

3) 650

4) 580

Q15. The number of elements in the relation $R = \{ (x, y) : 4x^2 + y^2 < 52, x, y \in \mathbb{Z} \}$ is [2026]

1) 86

2) 89

3) 67

4) 77

Q16. Let $f(x) = [x]^2 - [x + 3] - 3, x \in \mathbb{R}$, where $[\cdot]$ is the greatest integer function. Then: [2026]

1) $f(x) < 0$ only for $x \in [-1, 3)$

2) $\int_0^2 f(x) dx = -6$

3) $f(x) > 0$ only for $x \in [4, \infty)$

4) $f(x) = 0$ for finitely many values of x

Q17. Let $S = \{ z \in \mathbb{C} : 4z^2 + \bar{z} = 0 \}$. Then $\sum_{z \in S} |z|^2$ is equal to: [2026]

1) 7/64

2) 1/16

3) 5/64

4) 3/16

Q18. Let L be the line $\frac{x+1}{2} = \frac{y+1}{3} = \frac{z+3}{6}$ and let S be the set of all points (a, b, c) on L , whose distance from the line $\frac{x+1}{2} = \frac{y+1}{3} = \frac{z-9}{0}$ along the line L is 7. Then $\sum_{(a, b, c) \in S} (a + b + c)$ is equal to: [2026]

1) 6

2) 40

3) 34

4) 28

Q19. If $\lim_{x \rightarrow 0} \frac{e^{(a-1)x} + 2\cos bx + (c-2)e^{-x}}{x\cos x - \log_e(1+x)} = 2$, then $a^2 + b^2 + c^2$ is equal to: [2026]

1) 7

2) 3

3) 5

4) 9

Q20. If the mean deviation about the median of the numbers $k, 2k, 3k, \dots, 1000k$ is 500, then k^2 is equal to: [2026]

1) 9

2) 4

3) 1

4) 16

Q21. Let S be the set of the first 11 natural numbers. Then the number of elements in $A = \{ B \subseteq S : n(B) \geq 2 \text{ and the product of all elements of } B \text{ is even} \}$ is _____. [2026]

Q22. Suppose a, b, c are in A.P. and $a^2, 2b^2, c^2$ are in G.P. If $a < b < c$ and $a + b + c = 1$ then $9(a^2 + b^2 + c^2)$ is equal to _____. [2026]

Q23. Let $[\cdot]$ be the greatest integer function. If $\alpha = \int_0^{64} x^{1/3} - [x^{1/3}] dx$, then $\frac{1}{\pi} \int_0^{\alpha\pi} \left(\frac{\sin^2 \theta}{\sin^6 \theta + \cos^6 \theta} \right) d\theta$ is equal to _____. [2026]

Q24. Let $\cos(\alpha + \beta) = -\frac{1}{10}$ and $\sin(\alpha - \beta) = \frac{3}{8}$, where $0 < \alpha < \frac{\pi}{3}$ and $0 < \beta < \frac{\pi}{4}$. If $\tan 2\alpha = \frac{3(1-r\sqrt{5})}{\sqrt{11}(s+\sqrt{5})}$, $r, s \in \mathbb{N}$, then $r + s$ is equal to _____. [2026]

Q25. Let a vector $\vec{a} = \sqrt{2} \hat{i} - \hat{j} + \lambda \hat{k}$, $\lambda > 0$, make an obtuse angle with the vector $\vec{b} = -\lambda^2 \hat{i} + 4\sqrt{2} \hat{j} + 4\sqrt{2} \hat{k}$ and an angle θ , $\frac{\pi}{6} < \theta < \frac{\pi}{2}$, with the positive z-axis. If the set of all possible values of λ is $(\alpha, \beta) - \{\gamma\}$, then $\alpha + \beta + \gamma$ is equal to _____. [2026]

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Q26. The wavelength of light, while it is passing through water is 540 nm. The refractive index of water is $\frac{4}{3}$. The wavelength of the same light when it is passing through a transparent medium having refractive index of $\frac{3}{2}$ is _____ nm. [2026]

- | | |
|--------|--------|
| 1) 840 | 2) 380 |
| 3) 480 | 4) 540 |

Q27. In an open organ pipe v_3 and v_6 are 3rd and 6th harmonic frequencies, respectively. If $v_6 - v_3 = 2200$ Hz, the length of the pipe is _____ mm.

