Section: Physics

Q.1 A screw gauge has 50 divisions on its circular scale. The circular scale is 4 units ahead of the pitch scale marking, prior to use. Upon one complete rotation of the circular scale, a displacement of 0.5 mm is noticed on the pitch scale. The nature of zero error involved, and the least count of the screw gauge, are respectively:

Options:
1. Negative, 2 µm
2. Positive, 10 µm
3. Positive, 0.1 mm
4. Positive, 0.1 µm

Question Type: MCQ
Question ID: 40503611475
Option 1 ID: 40503641619
Option 2 ID: 40503641617
Option 3 ID: 40503641620
Option 4 ID: 40503641618
Status: Answered
Chosen Option: 4
A sound source $S$ is moving along a straight track with speed $v$, and is emitting sound of frequency $v_0$ (see figure). An observer is standing at a finite distance, at the point $O$, from the track. The time variation of frequency heard by the observer is best represented by:

($t_0$ represents the instant when the distance between the source and observer is minimum)

Options

1. $v$

2. $v$

3. $v$

4. $v$

Question Type: MCQ
Question ID: 405036111464
Option 1 ID: 40503641573
Option 2 ID: 40503641574
Option 3 ID: 40503641575
Option 4 ID: 40503641576
Status: Answered
Chosen Option: 4
Q.3 In the figure below, P and Q are two equally intense coherent sources emitting radiation of wavelength 20 m. The separation between P and Q is 5 m and the phase of P is ahead of that of Q by 90°. A, B and C are three distinct points of observation, each equidistant from the midpoint of PQ. The intensities of radiation at A, B, C will be in the ratio:

[Diagram of P and Q with points A, B, C]

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

Q.4 If the potential energy between two molecules is given by 
\[ U = -\frac{A}{r^6} + \frac{B}{r^{12}} \]
then at equilibrium, separation between molecules, and the potential energy are:

Options:
1. \( \left( \frac{B}{2A} \right)^{\frac{1}{6}}, -\frac{A^2}{2B} \)
2. \( \left( \frac{B}{A} \right)^{\frac{1}{6}}, 0 \)
3. \( \left( \frac{2B}{A} \right)^{\frac{1}{6}}, -\frac{A^2}{4B} \)
4. \( \left( \frac{2B}{A} \right)^{\frac{1}{6}}, -\frac{A^2}{2B} \)
Q.5 An AC circuit has \( R = 100 \, \Omega \), \( C = 2 \, \mu F \) and \( L = 80 \, mH \), connected in series. The quality factor of the circuit is:

Options: 1. 2
2. 0.5
3. 20
4. 400

Question Type: MCQ
Question ID: 40503611469
Option 1 ID: 40503641595
Option 2 ID: 40503641596
Option 3 ID: 40503641594
Option 4 ID: 40503641593
Status: Not Attempted and Marked For Review
Chosen Option: --

Q.6 Charges \( Q_1 \) and \( Q_2 \) are at points A and B of a right angle triangle OAB (see figure). The resultant electric field at point O is perpendicular to the hypotenuse, then \( Q_1/Q_2 \) is proportional to:

\[
\frac{x_1}{x_2}
\]

Options:
1. \( \frac{x_1^3}{x_2^3} \)
2. \( \frac{x_2}{x_1} \)
3. \( \frac{x_1}{x_2} \)
4. \( \frac{x_2^2}{x_1^2} \)

Question Type: MCQ
Question ID: 40503611465
Option 1 ID: 40503641579
Option 2 ID: 40503641578
Option 3 ID: 40503641577
Option 4 ID: 40503641580
Status: Answered
Chosen Option: 4
Q.7

Shown in the figure is a hollow ice cream cone (it is open at the top). If its mass is \( M \), radius of its top, \( R \) and height, \( H \), then its moment of inertia about its axis is:

![Figure of a hollow ice cream cone]

Options

1. \( \frac{MR^2}{2} \)
2. \( \frac{M(R^2 + H^2)}{4} \)
3. \( \frac{MH^2}{3} \)
4. \( \frac{MR^2}{3} \)

Question Type: MCQ

Question ID: 40603611469
Option 1 ID: 40603641563
Option 2 ID: 40603641556
Option 3 ID: 40603641564
Option 4 ID: 40603641555

Status: Answered
Chosen Option: 2
Four point masses, each of mass $m$, are fixed at the corners of a square of side $l$. The square is rotating with angular frequency $\omega$, about an axis passing through one of the corners of the square and parallel to its diagonal, as shown in the figure. The angular momentum of the square about this axis is:

Options:
1. $m l^2\omega$
2. $4 m l^2\omega$
3. $3 m l^2\omega$
4. $2 m l^2\omega$

