Q.1 One mole of an ideal gas passes through a process where pressure and volume obey

the relation \[ P = P_o \left(1 - \frac{1}{2} \left( \frac{V_o}{V} \right)^2 \right) \]. Here \( P_o \)
and \( V_o \) are constants. Calculate the change in the temperature of the gas if its volume changes from \( V_o \) to \( 2V_o \).

Options

1. \( \frac{P_o V_o}{2} \frac{V_o}{R} \)
2. \( \frac{5P_o V_o}{4} \frac{V_o}{R} \)
3. \( \frac{3P_o V_o}{4} \frac{V_o}{R} \)
4. \( \frac{1P_o V_o}{4} \frac{V_o}{R} \)

Q.2 The correct figure that shows, schematically, the wave pattern produced by superposition of two waves of frequencies 9 Hz and 11 Hz, is:

Options

1. [Graph of two overlapping waves]
2. [Graph of two non-overlapping waves]
Q.3 Light is incident normally on a completely absorbing surface with an energy flux of 25 W cm\(^{-2}\). If the surface has an area of 25 cm\(^2\), the momentum transferred to the surface in 40 min time duration will be:

Options
1. \(6.3 \times 10^{-4}\) Ns
2. \(1.4 \times 10^{-6}\) Ns
3. \(5.0 \times 10^{-3}\) Ns
4. \(3.5 \times 10^{-6}\) Ns

Q.4 A solid sphere of mass \(M\) and radius \(R\) is divided into two unequal parts. The first part has a mass of \(\frac{7M}{8}\) and is converted into a uniform disc of radius \(2R\). The second part is converted into a uniform solid sphere. Let \(I_1\) be the moment of inertia of the disc about its axis and \(I_2\) be the moment of inertia of the new sphere about its axis. The ratio \(I_1/I_2\) is given by:

Options
1. 185
2. 140
3. 285
4. 65

Q.5 A bullet of mass 20 g has an initial speed of 1 ms\(^{-1}\), just before it starts penetrating a mud wall of thickness 20 cm. If the wall offers a mean resistance of \(2.5 \times 10^{-2}\) N, the speed of the bullet after emerging from the other side of the wall is close to:

Options
1. 0.1 ms\(^{-1}\)
2. 0.7 ms\(^{-1}\)
3. 0.3 ms\(^{-1}\)
4. 0.4 ms\(^{-1}\)

Q.6 The time dependence of the position of a particle of mass \(m = 2\) is given by \(\mathbf{r}(t) = 2t \mathbf{i} - 3t^2 \mathbf{j}\). Its angular momentum, with respect to the origin, at time \(t = 2\) is:

Options
1. \(48 (\mathbf{i} + \mathbf{j})\)
2. \(36 \mathbf{k}\)
3. \(-34 (\mathbf{k} - \mathbf{i})\)
4. \(-48 \mathbf{k}\)
Q.7 A coil of self inductance 10 mH and resistance 0.1 Ω is connected through a switch to a battery of internal resistance 0.9 Ω. After the switch is closed, the time taken for the current to attain 80% of the saturation value is: \[\text{[take } \ln 5 = 1.6]\]

Options:
1. 0.324 s
2. 0.103 s
3. 0.002 s
4. 0.016 s

Q.8 In an experiment, brass and steel wires of length 1 m each with areas of cross section 1 mm² are used. The wires are connected in series and one end of the combined wire is connected to a rigid support and other end is subjected to elongation. The stress required to produce a net elongation of 0.2 mm is,

\[\text{[Given, the Young's Modulus for steel and brass are, respectively, } 120 \times 10^9 \text{ N/m}^2 \text{ and } 60 \times 10^9 \text{ N/m}^2]\]

Options:
1. \(1.2 \times 10^6 \text{ N/m}^2\)
2. \(4.0 \times 10^6 \text{ N/m}^2\)
3. \(1.8 \times 10^6 \text{ N/m}^2\)
4. \(0.2 \times 10^6 \text{ N/m}^2\)
A source of sound $S$ is moving with a velocity of 50 m/s towards a stationary observer. The observer measures the frequency of the source as 1000 Hz. What will be the apparent frequency of the source when it is moving away from the observer after crossing him? (Take velocity of sound in air is 350 m/s)

Options
1. 750 Hz
2. 857 Hz
3. 1143 Hz
4. 807 Hz

Q.10
A 2 mW laser operates at a wavelength of 500 nm. The number of photons that will be emitted per second is:

[Given Planck’s constant $h = 6.6 \times 10^{-34}$ Js, speed of light $c = 3.0 \times 10^8$ m/s]

Options
1. $5 \times 10^{15}$
2. $1.5 \times 10^{16}$
3. $2 \times 10^{16}$
4. $1 \times 10^{16}$

Q.11
A cubical block of side 0.5 m floats on water with 30% of its volume under water. What is the maximum weight that can be put on the block without fully submerging it under water?