(Take velocity of sound in air is 300 m/s) [2026]

- | | |
|--------|--------|
| 1) 200 | 2) 250 |
| 3) 275 | 4) 225 |

Q28. Given below are two statements :

Statement I : A satellite is moving around earth in the orbit very close to the earth surface. The time period of revolution of satellite depends upon the density of earth.

Statement II : The time period of revolution of the satellite is $T = 2\pi \sqrt{\frac{R_e}{g}}$ (for satellite very close to the earth surface), where R_e radius of earth and g acceleration due to gravity.

In the light of the above statements, choose the correct answer from the options given below : [2026]

- | | |
|--|--|
| 1) Statement I is true but Statement II is false | 2) Statement I is false but Statement II is true |
| 3) Both Statement I and Statement II are true | 4) Both Statement I and Statement II are false |

Q29. Three small identical bubbles of water having same charge on each coalesce to form a bigger bubble. Then the ratio of the potentials on one initial bubble and that on the resultant bigger bubble is : [2026]

- | | |
|------------------|------------------|
| 1) $3^{2/3} : 1$ | 2) $1 : 3^{1/3}$ |
| 3) $1 : 2^{2/3}$ | 4) $1 : 3^{2/3}$ |

Q30. Which of the following are true for a single slit diffraction ? [2026]

- A. Width of central maxima increases with increase in wavelength keeping slit width constant.
- B. Width of central maxima increases with decrease in wavelength keeping slit width constant.
- C. Width of central maxima increases with decrease in slit width at constant wavelength.
- D. Width of central maxima increases with increase in slit width at constant wavelength.
- E. Brightness of central maxima increases for decrease in wavelength at constant slit width.

- | | |
|-----------------|--------------|
| 1) A, D, E only | 2) B, D only |
| 3) A, D only | 4) B, C only |

Q31. Five positive charges each having charge q are placed at the vertices of a pentagon as shown in the figure. The electric potential (V) and the electric field \vec{E} at the center O of the pentagon due to these five positive charges are: **[2026]**

- | | |
|--|---|
| 1) $V = \frac{5q}{4\pi\epsilon_0 r}$ and $\vec{E} = \frac{5q}{4\pi\epsilon_0 r^2} \hat{r}$ | 2) $V = \frac{5q}{4\pi\epsilon_0 r}$ and $\vec{E} = 0$ |
| 3) $V = 0$ and $\vec{E} = 0$ | 4) $V = \frac{5q}{4\pi\epsilon_0 r}$ and $\vec{E} = \frac{5\sqrt{3} q}{8\pi\epsilon_0 r^2} \hat{r}$ |

Q32. An electric power line having total resistance of 2Ω , delivers 1 kW of power at 250 V . The percentage efficiency of transmission line is _____. **[2026]**

- | | |
|---------|---------|
| 1) 96.9 | 2) 92.5 |
| 3) 100 | 4) 86.5 |

Q33. Given below are two statements :

Statement I : An object moves from position r_1 to position r_2 under a conservative force field \vec{F} . The work done by the force is $W = - \int_{r_1}^{r_2} \vec{F} \cdot d\vec{r}$.

Statement II : Any object moving from one location to another location can follow infinite number of paths. Therefore, the amount of work done by the object changes with the path it follows for a conservative force.

In the light of the above statements, choose the correct answer from the options given below : **[2026]**

- | | |
|--|--|
| 1) Statement I is true but Statement II is false | 2) Both Statement I and Statement II are true |
| 3) Both Statement I and Statement II are false | 4) Statement I is false but Statement II is true |

Q34. When a part of a straight capillary tube is placed vertically in a liquid, the liquid raises upto certain height h . If the inner radius of the capillary tube, density of the liquid and surface tension of the liquid decrease by 1% each, then the height of the liquid in the tube will change by _____ %.

