In case the candidates want to submit documents in support of challenge of answer key, they should upload the PDF file.

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Q.1  The escape velocities of two planets A and B are in the ratio 1 : 2. If the ratio of their radii respectively is 1 : 3, then the ratio of acceleration due to gravity of planet A to the acceleration of gravity of planet B will be:

Options

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

Q.2  Equivalent resistance between the adjacent corners of a regular \( n \)-sided polygon of uniform wire of resistance \( R \) would be:

Options

1. \( \frac{n^2R}{n-1} \)
2. \( \frac{n}{n-1}R \)
3. \( \frac{(n-1)R}{(2n-1)} \)
4. \( \frac{(n-1)R}{n^2} \)
Q.3 Two objects A and B are placed at 15 cm and 25 cm from the pole in front of a concave mirror having radius of curvature 40 cm. The distance between images formed by the mirror is

Options
1. 100 cm
2. 160 cm
3. 40 cm
4. 60 cm

Q.4 In an amplitude modulation, a modulating signal having amplitude of X V is superimposed with a carrier signal of amplitude Y V in first case. Then, in second case, the same modulating signal is superimposed with different carrier signal of amplitude 2Y V. The ratio of modulation index in the two cases respectively will be:

Options
1. 2 : 1
2. 4 : 1
3. 1 : 1
4. 1 : 2
Q.5 Figures (a), (b), (c) and (d) show variation of force with time.

The impulse is highest in figure.

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

Q.6 Choose the correct statement about Zener diode:

1. It works as a voltage regulator in both forward and reverse bias.
2. It works as a voltage regulator in forward bias and behaves like simple pn junction diode in reverse bias.
3. It works as a voltage regulator only in forward bias.
4. It works as a voltage regulator in reverse bias and behaves like simple pn junction diode in forward bias.
Q.7 Given below are two statements : One is labelled as Assertion A and the other is labelled as Reason R.

**Assertion A**: Two metallic spheres are charged to the same potential. One of them is hollow and another is solid, and both have the same radii. Solid sphere will have lower charge than the hollow one.

**Reason R**: Capacitance of metallic spheres depend on the radii of spheres.

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

**Options**
1. A is false but R is true
2. A is true but R is false
3. Both A and R are true and R is the correct explanation of A
4. Both A and R are true but R is not the correct explanation of A

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Q.8 Choose the correct length (L) versus square of time period ($T^2$) graph for a simple pendulum executing simple harmonic motion.

Options

1. 

2. 

3. 

4. 

Q.9 The ratio of average electric energy density and total average energy density of electromagnetic wave is:

Options

1. $\frac{1}{2}$
2. $\frac{3}{2}$
3. $2$
4. $1$
Q.10 For three low density gases A, B, C pressure versus temperature graphs are plotted while keeping them at constant volume, as shown in the figure.

![Graph showing P( atm) vs Temperature (°C) for gases A, B, C]

The temperature corresponding to the point 'K' is:

Options
1. \(-100°C\)
2. \(-273°C\)
3. \(-40°C\)
4. \(-373°C\)

Q.11 An electron of a hydrogen-like atom, having \(Z = 4\), jumps from 4th energy state to 2nd energy state.

The energy released in this process, will be:

\(\text{Given: } R_h = 13.6 \text{ eV} \)
\(\text{Where } R = \text{Rydberg constant} \)
\(c = \text{Speed of light in vacuum} \)
\(h = \text{Planck's constant} \)

Options
1. \(10.5 \text{ eV}\)
2. \(40.8 \text{ eV}\)
3. \(13.6 \text{ eV}\)
4. \(3.4 \text{ eV}\)
Q.12  Given below are two statements : One is labelled as **Assertion A** and the other is labelled as **Reason R**.

**Assertion A**: For measuring the potential difference across a resistance of 600 Ω, the voltmeter with resistance 1000 Ω will be preferred over voltmeter with resistance 4000 Ω.

**Reason R**: Voltmeter with higher resistance will draw smaller current than voltmeter with lower resistance.

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

Options

1. A is correct but R is **not** correct
2. Both A and R are correct but R is **not** the correct explanation of A
3. A is **not** correct but R is correct
4. Both A and R are correct and R is the correct explanation of A

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Q.13  If the velocity of light c, universal gravitational constant G and Planck's constant h are chosen as fundamental quantities. The dimensions of mass in the new system is :

Options

1. \[ m^{-\frac{1}{2}} c^{\frac{1}{2}} G^{\frac{1}{2}} \]
2. \[ m^{\frac{1}{2}} c^{\frac{1}{2}} G^{\frac{1}{2}} \]
3. \[ m^{\frac{1}{2}} c^{\frac{1}{2}} G^{-\frac{1}{2}} \]
4. \[ m^{1} c^{1} G^{-1} \]
Q.14  As shown in the figure, a long straight conductor with semicircular arc of radius \( \frac{x}{10} \) m is carrying current \( I = 3A \). The magnitude of the magnetic field at the center O of the arc is:

(The permeability of the vacuum \( = 4\pi \times 10^{-7} \text{ NA}^{-2} \))

\[ \text{Options} \]
1. \( 6\mu T \)
2. \( 3\mu T \)
3. \( 4\mu T \)
4. \( 1\mu T \)