[Take, density of water = $10^3$ kg/m$^3$]

Options
1. 46.3 kg
2. 87.5 kg
3. 65.4 kg
4. 30.1 kg

Q.12 Two radioactive substances A and B have decay constants 5λ and λ respectively. At t=0, a sample has the same number of the two nuclei. The time taken for the ratio of the number of nuclei to become \( \left( \frac{1}{e} \right)^2 \) will be:

- Option 1: \( \frac{1}{2\lambda} \)
- Option 2: \( \frac{1}{4\lambda} \)
- Option 3: \( \frac{1}{\lambda} \)
- Option 4: \( \frac{2}{\lambda} \)

Q.13 Space between two concentric conducting spheres of radii a and b (b > a) is filled with a medium of resistivity \( \rho \). The resistance between the two spheres will be:

- Option 1: \( \frac{\rho}{4\pi} \left( \frac{1}{a} - \frac{1}{b} \right) \)
- Option 2: \( \frac{\rho}{2\pi} \left( \frac{1}{a} - \frac{1}{b} \right) \)
- Option 3: \( \frac{\rho}{2\pi} \left( \frac{1}{a} + \frac{1}{b} \right) \)
- Option 4: \( \frac{\rho}{4\pi} \left( \frac{1}{a} + \frac{1}{b} \right) \)
Q.14 In the formula \( X = 5YZ^2 \), \( X \) and \( Z \) have dimensions of capacitance and magnetic field, respectively. What are the dimensions of \( Y \) in SI units?

Options:
1. \([M^{-3} L^{-2} T^8 A^4]\)
2. \([M^{-1} L^{-2} T^4 A^2]\)
3. \([M^{-2} L^0 T^{-4} A^{-2}]\)
4. \([M^{-2} L^{-2} T^6 A^3]\)

Q.15 The graph shows how the magnification \( m \) produced by a thin lens varies with image distance \( v \). What is the focal length of the lens used?

Options:
1. \( \frac{b^2}{ac} \)
2. \( \frac{b^2c}{a} \)
3. \( \frac{a}{c} \)
4. \( \frac{b}{c} \)
Q.16 A submarine experiences a pressure of $5.05 \times 10^6$ Pa at a depth of $d_1$ in a sea. When it goes further to a depth of $d_2$, it experiences a pressure of $8.08 \times 10^6$ Pa. Then $d_2 - d_1$ is approximately (density of water = $10^3$ kg/m$^3$ and acceleration due to gravity = $10$ ms$^{-2}$):

Options
1. 300 m
2. 400 m
3. 600 m
4. 500 m

Q.17 In a Young’s double slit experiment, the ratio of the slit’s width is $4 : 1$. The ratio of the intensity of maxima to minima, close to the central fringe on the screen, will be:

Options
1. $25 : 9$
2. $9 : 1$
3. $4 : 1$
4. $(\sqrt{3} + 1)^4 : 16$

Q.18

https://cdn3.digialm.com//per/g21/pub/2083/touchstone/AssessmentQPHTMLMode1//2083O1951//2083O1951S8D37329//15549643...
A metal coin of mass 5 g and radius 1 cm is fixed to a thin stick AB of negligible mass as shown in the figure. The system is initially at rest. The constant torque, that will make the system rotate about AB at 25 rotations per second in 5 s, is close to:

Options
1. $4.0 \times 10^{-6}$ Nm
2. $1.6 \times 10^{-5}$ Nm
3. $7.9 \times 10^{-6}$ Nm
4. $2.0 \times 10^{-5}$ Nm

Q.19 In free space, a particle A of charge 1 $\mu$C is held fixed at a point P. Another particle B of the same charge and mass 4 $\mu$g is kept at a distance of 1 mm from P. If B is released, then its velocity at a distance of 9 mm from P is:

\[
\text{Take} \quad \frac{1}{4\pi\varepsilon_0} = 9 \times 10^9 \text{ Nm}^2\text{C}^{-2}
\]

Options
1. 1.0 m/s
2. $3.0 \times 10^4$ m/s
3. $2.0 \times 10^3$ m/s
4. $1.5 \times 10^2$ m/s

Q.20
The elastic limit of brass is 379 MPa. What should be the minimum diameter of a brass rod if it is to support a 400 N load without exceeding its elastic limit?

Options 1. 1.00 mm
2. 1.16 mm
3. 0.90 mm
4. 1.36 mm

Q.21
A spaceship orbits around a planet at a height of 20 km from its surface. Assuming that only gravitational field of the planet acts on the spaceship, what will be the number of complete revolutions of the planet made by the spaceship in 24 hours around the planet?

[Given: Mass of planet = \(8 \times 10^{22}\) kg,
Radius of planet = \(2 \times 10^6\) m,
Gravitational constant \(G = 6.67 \times 10^{-11}\) Nm\(^2\)/kg\(^2\)]

Options 1. 9
2. 17
3. 13
4. 11

Q.22

Question Type: MCQ
Question ID: 41652914323
Option 1 ID: 41652956072
Option 2 ID: 41652956071
Option 3 ID: 41652956070
Option 4 ID: 41652956073
Status: Answered
Chosen Option: 4
In \( \text{Li}^{+} \), electron in first Bohr orbit is excited to a level by a radiation of wavelength \( \lambda \). When the ion gets deexcited to the ground state in all possible ways (including intermediate emissions), a total of six spectral lines are observed. What is the value of \( \lambda \)?

