_{k=1}^{20} \frac{1}{\sin(k) \sin(k + f(k))}$$ is equal to:

Options:

1. $\sec^2(1) \sec(21) \cos(20)$

2. $\csc^2(21) \cos(20) \cos(2)$
3. \( \csc^2(1) \csc(21) \sin(20) \)

4. \( \sec^2(21) \sin(20) \sin(2) \)

---

Question Type: MCQ Is Question Mandatory: No

Correct Marks: 4 Wrong Marks: 1

---

\[ \sum_{k=1}^{20} \frac{1}{\sin(k) \sin(k + f(k))} \quad \text{Options:} \]

1. \( \sec^2(1) \sec(21) \cos(20) \)

2. \( \csc^2(21) \cos(20) \cos(2) \)

3. \( \csc^2(1) \csc(21) \sin(20) \)

4. \( \sec^2(21) \sin(20) \sin(2) \)

---

Question Type: MCQ Is Question Mandatory: No

Correct Marks: 4 Wrong Marks: 1
Let the mean and variance of the frequency distribution

\[ x: \quad x_1 = 2 \quad x_2 = 6 \quad x_3 = 8 \quad x_4 = 9 \]

\[ f: \quad 4 \quad 4 \quad \alpha \quad \beta \]

be 6 and 6.8 respectively. If \( x_3 \) is changed from 8 to 7, then the mean for the new data will be:

Options:

1. \( \frac{17}{3} \)

2. 5

3. \( \frac{16}{3} \)

4. 4

Question Type: MCQ Is Question Mandatory: No

Correct Marks: 4 Wrong Marks: 1
Consider a circle C which touches the y-axis at (0, 6) and cuts off an intercept $6\sqrt{5}$ on the x-axis. Then the radius of the circle C is equal to:

Options:

1. 8

2. $\sqrt{53}$

3. 9

4. $\sqrt{82}$
Two sides of a parallelogram are along the lines $4x + 5y = 0$ and $7x + 2y = 0$. If the equation of one of the diagonals of the parallelogram is $11x + 7y = 9$, then other diagonal passes through the point:

Options:

1. $(1, 2)$
2. $(2, 2)$
3. $(2, 1)$
4. $(1, 3)$
Question Type : MCQ Is Question Mandatory : No
Correct Marks : 4 Wrong Marks : 1

Let \( f : [0, \infty) \to [0, 3] \) be a function defined by

\[
 f(x) = \begin{cases} 
 \max \{ \sin t : 0 \leq t \leq x \}, & 0 \leq x \leq \pi \\
 2 + \cos x, & x > \pi 
\end{cases}
\]

Then which of the following is true?

Options :

1. \( f \) is not continuous exactly at two points in \((0, \infty)\)
2. \( f \) is continuous everywhere but not differentiable exactly at two points in \((0, \infty)\)

3. \( f \) is continuous everywhere but not differentiable exactly at one point in \((0, \infty)\)

4. \( f \) is differentiable everywhere in \((0, \infty)\)

---

**Question Type**: MCQ  
**Is Question Mandatory**: No

**Correct Marks**: 4  
**Wrong Marks**: 1

\[
\begin{align*}
\text{Given function} & \quad f : [0, \infty) \to [0, 3] \\
\text{Where} & \quad f(x) = \begin{cases} 
\max \{ \sin t : 0 \leq t \leq x \}, & 0 \leq x \leq \pi \\
2 + \cos x, & x > \pi 
\end{cases}
\end{align*}
\]

---

**Options**:

1. \((0, \infty)\) সমস্ত গাণিতিক ধার প্রত্যেকটি খুব ধীরে ধীরে \( f \) বিলম্ব লিখিত !

2. \((0, \infty)\) সমস্ত গাণিতিক ধার প্রত্যেকটি \( f \) সমস্ত ধার ধীরে ধীরে \( f \) বিলম্ব লিখিত !

3. \((0, \infty)\) সমস্ত গাণিতিক ধার প্রত্যেকটি \( f \) সমস্ত ধার ধীরে ধীরে \( f \) বিলম্ব লিখিত !

