JEE Main 2025 April 4 Shift 1 Chemistry Question Paper with Solutions

Time Allowed :3 Hours	Maximum Marks :300	Total Questions :75

General Instructions

Read the following instructions very carefully and strictly follow them:

1. Multiple choice questions (MCQs)
2. Questions with numerical values as answers.
3. There are three sections: **Mathematics, Physics, Chemistry**.
4. **Mathematics:** 25 (20+5) 10 Questions with answers as a numerical value. Out of 10 questions, 5 questions are compulsory.
5. **Physics:** 25 (20+5) 10 Questions with answers as a numerical value. Out of 10 questions, 5 questions are compulsory..
6. **Chemistry:** 25 (20+5) 10 Questions with answers as a numerical value. Out of 10 questions, 5 questions are compulsory.
7. Total: 75 Questions (25 questions each).
8. 300 Marks (100 marks for each section).
9. **MCQs:** Four marks will be awarded for each correct answer and there will be a negative marking of one mark on each wrong answer.
10. **Questions with numerical value answers:** Candidates will be given four marks for each correct answer and there will be a negative marking of 1 mark for each wrong answer.

Chemistry

Section - A

51. XY **is the membrane / partition between two chambers 1 and 2 containing sugar solutions of concentration** c_1 **and** $c_2\,(c_1 > c_2)\,\text{molL}^{-1}$**. For the reverse osmosis to take place identify the correct condition**

(Here p_1 and p_2 are pressures applied on chamber 1 and 2)

(A) Membrane/Partition ; Cellophane, $p_1 > \pi$

(B) Membrane/Partition ; Porous. $p_2 > \pi$

(C) Membrane/Partition ; Parchment paper, $p_1 > \pi$

(D) Membrane/Partition : Cellophane, $p_2 > \pi$

Choose the correct answer from the options given below:

(1) B and D only

(2) A and D only
(3) A and C only
(4) C only

Correct Answer: (3) A and C only

Solution:
1. Normal osmosis occurs from chamber 2 to chamber 1. 2. For reverse osmosis from chamber 1 to chamber 2, the pressure p_1 must be greater than the osmotic pressure π. 3. Therefore, the correct conditions are A and C.
Therefore, the correct answer is (3) A and C only.

Quick Tip

Reverse osmosis requires the pressure in the chamber with higher concentration to be greater than the osmotic pressure.

---

52. Let us consider a reversible reaction at temperature, T . In this reaction, both ΔH and ΔS were observed to have positive values. If the equilibrium temperature is T_e, then the reaction becomes spontaneous at:
(1) $T = T_e$
(2) $T_e > T$
(3) $T > T_e$
(4) $T_e = 5\ T$

Correct Answer: (3) $T > T_e$

Solution:
1. For a reaction to be spontaneous, $\Delta G < 0$.

$$\Delta G = \Delta H - T\Delta S$$

2. Given that both ΔH and ΔS are positive:

$$\Delta G = \Delta H - T\Delta S < 0$$

$$T > \frac{\Delta H}{\Delta S} = T_e$$

Therefore, the correct answer is (3) $T > T_e$.

Quick Tip

A reaction is spontaneous when the Gibbs free energy change is negative.

---

53. Which of the following molecules(s) show/s paramagnetic behavior?
(A) O_2

(B) N_2
(C) F_2
(D) S_2
(E) Cl_2
Choose the correct answer from the options given below:
(1) B only
(2) A & C only
(3) A & E only
(4) A & D only

Correct Answer: (4) A & D only

Solution:
1. Number of unpaired electrons: - (A) O_2: 2 - (B) N_2: 0 - (C) F_2: 0 - (D) S_2: 2 - (E) Cl_2: 0
2. Paramagnetic behavior: - Molecules with unpaired electrons exhibit paramagnetic behavior. - Therefore, O_2 and S_2 are paramagnetic.
Therefore, the correct answer is (4) A & D only.

Quick Tip

Molecules with unpaired electrons are paramagnetic.