(Given: \( h = 6.63 \times 10^{-34} \text{ Js} \);
\( c = 3 \times 10^{8} \text{ ms}^{-1} \))

Options
1. 11.4 nm
2. 9.4 nm
3. 12.3 nm
4. 10.8 nm

---

Q.23

A simple pendulum of length \( L \) is placed between the plates of a parallel plate capacitor having electric field \( E \), as shown in figure. Its bob has mass \( m \) and charge \( q \). The time period of the pendulum is given by:

\[
T = 2\pi \sqrt{\frac{L}{g + \frac{qE}{m}}}.
\]

Options
1. \( 2\pi \sqrt{\frac{L}{g + \frac{qE}{m}}} \)
2. \( 2\pi \sqrt{\frac{L}{\sqrt{g^2 - \frac{q^2E^2}{m^2}}}} \)
3. \( 2\pi \sqrt{\frac{L}{g - \frac{qE}{m}}} \)
4. \[ 2\pi \sqrt{\frac{L}{B^2 + \left( \frac{qE}{m} \right)^2}} \]

Q.24

The magnitude of the magnetic field at the center of an equilateral triangular loop of side 1 m which is carrying a current of 10 A is:

\[ \text{[Take } \mu_0 = 4\pi \times 10^{-7} \text{ NAm}^{-2}] \]

Options
1. 18 \(\mu\)T
2. 9 \(\mu\)T
3. 3 \(\mu\)T
4. 1 \(\mu\)T

Q.25

The figure represents a voltage regulator circuit using a Zener diode. The breakdown voltage of the Zener diode is 6 V and the load resistance is, \(R_L = 4 \text{ k}\Omega\). The series resistance of the circuit is \(R_s = 1 \text{ k}\Omega\). If the battery voltage \(V_B\) varies from 8 V to 16 V, what are the minimum and maximum values of the current through Zener diode?

Options
1. 0.5 mA; 6 mA
2. 1 mA; 8.5 mA
3. 0.5 mA; 8.5 mA
4. 1.5 mA; 8.5 mA

Q.26 When heat $Q$ is supplied to a diatomic gas of rigid molecules, at constant volume its temperature increases by $\Delta T$. The heat required to produce the same change in temperature, at a constant pressure is:

Options
1. $\frac{2}{3}Q$
2. $\frac{5}{3}Q$
3. $\frac{7}{5}Q$
4. $\frac{3}{2}Q$

Question Type: MCQ
Question ID: 41652914342
Option 1 ID: 41652956146
Option 2 ID: 41652956149
Option 3 ID: 41652956148
Option 4 ID: 41652956147
Status: Not Answered
Chosen Option: --

Q.27 Two blocks $A$ and $B$ of masses $m_A = 1$ kg and $m_B = 3$ kg are kept on the table as shown in figure. The coefficient of friction between $A$ and $B$ is 0.2 and between $B$ and the surface of the table is also 0.2. The maximum force $F$ that can be applied on $B$ horizontally, so that the block $A$ does not slide over the block $B$ is:

[Take $g = 10$ m/s$^2$]

Options
1. 8 N
2. 16 N
3. 40 N
4. 12 N
Q.28 Water from a tap emerges vertically downwards with an initial speed of 1.0 m/s. The cross-sectional area of the tap is 10^-4 m^2. Assume that the pressure is constant throughout the stream of water and that the flow is streamlined. The cross-sectional area of the stream, 0.15 m below the tap would be:
(Take g = 10 m/s^2)

Options
1. 2 \times 10^{-5} m^2
2. 5 \times 10^{-5} m^2
3. 5 \times 10^{-4} m^2
4. 1 \times 10^{-5} m^2

Q.29 A square loop is carrying a steady current I and the magnitude of its magnetic dipole moment is m. If this square loop is changed to a circular loop and it carries the same current, the magnitude of the magnetic dipole moment of circular loop will be:

Options
1. \frac{m}{\pi}
2. \frac{3m}{\pi}
3. \frac{2m}{\pi}
4. \frac{4m}{\pi}
Q.30 A plane is inclined at an angle $\alpha = 30^\circ$ with respect to the horizontal. A particle is projected with a speed $u = 2 \text{ m/s}$, from the base of the plane, making an angle $\theta = 15^\circ$ with respect to the plane as shown in the figure. The distance from the base, at which the particle hits the plane is close to:

(Take $g = 10 \text{ m/s}^2$)

Options:
1. 20 cm
2. 18 cm
3. 26 cm
4. 14 cm

Q.1 Number of stereo centers present in linear and cyclic structures of glucose are respectively:

Options:
1. 5 & 4
2. 4 & 4
3. 5 & 5
4. 4 & 5
The pH of a 0.02 M \( \text{NH}_4\text{Cl} \) solution will be [given \( K_b(\text{NH}_4\text{OH}) = 10^{-5} \) and \( \log 2 = 0.301 \)]

Options
1. 2.65
2. 4.35
3. 4.65
4. 5.35

Q.3 The major product ‘\( \text{Y} \)’ in the following reaction is:

\[
\begin{align*}
\text{Cl} & \quad \text{EtONa} \quad \text{Heat} \quad x \quad \text{HBr} \quad \text{Y} \\
\end{align*}
\]