4. \((0, \infty)\) সমস্ত গাণিতিক \( f \) সমস্ত ধার লিখিত !
Which of the following is the negation of the statement “for all $M > 0$, there exists $x \in S$ such that $x \geq M$”?

Options:

1. there exists $M > 0$, there exists $x \in S$ such that $x < M$
2. there exists $M > 0$, there exists $x \in S$ such that $x \geq M$
3. there exists $M > 0$, such that $x < M$ for all $x \in S$
4. there exists $M > 0$, such that $x \geq M$ for all $x \in S$

Question Type: MCQ Is Question Mandatory: No

Correct Marks: 4 Wrong Marks: 1

Which of the following is the negation of the statement “for all $M > 0$, there exists $x \in S$ such that $x \sim M$”?

Options:

1. $\forall M > 0 \exists x \in S$ such that $x < M$
2. $\forall M > 0 \exists x \in S$ such that $x \geq M$
3. $\forall M > 0 \exists x \in S$ such that $x < M$
4. $\forall M > 0 \exists x \in S$ such that $x \geq M$
The area of the region bounded by $y - x = 2$ and $x^2 = y$ is equal to:

Options:

1. \( \frac{\frac{2}{3}}{} \)
2. \( \frac{\frac{4}{3}}{} \)
3. \( \frac{\frac{9}{2}}{} \)
4. \( \frac{\frac{16}{3}}{} \)

The area of the region bounded by $y - x = 2$ and $x^2 = y$ is equal to:

Options:

1. \( \frac{\frac{2}{3}}{} \)
2. \( \frac{\frac{4}{3}}{} \)
Let \( y = y(x) \) be the solution of the differential equation \( (x - x^3)dy = (y + yx^2 - 3x^4)dx, \ x > 2 \).
If \( y(3) = 3 \), then \( y(4) \) is equal to:

Options:
1. 12
2. 8
3. 16
4. 4
The point P \((a, b)\) undergoes the following three transformations successively:

(a) reflection about the line \(y = x\).

(b) translation through 2 units along the positive direction of \(x\)-axis.

(c) rotation through angle \(\frac{\pi}{4}\) about the origin in the anti-clockwise direction.

If the co-ordinates of the final position of the point P are \(\left(\frac{1}{\sqrt{2}}, \frac{7}{\sqrt{2}}\right)\), then the value of \(2a + b\) is equal to:

**Options:**

1. 5
2. 7
3. 9
Question Type: MCQ Is Question Mandatory: No
Correct Marks: 4 Wrong Marks: 1

4. 13

Options:
1. 5
2. 7
3. 9
4. 13
A possible value of \( x \), for which the ninth term in the expansion of
\[
\left( 3 \log_3 \sqrt{25x^2 - 1} + 7 + 3 \left( -\frac{1}{8} \right) \log_3(5^{x-1}+1) \right)^{10}
\]
in the increasing powers of \( \left( -\frac{1}{8} \right) \log_3(5^{x-1}+1) \)
is equal to 180, is:

Options :
1. 0
2. 1
3. \(-1\)
4. 2
4. Let \( C \) be the set of all complex numbers. Let 
\[
S_1 = \{ z \in C : |z - 2| \leq 1 \} \quad \text{and} \\
S_2 = \{ z \in C : z(1+i) + \bar{z}(1-i) \geq 4 \}.
\]

Then, the maximum value of \( |z - \frac{5}{2}|^2 \) for \( z \in S_1 \cap S_2 \) is equal to:

Options:

1. \( \frac{3 + 2\sqrt{2}}{4} \)
2. \( \frac{3 + 2\sqrt{2}}{2} \)
3. \( \frac{5 + 2\sqrt{2}}{2} \)
4. \( \frac{5 + 2\sqrt{2}}{4} \)
Question Type : MCQ Is Question Mandatory : No
Correct Marks : 4 Wrong Marks : 1

Let \( f: (a, b) \to \mathbb{R} \) be twice differentiable function such that \( f(x) = \int_a^x g(t) \, dt \) for a differentiable function \( g(x) \). If \( f(x) = 0 \) has exactly five distinct roots in \((a, b)\), then \( g(x)g'(x) = 0 \) has at least :
Options:
1. three roots in \((a, b)\)
2. five roots in \((a, b)\)
3. seven roots in \((a, b)\)
4. twelve roots in \((a, b)\)

Question Type: MCQ Is Question Mandatory: No
Correct Marks: 4 Wrong Marks: 1

Options:
1. 
2. 
3. 
4. 