[2026]

- | | |
|-------|-------|
| 1) +3 | 2) -1 |
| 3) +1 | 4) -3 |

Q35. Using a simple pendulum experiment g is determined by measuring its time period T . Which of the following plots represent the correct relation between the pendulum length L and time period T ?

[2026]

- | | |
|----------------------|----------------------|
| 1) Enter Answer here | 2) Enter Answer here |
| 3) Enter Answer here | 4) Enter Answer here |

Q36. Consider two boxes containing ideal gases A and B such that their temperatures, pressures and number densities are same. The molecular size of A is half that of B and mass of molecule A is four times that of B. If the collision frequency in gas B is $32 \times 10^8 \text{ s}^{-1}$ then collision frequency in gas A is _____/s **[2026]**

- | | |
|---------------------|--------------------|
| 1) 32×10^8 | 2) 8×10^8 |
| 3) 2×10^8 | 4) 4×10^8 |

Q37. The smallest wavelength of Lyman series is 91 nm. The difference between the largest wavelengths of Paschen and Balmer series is nearly _____ nm. [2026]

- 1) 1217
- 2) 1550
- 3) 1784
- 4) 1875

Q38. A uniform bar of length 12 cm and mass 20m lies on a smooth horizontal table. Two point masses m and $2m$ are moving in opposite directions with same speed of v and in the same plane as the bar, as shown in figure. These masses strike the bar simultaneously and get stuck to it. After collision the entire system is rotating with angular frequency ω . The ratio of v and ω is : [2026]

- 1) $\sqrt{288}$
- 2) 33
- 3) 66
- 4) 32

Q39. In parallax method for the determination of focal length of a concave mirror, the object should always be placed: [2026]

- 1) between the focus (F) and the centre of curvature (C) of the mirror ONLY
- 2) at any point beyond the focus (F) of the mirror
- 3) between the pole (P) and the focus (F) of the concave mirror ONLY
- 4) beyond the centre of the curvature (C) of the mirror ONLY

Q40. Given below are two statements :

Statement I : For a mechanical system of many particles total kinetic energy is the sum of kinetic energies of all the particles.

Statement II : The total kinetic energy can be the sum of kinetic energy of the center of mass w.r.t the origin and the kinetic energy of all the particles w.r.t. the center of mass as the reference.

In the light of the above statements, choose the correct answer from the options given below : [2026]

- 1) Statement I is false but Statement II is true
- 2) Both Statement I and Statement II are false
- 3) Statement I is true but Statement II is false
- 4) Both Statement I and Statement II are true

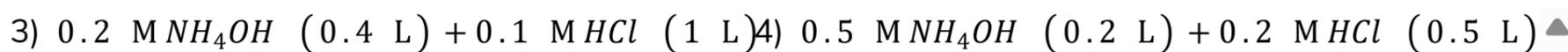
Q41. Figure shows the circuit that contains three resistances (9Ω each) and two inductors (4 mH each). The reading of ammeter at the moment switch K is turned ON, is _____ A. [2026]

- 1) 2
- 2) zero
- 3) 1
- 4) 3

Q42. Light is incident on a metallic plate having work function $110 \times 10^{-20} J$. If the produced photoelectrons have zero kinetic energy then the angular frequency of the incident light is _____ rad/s.

($h = 6.63 \times 10^{-34} \text{ J}\cdot\text{s}$) [2026]

- 1) 1.66×10^{15}
- 2) 1.04×10^{16}
- 3) 1.04×10^{13}
- 4) 1.66×10^{16}



Q52. The IUPAC name of the following compound is : [2026]

- 1) n-propyl-1-bromo-4-methylhexanoate 2) 2-bromo-5-methylhexylpropanoate
3) 2-bromo-5-methylpropanoate 4) n-propyl-2-bromo-5-methylheptanoate

Q53. When 1 g of compound (X) is subjected to Kjeldahl's method for estimation of nitrogen, 15 mL 1 M H_2SO_4 was neutralized by ammonia evolved. The percentage of nitrogen in compound (X) is : [2026]