Options
1. \( \text{Br} \)
2. \( \text{HO} \)
3. \( \text{Br} \)
4. \( \text{Br} \)

Q.4 Which of the following is NOT a correct method of the preparation of benzylamine from cyanobenzene?
Options
1. \( \text{H}_2/\text{Ni} \)
2. (i) \( \text{LiAlH}_4 \)  (ii) \( \text{H}_3\text{O}^+ \)
3. (i) \( \text{SnCl}_2 + \text{HCl} \text{(gas)} \)  (ii) \( \text{NaBH}_4 \)
4. (i) \( \text{HCl/H}_2\text{O} \)  (ii) \( \text{NaBH}_4 \)

**Q.5** The highest possible oxidation states of uranium and plutonium, respectively, are:

Options
1. 6 and 7
2. 6 and 4
3. 7 and 6
4. 4 and 6

**Q.6** A hydrated solid \( X \) on heating initially gives a monohydrated compound \( Y \). \( Y \) upon heating above 373 K leads to an anhydrous white powder \( Z \). \( X \) and \( Z \), respectively, are:

Options
1. Washing soda and soda ash.
2. Baking soda and dead burnt plaster.
3. Washing soda and dead burnt plaster.
4. Baking soda and soda ash.

**Q.7**
The correct order of the first ionization enthalpies is:

1. Ti < Mn < Zn < Ni
2. Ti < Mn < Ni < Zn
3. Mn < Ti < Zn < Ni
4. Zn < Ni < Mn < Ti

Q.8 The correct statements among (a) to (d) are:
(a) saline hydrides produce \( H_2 \) gas when reacted with \( H_2O \).
(b) reaction of \( \text{LiAlH}_4 \) with \( \text{BF}_3 \) leads to \( B_2\text{H}_6 \).
(c) \( \text{PH}_3 \) and \( \text{CH}_4 \) are electron - rich and electron - precise hydrides, respectively.
(d) \( \text{HF} \) and \( \text{CH}_4 \) are called as molecular hydrides.

Options 1. (a), (b), (c) and (d).
2. (c) and (d) only.
3. (a), (c) and (d) only.
4. (a), (b) and (c) only.

Q.9 The ratio of the shortest wavelength of two spectral series of hydrogen spectrum is found to be about 9. The spectral series are:

1. Lyman and Paschen
2. Balmer and Brackett
3. Brackett and Pfund
4. Paschen and Pfund

Q.10
The correct statement is:

Options
1. aniline is a froth stabilizer.
2. zincite is a carbonate ore.
3. sodium cyanide cannot be used in the metallurgy of silver.
4. zone refining process is used for the refining of titanium.

Q.11
The increasing order of nucleophilicity of the following nucleophiles is:

(a) \( \text{CH}_3\text{CO}_2^- \)
(b) \( \text{H}_2\text{O} \)
(c) \( \text{CH}_3\text{SO}_3^- \)
(d) \( \text{OH}^- \)

Options
1. (a) < (d) < (c) < (b)
2. (b) < (c) < (d) < (a)
3. (d) < (a) < (c) < (b)
4. (b) < (c) < (a) < (d)

Q.12
The correct option among the following is:

Options
1. Colloidal medicines are more effective because they have small surface area.
2. Addition of alum to water makes it unfit for drinking.
3. Colloidal particles in lyophobic sols can be precipitated by electrophoresis.
4. Brownian motion in colloidal solution is faster if the viscosity of the solution is very high.

Q.13 Which of these factors does not govern the stability of a conformation in acyclic compounds?

Options
1. Steric interactions
2. Torsional strain
3. Electrostatic forces of interaction
4. Angle strain

Q.14 In chromatography, which of the following statements is INCORRECT for $R_f$?

Options
1. $R_f$ value depends on the type of chromatography.
2. The value of $R_f$ can not be more than one.
3. Higher $R_f$ value means higher adsorption.
4. \( R_f \) value is dependent on the mobile phase.

**Q.15**
The crystal field stabilization energy (CFSE) of \([Fe(H_2O)_6]\text{Cl}_2\) and \(K_2[NiCl_4]\), respectively, are:

Options 1. \(-0.6\Delta_o \text{ and } -0.8\Delta_t\)
2. \(-0.4\Delta_o \text{ and } -0.8\Delta_t\)
3. \(-2.4\Delta_o \text{ and } -1.2\Delta_t\)
4. \(-0.4\Delta_o \text{ and } -1.2\Delta_t\)

**Q.16**
The difference between \(\Delta H\) and \(\Delta U\) (\(\Delta H - \Delta U\)), when the combustion of one mole of heptane(l) is carried out at a temperature \(T\), is equal to:

Options 1. \(-4RT\)
2. \(-3RT\)
3. \(4RT\)
4. \(3RT\)

**Q.17**
Which one of the following graphs between molar conductivity (\(\Lambda_m\)) versus \(\sqrt{C}\) is correct?

Options
Q.18 The correct match between Item - I and Item - II is:

<table>
<thead>
<tr>
<th>Item - I</th>
<th>Item - II</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) High density</td>
<td>(I) Peroxide catalyst</td>
</tr>
<tr>
<td>polythene</td>
<td></td>
</tr>
<tr>
<td>(b) Polyacrylonitrile</td>
<td>(II) Condensation at high temperature &amp; pressure</td>
</tr>
<tr>
<td>(c) Novolac</td>
<td>(III) Ziegler-Natta Catalyst</td>
</tr>
<tr>
<td>(d) Nylon 6</td>
<td>(IV) Acid or base catalyst</td>
</tr>
</tbody>
</table>

Options:
1. (a) → (IV), (b) → (II), (c) → (I), (d) → (III)
2. (a) $\rightarrow$ (II), (b) $\rightarrow$ (IV), (c) $\rightarrow$ (I), (d) $\rightarrow$ (III)
3. (a) $\rightarrow$ (III), (b) $\rightarrow$ (I), (c) $\rightarrow$ (II), (d) $\rightarrow$ (IV)
4. (a) $\rightarrow$ (III), (b) $\rightarrow$ (I), (c) $\rightarrow$ (IV), (d) $\rightarrow$ (II)

Q.19 Points I, II and III in the following plot respectively correspond to 
($V_{mp}$: most probable velocity)

![Distribution function, $f(v)$](https://cdn3.digialm.com/)

Options
1. $V_{mp}$ of $N_2$ (300 K); $V_{mp}$ of $O_2$ (400 K); $V_{mp}$ of $H_2$ (300 K)
2. $V_{mp}$ of $O_2$ (400 K); $V_{mp}$ of $N_2$ (300 K); $V_{mp}$ of $H_2$ (300 K)
3. $V_{mp}$ of $N_2$ (300 K); $V_{mp}$ of $H_2$ (300 K); $V_{mp}$ of $O_2$ (400 K)
4. $V_{mp}$ of $H_2$ (300 K); $V_{mp}$ of $N_2$ (300 K); $V_{mp}$ of $O_2$ (400 K)

Q.20
The major product obtained in the given reaction is:

\[ \text{CH}_3\text{O} + \text{CH}_2\text{CH}_2\text{CH}_3 + \text{AlCl}_3 \rightarrow \text{Product} \]

Options
1. \[ \text{H}_3\text{C} - \text{O} - \text{CH}_2\text{CH}_2\text{CH} = \text{CH}_3 \]
2. \[ \text{H}_3\text{C} - \text{O} - \text{CH}_2\text{CH}_2\text{CH} = \text{CH}_2 \]
3. \[ \text{H}_3\text{C} - \text{O} - \text{CH}_2\text{CH}_2\text{CH} = \text{CH}_3 \]
4. \[ \text{H}_3\text{C} - \text{O} - \text{CH}_2\text{CH}_2\text{CH} = \text{CH}_3 \]

Q.21 The minimum amount of \( \text{O}_2(g) \) consumed per gram of reactant is for the reaction:

(Given atomic mass: Fe = 56, O = 16, Mg = 24, P = 31, C = 12, H = 1)

Options
1. \( 4 \text{Fe}(s) + 3 \text{O}_2(g) \rightarrow 2 \text{Fe}_2\text{O}_3(s) \)
2. \( \text{P}_4(s) + 5 \text{O}_2(g) \rightarrow \text{P}_4\text{O}_{10}(s) \)
3. \( \text{C}_2\text{H}_4(g) + 5 \text{O}_2(g) \rightarrow 3 \text{CO}_2(g) + 4 \text{H}_2\text{O}(l) \)
4. \( 2 \text{Mg}(s) + \text{O}_2(g) \rightarrow 2 \text{MgO}(s) \)
For the reaction,
\[ 2 \text{SO}_2(\text{g}) + \text{O}_2(\text{g}) \rightarrow 2 \text{SO}_3(\text{g}), \]
\[ \Delta H = -57.2 \text{ kJ mol}^{-1} \text{ and} \]
\[ K_c = 1.7 \times 10^{16}, \]
Which of the following statement is INCORRECT?

The equilibrium constant is large
1. suggestive of reaction going to completion and so no catalyst is required.
2. The equilibrium will shift in forward direction as the pressure increases.
3. The equilibrium constant decreases as the temperature increases.
4. The addition of inert gas at constant volume will not affect the equilibrium constant.

Q.23
1 g of a non-volatile non-electrolyte solute is dissolved in 100 g of two different solvents A and B whose ebullioscopic constants are in the ratio of 1 : 5. The ratio of the elevation in their boiling points, \( \frac{\Delta T_b(A)}{\Delta T_b(B)} \), is:

Options
1. 5 : 1
2. 10 : 1
3. 1 : 5
4. 1 : 0.2

Q.24

Question Type : MCQ
Question ID : 41652914371
Option 1 ID : 41652956259
Option 2 ID : 41652956260
Option 3 ID : 41652956261
Option 4 ID : 41652956262
Status : Answered
Chosen Option : 3