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Let $A$ and $B$ be two $3 \times 3$ real matrices such that $(A^2 - B^2)$ is an invertible matrix. If $A^5 = B^5$ and $A^3 B^2 = A^2 B^3$, then the value of the determinant of the matrix $A^3 + B^3$ is equal to:

Options:
1. 0  
2. 1  
3. 2  
4. 4

Question Type: MCQ Is Question Mandatory: No  
Correct Marks: 4 Wrong Marks: 1

Question Type: MCQ Is Question Mandatory: No  
Correct Marks: 4 Wrong Marks: 1
Let \( N \) be the set of natural numbers and a relation \( R \) on \( N \) be defined by 
\[ R = \{(x, y) \in N \times N : x^3 - 3x^2y - xy^2 + 3y^3 = 0\} \]. Then the relation \( R \) is:

Options:
1. reflexive and symmetric, but not transitive
2. reflexive but neither symmetric nor transitive
3. symmetric but neither reflexive nor transitive
4. an equivalence relation

Question Type : MCQ Is Question Mandatory : No
Correct Marks : 4 Wrong Marks : 1

প্রদত্ত \( N \) হলো ধ্বজানন্দী সংখ্যাগুলির সেট, এবং \( N \) অনুসারে \( R \) এর ধরন (ব্যক্তি) মানের,
\[ R = \{(x, y) \in N \times N : x^3 - 3x^2y - xy^2 + 3y^3 = 0\} \] ধ্বজানন্দী সমান্তরাল। এরকম ধরনের \( R \) ছাড়া:

Options:
1. ধ্বজানন্দী ধরনের, তিনি ধ্বজানন্দী দুইটি এবং অপরটি দুইটি।
2. ধ্বজানন্দী, তিনি ধ্বজানন্দী দুইটি এবং অপরটি দুইটি।
3. পুৰী তিনি ধ্বজানন্দী দুইটি এবং অপরটি দুইটি।
4. এক ধ্বজানন্দী দুইটি (শুধুমাত্র)।
Let \( \alpha = \max_{x \in \mathbb{R}} \{8 \sin 3x, 4 \cos 3x\} \) and \( \beta = \min_{x \in \mathbb{R}} \{8 \sin 3x, 4 \cos 3x\} \).

If \( 8x^2 + bx + c = 0 \) is a quadratic equation whose roots are \( \sqrt[7]{\alpha} \) and \( \sqrt[7]{\beta} \), then the value of \( c - b \) is equal to:

Options:
1. 42
2. 43
3. 47
4. 50

---

Let \( \alpha = \max_{x \in \mathbb{R}} \{8 \sin 3x, 4 \cos 3x\} \) and \( \beta = \min_{x \in \mathbb{R}} \{8 \sin 3x, 4 \cos 3x\} \).

If \( 8x^2 + bx + c = 0 \) is a quadratic equation whose roots are \( \sqrt[7]{\alpha} \) and \( \sqrt[7]{\beta} \), then the value of \( c - b \) is:

Options:
1. 42
2. 43
3. $47$

4. $50$

Question Type: MCQ Is Question Mandatory: No
Correct Marks: 4 Wrong Marks: 1

The value of $\lim_{x \to 0} \left( \frac{x}{\sqrt[3]{1 - \sin x} - \sqrt[3]{1 + \sin x}} \right)$ is equal to:

Options:
1. 0
2. $-1$
3. $-4$
4. 4

Question Type: MCQ Is Question Mandatory: No
Correct Marks: 4 Wrong Marks: 1

$\lim_{x \to 0} \left( \frac{x}{\sqrt[3]{1 - \sin x} - \sqrt[3]{1 + \sin x}} \right)$ is equal to:

Options:
1. 0
2. $-1$
A student appeared in an examination consisting of 8 true-false type questions. The student guesses the answers with equal probability. The smallest value of \( n \), so that the probability of guessing at least \( n \) correct answers is less than \( \frac{1}{2} \), is:

Options:
1. 3
2. 4
3. 5
4. 6
For real numbers $\alpha$ and $\beta \neq 0$, if the point of intersection of the straight lines

\[
\frac{x - \alpha}{1} = \frac{y - 1}{2} = \frac{z - 1}{3} \quad \text{and} \quad \frac{x - 4}{\beta} = \frac{y - 6}{3} = \frac{z - 7}{3},
\]

lies on the plane $x + 2y - z = 8$, then $\alpha - \beta$ is equal to:

Options:

1. 3
2. 5
3. 7
4. 9
Correct Marks : 4 Wrong Marks : 1

\[
\frac{x - \alpha}{1} = \frac{y - 1}{2} = \frac{z - 1}{3}
\]

\[
\frac{x - 4}{\beta} = \frac{y - 6}{3} = \frac{z - 7}{3}
\]

Options :
1. 3
2. 5
3. 7
4. 9

Question Type : MCQ Is Question Mandatory : No
Correct Marks : 4 Wrong Marks : 1

If \( \tan \left( \frac{\pi}{9} \right), x, \tan \left( \frac{7\pi}{18} \right) \) are in arithmetic progression and \( \tan \left( \frac{\pi}{9} \right), y, \tan \left( \frac{5\pi}{18} \right) \) are also in arithmetic progression, then \( |x - 2y| \) is equal to :

Options :
1. 0
2. 1
3. 3
4. 4
Question Type : MCQ Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

\[ \tan \left( \frac{\pi}{9} \right), \tan \left( \frac{7\pi}{18} \right) \] \text{ are adjacent angles ( \text{ in radians})}. \text{ Prove that } \tan \left( \frac{\pi}{9} \right), \tan \left( \frac{5\pi}{18} \right) \text{ are perpendicular.} \]

Options :

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

Question Type : MCQ Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

Let \( \vec{a}, \vec{b} \) and \( \vec{c} \) be three vectors such that \( \vec{a} = \vec{b} \times (\vec{b} \times \vec{c}) \). If magnitudes of the vectors \( \vec{a}, \vec{b} \) and \( \vec{c} \) are \( \sqrt{2}, 1 \) and 2 respectively and the angle between \( \vec{b} \) and \( \vec{c} \) is \( \theta \left( 0 < \theta < \frac{\pi}{2} \right) \), then the value of \( 1 + \tan \theta \) is equal to :

Options :

1. 1
2. \[ \sqrt{3} + 1 \]

3. \[ \frac{\sqrt{3} + 1}{\sqrt{3}} \]

Question Type : MCQ Is Question Mandatory : No
Correct Marks : 4 Wrong Marks : 1
Options :
1. 1
2. 2
3. \[ \sqrt{3} + 1 \]
4. \[ \frac{\sqrt{3} + 1}{\sqrt{3}} \]
If the real part of the complex number \( z = \frac{3 + 2i \cos \theta}{1 - 3i \cos \theta} \) \( \theta \in \left( 0, \frac{\pi}{2} \right) \) is zero, then the value of \( \sin^2 \theta + \cos^2 \theta \) is equal to ________.
Correct Marks : 4 Wrong Marks : 0

\[ \theta \in \left( 0, \frac{\pi}{2} \right) \]

\[ z = \frac{3 + 2i \cos \theta}{1 - 3i \cos \theta} \]

If \( A = \begin{bmatrix} 1 & 1 & 1 \\ 0 & 1 & 1 \\ 0 & 0 & 1 \end{bmatrix} \) and \( M = A + A^2 + A^3 + \ldots + A^{20} \), then the sum of all the elements of the matrix \( M \) is equal to ________.
Question Type : SA
Correct Marks : 4 Wrong Marks : 0

Let \( n \) be a non-negative integer. Then the number of divisors of the form “4n + 1” of the number \( (10)^{10} \cdot (11)^{11} \cdot (13)^{13} \) is equal to \( \text{______} \).

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

Question Type : SA

The distance of the point P(3, 4, 4) from the point of intersection of the line joining the points Q(3, -4, -5) and R(2, -3, 1) and the plane 2x+y+z=7 is equal to ________.

Answer : 1
Let $y = y(x)$ be the solution of the differential equation $dy = e^{ax} + ydx; \alpha \in \mathbb{N}$.

