CBSE EXAMINATION PAPER-2023

CHEMISTRY

(Solved)

Time allowed : 3 hours | Maximum Marks : 18

General Instructions :

Read the following instructions carefully and follow them :

i. This question paper contains **18 questions.** All questions are **compulsory.**

ii. This question paper is divided into **3 sections.**

iii. **Section A** – questions number **1 to 15** are multiple choice questions Each question carries **1 marks.**

iv. **Section B** – questions number **16 to 17** are very short answer Each question carries **2 marks.**

v. **Section C** – questions number **18 to 18** are case based questions

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

vii. Use of calculator is NOT allowed.

Section A

Question 1.

A compound undergoes complete tetramerization in a given organic solvent. The van't Hoff factor 'i' is:

[1 Marks]

(A) 0.25

(B) 0.125

(C) 4.0

(D) 2.0

Explanation:

The correct option is 4.0. Tetramerization refers to the process of forming a tetramer, which consists of four identical monomer units. Therefore, if the compound undergoes complete tetramerization, we can infer that it results in four times the amount of the original compound, leading to a value of 4.0.

Question 2.

Which of the following structures represents -D-glucose ?

[1 Marks]

(A)

(B)

(C)

(D)

Explanation: The correct structure for -D-glucose will show the specific arrangement of hydroxyl (-OH) and hydrogen (-H) groups attached to the carbon chain. The context mentions the representation of organic compounds in various structural formats, which includes the proper connectivity of atoms that define glucose's unique cyclic structure. The choice that accurately depicts the arrangement according to standard conventions will be the correct option.

Question 3.

The ions of metals of Group 12 (Zn, Cd and Hg) have completely filled d orbitals and so they:

[1 Marks]

(A) are very high melting solids

(B) behave like superconductors

(C) do not behave like transition metals

(D) behave like semiconductors

Explanation:

The correct answer is 'do not behave like transition metals'. This is because zinc, cadmium, and mercury have a full d10 configuration in their ground state and common oxidation states, meaning they do not possess incomplete d orbitals as defined by IUPAC for transition metals. Therefore, these elements are not regarded as transition metals despite being located at the end of the transition series.

Question 4.

$[Co(NH_3)_5NO_3]SO_4$ and $[Co(NH_3)_5SO_4]NO_3$ exhibit:

[1 Marks]

(A) ionization isomerism

(B) optical isomerism

(C) linkage isomerism

(D) coordination isomerism

Explanation:

The correct answer is ionization isomerism. This is because these two complexes have the same formula but differ in the arrangement of their ions, where one of the counter ions can potentially act as a ligand. This is a classic example of ionization isomerism, wherein the counter ion (NO_3^- or SO_4^{2-}) can displace a ligand in the coordination sphere.

Question 5.

Reaction of 1-phenyl-2-chloropropane with alcoholic KOH gives mainly:

[1 Marks]

(A) 3-phenylpropene

(B) 1-phenylpropan-3-ol

(C) 1-phenylpropan-2-ol

(D) 1-phenylpropene

Explanation:

The correct answer is 1-phenylpropene. The reaction of 1-phenyl-2-chloropropane with alcoholic KOH leads to elimination reactions, resulting in the formation of alkenes. The predominant product is 1-phenylpropene due to the elimination of HCl and the formation of a more stable alkene. The context suggests that the elimination pathway, favored by the use of alcoholic KOH, leads to alkenes rather than alcohols.

Question 6.

The reduction of ethanenitrile with sodium and alcohol gives:

[1 Marks]

(A) Ethanamide

(B) 1-aminoethane

(C) 1-aminopropane

(D) Ethanoic acid

Explanation:

The correct option is 1-aminoethane. When ethanenitrile (which is an nitrile) is reduced with sodium in alcohol, it undergoes a process that converts the nitrile group (-C≡N) into an amine group (-NH2), resulting in the formation of 1-aminoethane.

Question 7.

How many Faradays are required to reduce 1 mol of MnO_4^- to Mn^{2+} ?

[1 Marks]

(A) 3

(B) 5

(C) 6

(D) 4

Explanation: The correct answer is 5. To reduce MnO_4^- (permanganate) to Mn^{2+}, a total of 5 electrons are required. Each electron transfer corresponds to one Faraday, as one Faraday represents the charge of one mole of electrons.

Question 8.

In a reaction, the initial concentration of the reactants increases four fold and the rate becomes sixteen times its initial value. The order of the reaction is:

[1 Marks]

(A) 3.5

(B) 1.5

(C) 2.5

(D) 2.0

Explanation: The rate of a reaction is proportional to the concentration raised to the power of the order. If the concentration increases fourfold (4^n) and the rate increases sixteen times (16), we set up the equation: 4^n = 16. Since 16 is equal to 4^2, we find that n = 2. Therefore, the order of the reaction is 2.0.

Question 9.

On hydrolysis, which of the following carbohydrates gives only glucose?