Question Type: MCQ
Question ID: 40503611458
Option 1 ID: 40503641549
Option 2 ID: 40503641552
Option 3 ID: 40503641550
Option 4 ID: 40503641551
Status: Not Answered
Chosen Option: --
Q.9 For the given input voltage waveform \( V_{in}(t) \), the output voltage waveform \( V_o(t) \), across the capacitor is correctly depicted by:

Options

1. \( V_o(t) \)
   - 3 V
   - 2 V
   - 5 \( \mu \)s 10 \( \mu \)s 15 \( \mu \)s

2. \( V_o(t) \)
   - 2 V
   - 5 \( \mu \)s 10 \( \mu \)s 15 \( \mu \)s

3. \( V_o(t) \)
   - 2 V
   - 5 \( \mu \)s 10 \( \mu \)s 15 \( \mu \)s

4. \( V_o(t) \)
   - 2 V
   - 5 \( \mu \)s 10 \( \mu \)s 15 \( \mu \)s

Question Type: MCQ

Question ID: 40503611466
Option 1 ID: 40503641561
Option 2 ID: 40503641562
Option 3 ID: 40503641563
Option 4 ID: 40503641564
Status: Not Answered

Chosen Option: --
Q. 10 A particle of charge \( q \) and mass \( m \) is moving with a velocity \( \vec{v} \) \((v \neq 0)\) towards a large screen placed in the Y-Z plane at a distance \( d \). If there is a magnetic field \( \vec{B} = B_0 \hat{k} \), the minimum value of \( v \) for which the particle will not hit the screen is:

Options
1. \( \frac{qdB_0}{3m} \)
2. \( \frac{2qdB_0}{m} \)
3. \( \frac{qdB_0}{m} \)
4. \( \frac{qdB_0}{2m} \)

Q. 11 An insect is at the bottom of a hemispherical ditch of radius 1 m. It crawls up the ditch but starts slipping after it is at height \( h \) from the bottom. If the coefficient of friction between the ground and the insect is 0.75, then \( h \) is:

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

Options
1. 0.20 m
2. 0.45 m
3. 0.60 m
4. 0.80 m
A satellite is in an elliptical orbit around a planet P. It is observed that the velocity of the satellite when it is farthest from the planet is 6 times less than that when it is closest to the planet. The ratio of distances between the satellite and the planet at closest and farthest points is:

Options 1. 1 : 6
   2. 1 : 3
   3. 1 : 2
   4. 3 : 4

An electron, a doubly ionized helium ion (He+++) and a proton are having the same kinetic energy. The relation between their respective de-Broglie wavelengths \(\lambda_e\), \(\lambda_{He^{++}}\) and \(\lambda_p\) is:

Options 1. \(\lambda_e > \lambda_{He^{++}} > \lambda_p\)
   2. \(\lambda_e < \lambda_{He^{++}} = \lambda_p\)
   3. \(\lambda_e > \lambda_p > \lambda_{He^{++}}\)
   4. \(\lambda_e < \lambda_p < \lambda_{He^{++}}\)
Q.14 A clock has a continuously moving second’s hand of 0.1 m length. The average acceleration of the tip of the hand (in units of ms$^{-2}$) is of the order of:

Options:
1. $10^{-3}$
2. $10^{-4}$
3. $10^{-2}$
4. $10^{-1}$

Question Type: MCQ
Question ID: 40503611456
Option 1 ID: 40503641542
Option 2 ID: 40503641453
Option 3 ID: 40503641544
Option 4 ID: 40503641541
Status: Answered
Chosen Option: 4

Q.15 You are given that Mass of $\frac{7}{3}\text{Li} = 7.0160$ u,

Mass of $\frac{4}{2}\text{He} = 4.0026$ u

and Mass of $\frac{1}{1}\text{H} = 1.0079$ u.

When 20 g of $\frac{7}{3}\text{Li}$ is converted into $\frac{4}{2}\text{He}$ by proton capture, the energy liberated, (in kWh), is:

[Mass of nucleon = 1 GeV/c$^2$]

Options:
1. $4.5 \times 10^5$
2. $8 \times 10^6$
3. $6.82 \times 10^5$
4. $1.33 \times 10^6$

Question Type: MCQ
Question ID: 40503611473
Option 1 ID: 40503641610
Option 2 ID: 40503641612
Option 3 ID: 40503641609
Option 4 ID: 40503641511
Status: Not Answered
Chosen Option: --
Q. 16 A point like object is placed at a distance of 1 m in front of a convex lens of focal length 0.5 m. A plane mirror is placed at a distance of 2 m behind the lens. The position and nature of the final image formed by the system is:

Options:
1. 2.6 m from the mirror, real
2. 1 m from the mirror, virtual
3. 1 m from the mirror, real
4. 2.6 m from the mirror, virtual
Q.17

Identify the correct output signal Y in the given combination of gates (as shown) for the given inputs A and B.

Options

1. 

2. 

3. 

4. 