If $y(\log_2 e) = \log_2 e$ and $y(0) = \log_2 \left(\frac{1}{2}\right)$, then the value of $\alpha$ is equal to ________.
If \[ \int_0^\pi (\sin^3 x) e^{-\sin^2 x} \, dx = \alpha - \frac{\beta}{e} \int_0^1 \sqrt{t} \, e^t \, dt, \] then \( \alpha + \beta \) is equal to \( \boxed{\ldots} \).
Let \( \vec{a} = \hat{i} - \alpha \hat{j} + \beta \hat{k}, \vec{b} = 3\hat{i} + \beta \hat{j} - \alpha \hat{k} \) and \( \vec{c} = -\alpha \hat{i} - 2 \hat{j} + \hat{k} \), where \( \alpha \) and \( \beta \) are integers. If \( \vec{a} \cdot \vec{b} = -1 \) and \( \vec{b} \cdot \vec{c} = 10 \), then \( (\vec{a} \times \vec{b}) \cdot \vec{c} \) is equal to _______.

Response Type: Numeric

Evaluation Required For SA: Yes

Show Word Count: Yes

Answers Type: Equal

Text Areas: PlainText Possible

Answers:

1

Let \( \vec{a} = \hat{i} - \alpha \hat{j} + \beta \hat{k}, \vec{b} = 3\hat{i} + \beta \hat{j} - \alpha \hat{k} \) and \( \vec{c} = -\alpha \hat{i} - 2 \hat{j} + \hat{k} \), where \( \alpha \) and \( \beta \) are integers. If \( \vec{a} \cdot \vec{b} = -1 \) and \( \vec{b} \cdot \vec{c} = 10 \), then \( (\vec{a} \times \vec{b}) \cdot \vec{c} \) is equal to _______.

Response Type: Numeric

Evaluation Required For SA: Yes

Show Word Count: Yes

Answers Type: Equal

Text Areas: PlainText Possible

Answers:

1
Let E be an ellipse whose axes are parallel to the co-ordinates axes, having its center at (3, -4), one focus at (4, -4) and one vertex at (5, -4). If mx - y = 4, m > 0 is a tangent to the ellipse E, then the value of 5m^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

Let E be an ellipse whose axes are parallel to the co-ordinates axes, having its center at (3, -4), one focus at (4, -4) and one vertex at (5, -4). If mx - y = 4, m > 0 is a tangent to the ellipse E, then the value of 5m^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
Let \( A = \{ n \in \mathbb{N} \mid n^2 \leq n + 10,000 \} \), \( B = \{ 3k + 1 \mid k \in \mathbb{N} \} \) and \( C = \{ 2k \mid k \in \mathbb{N} \} \), then the sum of all the elements of the set \( A \cap (B - C) \) is equal to ________.

**Response Type**: Numeric

**Evaluation Required For SA**: Yes

**Show Word Count**: Yes

**Answers Type**: Equal

**Text Areas**: PlainText Possible

**Answers**:

1

---

Let \( A = \{ n \in \mathbb{N} \mid n^2 \leq n + 10,000 \} \), \( B = \{ 3k + 1 \mid k \in \mathbb{N} \} \) and \( C = \{ 2k \mid k \in \mathbb{N} \} \), then \( A \cap (B - C) \) ________.

**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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Let \( A = \{ n \in \mathbb{N} \mid n^2 \leq n + 10,000 \} \), \( B = \{ 3k + 1 \mid k \in \mathbb{N} \} \) and \( C = \{ 2k \mid k \in \mathbb{N} \} \), then the sum of all the elements of the set \( A \cap (B - C) \) 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 real roots of the equation 
\[ e^{4x} - e^{3x} - 4e^{2x} - e^x + 1 = 0 \] is equal to \[ \underline{ \hspace{2cm} } \].

**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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Question Type: SA

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

\[ e^{4x} - e^{3x} - 4e^{2x} - e^x + 1 = 0 \] is equal to \[ \underline{ \hspace{2cm} } \].

**Response Type**: Numeric

**Evaluation Required For SA**: Yes

**Show Word Count**: Yes

**Answers Type**: Equal

**Text Areas**: PlainText Possible

**Answers**:

1