Question Type : MCQ
Question ID : 41652914370
Option 1 ID : 41652956259
Option 2 ID : 41652956260
Option 3 ID : 41652956261
Option 4 ID : 41652956262
Status : Not Answered
Chosen Option : --
For the reaction of $\text{H}_2$ with $\text{I}_2$, the rate constant is $2.5 \times 10^{-4}$ dm$^3$ mol$^{-1}$ s$^{-1}$ at 327 °C and 1.0 dm$^3$ mol$^{-1}$ s$^{-1}$ at 527 °C. The activation energy for the reaction, in kJ mol$^{-1}$ is:

\[ R = 8.314 \text{ J K}^{-1} \text{ mol}^{-1} \]

Options

1. 166
2. 150
3. 72
4. 59

Q.25 The INCORRECT statement is:

- the gemstone, ruby, has Cr$^{3+}$ ions occupying the octahedral sites of beryl.
- the spin-only magnetic moment of $[\text{Ni(NH}_3)_4(\text{H}_2\text{O})_2]^{2+}$ is 2.83 BM.
- the color of $[\text{CoCl(NH}_3)_5]^{2+}$ is violet as it absorbs the yellow light.
- the spin-only magnetic moments of $[\text{Fe(H}_2\text{O})_6]^{2+}$ and $[\text{Cr(H}_2\text{O})_6]^{2+}$ are nearly similar.

Q.26 Compound A($\text{C}_9\text{H}_{10}\text{O}$) shows positive iodoform test. Oxidation of A with $\text{KMnO}_4$/KOH gives acid B($\text{C}_8\text{H}_6\text{O}_4$). Anhydride of B is used for the preparation of phenolphthalein. Compound A is:
Q.27 The number of pentagons in $C_{60}$ and trigons (triangles) in white phosphorus, respectively, are:

Options
1. 20 and 3
2. 12 and 4
3. 12 and 3
4. 20 and 4

Q.28 Air pollution that occurs in sunlight is:

Options
1. reducing smog
2. acid rain
3. oxidising smog
4. fog

Q.29 The noble gas that does NOT occur in the atmosphere is:

Options
1. He
2. Kr
3. Ne
4. Ra

Q.30 The major product ‘Y’ in the following reaction is:

\[
\text{Ph-CH}_3 + \text{NaOCl} \xrightleftharpoons{X} \text{(i) SOCl}_2 \xrightarrow{(ii) aniline} Y
\]

Options
1. 
2. 
3. 
4. 

3.

4.

\[
\begin{align*}
\text{If } 5x + 9 &= 0 \text{ is the directrix of the hyperbola } \\
16x^2 - 9y^2 &= 144, \text{ then its corresponding focus is:}
\end{align*}
\]

Options:
1. \((5, 0)\)
2. \(\left(\frac{5}{3}, 0\right)\)
3. \(\left(\frac{5}{3}, 0\right)\)
4. \((-5, 0)\)

Q.2

The number of real roots of the equation
\[
5 + |2^x - 1| = 2^x(2^x - 2)
\]
is:

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

Question Type: MCQ
Question ID: 41652914397
Option 1 ID: 41652956367
Option 2 ID: 41652956368
Option 3 ID: 41652956369
Option 4 ID: 41652956366
Status: Answered
Chosen Option: 4
Q.3 The tangent and normal to the ellipse $3x^2 + 5y^2 = 32$ at the point $P(2, 2)$ meet the $x$-axis at $Q$ and $R$, respectively. Then the area (in sq. units) of the triangle $PQR$ is:

Options
1. $\frac{34}{15}$
2. $\frac{14}{3}$
3. $\frac{16}{3}$
4. $\frac{68}{15}$

Q.4 Let $f(x) = \log_e(\sin x), \ (0 < x < \pi)$ and $g(x) = \sin^{-1}(e^{-x}), \ (x \geq 0)$. If $\alpha$ is a positive real number such that $a = (f \circ g)'(\alpha)$ and $b = (f \circ g)(\alpha)$, then:

Options
1. $a \alpha^2 + b \alpha + a = 0$
2. $a \alpha^2 - b \alpha - a = 1$
3. $a \alpha^2 - b \alpha - a = 0$
4. $a \alpha^2 + b \alpha - a = -2\alpha^2$

Q.5
Suppose that 20 pillars of the same height have been erected along the boundary of a circular stadium. If the top of each pillar has been connected by beams with the top of all its non-adjacent pillars, then the total number of beams is:

Options 1. 170
2. 180
3. 210
4. 190

Q.6
If the tangent to the curve \( y = \frac{x}{x^2 - 3} \), \( x \in \mathbb{R} \), \( (x = \pm \sqrt{3}) \), at a point \((\alpha, \beta) \neq (0,0)\) on it is parallel to the line \(2x + 6y - 11 = 0\), then:

Options
1. \(|6\alpha + 2\beta| = 19\)
2. \(|6\alpha + 2\beta| = 9\)
3. \(|2\alpha + 6\beta| = 19\)
4. \(|2\alpha + 6\beta| = 11\)

Q.7
If the line \(ax + y = c\) touches both the curves \(x^2 + y^2 = 1\) and \(y^2 = 4\sqrt{2}x\), then \(|c|\) is equal to:

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

Q.8

The sum $1 + \frac{1^3 + 2^3}{1 + 2} + \frac{1^3 + 2^3 + 3^3}{1 + 2 + 3} + \ldots$

