CBSE EXAMINATION PAPER-2024

CHEMISTRY

(Solved)

Time allowed : 3 hours | Maximum Marks : 17

General Instructions :

Read the following instructions carefully and follow them :

i. This question paper contains **15 questions.** All questions are **compulsory.**

ii. This question paper is divided into **4 sections.**

iii. **Section A** – questions number **1 to 9** are multiple choice questions Each question carries **1 marks.**

iv. **Section B** – questions number **10 to 10** are very short answer Each question carries **2 marks.**

v. **Section C** – questions number **11 to 12** are short answer Each question carries **3 marks.**

vi. **Section D** – questions number **13 to 15** are case based questions

vii. There is no overall choice given in the question paper. However, an internal choice has been provided in few questions.

viii. Use of calculator is NOT allowed.

Section A

Question 1.

Which of the following ligand forms chelate complex ?

[1 Marks]

(A) $C_2O_4^{2-}$

(B) Cl^-

(C) NH_3

(D) NO_2^-

Explanation: The correct answer is $C_2O_4^{2-}$. This ligand is a bidentate ligand, meaning it can bind to a metal ion through two donor atoms simultaneously, thus forming a chelate complex. In contrast, the other options such as NO2-, NH3, and Cl- are either unidentate or do not have the capability to form stable chelate structures.

Question 2.

Anisole reacts with HI to give :

[1 Marks]

(A)

(B)

(C)

(D)

Explanation:

Anisole, which is an ether (methoxybenzene), reacts with hydroiodic acid (HI) to give iodoalkane (iodobenzene) and methanol. The reaction involves the cleavage of the C-O bond in the ether, leading to the formation of the alkyl iodide and alcohol.

Question 3.

An azeotropic solution of two liquids has boiling point lower than either of them when it :

[1 Marks]

(A) shows positive deviation from Raoult's law

(B) is saturated

(C) shows negative deviation from Raoult's law

(D) show no deviation from Raoult's law

Explanation:

The correct answer is 'shows negative deviation from Raoult's law'. This is because an azeotropic mixture exhibits a lower boiling point than the boiling points of the individual

components due to the strong intermolecular attractions between the different species, leading to a negative deviation from Raoult's law.

Question 4.

The relative lowering of vapour pressure of an aqueous solution containing non-volatile solute is 0·0225. The mole fraction of the non-volatile solute is :

[1 Marks]

(A) 0·725

(B) 0·0225

(C) 0·15

(D) 0·80

Explanation:

The correct option is 0·0225, because the relative lowering of vapor pressure is equal to the mole fraction of the solute in dilute solutions, according to Raoult's law. Thus, if the relative lowering of vapor pressure is 0.0225, the mole fraction of the solute would also be 0.0225.

Question 5.

The addition of catalyst during a chemical reaction alters which of the following quantities of the reaction ?

[1 Marks]

(A) Activation energy

(B) Entropy

(C) Enthalpy

(D) Internal energy

Explanation:

The correct answer is Activation energy. A catalyst lowers the activation energy of a reaction, thus speeding up the reaction without altering the overall enthalpy, internal energy, or entropy of the reaction.

Question 6.

For the elementary reaction P → Q, if the rate of disappearance of P increases by a factor of 8 upon doubling the concentration of P, the order of the reaction with respect to P is

[1 Marks]

(A) 4

(B) 1

(C) 3

(D) 2

Explanation: The rate of disappearance of P increases by a factor of 8 when the concentration of P is doubled. This indicates that the rate is proportional to the concentration of P raised to the power of 3, since 2^3 = 8. Therefore, the order of the reaction with respect to P is 3.

Question 7.

Assertion (A) : Aliphatic primary amines can be prepared by Gabriel phthalimide synthesis.

Reason (R) : Alkyl halides undergo nucleophilic substitution with anion formed by phthalimide.

[1 Marks]

(A) Assertion (A) is false, but Reason (R) is true.

(B) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).

(C) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).

(D) Assertion (A) is true, but Reason (R) is false.

Explanation:

Both Assertion (A) and Reason (R) are true, and Reason (R) is the correct explanation of the Assertion (A). Gabriel phthalimide synthesis involves the nucleophilic substitution of alkyl halides with the anion of phthalimide to form primary amines, making both statements accurate and logically connected.

Question 8.

Assertion (A) : Uracil base is present in DNA.

Reason (R) : DNA undergoes self-replication.

[1 Marks]

(A) Assertion (A) is false, but Reason (R) is true.

(B) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).

(C) Assertion (A) is true, but Reason (R) is false.

(D) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).

Explanation: Assertion (A) is false, but Reason (R) is true. Uracil is not found in DNA; it is present in RNA. On the other hand, it is correct that DNA undergoes self-replication. Therefore, the two statements are not related, making the assertion incorrect while the reason is valid.

Question 9.

Assertion (A) : Diazonium salts of aromatic amines are more stable than those of aliphatic amines.

Reason (R) : Diazonium salts of aliphatic amines show resonance.

[1 Marks]

(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).

(B) Assertion (A) is true, but Reason (R) is false.

(C) Assertion (A) is false, but Reason (R) is true.

(D) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).