Question Type : MCQ
Question ID : 7155051182
Option 1 ID : 7155053558
Option 2 ID : 7155053556
Option 3 ID : 7155053557
Option 4 ID : 7155053555
Status : Answered
Chosen Option : 1

Q.15  The threshold frequency of a metal is \( f_0 \). When the light of frequency \( 2f_0 \) is incident on the metal plate, the maximum velocity of photoelectrons is \( v_1 \). When the frequency of incident radiation is increased to \( 5f_0 \), the maximum velocity of photoelectrons emitted is \( v_2 \). The ratio of \( v_1 \) to \( v_2 \) is:

\[ \text{Options} \]
1. \( \frac{v_1}{v_2} = \frac{1}{16} \)
2. \( \frac{v_1}{v_2} = \frac{1}{8} \)
3. \( \frac{v_1}{v_2} = \frac{1}{2} \)
4. \( \frac{v_1}{v_2} = \frac{1}{4} \)

Question Type : MCQ
Question ID : 7155051187
Option 1 ID : 7155053578
Option 2 ID : 7155053577
Option 3 ID : 7155053576
Option 4 ID : 7155053575
Status : Answered
Chosen Option : 4
Q.16 As shown in the figure a block of mass 10 kg lying on a horizontal surface is pulled by a force F acting at an angle 30° with horizontal. For μ_s=0.25, the block will just start to move for the value of F: [Given g = 10 m/s²]

Options 1. 20 N
2. 33.3 N
3. 25.2 N
4. 35.7 N

Q.17 For a body projected at an angle with the horizontal from the ground, choose the correct statement.

Options 1. The Kinetic Energy (K.E.) is zero at the highest point of projectile motion.
2. The vertical component of momentum is maximum at the highest point.
3. The horizontal component of velocity is zero at the highest point.
4. Gravitational potential energy is maximum at the highest point.

Q.18 The Young’s modulus of a steel wire of length 6 m and cross-sectional area 3 mm², is 2 × 10¹¹ N/m². The wire is suspended from its support on a given planet. A block of mass 4 kg is attached to the free end of the wire. The acceleration due to gravity on the planet is 1/4 of its value on the earth. The elongation of wire is (Take g on the earth = 10 m/s²):

Options 1. 0.1 mm
2. 1 mm
3. 0.1 cm
4. 1 cm
Q.19 A Carnot engine operating between two reservoirs has efficiency $\frac{1}{3}$. When the temperature of cold reservoir is raised by $x$, its efficiency decreases to $\frac{1}{6}$. The value of $x$, if the temperature of hot reservoir is $99^\circ C$, will be:

Options 1. 33 K
2. 16.5 K
3. 66 K
4. 62 K

Question Type: MCQ
Question ID: 7155051176
Option 1 ID: 7155053532
Option 2 ID: 7155053531
Option 3 ID: 7155053534
Option 4 ID: 7155053533
Status: Answered
Chosen Option: 1

Q.20 A coil is placed in a magnetic field such that plane of coil is perpendicular to the direction of magnetic field. The magnetic flux through a coil can be changed:

A. By changing the magnitude of the magnetic field within the coil.
B. By changing the area of coil within the magnetic field.
C. By changing the angle between the direction of magnetic field and the plane of the coil.
D. By reversing the magnetic field direction abruptly without changing its magnitude.

Choose the most appropriate answer from the options given below:

Options 1. A, B and C only
2. A and B only
3. A, B and D only
4. A and C only

Question Type: MCQ
Question ID: 7155051184
Option 1 ID: 7155053565
Option 2 ID: 7155053563
Option 3 ID: 7155053566
Option 4 ID: 7155053564
Status: Answered
Chosen Option: 1

Q.21 A force $F = (5 + 3y^2)$ acts on a particle in the y-direction, where $F$ is in newton and $y$ is in meter. The work done by the force during a displacement from $y = 2$ m to $y = 5$ m is _________ J.

Given 21
Answer:

Question Type: SA
Question ID: 7155051192
Status: Answered

Q.22 For a train engine moving with speed of 20 ms$^{-1}$, the driver must apply brakes at a distance of 500 m before the station for the train to come to rest at the station. If the brakes were applied at half of this distance, the train engine would cross the station with speed $\sqrt{5}$ ms$^{-1}$. The value of $x$ is

Assuming same retardation is produced by brakes

Given 2
Answer:

Question Type: SA
Question ID: 7155051191
Status: Answered
Q.23 A cubical volume is bounded by the surfaces $x = 0, x = a, y = 0, y = a, z = 0, z = a$. The electric field in the region is given by $E = E_0 \hat{i}$. Where $E_0 = 4 \times 10^4 \text{NC}^{-1} \text{m}^{-1}$. If $a = 2 \text{ cm}$, the charge contained in the cubical volume is $Q = 10^{-14} \text{C}$. The value of $Q$ is ________.
Given $E_0 = 9 \times 10^{-12} \text{C}^2/\text{Nm}^2$

Answer:

Question Type : SA
Question ID : 7155051196
Status : Not Attempted and Marked For Review

Q.24 In the given circuit, the value of $\left| \frac{I_1 + I_3}{I_2} \right|$ is ________

Given 2

Answer 2:

Question Type : SA
Question ID : 7155051197
Status : Answered

Q.25 A square shaped coil of area 70 cm$^2$ having 600 turns rotates in a magnetic field of 0.4 T when $\text{cm}^{-2}$, about an axis which is parallel to one of the side of the coil and perpendicular to the direction of field. If the coil completes 500 revolution in a minute, the instantaneous emf when the plane of the coil is inclined at 60° with the field, will be ________ V. (Take $\pi = \frac{22}{7}$)

Given 44

Answer 44:

Question Type : SA
Question ID : 7155051198
Status : Answered

Q.26 A block is fastened to a horizontal spring. The block is pulled to a distance $x = 10 \text{ cm}$ from its equilibrium position (at $x = 0$) on a frictionless surface from rest. The energy of the block at $x = 5 \text{ cm}$ is 0.25 J. The spring constant of the spring is ________ Nm$^{-1}$.

Given --

Answer --

Question Type : SA
Question ID : 7155051195
Status : Not Answered
Q.27
Given
Answer:

As shown in the figure, in Young’s double slit experiment, a thin plate of thickness $t = 10\text{nm}$ and refractive index $\mu = 1.2$ is inserted in front of slit $S_1$. The experiment is conducted in air ($\mu = 1$) and uses a monochromatic light of wavelength $\lambda = 500\text{ nm}$. Due to the insertion of the plate, central maxima is shifted by a distance of $\delta x_0$. $\delta x_0$ is the fringe-width before the insertion of the plate. The value of the $x$ is _________.

Q.28
Given
Answer:

Moment of inertia of a disc of mass $M$ and radius ‘$R$’ about any of its diameter is $\frac{MR^2}{4}$. The moment of inertia of this disc about an axis normal to the disc and passing through a point on its edge will be, $\frac{3}{2}MR^2$. The value of $x$ is _________.

Q.29
Given
Answer:

The surface of water in a water tank of cross section area $750\text{ cm}^2$ on the top of a house is $h$ m above the tap level. The speed of water coming out through the top of cross section area $500\text{ mm}^2$ is $30\text{ cm/s}$. At that instant, $\frac{dh}{dt}$ is $x \times 10^{-3}\text{ m/s}$. The value of $x$ will be _________.

Q.30
Given
Answer:

Nucleus A having $Z = 17$ and equal number of protons and neutrons has $1.2\text{ MeV}$ binding energy per nucleon.

Another nucleus B of $Z = 12$ has total 26 nucleons and $1.8\text{ MeV}$ binding energy per nucleons.

The difference of binding energy of B and A will be ________ MeV.

Section: Chemistry Section A
Q.31 Given below are two statements: one is labelled as Assertion (A) and the other is labelled as
Reason (R).
  Assertion (A): Cu²⁺ in water is more stable than Cu⁺.
  Reason (R): Enthalpy of hydration for Cu²⁺ is much less than that of Cu⁺.
In the light of the above statements, choose the correct answer from the options given below:

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

Q.32 The effect of addition of helium gas to the following reaction in equilibrium state, is:

\[ \text{PCl}_3(g) \rightleftharpoons \text{PCl}_5(g) + \text{Cl}_2(g) \]

Options
1. the equilibrium will go backward due to suppression of dissociation of \text{PCl}_5
2. the equilibrium will shift in the forward direction and more of \text{Cl}_2 and \text{PCl}_5 gases will be produced.
3. helium will deactivate \text{PCl}_5 and reaction will stop.
4. addition of helium will not affect the equilibrium.
Q.33 In figure, a straight line is given for Freundlich Adsorption ($y = 3x + 2.505$). The value of $\frac{1}{n}$ and $\log K$ are respectively.

Options 1. 0.3 and $\log 2.505$
2. 3 and 2.505
3. 3 and 0.7033
4. 0.3 and 0.7033

Q.34 The structures of major products A, B and C in the following reaction are sequence.

Options 1. A = \[\text{OH} \quad \text{CN} \quad \text{OH} \quad \text{CHO} \quad \text{CO}_2\text{H}\], B = \[\text{H} \quad \text{OH} \quad \text{H} \quad \text{H} \quad \text{H}\], C = \[\text{HO} \quad \text{SO}_2\text{Cl} \quad \text{H}\]
2. A = \[\text{HO} \quad \text{SO}_3\text{H} \quad \text{H} \quad \text{OH} \quad \text{H}\], B = \[\text{H} \quad \text{HO} \quad \text{H} \quad \text{H} \quad \text{H}\], C = \[\text{HO} \quad \text{SO}_2\text{Na} \quad \text{H} \quad \text{Cl} \quad \text{H}\]
3. A = \[\text{HO} \quad \text{CN} \quad \text{H} \quad \text{H} \quad \text{H}\], B = \[\text{H} \quad \text{OH} \quad \text{H} \quad \text{H} \quad \text{H}\], C = \[\text{HO} \quad \text{NH}_2 \quad \text{H} \quad \text{CO}_2\text{H} \quad \text{H}\]
4. A = \[\text{HO} \quad \text{CN} \quad \text{H} \quad \text{H} \quad \text{H}\], B = \[\text{H} \quad \text{OH} \quad \text{H} \quad \text{H} \quad \text{H}\], C = \[\text{HO} \quad \text{NH}_2 \quad \text{H} \quad \text{CO}_2\text{H} \quad \text{H}\]
### Q.35
Given below are two statements: one is labelled as **Assertion (A)** and the other is labelled as **Reason (R)**.