- 1) 0.42 2) 42
3) 0.21 4) 21

Q54. Among H_2S , H_2O , NF_3 , NH_3 and CHCl_3 , identify the molecule (X) with lowest dipole moment value. The number of lone pairs of electrons present on the central atom of the molecule (X) is : [2026]

- 1) 3 2) 2
3) 1 4) 0

Q55. Given below are two statements :

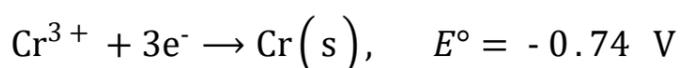
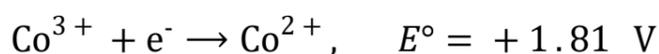
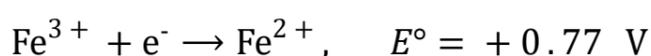
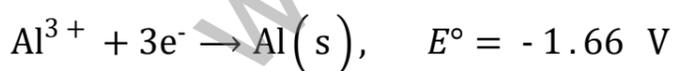
Statement I : Elements 'X' and 'Y' are the most and least electronegative elements, respectively among N, As, Sb and P. The nature of the oxides X_2O_3 and Y_2O_3 is acidic and amphoteric, respectively.

Statement II : BCl_3 is covalent in nature and gets hydrolysed in water. It produces $[\text{B}(\text{OH})_4]^-$ and $[\text{B}(\text{H}_2\text{O})_6]^{3+}$ in aqueous medium.

In the light of the above statements, choose the correct answer from the options given below : [2026]

- 1) Both Statement I and Statement II are true 2) Statement I is false but Statement II is true
3) Statement I is true but Statement II is false 4) Both Statement I and Statement II are false

Q56. Consider the following reduction processes:



The tendency to act as reducing agent decreases in the order: [2026]

- 1) $\text{Al} > \text{Fe}^{2+} > \text{Cr} > \text{Co}^{2+}$ 2) $\text{Al} > \text{Cr} > \text{Co}^{2+} > \text{Fe}^{2+}$
3) $\text{Cr} > \text{Fe}^{2+} > \text{Al} > \text{Co}^{2+}$ 4) $\text{Al} > \text{Cr} > \text{Fe}^{2+} > \text{Co}^{2+}$

Q57. $A + 2B \rightarrow AB_2$

36.0 g of 'A' (Molar mass : 60 g mol^{-1}) and 56.0 g of 'B' (Molar mass : 80 g mol^{-1}) are allowed to react. Which of the following statements are correct ?

- A. 'A' is the limiting reagent.
- B. 77.0 g of AB_2 is formed.
- C. Molar mass of AB_2 is 140 g mol^{-1} .
- D. 15.0 g of A is left unreacted after the completion of reaction.

Choose the correct answer from the options given below : [2026]

- 1) B and D Only
- 2) A and B Only
- 3) A and C Only
- 4) C and D Only

Q58. Given below are two statements :

Statement I : $C < O < N < F$ is the correct order in terms of first ionization enthalpy values.

Statement II : $S > Se > Te > Po > O$ is the correct order in terms of the magnitude of electron gain enthalpy values.

In the light of the above statements, choose the correct answer from the options given below : [2026]

- 1) Both Statement I and Statement II are false
- 2) Both Statement I and Statement II are true
- 3) Statement I is false but Statement II is true
- 4) Statement I is true but Statement II is false

Q59. The dibromo compound [P] (molecular formula : $C_9H_{10}Br_2$) when heated with excess sodamide followed by treatment with dilute HCl gives [Q]. On warming [Q] with mercuric sulphate and dilute sulphuric acid yield [R] which gives positive Iodoform test but negative Tollen's test. The compound [P] is : [2026]

- 1) Enter Answer here
- 2) Enter Answer here
- 3) Enter Answer here
- 4) Enter Answer here