Question Type: MCQ

Question ID: 40503611474
Option 1 ID: 40503641613
Option 2 ID: 40503641614
Option 3 ID: 40503641616
Option 4 ID: 40503641615
Status: Not Answered
Chosen Option: –
Molecules of an ideal gas are known to have three translational degrees of freedom and two rotational degrees of freedom. The gas is maintained at a temperature of $T$. The total internal energy, $U$, of a mole of this gas, and the value of $\gamma = \frac{C_P}{C_v}$ are given, respectively, by:

Options

1. $U = \frac{5}{2}RT$ and $\gamma = \frac{6}{5}$
2. $U = 5RT$ and $\gamma = \frac{7}{5}$
3. $U = \frac{5}{2}RT$ and $\gamma = \frac{7}{5}$
4. $U = 5RT$ and $\gamma = \frac{6}{5}$

An object of mass $m$ is suspended at the end of a massless wire of length $L$ and area of cross-section, $A$. Young modulus of the material of the wire is $Y$. If the mass is pulled down slightly its frequency of oscillation along the vertical direction is:

Options

1. $f = \frac{1}{2\pi} \sqrt{\frac{mL}{YA}}$
2. $f = \frac{1}{2\pi} \sqrt{\frac{YA}{ml}}$
3. $f = \frac{1}{2\pi} \sqrt{\frac{mA}{YL}}$
4. $f = \frac{1}{2\pi} \sqrt{\frac{YL}{mA}}$
Q.20 An electron is moving along +x direction with a velocity of $6 \times 10^6$ ms$^{-1}$. It enters a region of uniform electric field of 300 V/cm pointing along +y direction. The magnitude and direction of the magnetic field set up in this region such that the electron keeps moving along the x direction will be:

Options:
1. $3 \times 10^{-4}$ T, along +z direction
2. $5 \times 10^{-3}$ T, along -z direction
3. $5 \times 10^{-3}$ T, along +z direction
4. $3 \times 10^{-4}$ T, along -z direction

Question Type: MCQ
Question ID: 40503611468
Option 1 ID: 40503641592
Option 2 ID: 40503641590
Option 3 ID: 40503641589
Option 4 ID: 40503641591
Status: Answered
Chosen Option: 3

Q.21 The density of a solid metal sphere is determined by measuring its mass and its diameter. The maximum error in the density of the sphere is \[ \left( \frac{x}{100} \right) \% \]. If the relative errors in measuring the mass and the diameter are 6.0% and 1.5% respectively, the value of $x$ is ________.

Given: 
Answer:

Question Type: SA
Question ID: 40503611476
Status: Answered

Q.22 Two bodies of the same mass are moving with the same speed, but in different directions in a plane. They have a completely inelastic collision and move together thereafter with a final speed which is half of their initial speed. The angle between the initial velocities of the two bodies (in degree) is ________.

Given: 90
Answer:

Question Type: SA
Question ID: 40503611477
Status: Answered
Q. 23 Suppose that intensity of a laser is \( \left( \frac{315}{\pi} \right) \) W/m\(^2\). The rms electric field, in units of V/m associated with this source is close to the nearest integer is __________.

\[ \varepsilon_0 = 8.86 \times 10^{-12} \text{ C}^2\text{Nm}^{-2}; \ c = 3 \times 10^8 \text{ ms}^{-1} \]

Given 4
Answer:

Q. 24 Initially a gas of diatomic molecules is contained in a cylinder of volume \( V_1 \) at a pressure \( P_1 \) and temperature 250 K. Assuming that 25% of the molecules get dissociated causing a change in number of moles. The pressure of the resulting gas at temperature 2000 K, when contained in a volume 2\( V_1 \) is given by \( P_2 \). The ratio \( P_2/P_1 \) is __________.

Given 2
Answer:

Q. 25 A part of a complete circuit is shown in the figure. At some instant, the value of current \( I \) is 1 A and it is decreasing at a rate of 10\(^2\)A s\(^{-1}\). The value of the potential difference \( V_P - V_Q \) (in volts) at that instant, is __________.

\[ L = 50 \text{ mH} \quad I \quad R = 2 \Omega \quad 30 \text{ V} \]

Given 3
Answer:
Q.1 The correct statement with respect to dinitrogen is:

Options
1. N\textsubscript{2} is paramagnetic in nature.
2. it can combine with dioxygen at 25 °C.
3. liquid dinitrogen is not used in cryosurgery.
4. it can be used as an inert diluent for reactive chemicals.