**Assertion (A):** Gypsum is used for making fireproof wall boards.

**Reason (R):** Gypsum is unstable at high temperatures.

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

**Options**

1. **(A) is not correct but (R) is correct**
2. Both (A) and (R) are not the correct explanation of (A)
3. Both (A) and (R) are correct and (R) is the correct explanation of (A)
4. **(A) is correct but (R) is not correct**

---

### Q.36
Which element is not present in Nessler's reagent?

**Options**

1. Mercury
2. Iodine
3. Potassium
4. Oxygen

---

### Q.37
The starting material for convenient preparation of deuterated hydrogen peroxide (D₂O₂) in laboratory is:

**Options**

1. K₂S₂O₈
2. BaO
3. BaO₂
4. 2-ethylanthraquinol
Q.38 Which one of the following sets of ions represents a collection of isoelectronic species?
(Given: Atomic Number: F : 9, Cl : 17, Na : 11, Mg : 12, Al : 13, K : 19, Ca : 20, Sc : 21)
Options
1. \(N^3^-\), \(O^{2-}\), \(F^-\), \(S^{2-}\)
2. \(Ba^{2+}\), \(Sr^{2+}\), \(K^+\), \(Ca^{2+}\)
3. \(Li^+\), \(Na^+\), \(Mg^{2+}\), \(Ca^{2+}\)
4. \(K^+\), \(Cl^-\), \(Ca^{2+}\), \(Sc^{3+}\)

Question Type: MCQ
Question ID: 7155051201
Option 1 ID: 7155053601
Option 2 ID: 7155053604
Option 3 ID: 7155053603
Option 4 ID: 7155053602
Status: Answered
Chosen Option: 1

Q.39 Given below are two statements:
Statement I: Sulphanilic acid gives esterification test for carboxyl group.
Statement II: Sulphanilic acid gives red colour in Lassaigne’s test for extra element detection.
In the light of the above statements, choose the most appropriate answer from the options given below:
Options
1. Statement I is incorrect but Statement II is correct
2. Both Statement I and Statement II are correct
3. Both Statement I and Statement II are incorrect
4. Statement I is correct but Statement II is incorrect

Question Type: MCQ
Question ID: 7155051212
Option 1 ID: 7155053648
Option 2 ID: 7155053645
Option 3 ID: 7155053646
Option 4 ID: 7155053647
Status: Answered
Chosen Option: 2

Q.40 Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): An aqueous solution of KOH when used for volumetric analysis, its concentration should be checked before the use.
Reason (R): On aging, KOH solution absorbs atmospheric CO₂.
In the light of the above statements, choose the correct answer from the options given below:
Options
1. Both (A) and (R) are correct but (R) is not the correct explanation of (A)
2. Both (A) and (R) are correct and (R) is the correct explanation of (A)
3. (A) is correct but (R) is not correct
4. (A) is not correct but (R) is correct

Question Type: MCQ
Question ID: 7155051220
Option 1 ID: 7155053678
Option 2 ID: 7155053677
Option 3 ID: 7155053679
Option 4 ID: 7155053680
Status: Answered
Chosen Option: 1
Q.41 The graph which represents the following reaction is:

\[
\text{(C}_6\text{H}_5\text{)}_3\text{C} - \text{Cl} \xrightarrow{\text{OH}^- / \text{Pyridine}} \text{(C}_6\text{H}_5\text{)}_3\text{C} - \text{OH}
\]

Options

1. 

2. 

3. 

4. 

Question Type: MCQ
Question ID: 7155051214
Option 1 ID: 7155053653
Option 2 ID: 7155053654
Option 3 ID: 7155053656
Option 4 ID: 7155053655
Status: Answered
Chosen Option: 1
Q.42  O – O bond length in H₂O₂ is \( \underline{\text{X}} \) than the O – O bond length in F₂O₂. The O – H bond length in H₂O₂ is \( \underline{\text{Y}} \) than that of the O – F bond in F₂O₂.
Choose the correct option for \( \underline{\text{X}} \) and \( \underline{\text{Y}} \) from those given below:

Options:
1. \( \underline{\text{X}} \) - longer, \( \underline{\text{Y}} \) - longer
2. \( \underline{\text{X}} \) - shorter, \( \underline{\text{Y}} \) - shorter
3. \( \underline{\text{X}} \) - shorter, \( \underline{\text{Y}} \) - longer
4. \( \underline{\text{X}} \) - longer, \( \underline{\text{Y}} \) - shorter

---

Q.43  In a reaction,

\[
\begin{align*}
&\text{OH} &\text{COOCH₃} \\
\rightarrow &\text{X'} &\text{OH} &\text{COOH} \\
\rightarrow &\text{X} &\text{OCOCH₃} &\text{COOH}
\end{align*}
\]

reagents \( \text{X'} \) and \( \text{X} \) respectively are:

Options:
1. CH₃OH/H⁺, \( \Delta \) and (CH₃CO)₂O/H⁺
2. CH₃OH/H⁺, \( \Delta \) and CH₃OH/H⁺, \( \Delta \)
3. (CH₃CO)₂O/H⁺ and (CH₃CO)₂O/H⁺
4. (CH₃CO)₂O/H⁺ and CH₃OH/H⁺, \( \Delta \)
Q. 44 All structures given below are of vitamin C. Most stable of them is:

Options

1. ![Structure 1]

2. ![Structure 2]

3. ![Structure 3]

4. ![Structure 4]
Q.45

\[ \text{'X' is: } \quad \text{\begin{tikzpicture}
      \node[draw, circle, label=above:{$X$}](c){};
      \node[draw, circle, label=above:{$X$}](d){};
      \draw[->] (c) -- (d);
    \end{tikzpicture}} \quad \xrightarrow{\text{HF}} \quad \text{Major product} \]

**Question Type:** MCQ

**Question ID:** 7155051213

**Option 1 ID:** 7155053651

**Option 2 ID:** 7155053652

**Option 3 ID:** 7155053650

**Option 4 ID:** 7155053649

**Status:** Answered

**Chosen Option:** 2
Q.46 The industrial activity held least responsible for global warming is:

Options:
1. Electricity generation in thermal power plants
2. Industrial production of urea
3. Manufacturing of cement
4. Steel manufacturing

Question Type: MCQ
Question ID: 7155051211
Option 1 ID: 7155053642
Option 2 ID: 7155053641
Option 3 ID: 7155053643
Option 4 ID: 7155053644
Status: Answered
Chosen Option: 3

Q.47 For electron gain enthalpies of the elements denoted as $\Delta_{eg} H$, the incorrect option is:

Options:
1. $\Delta_{eg} H (I) < \Delta_{eg} H (At)$
2. $\Delta_{eg} H (Cl) < \Delta_{eg} H (F)$
3. $\Delta_{eg} H (Te) < \Delta_{eg} H (Po)$
4. $\Delta_{eg} H (Se) < \Delta_{eg} H (S)$

Question Type: MCQ
Question ID: 7155051205
Option 1 ID: 7155053620
Option 2 ID: 7155053618
Option 3 ID: 7155053619
Option 4 ID: 7155053617
Status: Answered
Chosen Option: 3

Q.48 The correct order of bond enthalpy (kJ mol$^{-1}$) is:

Options:
1. C – C > Si – Si > Ge – Ge > Sn – Sn
2. C – C > Si – Si > Sn – Sn > Ge – Ge
3. Si – Si > C – C > Ge – Ge > Sn – Sn
4. Si – Si > C – C > Sn – Sn > Ge – Ge

Question Type: MCQ
Question ID: 7155051208
Option 1 ID: 7155053632
Option 2 ID: 7155053629
Option 3 ID: 7155053630
Option 4 ID: 7155053631
Status: Answered
Chosen Option: 1
Q.49 Given below are two statements: one is labelled as **Assertion (A)** and the other is labelled as **Reason (R)**.

**Assertion (A)**: α-halocarboxylic acid on reaction with dil NH₃ gives good yield of α-amino carboxylic acid whereas the yield of amines is very low when prepared from alkyl halides.

**Reason (R)**: Amino acids exist in zwitter ion form in aqueous medium.

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

1. Both (A) and (R) are correct but (R) is **not** the correct explanation of (A)
2. (A) is **not** correct but (R) is correct
3. (A) is correct but (R) is **not** correct
4. Both (A) and (R) are correct and (R) is the correct explanation of (A)

---

Q.50 The complex cation which has two isomers is:

1. \([\text{Co(NH}_3\text{)}_2\text{Cl}]^{2+}\)
2. \([\text{Co(NH}_3\text{)}_2\text{NO}_2]^{2+}\)
3. \([\text{Co(NH}_3\text{)}_2\text{Cl}]^{+}\)
4. \([\text{Co(H}_2\text{O)}_6]^{3+}\)

---

Q.51 The molality of a 10% (v/v) solution of di-bromine solution in CCl₄ (carbon tetrachloride) is ‘x’.

\[
x = \frac{160 \text{ g mol}^{-1}}{12 \text{ g mol}^{-1} + 35.5 \text{ g mol}^{-1} + 3.2 \text{ g cm}^{-3} + 1.6 \text{ g cm}^{-3}}
\]

Given: molar mass of Br₂ = 160 g mol⁻¹
atomic mass of C = 12 g mol⁻¹
atomic mass of Cl = 35.5 g mol⁻¹
density of dibromine = 3.2 g cm⁻³
density of CCl₄ = 1.6 g cm⁻³

Given 1583

Answer:
Q.52  A → B
The above reaction is of zero order. Half life of this reaction is 50 min. The time taken for the concentration of A to reduce to one-fourth of its initial value is ________ min.
(Nearest integer)

Given: 0.7
Answer:

Question Type: SA
Question ID: 7155051226
Status: Answered

Q.53  0.3 g of ethane undergoes combustion at 27°C in a bomb calorimeter. The temperature of calorimeter system (including the water) is found to rise by 0.5°C. The heat evolved during combustion of ethane at constant pressure is ________ kJ mol⁻¹.
(Nearest integer)

[Given: The heat capacity of the calorimeter system is 20 kJ K⁻¹, R = 8.3 J K⁻¹ mol⁻¹.
Assume ideal gas behaviour.
Atomic mass of C and H are 12 and 1 g mol⁻¹ respectively]

Given: --
Answer: --

Question Type: SA
Question ID: 7155051224
Status: Not Answered

Q.54  The spin only magnetic moment of [Mn(H₂O)₆]²⁺ complexes is _____ B.M. (Nearest integer)

(Given: Atomic no. of Mn is 25)

Given: --
Answer: --

Question Type: SA
Question ID: 7155051227
Status: Not Answered

Q.55  20% of acetic acid is dissociated when its 5 g is added to 500 mL of water. The depression in freezing point of such water is ________ > 10⁻³°C.