---

54. Aldol condensation is a popular and classical method to prepare α, β-unsaturated carbonyl compounds. This reaction can be both intermolecular and intramolecular. Predict which one of the following is not a product of intramolecular aldol condensation?

Correct Answer: (4)

Solution:
1. Intramolecular aldol condensation products: - (1), (2), and (3) are products of intramolecular aldol condensation. - (4) is a product of intermolecular aldol condensation.
Therefore, the correct answer is (4).

Quick Tip

Intramolecular aldol condensation involves the reaction within the same molecule, while intermolecular aldol condensation involves the reaction between two different molecules.

---

55. One mole of an ideal gas expands isothermally and reversibly from $10dm^3$ to $20dm^3$ at 300 K.ΔU, q and work done in the process respectively are :
Given : R = $8.3JK^{-1}$ and mol^{-1}
In 10 = 2.3
$\log 2 = 0.30$

$\log 3 = 0.48$
(1) $0, 21.84$ kJ, -1.26 kJ
(2) $0, -17.18$ kJ, 1.718 J
(3) $0, 21.84$ kJ, $21, 84$ kJ
(4) $0, 178$ kJ, -1.718 kJ

Correct Answer: (4) $0, 178$ kJ, -1.718 kJ

Solution:
1. Given: - Isothermal expansion from 10dm^3 to 20dm^3 at 300 K. - R = $8.3\text{JK}^{-1}\text{mol}^{-1}$.
2. Calculate the work done (w):

$$w = -nRT \ln \frac{V_2}{V_1}$$

$$w = -8.3 \times 300 \times \ln \left(\frac{20}{10} \right)$$

$$w = -1.718 \text{ kJ}$$

3. Calculate the heat transferred (q):

$$q = -w = 1.718 \text{ kJ}$$

4. Calculate the change in internal energy (ΔU):

$$\Delta U = 0 \quad (\text{since} \Delta T = 0)$$

Therefore, the correct answer is (4) $0, 178$ kJ, -1.718 kJ.

Quick Tip

For an isothermal process, the change in internal energy is zero.

---

56. Which one of the following complexes will have $\Delta_0 = 0$ and $\mu = 5.96$ B.M.?
(1) $[\text{Fe(CN)}_6]^4$
(2) $[\text{CO}\,(\text{NH}_3)_6]^{3+}$
(3) $[\text{FeF}_6]^4$
(4) $[\text{Mn(SCN)}_6]^4$

Correct Answer: (4) $[\text{Mn(SCN)}_6]^4$

Solution:
1. $[\text{Fe(CN)}_6]^4$: - $Fe^{2+} \Rightarrow 3\ d^6 4\ s^0$ - CN^- is a strong field ligand. - $\mu = 0$
2. $[\text{CO}\,(\text{NH}_3)_6]^{3+}$: - $Co^{3+} \Rightarrow 3\ d^6 4\ s^0$ - NH_3 is a strong field ligand. - $\mu = 0$
3. $[\text{FeF}_6]^4$: - $Fe^{2+} \Rightarrow 3\ d^6 4\ s^0$ - F^- is a weak field ligand. - $\mu = 0$
4. $[\text{Mn(SCN)}_6]^4$: - $Mn^{2+} \Rightarrow 3\ d^5 4\ s^0$ - SCN^- is a weak field ligand. - $\mu = \sqrt{35}$ BM = 5.96 BM - $\Delta_0 = 0$

Therefore, the correct answer is (4) $[\text{Mn(SCN)}_6]^4$.

Quick Tip

The magnetic moment and crystal field stabilization energy depend on the ligand field strength.

---

57. For $A_2 + B_2 \rightleftharpoons 2AB$ E_a for forward and backward reaction are 180 and 200 kJ mol^{-1} respectively. If catalyst lowers E_a for both reaction by 100 kJ mol^{-1}. Which of the following statement is correct?