Explanation:

Assertion (A) is true, but Reason (R) is false. Diazonium salts of aromatic amines are indeed more stable due to the stability provided by resonance in the aromatic system, while diazonium salts of aliphatic amines are less stable and do not benefit from the

same level of resonance stabilization. Therefore, the reason provided does not correctly explain the assertion.

Section B

Question 10.

Why do transition metals have high enthalpy of atomization ? Which element of 3d-series has lowest enthalpy of atomization ?

[2 Marks]

Answer: (a) Transition metals have high enthalpy of atomization because they have many unpaired d-electrons that create strong metallic bonds due to overlapping orbitals. This strong bonding requires more energy to break the atoms apart into gaseous atoms.
(b) Zinc, among the 3d-series elements, has the lowest enthalpy of atomization because it has a completely filled d^{10} electronic configuration with no unpaired electrons, resulting in weaker metallic bonds and lower energy required to separate its atoms.

Section C

Question 11.

Write the structures of A, B and C in the following reactions :

[3 Marks]

Answer: Answer:
(a) **Structure of A:** A is the reactant organomagnesium compound, known as the Grignard reagent. Its general formula is R-MgX, where R is an alkyl or aryl group and X is a halogen.
Example: Phenylmagnesium bromide, C_6H_5-MgBr.
(b) **Structure of B:** B is the halide or electrophile reacting with the Grignard reagent. It is generally an alkyl halide such as RX.
Example: Bromobenzene, C_6H_5-Br.
(c) **Structure of C:** C is the product formed after the reaction of A and B followed by hydrolysis with water or deuterium oxide (D_2O). This product is an alkane or corresponding hydrocarbon with the R groups joined.
Example: Biphenyl, C_6H_5-C_6H_5.
This reaction proceeds by nucleophilic attack of the Grignard reagent (A) on the alkyl halide (B) to form C after protonation.

Summary: A is the Grignard reagent (R-MgX), B is the alkyl or aryl halide (R-X), and C is the coupled hydrocarbon formed after addition and hydrolysis (R-R).

Question 12.

The vapour pressure of a solvent at 283 K is 100 mm Hg. Calculate the vapour pressure of a dilute solution containing 1 mole of a strong electrolyte AB in 50 moles of the solvent at 283 K (assuming complete dissociation of solute AB).

[3 Marks]

Answer: Given:
Vapour pressure of pure solvent, P0 = 100 mm Hg
Moles of solute AB = 1 mole
Moles of solvent = 50 moles
AB is a strong electrolyte and dissociates completely into A^+ and B^- ions, so van't Hoff factor i = 2

Step 1: Calculate total moles of particles in solution = moles of solvent + i * moles of solute = 50 + 2 * 1 = 52
Step 2: Calculate mole fraction of solvent, X_solvent = moles of solvent / total moles = 50 / 52 = 0.9615

Step 3: Apply Raoult's law for vapour pressure of solution:
P_solution = X_solvent * P0 = 0.9615 * 100 = 96.15 mm Hg

Therefore, the vapour pressure of the solution at 283 K is approximately 96.15 mm Hg.

Section D

Question 13. Carbohydrates are essential for life in both plants and animals. Carbohydrates are used as storage molecules as starch in plants and glycogen in animals. Chemically they are polyhydroxy aldehydes or ketones. On the basis of their behaviour on hydrolysis, carbohydrates are classified as monosaccharides, oligosaccharides and polysaccharides. All monosaccharide like glucose is aldohexose and its molecular formula was found to be C6H12O6. After reacting with different reagents like HI, H2N OH, Bromine water, (CH3CO)2O, etc. its structure was found to contain one aldehyde group, one primary alcoholic group, (CH2OH) and four secondary alcoholic groups (CHOH). Despite having the aldehyde group, glucose does not give some of the reactions of aldehyde group like Schiff addition. This explains the existence of glucose in two cyclic hemiacetal forms which differ only in the configuration of the hydroxyl group at C 1.

Question 14.

Carbohydrates are essential for life in both plants and animals. Carbohydrates are used as storage molecules as starch in plants and glycogen in animals. Chemically they are polyhydroxy aldehydes or ketones. On the basis of their behaviour on hydrolysis, carbohydrates are classified as monosaccharides, oligosaccharides and polysaccharides. All

Question 15.

Carbohydrates are essential for life in both plants and animals. Carbohydrates are used as storage molecules as starch in plants and glycogen in animals. Chemically they are polyhydroxy aldehydes or ketones. On the basis of their behaviour on hydrolysis, carbohydrates are classified as monosaccharides, oligosaccharides and polysaccharides. All monosaccharides are reducing sugars, meaning they can be oxidized by Tollens' reagent and Fehling's solution. monosaccharides are reducing sugars, meaning they can be oxidized by Tollens' reagent and Fehling's solution. A monosaccharide like glucose is aldohexose and its molecular formula was found to be C6H12O6. After reacting with different reagents like HI, H2N OH, Bromine water, (CH3CO)2O, etc. its structure was found to contain one aldehyde group, one primary alcoholic group, (CH2OH) and four secondary alcoholic groups (CHOH). Despite having the aldehyde group, glucose does not give some of the reactions of aldehyde group like Schiff's test ,NaHSO3 addition. This explains the existence of glucose in two cyclic hemiacetal forms which differ only in the configuration of the hydroxyl group at C 1.