Q60. Match List – I with List – II

List – I	Reaction of Glucose with	List – II	Product formed
A	Hydroxylamine	I	Gluconic acid
B	Br_2 water	II	Glucose pentaacetate
C	Excess acetic anhydride	III	Saccharic acid
D	Concentrated HNO_3	IV	Glucoxime

Choose the correct answer from the options given below : [2026]

- 1) A-IV, B-III, C-II, D-I
- 2) A-III, B-I, C-IV, D-II
- 3) A-I, B-III, C-IV, D-II
- 4) A-IV, B-I, C-II, D-III

Q61. At T(K), 100 g of 98% H_2SO_4 (w/w) aqueous solution is mixed with 100 g of 49% H_2SO_4 (w/w) aqueous solution. What is the mole fraction of H_2SO_4 in the resultant solution?

(Given : Atomic mass H = 1 u ; S = 32 u ; O = 16 u).

(Assume that temperature after mixing remains constant) [2026]

- | | |
|--------|----------|
| 1) 0.9 | 2) 0.633 |
| 3) 0.1 | 4) 0.337 |

Q62. Identify the correct statements :

- A. Hydrated salts can be used as primary standard.
- B. Primary standard should not undergo any reaction with air.
- C. Reactions of primary standard with another substance should be instantaneous and stoichiometric.
- D. Primary standard should not be soluble in water.
- E. Primary standard should have low relative molar mass.

Choose the correct answer from the options given below : [2026]

- | | |
|--------------------|-----------------------|
| 1) A, B and C Only | 2) A, B, C and E Only |
| 3) A, B and E Only | 4) D and E Only |

Q63. The final product [B] is : [2026]

- | | |
|----------------------|----------------------|
| 1) Enter Answer here | 2) Enter Answer here |
| 3) Enter Answer here | 4) Enter Answer here |

Q64. $[Ni(PPH_3)_2Cl_2]$ is a paramagnetic complex. Identify the INCORRECT statements about this complex.

- A. The complex exhibits geometrical isomerism.
- B. The complex is white in colour.
- C. The calculated spin-only magnetic moment of the complex is 2.84 BM.
- D. The calculated CFSE (Crystal Field Stabilization Energy) of Ni in this complex is $-0.8 \Delta_0$.
- E. The geometrical arrangement of ligands in this complex is similar to that in $Ni(CO)_4$.

Choose the correct answer from the options given below : [2026]

- | | |
|--------------------|--------------------|
| 1) C, D and E Only | 2) A, B and D Only |
| 3) C and D Only | 4) A and B Only |

Q65. The energy of first (lowest) Balmer line of H atom is x J. The energy (in J) of second Balmer line of H atom is : [2026]

- | | |
|----------|---------------|
| 1) 1.35x | 2) x^2 |
| 3) 2x | 4) $x / 1.35$ |

Q66. The compound A, $C_8H_8O_2$ reacts with acetophenone to form a single product via cross-Aldol condensation. The compound A on reaction with conc. NaOH forms a substituted benzyl alcohol as one of the two products. The compound A is : [2026]

- | | |
|---------------------------|---------------------------|
| 1) 4-hydroxy benzaldehyde | 2) 4-methoxy benzaldehyde |
| 3) 4-methyl benzoic acid | 4) 2-hydroxy acetophenone |

Q67. 3, 3-Dimethyl-2-butanol cannot be prepared by :

Choose the correct answer from the options given below : [2026]

- | | |
|-----------------|--------------------|
| 1) B Only | 2) B and E Only |
| 3) B and C Only | 4) B, C and E Only |

Q68. Correct statements regarding Arrhenius equation among the following are :

- A. Factor $e^{-E_a/RT}$ corresponds to fraction of molecules having kinetic energy less than E_a .
B. At a given temperature, lower the E_a , faster is the reaction.
C. Increase in temperature by about 10°C doubles the rate of reaction.
D. Plot of $\log k$ vs $1/T$ gives a straight line with slope = $-E_a/R$.