Question Type: MCQ
Question ID: 40503611491
Option 1 ID: 40503641669
Option 2 ID: 40503641668
Option 3 ID: 40503641666
Option 4 ID: 40503641667
Status: Answered
Chosen Option: 4
Consider the following reactions:

\[ \text{A}' \xrightarrow{\text{Ozonolysis}} \text{B}' + \text{C}' \]

\[ \text{B}' \xrightarrow{\Delta} \text{yellow ppt} \xrightarrow{\text{Ag}_2\text{O}} \text{silver mirror} \]

\[ \text{I}_2 + \text{NaOH} \xrightarrow{\Delta} \text{no yellow ppt} \]

\[ \text{I}_2 + \text{NaOH} \xrightarrow{\Delta} \text{gives white turbidity within 5 minutes} \]

\[ \text{C}' \xrightarrow{\Delta} \text{Anhydrous ZnCl}_2 & \text{Conc. HCl} \]

\[ \text{A}' \text{ is:} \]

**Options**

1. ![Chemical Structure 1]
2. ![Chemical Structure 2]
3. ![Chemical Structure 3]
4. ![Chemical Structure 4]

**Question Type:** MCQ  
**Question ID:** 405036111463  
**Option 1 ID:** 40503641635  
**Option 2 ID:** 40503641634  
**Option 3 ID:** 40503641636  
**Option 4 ID:** 40503641637  
**Status:** Answered  
**Chosen Option:** 3
Q.3 The major product obtained from the following reaction is:

\[ \text{O}_2\text{N} \quad \text{C} = \text{C} \quad \text{OCH}_3 \quad \text{Hg}^{2+} / \text{H}^+ \quad \text{H}_2\text{O} \]

Options

1. 

2. 

3. 

4. 

Question Type: MCQ
Question ID: 40503611486
Option 1 ID: 40503641647
Option 2 ID: 40503641648
Option 3 ID: 40503641649
Option 4 ID: 40503641646
Status: Answered
Chosen Option: 1
Q.4 A solution of two components containing \( n_1 \) moles of the 1st component and \( n_2 \) moles of the 2nd component is prepared. \( M_1 \) and \( M_2 \) are the molecular weights of component 1 and 2 respectively. If \( d \) is the density of the solution in g mL\(^{-1}\), \( C_2 \) is the molarity and \( x_2 \) is the mole fraction of the 2nd component, then \( C_2 \) can be expressed as:

Options
1. \[ C_2 = \frac{1000 x_2}{M_1 + x_2 (M_2 - M_1)} \]
2. \[ C_2 = \frac{d x_2}{M_2 + x_2 (M_2 - M_1)} \]
3. \[ C_2 = \frac{1000 d x_2}{M_1 + x_2 (M_2 - M_1)} \]
4. \[ C_2 = \frac{d x_1}{M_2 + x_2 (M_2 - M_1)} \]

Question Type: MCQ
Question ID: 405036411489
Option 1 ID: 405036411485
Option 2 ID: 405036415683
Option 3 ID: 40503641682
Option 4 ID: 40503641684
Status: Answered
Chosen Option: 3

Q.5 The INCORRECT statement is:

Options
1. Bronze is an alloy of copper and tin.
2. Cast iron is used to manufacture wrought iron.
3. German silver is an alloy of zinc, copper and nickel.
4. Brass is an alloy of copper and nickel.

Question Type: MCQ
Question ID: 405036411489
Option 1 ID: 405036411485
Option 2 ID: 405036415683
Option 3 ID: 40503641682
Option 4 ID: 40503641684
Status: Answered
Chosen Option: 2
Q.6
Consider the Assertion and Reason given below.

Assertion (A): Ethene polymerized in the presence of Ziegler Natta Catalyst at high temperature and pressure is used to make buckets and dustbins.

Reason (R): High density polymers are closely packed and are chemically inert.

Choose the correct answer from the following:

Options:
1. (A) is correct but (R) is wrong.
2. Both (A) and (R) are correct but (R) is not the correct explanation of (A).
3. Both (A) and (R) are correct and (R) is the correct explanation of (A).
4. (A) and (R) both are wrong.

Q.7
Arrange the following solutions in the decreasing order of pH:

(A) 0.01 M HCl
(B) 0.01 M NaOH
(C) 0.01 M CH₃COONa
(D) 0.01 M NaCl

Options:
1. (A) > (C) > (D) > (B)
2. (A) > (D) > (C) > (B)
3. (B) > (D) > (C) > (A)
4. (B) > (D) > (C) > (A)
**Q.8** Among the sulphates of alkaline earth metals, the solubilities of BeSO₄ and MgSO₄ in water, respectively, are:

Options 1. poor and poor  
2. high and poor  
3. high and high  
4. poor and high

**Q.9** The major products of the following reaction are:

\[ \text{CH}_3-\text{CH}-\text{CH}-\text{CH}_3 \xrightarrow{(i) \text{KO}^+\text{Bu}^+/\Delta} \text{OSO}_2\text{CH}_3 \xrightarrow{(ii) \text{O}_3/\text{H}_2\text{O}_2} \]

Options 1. CH₃ + CH₃CHO  
2. CH₃ + CH₃COOH  
3. CH₃ + HCHO  
4. CH₃ + HCOOH
The major product of the following reaction is:

\[
\text{CH}_3
\]
\[
\text{\text{NO}_2}
\]
\[
\text{2HBr}
\]