Atomic mass of C, H and O are 12, 1 and 16 a.m.u. respectively.

[Given: Molal depression constant and density of water are 1.86 K kg mol⁻¹ and 1 g cm⁻³ respectively]

Given: --
Answer: --

Question Type: SA
Question ID: 7155051223
Status: Not Answered

Q.56  A metal M crystallizes into two lattices: - face centred cubic (fcc) and body centred cubic (bcc) with unit cell edge length of 2.0 and 2.5 Å respectively. The ratio of densities of lattices fcc to bcc for the metal M is ________.

(Nearest integer)

Given: --
Answer: --

Question Type: SA
Question ID: 7155051222
Status: Not Answered
Q.57 Among the following, the number of tranquilizer/s is/are ________.

A. Chloraloxazepoxide  
B. Veronol  
C. Valium  
D. Salvarsan

Given 2  
Answer :  

Q.58 Among following compounds, the number of those present in copper matte is ________.

A. CuCO₂  
B. Cu₂S  
C. CuₓO  
D. FeO

Given 3  
Answer :  

Q.59 \(1 \times 10^{-5} \text{ M AgNO₃}\) is added to 1 L of saturated solution of AgBr. The conductivity of this solution at 298 K is ________ \(\times 10^{-8} \text{ S m}^2\text{ mol}^{-1}\).

[Given : \(K_{sp}(AgBr) = 4.9 \times 10^{-13}\) at 298 K]

\[ \chi^{0}_{Ag} = 6 \times 10^{-3} \text{ S m}^2\text{ mol}^{-1} \]
\[ \chi^{0}_{Br} = 8 \times 10^{-3} \text{ S m}^2\text{ mol}^{-1} \]
\[ \chi^{0}_{NO₃} = 7 \times 10^{-3} \text{ S m}^2\text{ mol}^{-1}\]

Given --  
Answer :

Q.60 Testosterone, which is a steroidal hormone, has the following structure.

![Testosterone structure](https://cdn3.digialm.com//per/g28/pub/2083/touchstone/AssessmentQPHTMLMode1//2083O234/2083O234S18D60970/1675242435676.png)

The total number of asymmetric carbon atom/s in testosterone is ________.

Given 13  
Answer :  

---

Question Type : SA  
Question ID: 7155051229  
Status: Answered

Question Type : SA  
Question ID: 7155051228  
Status: Answered

Question Type : SA  
Question ID: 7155051225  
Status: Not Answered

Question Type : SA  
Question ID: 7155051230  
Status: Answered
Q.61  The number of integral values of \( k \), for which one root of the equation \( 2x^2 - 8x + k = 0 \) lies in the interval (1, 2) and its other root lies in the interval (2, 3), is:

Options

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

Q.62  Let \( \alpha = \exp(x^2+y^2) \) be the solution of the differential equation \( 2x^2y \frac{dy}{dx} - (1 - xy^2) \frac{dx}{dy} = 0, \ x > 0, \ y(2) = \frac{1}{\log_e 2} \). Then \( \alpha + \beta - \gamma \) equals:

Options

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

Q.63  The area of the region given by \( \{(x,y) : xy \leq 8, 1 \leq y \leq x^2 \} \) is:

Options

1. \( 16 \log_e 2 - \frac{14}{3} \)
2. \( 16 \log_e 2 + \frac{7}{3} \)
3. \( 8 \log_e 2 - \frac{13}{3} \)
4. \( 8 \log_e 2 + \frac{7}{6} \)
Q.64 Let $x_1 < x_2 < \ldots < x_7$ be in an A.P. with common difference $d$. If the standard deviation of $x_1, x_2, \ldots, x_7$ is 4 and the mean is $\bar{x}$, then $\bar{x} + x_6$ is equal to:

Options
1. $2\left(9 + \frac{8}{\sqrt{7}}\right)$
2. 25
3. $18\left(1 + \frac{1}{\sqrt{3}}\right)$
4. 34

Q.65 For the system of linear equations $ax + y + z = 1$, $x + ay + z = 1$, $x + y + az = \beta$, which one of the following statements is NOT correct?

Options
1. It has no solution if $a = -2$ and $\beta = 1$
2. It has infinitely many solutions if $a = 1$ and $\beta = 1$
3. $x + y + z = \frac{3}{4}$ if $a = 2$ and $\beta = 1$
4. It has infinitely many solutions if $a = 2$ and $\beta = -1$

Q.66 Let $P(S)$ denote the power set of $S = \{1, 2, 3, \ldots, 10\}$. Define the relations $R_1$ and $R_2$ on $P(S)$ as:

AR$_1$B if $(A \cap B^c) \cup (B \cap A^c) = \emptyset$ and AR$_2$B if $A \cup B = B \cup A^c$, $\forall A, B \in P(S)$. Then:

Options
1. only $R_1$ is an equivalence relation
2. both $R_1$ and $R_2$ are not equivalence relations
3. both $R_1$ and $R_2$ are equivalence relations
4. only $R_2$ is an equivalence relation
Q.67 Let \( P(x_0, y_0) \) be the point on the hyperbola \( 3x^2 - 4y^2 = 36 \), which is nearest to the line \( 3x + 2y = 1 \).