(1) Catalyst does not alter the Gibbs energy change of a reaction.
(2) Catalyst can cause non-spontaneous reactions to occur.
(3) The enthalpy change for the reaction is +20 kJ mol^{-1}.
(4) The enthalpy change for the catalysed reaction is different from that of uncatalysed reaction.

Correct Answer: (1) Catalyst does not alter the Gibbs energy change of a reaction.

Solution:
1. Given: - $A_2 + B_2 \rightleftharpoons 2AB$ - $E_f = 180$ kJ mol^{-1} - $E_b = 200$ kJ mol^{-1}
2. Calculate the enthalpy change (ΔH):

$$\Delta H = E_f - E_b = 180 \text{ kJ mol}^{-1} - 200 \text{ kJ mol}^{-1} = -20 \text{ kJ mol}^{-1}$$

3. Effect of catalyst: - Catalyst lowers the activation energy but does not change the Gibbs free energy change (ΔG) or the enthalpy change (ΔH) of the reaction.
Therefore, the correct answer is (1) Catalyst does not alter the Gibbs energy change of a reaction.

Quick Tip

Catalysts lower the activation energy but do not change the thermodynamic properties of the reaction.

---

58. Rate law for a reaction between A and B is given by $R = k[A]^n[B]^m$. If concentration of A is doubled and concentration of B is halved from their initial value, the ratio of new rate of reaction to the initial rate of reaction $\left(\frac{r_2}{r_1}\right)$ is

(1) $2^{(n-m)}$
(2) $(n - m)$
(3) $(m + n)$
(4) $\frac{1}{2^{(m+n)}}$

Correct Answer: (1) $2^{(n-m)}$

Solution:
1. Initial rate law:

$$r_1 = k[A]^n[B]^m$$

2. New concentrations: - Concentration of A is doubled: $2[A]$ - Concentration of B is halved: $\frac{[B]}{2}$
3. New rate law:

$$r_2 = k(2[A])^n \left(\frac{[B]}{2}\right)^m$$

$$r_2 = k \cdot 2^n [A]^n \cdot \frac{[B]^m}{2^m}$$

4. Ratio of new rate to initial rate:

$$\frac{r_2}{r_1} = \frac{k \cdot 2^n [A]^n \cdot \frac{[B]^m}{2^m}}{k[A]^n[B]^m} = 2^n \cdot \frac{1}{2^m} = 2^{(n-m)}$$

Therefore, the correct answer is (1) $2^{(n-m)}$.

Quick Tip

The rate law depends on the concentrations of the reactants raised to their respective orders.

---

59. Number of stereoisomers possible for the complexes, $[CrCl_3(py)_3]$ and $[CrCl_2(ox)_2]^{3-}$ are respectively
(py = pyridine, ox = oxalate)
(1) 3&3
(2) 2&2
(3) 2&3
(4) 1&2

Correct Answer: (3) 2&3

Solution:
1. $[CrCl_3(py)_3]$: - Facial and meridional isomers are possible. - Total stereoisomers = 2.
2. $[CrCl_2(ox)_2]^{3-}$: - Geometrical isomers: cis and trans. - Optical isomers for cis: 2. - Optical isomers for trans: 1. - Total stereoisomers = 3.
Therefore, the correct answer is (3) 2&3.

Quick Tip

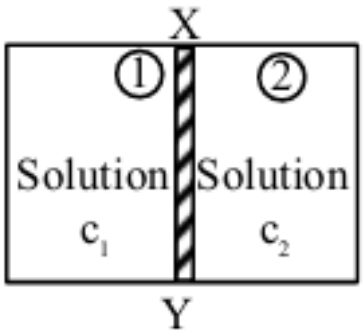
Stereoisomers include geometrical and optical isomers.

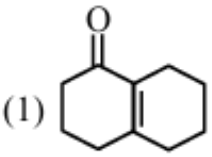
---

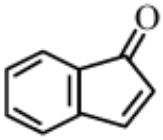
60. The major product (A) formed in the following reaction sequence is

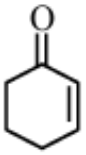
Correct Answer: (2)

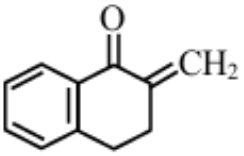
Solution:
1. Reaction sequence: - The major product formed is (2).