$= \frac{1^3 + 2^3 + 3^3 + \ldots + 15^3}{1 + 2 + 3 + \ldots + 15} - \frac{1}{2}(1 + 2 + 3 + \ldots + 15)$

is equal to:

Options

1. 620
2. 1240
3. 1860
4. 660

Q.9

If $z$ and $w$ are two complex numbers such that $|zw| = 1$ and $\arg(z) - \arg(w) = \frac{\pi}{2}$,

then:

Options

1. $\frac{\bar{z}w}{i}$
2. $\frac{z}{\bar{w}} = \frac{-1 + i}{\sqrt{2}}$
3. $\bar{z}w = -i$
4. $\frac{z}{\bar{w}} = \frac{1 + i}{\sqrt{2}}$

Q.10

The sum $1 + \frac{1^3 + 2^3}{1 + 2} + \frac{1^3 + 2^3 + 3^3}{1 + 2 + 3} + \ldots$

$= \frac{1^3 + 2^3 + 3^3 + \ldots + 15^3}{1 + 2 + 3 + \ldots + 15} - \frac{1}{2}(1 + 2 + 3 + \ldots + 15)$

is equal to:

Options

1. 620
2. 1240
3. 1860
4. 660
Let \( \lambda \) be a real number for which the system of linear equations
\[
\begin{align*}
x + y + z &= 6 \\
4x + \lambda y - \lambda z &= \lambda - 2 \\
3x + 2y - 4z &= -5
\end{align*}
\]
has infinitely many solutions. Then \( \lambda \) is a root of the quadratic equation:

Options

1. \( \lambda^2 + 3\lambda - 4 = 0 \)
2. \( \lambda^2 - 3\lambda - 4 = 0 \)
3. \( \lambda^2 + \lambda - 6 = 0 \)
4. \( \lambda^2 - \lambda - 6 = 0 \)

Q.11
If \( \cos^{-1} x - \cos^{-1} \frac{y}{2} = \alpha \), where \(-1 \leq x \leq 1, -2 \leq y \leq 2, \frac{y}{2} \), then for all \( x, y, \)
\[
4x^2 - 4xy \cos \alpha + y^2
\]
is equal to:

Options

1. \( 4 \sin^2 \alpha \)
2. \( 2 \sin^2 \alpha \)
3. \( 4 \sin^2 \alpha - 2x^2y^2 \)
4. \( 4 \cos^2 \alpha + 2x^2y^2 \)

Q.12
The distance of the point having position vector \( \hat{\mathbf{i}} + 2\hat{\mathbf{j}} + 6\hat{\mathbf{k}} \) from the straight line passing through the point \((2, 3, -4)\) and parallel to the vector, \(6\hat{\mathbf{i}} + 3\hat{\mathbf{j}} - 4\hat{\mathbf{k}}\)
is:

Options

1. \( 7 \)
2. \( 4\sqrt{3} \)
3. $6$
4. $2\sqrt{13}$

Q.13 The area (in sq. units) of the region bounded by the curves $y = 2^x$ and $y = |x+1|$, in the first quadrant is:

Options
1. $\log_e 2 + \frac{3}{2}$
2. $\frac{3}{2}$
3. $\frac{1}{2}$
4. $\frac{3}{2} - \frac{1}{\log_e 2}$

Q.14 A spherical iron ball of radius 10 cm is coated with a layer of ice of uniform thickness that melts at a rate of 50 cm$^3$/min. When the thickness of the ice is 5 cm, then the rate at which the thickness (in cm/min) of the ice decreases, is:

Options
1. $\frac{1}{18\pi}$
2. $\frac{1}{36\pi}$
3. $\frac{5}{6\pi}$
4. $\frac{1}{9\pi}$
Q.15 If \( \int x^2 e^{-x^2} \, dx = g(x) e^{-x^2} + c \), where \( c \) is a constant of integration, then \( g(-1) \) is equal to:

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

Option 1 ID: 41652956328
Option 2 ID: 41652956326
Option 3 ID: 41652956327
Option 4 ID: 41652956329
Status: Not Answered
Chosen Option: --

Q.16 The smallest natural number \( n \), such that the coefficient of \( x \) in the expansion of \( \left( x^2 + \frac{1}{x^3} \right)^n \) is \( \binom{n}{23} \), is:

Options:
1. 38
2. 58
3. 23
4. 35

Option 1 ID: 41652956335
Option 2 ID: 41652956337
Option 3 ID: 41652956334
Option 4 ID: 41652956336
Status: Answered
Chosen Option: 2

Q.17 The sum of the real roots of the equation

\[
\begin{vmatrix}
  x & -6 & -1 \\
  2 & -3x & x-3 \\
  -3 & 2x & x+2 \\
\end{vmatrix} = 0,
\]

is equal to:

Options:
1. 6
2. 0

Option 1 ID: 41652956307
Option 2 ID: 41652956309
Option 3 ID: 41652956306
Option 4 ID: 41652956308
Status: Answered
Chosen Option: 2
Q.18  Minimum number of times a fair coin must be tossed so that the probability of getting at least one head is more than 99% is:

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

Q.19  The angles A, B and C of a triangle ABC are in A.P. and a : b = 1 : \(\sqrt{3}\). If c = 4 cm, then the area (in sq.cm) of this triangle is:

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

Q.20  The negation of the Boolean expression \(\neg s \lor (\neg r \land s)\) is equivalent to:

Options 1. \(\neg s \land \neg r\)
2. \( r \)
3. \( s \lor r \)
4. \( s \land r \)

**Q.21**
A perpendicular is drawn from a point on the line \( \frac{x-1}{2} = \frac{y+1}{-1} = \frac{z}{1} \) to the plane \( x + y + z = 3 \) such that the foot of the perpendicular \( Q \) also lies on the plane \( x - y + z = 3 \). Then the co-ordinates of \( Q \) are:

Options:
1. \( (1, 0, 2) \)
2. \( (2, 0, 1) \)
3. \( (-1, 0, 4) \)
4. \( (4, 0, -1) \)

**Q.22**
Let \( a, b \) and \( c \) be in G.P. with common ratio \( r \), where \( a \neq 0 \) and \( 0 < r \leq \frac{1}{2} \). If \( 3a, 7b \) and \( 15c \) are the first three terms of an A.P., then the 4th term of this A.P. is:

Options:
1. \( \frac{2}{3}a \)
2. \( 5a \)
3. \( \frac{7}{3}a \)
4. \( a \)
Q.23

Lines are drawn parallel to the line $4x - 3y + 2 = 0$, at a distance $\frac{3}{5}$ from the origin. Then which one of the following points lies on any of these lines?

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

Question Type: MCQ
Question ID: 41652914393
Option 1 ID: 41652956353
Option 2 ID: 41652956351
Option 3 ID: 41652956350
Option 4 ID: 41652956352
Status: Answered
Chosen Option: 3

Q.24

If both the mean and the standard deviation of 50 observations $x_1, x_2, ..., x_{50}$ are equal to 16, then the mean of $(x_1 - 4)^2, (x_2 - 4)^2, ..., (x_{50} - 4)^2$ is:

Options
1. 400
2. 380
3. 525
4. 480

Question Type: MCQ
Question ID: 41652914401
Option 1 ID: 41652956383
Option 2 ID: 41652956382
Option 3 ID: 41652956385
Option 4 ID: 41652956364
Status: Answered
Chosen Option: 1

Q.25

If $\lim_{x \to 1} \frac{x^2 - ax + b}{x - 1} = 5$, then $a + b$ is equal to:

Options
1. $-4$
2. 5
3. $-7$
Q.26 Let \( a_1, a_2, a_3, \ldots \) be an A.P. with \( a_6 = 2 \). Then the common difference of this A.P., which maximises the product \( a_1 a_4 a_5 \), is:

Options

1. \( \frac{3}{2} \)
2. \( \frac{8}{5} \)
3. \( \frac{6}{5} \)
4. \( \frac{2}{3} \)

Q.27 The integral \( \int_{\frac{\pi}{6}}^{\frac{\pi}{3}} \sec^{2/3} x \csc^{4/3} x \, dx \) is equal to:

Options

1. \( \frac{3}{5} - \frac{2}{3} \)
2. \( \frac{3}{5} - \frac{3}{5} \)
3. \( \frac{3}{7} - \frac{5}{3} \)
4. \( \frac{3}{5} - \frac{3}{3} \)
If the plane \(2x - y + 2z + 3 = 0\) has the
distances \(\frac{1}{3}\) and \(\frac{2}{3}\) units from the planes
\(4x - 2y + 4z + \lambda = 0\) and \(2x - y + 2z + \mu = 0\),
respectively, then the maximum value of \(\lambda + \mu\) is equal to:

Options 1. 9
2. 15
3. 5
4. 13

Q.29 Let \(y = y(x)\) be the solution of the differential

\[\frac{dy}{dx} + y \tan x = 2x + x^2 \tan x,\]

\[x \in \left(\frac{-\pi}{2}, \frac{\pi}{2}\right),\] such that \(y(0) = 1\). Then:

Options
1. \(y\left(\frac{\pi}{4}\right) + y\left(-\frac{\pi}{4}\right) = \frac{\pi^2}{2} + 2\)
2. \(y\left(\frac{\pi}{4}\right) + y\left(-\frac{\pi}{4}\right) = -\sqrt{2}\)
3. \(y\left(\frac{\pi}{4}\right) - y\left(-\frac{\pi}{4}\right) = \sqrt{2}\)
4. \(y\left(\frac{\pi}{4}\right) - y\left(-\frac{\pi}{4}\right) = \pi - \sqrt{2}\)

Q.30 The locus of the centres of the circles, which
touch the circle, \(x^2 + y^2 = 1\) externally, also
touch the \(y\)-axis and lie in the first quadrant,
is:

Options
1. \(x = \sqrt{1 + 4y}, \ y \geq 0\)
2. $y = \sqrt{1+2x}, \ x \geq 0$
3. $y = \sqrt{1+4x}, \ x \geq 0$
4. $x = \sqrt{1+2y}, \ y \geq 0$

Question Type: MCQ
Question ID: 41652914394
Option 1 ID: 41652956356
Option 2 ID: 41652956354
Option 3 ID: 41652956355
Option 4 ID: 41652956357
Status: Answered
Chosen Option: 3