Then \( \sqrt{2} (y_0 - x_0) \) is equal to:

Options
1. \(-9\)
2. \(-3\)
3. \(3\)
4. \(9\)

Q.68 Let \( S = \{ x \in \mathbb{R} : 0 < x < 1 \text{ and } 2 \tan^{-1}\left(\frac{1-x}{1+x}\right) = \cos^{-1}\left(\frac{1-x^2}{1+x^2}\right) \} \).

If \( n(S) \) denotes the number of elements in \( S \) then:

1. \( n(S) = 1 \) and the element in \( S \) is less than \( \frac{1}{2} \).
2. \( n(S) = 0 \)
3. \( n(S) = 1 \) and the elements in \( S \) is more than \( \frac{1}{2} \).
4. \( n(S) = 2 \) and only one element in \( S \) is less than \( \frac{1}{2} \).

Q.69 Let \( \overrightarrow{a} = 2\hat{i} - 2\hat{j} + 5\hat{k} \), \( \overrightarrow{b} = \hat{i} + \hat{k} \) and \( \overrightarrow{c} = \hat{i} + 2\hat{j} - 3\hat{k} \) be three given vectors. If \( \overrightarrow{r} \) is a vector such that \( \overrightarrow{r} \times \overrightarrow{a} = \overrightarrow{c} \times \overrightarrow{a} \) and \( \overrightarrow{r} \cdot \overrightarrow{b} = 0 \), then \( |\overrightarrow{r}| \) is equal to:

Options
1. \( \frac{11}{7} \)
2. \( \frac{11}{7}\sqrt{2} \)
3. \( \frac{11}{5}\sqrt{2} \)
4. \( \frac{\sqrt{914}}{7} \)
Q.70 Two dice are thrown independently. Let A be the event that the number appeared on the 1st die is less than the number appeared on the 2nd die, B be the event that the number appeared on the 1st die is even and that on the second die is odd, and C be the event that the number appeared on the 1st die is odd and that on the 2nd die is even. Then:

Options 1. B and C are independent
2. the number of favourable cases of the events A, B and C are 15, 6 and 6 respectively
3. A and B are mutually exclusive
4. the number of favourable cases of the event $(A \cup B) \cap C$ is 6

Q.71 Let $a, b$ be two real numbers such that $ab < 0$. If the complex number $\frac{3 + 2i}{a + bi}$ is of unit modulus and $\frac{a}{a + bi} = \frac{1}{z}$, then a possible value of $\frac{3 + 2i}{a}$, where $[r]$ is greatest integer function, is:

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

Q.72 If $A = \begin{bmatrix} 1 & \sqrt{3} \\ -\sqrt{3} & 1 \end{bmatrix}$, then:

Options 1. $A^{30} + A^{25} - A = I$
2. $A^{30} = A^{25}$
3. $A^{30} + A^{25} + A = I$
4. $A^{30} - A^{25} = 2I$
Q.73 Let the plane P pass through the intersection of the planes $2x + 3y - z = 2$ and $x + 2y + 3z = 6$, and be perpendicular to the plane $2x + y - z + 1 = 0$. If $d$ is the distance of P from the point ($-7$, 1, 1), then $d^2$ is equal to:

Options

1. $\frac{25}{83}$
2. $\frac{250}{83}$
3. $\frac{82}{250}$
4. $\frac{15}{53}$

Q.74 The value of the integral $\int_{-\frac{\pi}{4}}^{\frac{\pi}{4}} \frac{x + \frac{\pi}{4}}{2 - \cos 2x} \, dx$ is:

Options

1. $\frac{\pi^2}{6\sqrt{3}}$
2. $\frac{\pi^2}{3\sqrt{3}}$
3. $\frac{\pi^2}{6}$
4. $\frac{\pi^2}{12\sqrt{3}}$
Q.75 Let \( \vec{a} = 5\hat{i} - 3\hat{j} \) and \( \vec{b} = \hat{i} + 3\hat{j} + 5\hat{k} \) be two vectors. Then which one of the following statements is TRUE?

Options 1.
- Projection of \( \vec{a} \) on \( \vec{b} \) is \( \frac{-17}{\sqrt{35}} \) and the direction of the projection vector is opposite to the direction of \( \vec{b} \).
- Projection of \( \vec{a} \) on \( \vec{b} \) is \( \frac{17}{\sqrt{35}} \) and the direction of the projection vector is opposite to the direction of \( \vec{b} \).
- Projection of \( \vec{a} \) on \( \vec{b} \) is \( \frac{-17}{\sqrt{35}} \) and the direction of the projection vector is same as of \( \vec{b} \).
- Projection of \( \vec{a} \) on \( \vec{b} \) is \( \frac{-17}{\sqrt{35}} \) and the direction of the projection vector is same as of \( \vec{b} \).