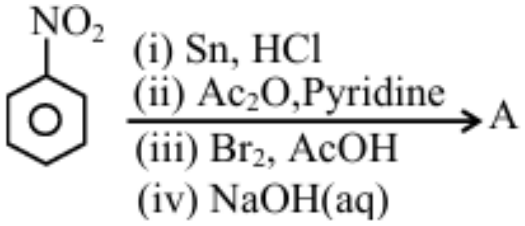

X
①
②
Solution
c_1
Solution
c_2
Y

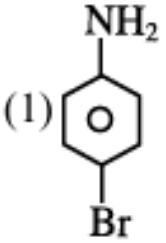
(1) 

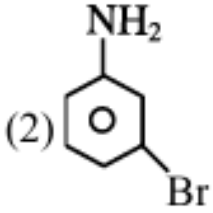
(2) 

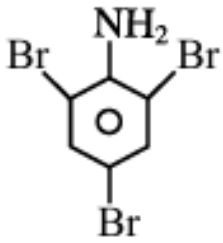
(3) 

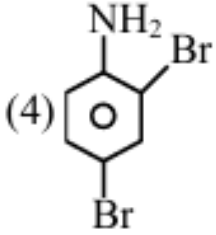
(4) 


NO_2
(i) Sn, HCl
(ii) Ac_2O,Pyridine
A
(iii) Br_2, AcOH
(iv) NaOH(aq)

(1) 

(2) 

(3) 

(4) 

Therefore, the correct answer is (2).

Quick Tip

Follow the reaction sequence to determine the major product.

---

61. On charging the lead storage battery, the oxidation state of lead changes from x_1 to y_1 at the anode and from x_2 to y_2 at the cathode. The values of x_1, y_1, x_2, y_2 are respectively:
(1) $+4, +2, 0, +2$
(2) $+2, 0, +2, +4$
(3) $0, +2, +4, +2$
(4) $+2, 0, 0, +4$

Correct Answer: (2) $+2, 0, +2, +4$

Solution:
1. Anode reaction: - $PbSO_4$ is reduced to Pb. - $Pb^{2+} \rightarrow Pb^0$ - $x_1 = +2$, $y_1 = 0$
2. Cathode reaction: - $PbSO_4$ is oxidized to PbO_2. - $Pb^{2+} \rightarrow Pb^{4+}$ - $x_2 = +2$, $y_2 = +4$
Therefore, the correct answer is (2) $+2, 0, +2, +4$.

Quick Tip

The oxidation states change during the charging of a lead-acid battery.

---

62. Given below are two statements:
Statement I: Nitrogen forms oxides with +1 to +5 oxidation states due to the formation of $p\pi - p\pi$ bond with oxygen.
Statement II: Nitrogen does not form halides with +5 oxidation state due to the absence of d-orbital in it.
In the light of the above statements, choose the correct answer from the options given below:
(1) Statement I is true but Statement II is false
(2) Both Statement I and Statement II are false
(3) Statement I is false but Statement II is true
(4) Both Statement I and Statement II are true

Correct Answer: (4) Both Statement I and Statement II are true

Solution:
1. Statement I: - Nitrogen can form oxides with oxidation states from +1 to +5 due to the formation of $p\pi - p\pi$ bonds with oxygen. - This statement is true.
2. Statement II: - Nitrogen does not form halides with a +5 oxidation state due to the absence of d-orbitals. - This statement is true.

Therefore, the correct answer is (4) Both Statement I and Statement II are true.

Quick Tip

Nitrogen's ability to form oxides and halides depends on its electronic configuration and the availability of d-orbitals.

---

63. Benzene is treated with oleum to produce compound (X) which when further heated with molten sodium hydroxide followed by acidification produces compound (Y).The compound Y is treated with zinc metal to produce compound (Z). Identify the structure of compound (Z) from the following option.