Choose the correct answer from the options given below : [2026]

- | | |
|-----------------|-----------------|
| 1) B and D Only | 2) A and B Only |
| 3) B and C Only | 4) A and C Only |

Q69. Given below are two statements :

Statement I : The first ionization enthalpy of Cr is lower than that of Mn.

Statement II : The second and third ionization enthalpies of Cr are higher than those of Mn.

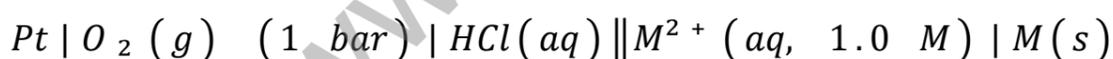
In the light of the above statements, choose the correct answer from the options given below : [2026]

- | | |
|--|--|
| 1) Both Statement I and Statement II are false | 2) Both Statement I and Statement II are true |
| 3) Statement I is true but Statement II is false | 4) Statement I is false but Statement II is true |

Q70. Consider the following reaction : [2026]

- | | |
|----------------------|-----------------------|
| 1) 2-methylhex-2-yne | 2) 5-methylhex-2-yne |
| 3) 2-methylhex-3-yne | 4) Isopropylbut-1-yne |

Q71. Consider the following electrochemical cell :

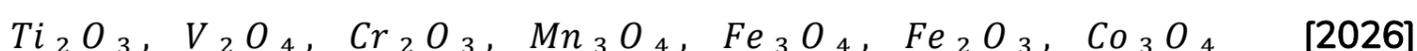


The pH above which, oxygen gas would start to evolve at anode is _____ (nearest integer). [2026]

Q72. The mass of benzanilide obtained from the benzoylation reaction of 5.8 g of aniline, if yield of product is 82%, is _____ g (nearest integer).

(Given molar mass in g mol^{-1} H : 1, C : 12, N : 14, O : 16) [2026]

Q73. Among the following oxides of 3d elements, the number of mixed oxides are _____.



Q74. If the enthalpy of sublimation of Li is 155 kJ mol^{-1} , enthalpy of dissociation of F_2 is 150 kJ mol^{-1} , ionization enthalpy of Li is 520 kJ mol^{-1} , electron gain enthalpy of F is -313 kJ mol^{-1} , standard enthalpy of formation of LiF is -594 kJ mol^{-1} . The magnitude of lattice enthalpy of LiF is _____ kJ mol^{-1} . (Nearest Integer) [2026]

Q75. Consider $A \xrightarrow{k_1} B$ and $C \xrightarrow{k_2} D$ are two reactions. If the rate constant (k_1) of the $A \rightarrow B$ reaction can be expressed by the following equation $\log_{10} k = 14.34 - \frac{1.5 \times 10^4}{T/K}$ and activation energy of $C \rightarrow D$ reaction (E_{a_2}) is $\frac{1}{5}$ th of the $A \rightarrow B$ reaction (E_{a_1}), then the value of (E_{a_2}) is _____ kJ mol^{-1} . (Nearest Integer) [2026]

Answer Key

Q1 : 4 Q2 : 2 Q3 : 4 Q4 : 2 Q5 : 1 Q6 : 4 Q7 : 2 Q8 : 1 Q9 : 3

Q10 : 3 Q11 : 4 Q12 : 2 Q13 : 2 Q14 : 1 Q15 : 4 Q16 : 1 Q17 : 4

Q18 : 3 Q19 : 1 Q20 : 2 Q21 : 1979 Q22 : 9 Q23 : 36 Q24 : 20 Q25 : 5

Q26 : 3 Q27 : 4 Q28 : 3 Q29 : 4 Q30 : 1 Q31 : 2 Q32 : 1 Q33 : 1

Q34 : 3 Q35 : 2 Q36 : 4 Q37 : 1 Q38 : 2 Q39 : 2 Q40 : 4 Q41 : 3

Q42 : 2 Q43 : 2 Q44 : 4 Q45 : 3 Q46 : 14 Q47 : 2 Q48 : 7 Q49 : 1

O50 : 4 O51 : 2 O52 : 4 O53 : 2 O54 : 3 O55 : 3 O56 : 4 O57 : 1

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