Q.76 If \( y(x) = x^x \), \( x > 0 \), then \( y'(2) - 2y'(2) \) is equal to:

Options 1.
- \( 8 \log_e{2} - 2 \)
- \( 4 \log_e{2} + 2 \)
- \( 4 (\log_e{2})^2 + 2 \)
- \( 4 (\log_e{2})^2 - 2 \)
Q.77 Let \( f : \mathbb{R} \to \{0,1\} \to \mathbb{R} \) be a function such that \( f(x) + f\left(\frac{1}{1-x}\right) = 1 + x \). Then \( f(2) \) is equal to

Options
1. 7
2. 3
3. 7
4. 4

Q.78 The sum \( \sum_{n=1}^{\infty} \frac{2n^2 + 3n + 4}{(2n)!} \) is equal to:

Options
1. \( \frac{11e}{2} + \frac{7}{2e} - 4 \)
2. \( \frac{13e}{4} + \frac{5}{4e} - 4 \)
3. \( \frac{11e}{2} + \frac{7}{2e} \)
4. \( \frac{13e}{4} + \frac{5}{4e} \)

Q.79 Which of the following statements is a tautology?

Options
1. \( p \lor (p \land q) \)
2. \( p \rightarrow (p \land (p \rightarrow q)) \)
3. \((p \land (p \rightarrow q)) \rightarrow \neg q \)
4. \( (p \land q) \rightarrow (\neg p \rightarrow q) \)
Q.80 The sum of the absolute maximum and minimum values of the function 
\[ f(x) = |x^2 - 5x + 6| - 3x + 2 \] in the interval \([-1, 3]\) is equal to:

Options:
1. 12
2. 24
3. 13
4. 10

Question Type: MCQ
Question ID: 7155051239
Option 1 ID: 7155053724
Option 2 ID: 7155053726
Option 3 ID: 7155053725
Option 4 ID: 7155053723
Status: Answered
Chosen Option: 4

Section: Mathematics Section B

Q.81 The point of intersection C of the plane \(8x + y + 2z = 0\) and the line joining the points \(A(-3, -6, 1)\)
and \(B(2, 4, -3)\) divides the line segment \(AB\) internally in the ratio \(k : 1\). If \(a, b, c\) are coprime) are the direction ratios of the perpendicular from the point \(C\) on the line
\[ \frac{1 - x}{1} = \frac{y + 4}{2} = \frac{z + 2}{3} \] then \(|a + b + c|\) is equal to______.

Given:
Answer:

Question Type: SA
Question ID: 7155051260
Status: Not Answered

Q.82 If the x-intercept of a focal chord of the parabola \(y^2 = 8x + 4y + 4\) is 3, then the length of this chord
is equal to______.

Given: 14
Answer:

Question Type: SA
Question ID: 7155051258
Status: Answered

Q.83 Number of integral solutions to the equation \(x + y + z = 21\), where \(x \geq 1, y \geq 3, z \geq 4\), is equal to

Given: 0
Answer:

Question Type: SA
Question ID: 7155051255
Status: Answered

Q.84 If \( \int_{0}^{\pi} \frac{\cos x + \cos 3x + \cos 5x + \cos 7x}{1 + \sin x} \, dx = \frac{kx}{16} \), then \(k\) is equal to______.

Given: 2
Answer:

Question Type: SA
Question ID: 7155051256
Status: Answered
Q.85 The sum of the common terms of the following three arithmetic progressions.
3, 7, 11, 15, . . . . . , 399,
2, 5, 8, 11, . . . . . , 359 and
2, 7, 12, 17, . . . . . , 197,
is equal to ___________.

Given 0
Answer:

Question Type: SA
Question ID: 7155051253
Status: Answered

Q.86 The line $x - 8$ is the directrix of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ with the corresponding focus $(2, 0)$. If the tangent to E at the point P in the first quadrant passes through the point $(0, 4\sqrt{3})$ and intersects the x-axis at Q, then $|3PQ|^2$ is equal to ___________.

Given --
Answer:

Question Type: SA
Question ID: 7155051259
Status: Not Answered

Q.87 If the term without $x$ in the expansion of $\left( \frac{1}{x^2} + \frac{\alpha}{x} \right)^{32}$ is 7315, then $|\alpha|$ is equal to ________

Given --
Answer:

Question Type: SA
Question ID: 7155051254
Status: Not Answered

Q.88 Let $ax + by + z = 1$ be the equation of a plane passing through the point $(3, -2, 5)$ and perpendicular to the line joining the points $(1, 2, 3)$ and $(-2, 3, 5)$. Then the value of $a\beta$ is equal to ________.

Given --
Answer:

Question Type: SA
Question ID: 7155051257
Status: Not Answered

Q.89 Let the sixth term in the binomial expansion of $\left( 2^{(x-2)\log_3 2}\right)^n$, in the increasing powers of $2^{(x-2)\log_3 2}$, be 21. If the binomial coefficients of the second, third and fourth terms in the expansion are respectively the first, third and fifth terms of an A.P., then the sum of the squares of all possible values of $x$ is ________.

Given --
Answer:

Question Type: SA
Question ID: 7155051252
Status: Not Answered
Q.90  The total number of six digit numbers, formed using the digits 4, 5, 9 only and divisible by 6, is

Given 2
Answer : 2