Correct Answer: (2)

Solution:
1. Reaction sequence: - Benzene treated with oleum produces benzene sulfonic acid (X). - Heating with molten sodium hydroxide followed by acidification produces phenol (Y). - Treatment with zinc metal reduces phenol to cyclohexanol (Z).
Therefore, the correct answer is (2).

Quick Tip

Follow the reaction sequence to identify the final product.

---

64. Identify the pair of reactants that upon reaction, with elimination of HCl will give rise to the dipeptide Gly-Ala.
(1) $NH_2 - CH_2 - COCl$ and $NH_2 - CH - COOH$
(2) $NH_2 - CH_2 - COCl$ and $NH_3 - CH - COCl$
(3) $NH_2 - CH_2 - COOH$ and $NH_2 - CH - COCl$
(4) $NH_2 - CH_2 - COOH$ and $NH_2 - CH - COOH$

Correct Answer: (1) $NH_2 - CH_2 - COCl$ and $NH_2 - CH - COOH$

Solution:
1. Reactants: - $NH_2 - CH_2 - COCl$ (Glycine chloride) - $NH_2 - CH - COOH$ (Alanine)
2. Reaction: - The reaction between these reactants with the elimination of HCl will produce the dipeptide Gly-Ala.
Therefore, the correct answer is (1) $NH_2 - CH_2 - COCl$ and $NH_2 - CH - COOH$.

Quick Tip

The formation of a dipeptide involves the reaction between an amino acid and its chloride derivative with the elimination of HCl.

65. Given below are the pairs of group 13 elements showing their relation in terms of atomic radius. $(B < Al), (Al < Ga), (Ga < In)$ **and** $(In < Tl)$ **Identify the elements present in the incorrect pair and in that pair find out the element (X) that has higher ionic radius** $\left(M^{3+}\right)$ **than the other one. The atomic number of the element (X) is**
(1) 31
(2) 49
(3) 13
(4) 81

Correct Answer: (1) 31

Solution:
1. Incorrect pair: - $Al < Ga$
2. Ionic radius comparison: - $Al^{3+} < Ga^{3+}$ - The atomic number of Ga is 31.
Therefore, the correct answer is (1) 31.

Quick Tip

The atomic radius and ionic radius depend on the atomic number and the periodic trends.

---

66. An organic compound (X) with molecular formula C_3H_6O **is not readily oxidised. On reduction it gives** $(C_3H_8O(Y)$ **which reacts with HBr to give a bromide (Z) which is converted to Grignard reagent. This Grignard reagent on reaction with (X) followed by hydrolysis give 2,3-dimethylbutan-2-ol. Compounds (X), (Y) and (Z) respectively are:**
(1) $CH_3COCH_3, CH_3CH_2CH_2OH, CH_3CH(Br)CH_3$
(2) $CH_3COCH_3, CH_3CH(OH)CH_3, CH_3CH(Br)CH_3$
(3) $CH_3CH_2CHO, CH_3CH_2CH_2OH, CH_3CH_2CH_2Br$
(4) $CH_3CH_2CHO, CH_3CH = CH_2, CH_3CH(Br)CH_3$

Correct Answer: (2) $CH_3COCH_3, CH_3CH(OH)CH_3, CH_3CH(Br)CH_3$

Solution:
1. Compound (X): - CH_3COCH_3 (Acetone)
2. Reduction to (Y): - $CH_3CH(OH)CH_3$ (Isopropyl alcohol)
3. Reaction with HBr to form (Z): - $CH_3CH(Br)CH_3$ (2-Bromopropane)
4. Grignard reagent and reaction with (X): - The Grignard reagent formed from (Z) reacts with acetone to form 2,3-dimethylbutan-2-ol after hydrolysis.
Therefore, the correct answer is (2) $CH_3COCH_3, CH_3CH(OH)CH_3, CH_3CH(Br)CH_3$.