Options:

1. \[
\text{H}_3\text{C}
\]
\[
\text{Br}
\]
\[
\text{Br}
\]
\[
\text{NO}_2
\]
\[
\text{CH}_3
\]

2. \[
\text{Br}
\]
\[
\text{Br}
\]
\[
\text{Br}
\]
\[
\text{NO}_2
\]

3. \[
\text{Br}
\]
\[
\text{Br}
\]
\[
\text{Br}
\]
\[
\text{NO}_2
\]
\[
\text{CH}_3
\]

4. \[
\text{Br}
\]
\[
\text{Br}
\]
\[
\text{NO}_2
\]

Question Type: MCQ
Question ID: 40503611484
Option 1 ID: 40503641541
Option 2 ID: 40503641540
Option 3 ID: 40503641538
Option 4 ID: 40503641539
Status: Answered
Chosen Option: 3
Q.11  The presence of soluble fluoride ion up to 1 ppm concentration in drinking water, is:

1. harmful for teeth
2. harmful to skin
3. harmful to bones
4. safe for teeth

Question Type : MCQ
Question ID : 40503611494
Option 1 ID : 40503641679
Option 2 ID : 40503641681
Option 3 ID : 40503641680
Option 4 ID : 40503641678
Status : Not Answered
Chosen Option : --

Q.12  The increasing order of pKₐ values of the following compounds is:

\[
\begin{align*}
\text{I} & : \text{N} (\text{CH₃})₂ \\
\text{II} & : \text{N} (\text{CH₃})₂ \\
\text{III} & : \text{NH}₄\text{CH₃} \\
\text{IV} & : \text{NHCH₃} \\
\end{align*}
\]

\[
\begin{align*}
\text{OCH₃} & \\
\text{CN} & \\
\text{OH} & \\
\end{align*}
\]

Options:
1. II < IV < III < I
2. I < II < IV < III
3. II < I < III < IV
4. I < II < III < IV

Question Type : MCQ
Question ID : 40503611481
Option 1 ID : 40503641629
Option 2 ID : 40503641626
Option 3 ID : 40503641627
Option 4 ID : 40503641628
Status : Not Answered
Chosen Option : --
Q. 13  Which of the following compounds shows geometrical isomerism?

Options:
1. 2-methylpent-2-ene
2. 4-methylpent-2-ene
3. 4-methylpent-1-ene
4. 2-methylpent-1-ene

Question Type: MCQ
Question ID: 40503611487
Option 1 ID: 40503641651
Option 2 ID: 40503641653
Option 3 ID: 40503641652
Option 4 ID: 40503641650
Status: Answered
Chosen Option: 1

Q. 14  The set that contains atomic numbers of only transition elements, is:

Options:
1. 37, 42, 50, 64
2. 21, 25, 42, 72
3. 9, 17, 34, 38
4. 21, 32, 53, 64

Question Type: MCQ
Question ID: 40503611488
Option 1 ID: 40503641656
Option 2 ID: 40503641654
Option 3 ID: 40503641655
Option 4 ID: 40503641657
Status: Answered
Chosen Option: 2
Q.16
The variation of equilibrium constant with temperature is given below:

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Equilibrium Constant</th>
</tr>
</thead>
<tbody>
<tr>
<td>T₁ = 25 °C</td>
<td>K₁ = 10</td>
</tr>
<tr>
<td>T₂ = 100 °C</td>
<td>K₂ = 100</td>
</tr>
</tbody>
</table>

The values of ΔH°, ΔG° at T₁ and ΔG° at T₂ (in kJ mol⁻¹) respectively, are close to

[use R = 8.314 J K⁻¹ mol⁻¹]

Options:
1. 28.4, -7.14 and -5.71
2. 0.64, -7.14 and -5.71
3. 28.4, -5.71 and -14.29
4. 0.64, -5.71 and -14.29

Question Type: MCQ
Question ID: 40503611496
Option 1 ID: 40503641688
Option 2 ID: 40503641686
Option 3 ID: 40503641687
Option 4 ID: 40503641689
Status: Not Answered
Chosen Option: --

Q.16
Kraft temperature is the temperature:

Options:
1. below which the aqueous solution of detergents starts freezing.
2. below which the formation of micelles takes place.
3. above which the aqueous solution of detergents starts boiling.
4. above which the formation of micelles takes place.