[1 Marks]

(A) Maltose

(B) Sucrose

(C) Lactose

(D) Galactose

Explanation:

Maltose is a disaccharide composed of two glucose molecules. Upon hydrolysis, it breaks down into two glucose units, thus giving only glucose. Sucrose and lactose, on the other hand, yield other monosaccharides (fructose from sucrose and galactose from lactose) upon hydrolysis.

Question 10.

Deficiency of which of the following vitamins causes Pernicious anaemia?

[1 Marks]

(A) Vitamin B_2

(B) Vitamin B_1

(C) Vitamin B_{12}

(D) Vitamin B_6

Explanation:

The correct answer is Vitamin B_{12}. According to the provided context, Vitamin B_{12}, also known as cyanocobalamine, is referred to as the anti-pernicious anaemia factor. This

indicates that a deficiency in Vitamin B_{12} is specifically linked to the development of pernicious anaemia.

Question 11.

This reaction is known as:

[1 Marks]

(A) Cannizzaro's reaction

(B) Aldol condensation

(C) Friedel-Crafts reaction

(D) Cross-Aldol condensation

Explanation: The reaction described in the context refers to a situation where two different aldehydes and/or ketones are used, resulting in a mixture of products. This process is specifically stated to be called Cross Aldol condensation when aldol condensation occurs between distinct aldehydes or ketones, which confirms that the correct option is 'Cross-Aldol condensation'.

Question 12.

In which of the following does the central atom exhibit an oxidation state of +3?

[1 Marks]

(A) $[Cu(NH_3)_4]^{2+}$

(B) $[Fe(C_2O_4)_3]^{3-}$

(C) $K_4[Fe(CN)_6]$

(D) $K_2[Ni(CN)_4]$

Explanation:

$[Fe(C_2O_4)_3]^{3-}$ is the correct option because in this complex, iron (Fe) is bonded to three oxalate (C_2O_4) ions. Since the overall charge of the complex is -3 and each oxalate ion has a -2 charge, the oxidation state of iron must be +3 to balance the charges (3 * -2 + +3 = -3). This aligns with the context, which explains that in complexes like [Co(NH3)6]3+, the central metal is in a +3 oxidation state.

Question 13.

Assertion (A) : When NaCl is added to water, a depression in freezing point is observed.

Reason (R) : The lowering of vapour pressure of a solution causes depression in the freezing point.

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

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

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

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

Explanation:

Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A). When NaCl is dissolved in water, it lowers the vapour pressure of the solution, leading to a depression in the freezing point as outlined in the context regarding the effects of solute on the physical properties of the solvent.

Question 14.

Assertion (A) : Zr and Hf have almost identical radii.

Reason (R) : Both Zr and Hf exhibit similar properties.

[1 Marks]

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

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

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

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

Explanation:

Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A). The context indicates that Zr and Hf have very similar radii (160 pm and 159 pm respectively) due to lanthanoid contraction, which indeed contributes to their

similar physical and chemical properties, validating the relationship between their radii and properties.

Question 15.

Assertion (A) : Monobromination of aniline can be conveniently done by protecting the amino group by acetylation.

Reason (R) : Acetylation decreases the activating effect of the amino group.

[1 Marks]

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

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

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

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

Explanation:

Both Assertion (A) and Reason (R) are true, and Reason (R) is the correct explanation of Assertion (A). Acetylation of aniline indeed protects the amino group, making it less reactive towards electrophilic substitution, thus facilitating monobromination at the aromatic ring.

Section B

Question 16.

What type of deviation from Raoult's Law is shown by a mixture of ethanol and acetone ? Give reason.

[2 Marks]

Answer: A mixture of ethanol and acetone shows **positive deviation** from Raoult's Law. This happens because in pure ethanol, molecules are hydrogen bonded strongly. When acetone is added, its molecules insert themselves between ethanol molecules and break some hydrogen bonds. This reduces the intermolecular attraction in the mixture, resulting in higher vapor pressure than expected. Hence, the mixture shows positive deviation from Raoult's Law.

Question 17.

Define Azeotrope. What type of azeotrope is formed by negative deviation from Raoult's law? give an example .

[2 Marks]

Answer: An azeotrope is a mixture of two or more liquids that has a constant boiling point and composition throughout distillation. In a negative deviation from Raoult's law, the mixture exhibits stronger intermolecular attractions that lower the vapor pressure. This results in the formation of a maximum boiling azeotrope. An example of this is the nitric acid and water mixture, which consists of approximately 68% nitric acid and 32% water by mass, boiling at 393.5 K.

Section C

Question 18. Living systems are made up of various complex biomolecules like carbohydrates, proteins, nucleic acids, lipids, etc. Carbohydrates are optically active polyhydroxy aldehydes or ketones or molecules which provide such units on hydrolysis. They are broadly classified into three groups monosaccharides, oligosaccharides and polysaccharides. Monosaccharides are held together by glycosidic linkages to form disaccharides like sucrose, maltose or polysaccharides like starch and cellulose. Another biomolecule: proteins are polymers of -amino acids which are linked by peptide bonds. Ten amino acids are called essential amino acids. Structure and shape of proteins can be studied at four different levels i.e. primary, secondary, tertiary and quaternary, each level being more complex than the previous one.