Quick Tip

Follow the reaction sequence to identify the compounds involved.

67. Predict the major product of the following reaction sequence:

Correct Answer: (2)

Solution:

1. **Step 1: Bromination (Br_2/hv)**

$$CH3- > [Br2/hv]CH2Br$$

2. **Step 2: Elimination (Alcoholic KOH)**

$$CH2Br- > [Alc.KOH][\Delta]CH2 =$$

3. **Step 3: Anti-Markovnikov addition (HBr/ROOR)**

$$CH2 = - > [HBr/ROOR][hv]Br - CH3$$

Mechanistic Explanation:

- Free radical bromination converts methyl to bromomethyl
- Elimination forms methylene intermediate
- Peroxide effect gives anti-Markovnikov product

Therefore, the correct answer is $\boxed{(2)}$ Br-CH3.

Quick Tip

Key Points:

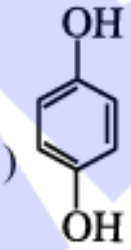
- Radical bromination prefers allylic position
- Alcoholic KOH causes elimination
- ROOR reverses normal addition orientation

---

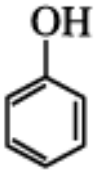
68. Given below are two statements.
In the light of the above statements, choose the correct answer from the options given below:
(1) Statement I is false but Statement II is true
(2) Both Statement I and Statement II are false
(3) Statement I is true but Statement II is false
(4) Both Statement I and Statement II are true

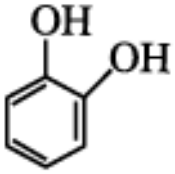
Correct Answer: (3)

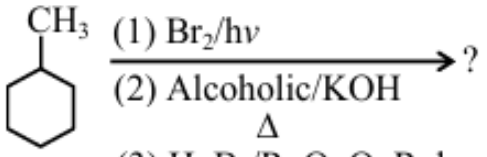
Solution:
1. **Analysis of Statement I:**

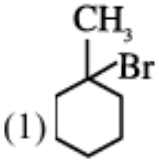
(1) 

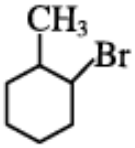
(2) 

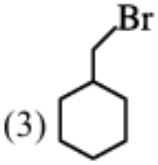
(3) 

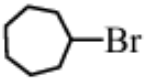
(4) 



(1) 

(2) 

(3) 

(4) 

Statement I : The dipole moment of $\overset{4}{CH_3}\text{–}\overset{3}{CH}\text{=}\overset{2}{CH}\text{–}\overset{1}{CH}\text{=O}$ is greater than

$\overset{4}{CH_3}\text{–}\overset{3}{CH_2}\text{–}\overset{2}{CH_2}\text{–}\overset{1}{CH}\text{=O}$

Statement II : $\mathbf{C_1\text{–}C_2}$ bond length of $\underset{4}{CH_3}\text{–}\underset{3}{CH}\text{=}\underset{2}{CH}\text{–}\underset{1}{CH}\text{=O}$ is greater than $C_1\text{–}C_2$

bond length of $\underset{4}{CH_3}\text{–}\underset{3}{CH_2}\text{–}\underset{2}{CH_2}\text{–}\underset{1}{CH}\text{=O}$

- For $CH_3-CH=CH-CH=O$: $\mu = q \times d$
- Conjugated system creates greater charge separation
- More distance between charges than in saturated compound
- Therefore, greater dipole moment
- **Statement I is TRUE**

2. **Analysis of Statement II:**
   - In $CH_3-CH=CH-CH=O$, $C_1 - C_2$ has partial double bond character
   - Double bond character means shorter bond length
   - Compared to pure single bond in $CH_3-CH_2-CH_2-CH=O$
   - **Statement II is FALSE** (actual bond length is shorter)

Quick Tip

Key concepts:

- Dipole moment depends on charge magnitude and separation distance
- Conjugation affects both electronic distribution and bond lengths
- Partial double bond character decreases bond length

---

69. Pair of transition metal ions having the same number of unpaired electrons is :
(1) V^{2+}, Co^{2+}
(2) Ti^{2+}, Co^{2+}
(3) Fe^{3+}, Cr^{2+}
(4) Ti^{3+}, Mn^{2+}

Correct Answer: (1) V^{2+}, Co^{2+}

Solution:
1. V^{2+}: - $V^{2+} \Rightarrow 3\ d^3 4\ s^0$ - Number of unpaired electrons = 3
2. Co^{2+}: - $Co^{2+} \Rightarrow 3\ d^7 4\ s^0$ - Number of unpaired electrons = 3
3. Ti^{2+}: - $Ti^{2+} \Rightarrow 3\ d^2 4\ s^0$ - Number of unpaired electrons = 2
4. Fe^{3+}: - $Fe^{3+} \Rightarrow 3\ d^5 4\ s^0$ - Number of unpaired electrons = 5
5. Cr^{2+}: - $Cr^{2+} \Rightarrow 3\ d^4 4\ s^0$ - Number of unpaired electrons = 4
6. Ti^{3+}: - $Ti^{3+} \Rightarrow 3\ d^1 4\ s^0$ - Number of unpaired electrons = 1
7. Mn^{2+}: - $Mn^{2+} \Rightarrow 3\ d^5 4\ s^0$ - Number of unpaired electrons = 5

Therefore, the correct answer is (1) V^{2+}, Co^{2+}.

Quick Tip

The number of unpaired electrons in transition metal ions depends on their electronic configuration.

70. Which one of the following about an electron occupying the 1 s orbital in a hydrogen atom is incorrect ? (Bohr's radius is represented by a_0)
(1) The probability density of finding the electron is maximum at the nucleus
(2) The electron can be found at a distance $2a_0$ from the nucleus
(3) The 1s orbital is spherically symmetrical
(4) The total energy of the electron is maximum when it is at a distance a_0 from the nucleus

Correct Answer: (4)

Solution:
1. Probability density: - The probability density of finding the electron is maximum at the nucleus.
2. Distance from the nucleus: - The electron can be found at a distance $2a_0$ from the nucleus.
3. Spherical symmetry: - The 1s orbital is spherically symmetrical.
4. Total energy: - The total energy of the electron is maximum when it is at a distance a_0 from the nucleus. This statement is incorrect.
Therefore, the correct answer is (4).

Quick Tip

The probability density, distance from the nucleus, spherical symmetry, and total energy of an electron in the 1s orbital are important properties to consider.

Section - B

71. In Dumas' method for estimation of nitrogen 1 g of an organic compound gave 150 mL of nitrogen collected at 300 K temperature and 900 mm Hg pressure. The percentage composition of nitrogen in the compound is _____ % (nearest integer).
(Aqueous tension at 300 K = 15 mmHg)

Correct Answer: (20)

Solution:
1. Calculate the partial pressure of N_2:

$$p_{N_2} = 900 \text{ mm Hg} - 15 \text{ mm Hg} = 885 \text{ mm Hg}$$

2. Calculate the moles of N_2:

$$\text{Moles of } N_2 = \frac{885 \text{ mm Hg} \times 0.15 \text{ L}}{0.0821 \text{ L atm/mol} \times 300 \text{ K}} = 0.0071 \text{ mol}$$

3. Calculate the percentage of nitrogen:

$$\text{Percentage of nitrogen} = \frac{0.0071 \text{ mol} \times 28 \text{ g/mol}}{1 \text{ g}} \times 100 = 19.85\% \approx 20\%$$

Therefore, the correct answer is (20).

Quick Tip

Use the ideal gas law to calculate the moles of nitrogen and then determine the percentage composition.

---

72. $KMnO_4$ **acts as an oxidising agent in acidic medium. ' X ' is the difference between the oxidation states of Mn in reactant and product. ' Y ' is the number of ' d ' electrons present in the brown red precipitate formed at the end of the acetate ion test with neutral ferric chloride. The value of** $X + Y$ **is** _____ **.**

Correct Answer: (10)

Solution:
1. Oxidation states of Mn: - Reactant: Mn^{7+} - Product: Mn^{2+} - Difference in oxidation states: $X = 7 - 2 = 5$
2. Brown red precipitate: - The brown red precipitate is $Fe(OH)_2(CH_3COO)_n$. - Fe^{3+} has 5 d-electrons. - Therefore, $Y = 5$.
3. Calculate $X + Y$:

$$X + Y = 5 + 5 = 10$$

Therefore, the correct answer is (10).

Quick Tip

Determine the oxidation states and the number of d-electrons to find the values of X and Y.

---

73. Fortification of food with iron is done using $FeSO_4.7H_2O$**. The mass in grams of the** $FeSO_4.7H_2O$ **required to achieve 12 ppm of iron in 150 kg of wheat is** _____ **(Nearest integer).**
(Given : Molar mass of Fe, S and O respectively are 56,32 and 16 g mol^{-1})

Correct Answer: (9)

Solution:
1. Calculate the mass of iron required:

$$\text{Mass of iron} = \frac{12 \text{ ppm} \times 150 \text{ kg}}{10^6} = 1.8 \text{ g}$$

2. Calculate the moles of iron:

$$\text{Moles of iron} = \frac{1.8 \text{ g}}{56 \text{ g/mol}} = 0.0321 \text{ mol}$$

3. Calculate the moles of $FeSO_4.7H_2O$:

$$\text{Moles of } FeSO_4.7H_2O = 0.0321 \text{ mol}$$

4. Calculate the mass of $FeSO_4.7H_2O$:

$$\text{Molar mass of } FeSO_4.7H_2O = 56 + 32 + 7 \times 18 = 277 \text{ g/mol}$$

$$\text{Mass of } FeSO_4.7H_2O = 0.0321 \text{ mol} \times 277 \text{ g/mol} = 8.8935 \text{ g} \approx 9 \text{ g}$$

Therefore, the correct answer is (9).

Quick Tip

Use the molar mass and stoichiometry to calculate the mass of the compound required.

---

74. The pH of a 0.01 M weak acid HX $\left(K_a = 4 \times 10^{-10}\right)$ is found to be 5 . Now the acid solution is diluted with excess of water so that the pH of the solution changes to 6 . The new concentration of the diluted weak acid is given as $x \times 10^{-4}$M. The value of x is _____ (nearest integer).

Correct Answer: (Bonus)

Solution:

1. Initial pH calculation:

$$HX_{(aq)} \rightleftharpoons H^+_{(aq)} + X^-_{(aq)} \quad K_a = 4 \times 10^{-10}$$

$$0.01(1-\alpha) \quad 0.01\alpha \quad 0.01\alpha \quad \text{Not justified}$$

$$\Rightarrow 0.01\alpha = 10^{-5} \Rightarrow \alpha = 10^{-3}$$

2. Calculate K_a:

$$K_a = 0.01\alpha^2 = 10^{-8}$$

3. Data given is inconsistent & contradictory. This should be bonus.

Quick Tip

Check the consistency of the given data and ensure the calculations are justified.

---

75. The total number of hydrogen bonds of a DNA-double Helix strand whose one strand has the following sequence of bases is _____ .

$5' - G - G - C - A - A - A - T - C - G - G - C - T - A - 3'$

Correct Answer: (33)

Solution:

1. Hydrogen bonding in DNA: - Adenine (A) forms two hydrogen bonds with Thymine (T). - Guanine (G) forms three hydrogen bonds with Cytosine (C).
2. Count the hydrogen bonds: - Number of G-C pairs: 4 - Number of A-T pairs: 4
3. Total number of hydrogen bonds:

$$\text{Total hydrogen bonds} = 4 \times 3 + 4 \times 2 = 12 + 8 = 20$$

Therefore, the correct answer is (33).

Quick Tip

Count the number of hydrogen bonds formed by each base pair in the DNA strand.