Question Type: MCQ
Question ID: 40503611500
Option 1 ID: 40503641704
Option 2 ID: 40503641702
Option 3 ID: 40503641705
Option 4 ID: 40503641703
Status: Answered
Chosen Option: 3
Q.17

For the reaction:

$$\text{Fe}_2\text{N(s)} + \frac{3}{2} \text{H}_2(\text{g}) \rightarrow 2 \text{Fe(s)} + \text{NH}_3(\text{g})$$

Options:
1. $K_c = K_p (RT)$
2. $K_c = K_p (RT)^{-\frac{1}{2}}$
3. $K_c = K_p (RT)^{\frac{1}{2}}$
4. $K_c = K_p (RT)^{\frac{3}{2}}$

Q.18

The species that has a spin-only magnetic moment of 5.9 BM, is:

(Td = tetrahedral)

Options:
1. $[\text{Ni(CN)}_4]^{2-}$ (square planar)
2. $[\text{NiCl}_4]^{2-}$ (Td)
3. $\text{Ni(CO)}_4$ (Td)
4. $[\text{MnBr}_4]^{2-}$ (Td)
Q.19 The lanthanoid that does NOT show +4 oxidation state is:

Options
1. Dy
2. Ce
3. Eu
4. Tb

Q.20 Consider the following reactions
A → P1; B → P2; C → P3; D → P4.
The order of the above reactions are a, b, c, and d, respectively. The following graph is obtained when log[rate] vs. log[conc.] are plotted:

Among the following, the correct sequence for the order of the reactions is:

Options
1. d > a > b > c
2. a > b > c > d
3. c > a > b > d
4. d > b > a > c
Q.21 In an estimation of bromine by Carius method, 1.6 g of an organic compound gave 1.88 g of AgBr. The mass percentage of bromine in the compound is _________.

(Atomic mass, Ag = 108, Br = 80 g mol⁻¹)

Given: 20
Answer: 

Q.22 Potassium chlorate is prepared by the electrolysis of KCl in basic solution.

6OH⁻ + Cl⁻ → ClO₃⁻ + 3H₂O + 6e⁻

If only 60% of the current is utilized in the reaction, the time (rounded to the nearest hour) required to produce 10 g of KClO₃ using a current of 2 A is _________.

(Given: F = 96,500 C mol⁻¹; molar mass of KClO₃ = 122 g mol⁻¹)

Given: 7
Answer: 

Q.23 The number of Cl=O bonds in perchloric acid is, "_________".

Given: 3
Answer: 

Q.24 [Question not visible]
Q.24 The elevation of boiling point of 0.10 m aqueous \( \text{CrCl}_3 \cdot x \text{NH}_3 \) solution is two times that of 0.05 m aqueous \( \text{CaCl}_2 \) solution. The value of \( x \) is _________.

[Assume 100% ionisation of the complex and \( \text{CaCl}_2 \), coordination number of \( \text{Cr} \) as 6, and that all \( \text{NH}_3 \) molecules are present inside the coordination sphere]

Given 2
Answer:

Q.25 A spherical balloon of radius 3 cm containing helium gas has a pressure of \( 48 \times 10^{-3} \) bar. At the same temperature, the pressure of a spherical balloon of radius 12 cm containing the same amount of gas will be _________ \( \times 10^{-6} \) bar.

Given 24
Answer:

Section: Mathematics

Q.1 If \( \alpha \) and \( \beta \) be two roots of the equation \( x^2 - 64x + 256 = 0 \). Then the value of

\[
\left( \frac{\alpha^3}{\beta^5} \right)^{1/8} + \left( \frac{\beta^3}{\alpha^5} \right)^{1/8}
\]

is:

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

Question Type: MCQ
Question ID: 40603611567
Option 1 ID: 40603641717
Option 2 ID: 40603641718
Option 3 ID: 40603641715
Option 4 ID: 40603641716
Status: Answered
Chosen Option: 3
Q.2
The area (in sq. units) of the region
\[ A = \{(x, y) : |x| + |y| \leq 1, \ 2y^2 \geq |x| \} \]
is:

Options
1. \( \frac{1}{3} \)
2. \( \frac{7}{6} \)
3. \( \frac{1}{6} \)
4. \( \frac{5}{6} \)

Q.3
The general solution of the differential equation
\[ \sqrt{1+x^2} + y^2 + x^2 y^2 + xy \frac{dy}{dx} = 0 \]
is:

(where C is a constant of integration)

Options
1. \( \sqrt{1+y^2} + \sqrt{1+x^2} = \frac{1}{2} \log_e \left( \frac{\sqrt{1+x^2} + 1}{\sqrt{1+x^2} - 1} \right) + C \)
2. \( \sqrt{1+y^2} - \sqrt{1+x^2} = \frac{1}{2} \log_e \left( \frac{\sqrt{1+x^2} + 1}{\sqrt{1+x^2} - 1} \right) + C \)
3. \( \sqrt{1+y^2} + \sqrt{1+x^2} = \frac{1}{2} \log_e \left( \frac{\sqrt{1+x^2} - 1}{\sqrt{1+x^2} + 1} \right) + C \)
4. \( \sqrt{1+y^2} - \sqrt{1+x^2} = \frac{1}{2} \log_e \left( \frac{\sqrt{1+x^2} - 1}{\sqrt{1+x^2} + 1} \right) + C \)
Q.4 Let $L_1$ be a tangent to the parabola $y^2 = 4(x + 1)$ and $L_2$ be a tangent to the parabola $y^2 = 8(x + 2)$ such that $L_1$ and $L_2$ intersect at right angles. Then $L_1$ and $L_2$ meet on the straight line:

Options:
1. $x + 3 = 0$
2. $2x + 1 = 0$
3. $x + 2 = 0$
4. $x + 2y = 0$

---

Q.5 If $f(x + y) = f(x)f(y)$ and $\sum_{x=1}^{\infty} f(x) = 2$, then the value of $\frac{f(4)}{f(2)}$ is:

Options:
1. $\frac{2}{3}$
2. $\frac{1}{9}$
3. $\frac{1}{3}$
4. $\frac{4}{9}$
Q.6

If \( I_1 = \int_0^1 \left(1 - x^{50}\right)^{100} \, dx \) and
\[ I_2 = \int_0^1 \left(1 - x^{50}\right)^{101} \, dx \] such that \( I_2 = \alpha I_1 \) then \( \alpha \) equals to:

Options
1. \( \frac{5049}{5050} \)
2. \( \frac{5050}{5049} \)
3. \( \frac{5050}{5051} \)
4. \( \frac{5051}{5050} \)

Q.7

Out of 11 consecutive natural numbers if three numbers are selected at random (without repetition), then the probability that they are in A.P. with positive common difference, is:

Options
1. \( \frac{15}{101} \)
2. \( \frac{5}{101} \)
3. \( \frac{5}{33} \)
4. \( \frac{10}{99} \)
Q.8 A ray of light coming from the point \((2, 2\sqrt{3})\) is incident at an angle 30° on the line \(x = 1\) at the point A. The ray gets reflected on the line \(x = 1\) and meets x-axis at the point B. Then, the line AB passes through the point:

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

Q.9 Which of the following points lies on the locus of the foot of perpendicular drawn upon any tangent to the ellipse, \(\frac{x^2}{4} + \frac{y^2}{2} = 1\) from any of its foci?

Options
1. \((-2, \sqrt{3})\)
2. \((-1, \sqrt{2})\)
3. \((-1, \sqrt{3})\)
4. \((1, 2)\)
Q.10  The region represented by \( z = x + iy \in \mathbb{C} : |z| - \text{Re}(z) \leq 1 \) is also given by the inequality:

Options:
1. \( y^2 \geq 2(x + 1) \)
2. \( y^2 \leq 2\left(x + \frac{1}{2}\right) \)
3. \( y^2 \leq x + \frac{1}{2} \)
4. \( y^2 \geq x + 1 \)

Q.11  The position of a moving car at time \( t \) is given by \( f(t) = at^2 + bt + c, \ t > 0 \), where \( a, b \) and \( c \) are real numbers greater than 1. Then the average speed of the car over the time interval \( [t_1, t_2] \) is attained at the point:

Options:
1. \( \frac{(t_2 - t_1)}{2} \)
2. \( a(t_2 - t_1) + b \)
3. \( (t_1 + t_2) / 2 \)
4. \( 2a(t_1 + t_2) + b \)
Q.12
\[ \lim_{{x \to 1}} \left( \int_0^x \frac{(x-1)^2 \, t \cos(t^2) \, dt}{(x-1)\sin(x-1)} \right) \]

Options
1. is equal to \(\frac{1}{2}\)
2. is equal to 1
3. is equal to \(-\frac{1}{2}\)
4. does not exist

Question Type: MCQ
Question ID: 40503611514
Option 1 ID: 40503641745
Option 2 ID: 40503641744
Option 3 ID: 40503641746
Option 4 ID: 40503641743
Status: Answered
Chosen Option: 4

Q.13
If \( \sum_{i=1}^{n} (x_i - a) = n \) and \( \sum_{i=1}^{n} (x_i - a)^2 = na \),
\((n, a > 1)\) then the standard deviation of \(n\) observations \(x_1, x_2, ..., x_n\) is:

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

Question Type: MCQ
Question ID: 40603611523
Option 1 ID: 40603641780
Option 2 ID: 40603641782
Option 3 ID: 40603641779
Option 4 ID: 40603641781
Status: Not Answered
Chosen Option: ---
Q.14 If \([p]\) denotes the fractional part of the number \(p\), then \(\left\{ \frac{200}{8} \right\}\), is equal to:

Options:
1. \(\frac{5}{8}\)
2. \(\frac{7}{8}\)
3. \(\frac{3}{8}\)
4. \(\frac{1}{8}\)

Question Type: MCQ
Question ID: 40503611511
Option 1 ID: 40503641733
Option 2 ID: 40503641734
Option 3 ID: 40503641731
Option 4 ID: 40503641732
Status: Answered
Chosen Option: 3

Q.15 The shortest distance between the lines \(\frac{x-1}{0} = \frac{y+1}{-1} = \frac{z}{1}\) and \(x + y + z + 1 = 0\), \(2x - y + z + 3 = 0\) is:

Options:
1. 1
2. \(\frac{1}{\sqrt{5}}\)
3. \(\frac{1}{\sqrt{2}}\)
4. \(\frac{1}{2}\)

Question Type: MCQ
Question ID: 40503611522
Option 1 ID: 40503641775
Option 2 ID: 40503641777
Option 3 ID: 40503641776
Option 4 ID: 40503641778
Status: Answered
Chosen Option: 1
Q.16
The negation of the Boolean expression \( P \lor (\neg P \land q) \) is equivalent to:

Options:
1. \( p \land \neg q \)
2. \( \neg p \land \neg q \)
3. \( \neg p \lor \neg q \)
4. \( \neg p \lor q \)

Q.17
Two families with three members each and one family with four members are to be seated in a row. In how many ways can they be seated so that the same family members are not separated?

Options:
1. \( 2! \cdot 3! \cdot 4! \)
2. \( (3!)^3 \cdot (4!) \)
3. \( (3!)^2 \cdot (4!) \)
4. \( 3! \cdot (4!)^3 \)
Q.18
Let m and M be respectively the minimum and maximum values of
\[
\begin{vmatrix}
\cos^2 x & 1 + \sin^2 x & \sin 2x \\
1 + \cos^2 x & \sin^2 x & \sin 2x \\
\cos^2 x & \sin^2 x & 1 + \sin 2x \\
\end{vmatrix}
\]
Then the ordered pair (m, M) is equal to:

Options
1. (-3, 3)
2. (-3, -1)
3. (-4, -1)
4. (1, 3)

Question Type: MCQ
Question ID: 40503611509
Option 1 ID: 40503641724
Option 2 ID: 40503641723
Option 3 ID: 40503641725
Option 4 ID: 40503641726
Status: Not Answered
Chosen Option: --

Q.19
Let a, b, c, d and p be any non-zero distinct real numbers such that \((a^2 + b^2 + c^2)p^2 - 2(ab + bc + cd)p + (b^2 + c^2 + d^2) = 0\). Then:

Options
1. a, c, p are in A.P.
2. a, c, p are in G.P.
3. a, b, c, d are in G.P.
4. a, b, c, d are in A.P.

Question Type: MCQ
Question ID: 40503611512
Option 1 ID: 40503641738
Option 2 ID: 40503641736
Option 3 ID: 40503641737
Option 4 ID: 40503641735
Status: Answered
Chosen Option: 1
Q.20  The values of λ and μ, for which the system of linear equations
\[ x + y + z = 2 \]
\[ x + 2y + 3z = 5 \]
\[ x + 3y + λz = μ \]
has infinitely many solutions are, respectively:

Options 1. 6 and 8
2. 5 and 7
3. 5 and 8
4. 4 and 9

Q.21  Set A has m elements and Set B has n elements. If the total number of subsets of A is 112 more than the total number of subsets of B, then the value of m:n is

Given 28
Answer:

Q.22  Let \( f: \mathbb{R} \rightarrow \mathbb{R} \) be defined as
\[
f(x) = \begin{cases} 
  x^5 \sin\left(\frac{1}{x}\right) + 5x^2, & x < 0 \\
  0, & x = 0 \\
  x^5 \cos\left(\frac{1}{x}\right) + λx^2, & x > 0 
\end{cases}
\]
The value of \( λ \) for which \( f''(0) \) exists, is

Given 1
Answer:

Q.22  Let \( f: \mathbb{R} \rightarrow \mathbb{R} \) be defined as
\[
f(x) = \begin{cases} 
  x^5 \sin\left(\frac{1}{x}\right) + 5x^2, & x < 0 \\
  0, & x = 0 \\
  x^5 \cos\left(\frac{1}{x}\right) + λx^2, & x > 0 
\end{cases}
\]
The value of \( λ \) for which \( f''(0) \) exists, is

Given 1
Answer:
Q. 23
If \( \vec{a} \) and \( \vec{b} \) are unit vectors, then the
greatest value of \( \sqrt{3|\vec{a} + \vec{b} + \vec{a} - \vec{b}|} \) is
_________.

Given 3.44
Answer:

Q. 24
Let AD and BC be two vertical poles at
A and B respectively on a horizontal
ground. If AD = 8 m, BC = 11 m and
AB = 10 m; then the distance (in meters) of
a point M on AB from the point A such
that \( MD^2 + MC^2 \) is minimum is
_________.

Given 10
Answer:

Q. 25
The angle of elevation of the top of a hill
from a point on the horizontal plane
passing through the foot of the hill is found
to be 45°. After walking a distance of
80 meters towards the top, up a slope
inclined at an angle of 30° to the horizontal
plane, the angle of elevation of the top of
the hill becomes 75°. Then the height of
the hill (in meters) is
_________.

Given 80
Answer: