CBSE EXAMINATION PAPER-2024

CHEMISTRY

(Solved)

Time allowed : 3 hours | Maximum Marks : 74

General Instructions :

Read the following instructions carefully and follow them :

i. This question paper contains **37 questions.** All questions are **compulsory.**

ii. This question paper is divided into **5 sections.**

iii. **Section A** – questions number **1 to 3** are case based questions

iv. **Section B** – questions number **4 to 19** are multiple choice questions

v. **Section C** – questions number **20 to 25** are very short answer

vi. **Section D** – questions number **26 to 32** are short answer

vii. **Section E** – questions number **33 to 37** are long answer

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

ix. Use of calculator is NOT allowed.

Section A

Question 1. The oxidation number of the central atom in a complex is defined as the charge it would carry if all the ligands are removed along with the electron pairs that are shared with the central atom. Similarly, the charge on the complex is the sum of the charges of the constituent parts i.e. the sum of the charges on the central metal ion and its surrounding ligands. Based on this, the complex is called neutral if the sum of the charges of the constituents is equal to zero. However, for an anionic or cationic complex, the sum of the charges of the constituents is equal to the charge on the coordination sphere. Based on the above information, answer the following questions.

Question 2.

The following questions are case-based questions. Read the case carefully and answer the questions that follow:

The oxidation number of the central atom in a complex is defined as the charge it would carry if all the ligands are removed along with the electron pairs that are shared with the central atom. Similarly the charge on the complex is the sum of the charges of the constituent parts Le. the sum of the charges on the central metal ion and its surrounding ligands. Based on this, the complex is called neutral if the sum of the charges of the constituents is equal to zero. However, for an anion or cationic complex, the sum of the charges of the constituents is equal to the charge on the coordination sphere.

Based on the above information, answer the following questions:

(1)

Define ambidentate ligand with an example.

[1 Marks]

(2)

What type of isomerism is shown by $[Co(NH_3)_5, CL]SO_4$, and $[Co(NH_3)_5\ SO_4]CL$?

[1 Marks]

(3)

Find the coordination number and oxidation state of chromium in $Na_3\ (Cr(C_2O_4)_3]$.

[2 Marks]

(4)

Define Chelate effect. How it affects the stability of complex?

[2 Marks]

Question 3.

Certain organic compounds are required in small amounts in our diet but their deficiency causes specific disease. These compounds are called vitamins. Most of the vitamins cannot be synthesized in

our body but plants can synthesize almost all of them. So they are considered as essential food factors. However, the bacteria of the gut can produce some of the vitamins required by us. All the vitamins are generally available in our diet. The term 'vitamin' was coined from the words vital amine. since the earlier identified compounds had amino group. Vitamins are classified into two groups depending upon their solubility in water or fat namely fat soluble vitamins and water soluble vitamins.

Answer the following questions :

(1)

What is the other name of vitamin B_6?

[1 Marks]

(2)

Name the vitamin whose deficiency causes increased blood clotting time.

[1 Marks]

(3)

Why can't vitamin C be stored in our body? Name the disease caused by the deficiency of this vitamin.

[2 Marks]

(4)

Xerophthalmia is caused by the deficiency of which vitamin? Give two sources of this vitamin.

[2 Marks]

Section B

Question 4.

The specific sequence in which amino acids are arranged in a protein is called its

[1 Marks]

(A) Secondary structure

(B) Tertiary structure

(C) Primary structure

(D) Quaternary structure

Question 5.

The correct name of the given reaction is

[1 Marks]

$$Ar - N_2^+ X^- \xrightarrow{Cu\ CN/KCN} Ar - CN + N_2$$

(A) Sandmeyer's reaction

(B) Gabriel Phthalimide synthesis

(C) Hoffmann bromamide degradation reaction

(D) Carbyl amine reaction

Question 6.

Out of the following alkenes, the one which will produce tertiary butyl alcohol on acid catalysed hydration is

[1 Marks]

(A) CH_3-CH=CH-CH_3

(B) $(CH_3)_2C=CH_2$

(C) $CH_3CH_2CH=CH_2$

(D) $CH_3CH=CH_2$

Question 7.

Auto-oxidation of chloroform in air and light produces a poisonous gas known as

[1 Marks]

(A) Phosgene

(B) Tear gas

(C) Mustard gas

(D) Phosphine

Question 8.

Transition metals are known to make interstitial compounds. Formation of interstitial compounds makes the transition metal

[1 Marks]

(A) more metallic

(B) more ductile

(C) more hard

(D) more soft

Question 9.

Isotonic solutions have the same

[1 Marks]

(A) volume

(B) osmotic pressure

(C) density

(D) refractive index

Question 10.

Which of the following cell was used in Apollo space programme?

[1 Marks]

(A) Ni-Cd cell

(B) Dry cell

(C) H_2-O_2 fuel cell

(D) Mercury cell

Question 11.

The rate of a reaction increases sixteen times when the concentration of the reactant increases four times. The order of the reaction is

[1 Marks]

(A) 2.0

(B) 2.5

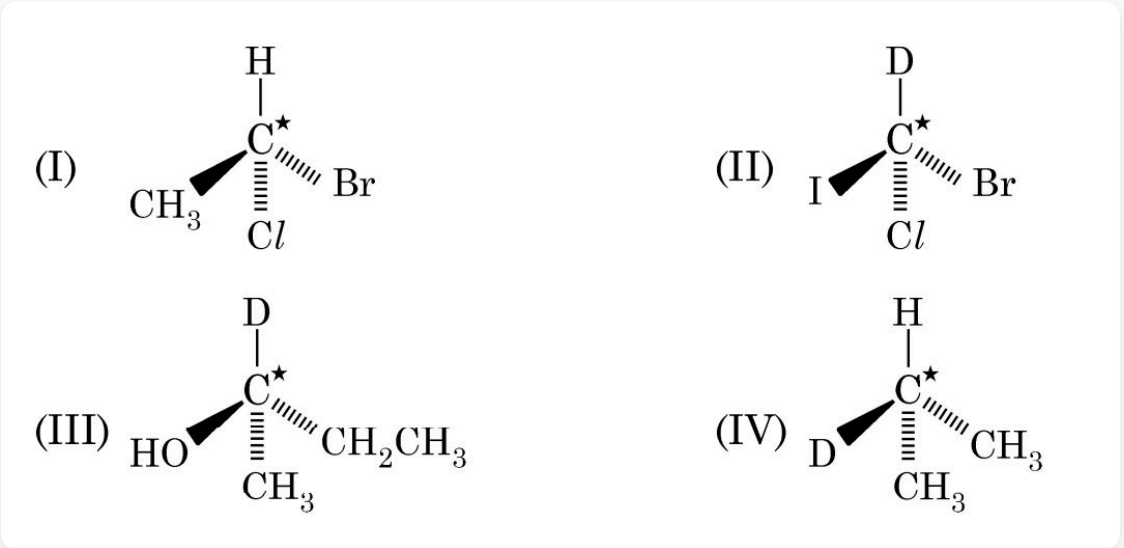
(C) 1.5

(D) 0.5

Question 12.

In which of the following molecules, C atom marked with asterisk is chiral?

[1 Marks]



(A) I,II,III,IV

(B) I,II,III,

(C) II, III,IV

(D) I, III, IV

Question 13.

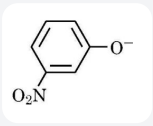
Which of the following species can act as the strongest base?

[1 Marks]

(A) RO^-

(B) OH^-

(C)



(D) $C_6H_5O^-$

Question 14.

Dilution affects both conductivity as well as molar conductivity. Effect of dilution on both is as follows

[1 Marks]

(A) both decrease with dilution

(B) both increase with dilution

(C) conductivity increases whereas molar conductivity decreases on dilution

(D) conductivity decreases whereas molar conductivity increases on dilution

Question 15.

Van't Hoff factor for $Na_2SO_4 \cdot 10H_2O$ solution, assuming complete ionization is

[1 Marks]

(A) 3

(B) 13

(C) 2

(D) 1

Question 16.

Assertion (A): Zr and Hf are of almost similar atomic radii.

Reason (R): This is due to Lanthanoid contraction.

[1 Marks]

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

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

Question 17.

Assertion (A): The units of rate constant of a zero order reaction and rate of reaction are the same

Reason (R): In a zero order reaction, the rate of reaction is independent of the concentration of reactants.

[1 Marks]

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

(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 false, but Reason (R) is true.

Question 18.

Assertion (A): Inversion of configuration is observed in SN_2 reaction.

Reason (R): The reaction proceeds with the formation of a carbocation.

[1 Marks]

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

(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 false, but Reason (R) is true.

Question 19.

Assertion (A): p-methoxyphenol is a stronger acid than p-nitrophenol.

Reason (R): Methoxy group shows +I effect whereas nitro group shows -I effect.

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

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

Section C

Question 20.

State:

(a) Kohlrausch law of independent migration of ions.

(b) Faraday's first law of electrolysis.

[2 Marks]

Question 21. Classify the following sugars into monosaccharides and disaccharides: Galactose, Glucose, Lactose, and Maltose.

[2 Marks]

Question 22.

Carry out the following conversions:

(i) Nitrobenzene to Aniline

(ii) Aniline to Phenol.

[2 Marks]

Question 23.

(i) Write a chemical test to distinguish between Dimethyl amine and Ethanamine.

(ii) Write the product formed when benzene diazonium chloride is treated with KI.

[2 Marks]

Question 24.

Show that in case of a first order reaction, the time taken for completion of 99% reaction is twice the time required for 90% completion of the reaction. (log 10 = 1)

[2 Marks]

Question 25.

Resistance of a conductivity cell filled with 0.2 mol L^{-1} KCI solution is 200 Ω. If the resistance of the same cell when filled with 0.05 mol L^{-1} KCI solution is 620 Ω, calculate the conductivity and molar conductivity of 0.05 mol L^{-1} KC/ solution. The conductivity of 0.2 mol L^{-1} KCl solution is 0.0248 S cm^{-1}.

[2 Marks]

Section D

Question 26.

Give the structure of the major product expected from the following reactions:

(a) Reaction of Ethanal with methyl-magnesium bromide followed by hydrolysis.

(b) Hydration of But-1-ene in the presence of dilute sulphuric acid.

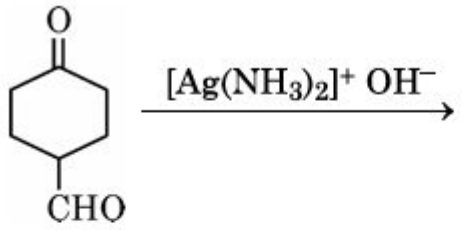
(c) Reaction of phenol with bromine water.

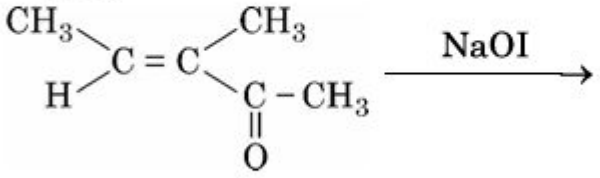
[3 Marks]

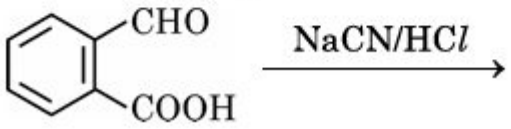
Question 27.

Draw the structures of major product(s) in each of the following reactions

[3 Marks]

(a) 

(b) 

(c) 

Question 28.

Calculate the emf of the following cell:

$Ni(s) + 2Ag^{+}(0.01\ M) \rightarrow Ni^{2+}\ (0.1\ M)\ 2Ag(s)$

Given that E°cell= 1.05 V, log 10 =1

[3 Marks]

Question 29.

The rate constant of a reaction quadruples when the temperature changes from 300 K to 320 K. Calculate the activation energy for this reaction. [log2 =0.30, log 4=0.60, 2.303 R =19.15 J K^{-1} mol^{-1}]

[3 Marks]

Question 30.

A compound X with molecular formula C_3H_9N reacts with $C_6H_5SO_2Cl$ to give a solid, insoluble in alkali. Identify 'X' and give the IUPAC name of the product. Write the reaction involved.

[3 Marks]

Question 31.

Write the IUPAC names of the following coordination compounds :

(a) $[Co(NH_3)_4Cl(NO_2)]Cl$

(b) $[Ni(NH_3)_6]Cl_2$

(c) $K_3[Cr(C_2O_4)_3]$

(d) $[Co(en)_2Br_2]^{+}$

[3 Marks]

Question 32.

Account for the following:

(a) Haloalkanes react with AgCN to form isocyanide as main product.

(b) Allyl chloride shows high reactivity towardsSn1 reaction.

(c) Haloarenes are extremely lesa reactive towards nucleophilic substitution reactions.

[3 Marks]

Section E

Question 33.

Attempt any five of the following:

(a) Ce(III) is easily oxidised to Ce(IV). Comment.

(b) $E°(Mn^{2+}/Mn)$ is -1.18 V. Why is this value highly negative in comparison to neighboring d-block elements?

(c) Which element of the 3d series has the lowest enthalpy of atomisation and why?

(d) What happens when sodium chromate is acidified ?

(e) Zn, Cd and Hg are soft metals. Why?

(f) Why is permanganate titration not carried out in the presence of HCI?

(g) The lower oxides of transition metals are basic whereas the highest are amphoteric/acidic. Give reason.

[5 Marks]

Question 34.

(i) Ishan's automobile radiator is filled with 1.0 kg of water. How many grams of ethylene glycol (Molar mass 62 g mol^{-1}) must Ishan add to get the freezing point of the solution lowered to-2.8 °C. Kf for water is 1.86 K kg mol^{-1}

(ii) What type of deviation from Raoult's law is shown by ethanol and acetone mixture ? Give reason.

[5 Marks]

Question 35.

(i) Boiling point of water at 750 mm Hg pressure is 99.68 °C. How much sucrose (Molar mass = 342 g mol^{-1}) is to be added to 500 g of water such that it boils at 100 °C? (K_b for water = 0.52 K kg mol^{-1}).

(ii) State Henry's law and write its any one application

[5 Marks]

Question 36.

An organic compound (A) with the molecular formula $C_9H_{10}O$ forma 2, 4-DNP derivative, reduces Fehling solution and undergoes Cannizzaro reaction. On vigorous oxidation, it gives 1, 2-benzene dicarboxylic acid.

(i) Identify the compound (A) and write its IUPAC name.

(ii) Write the reaction of compound (A) with

(1) 2,4-Dinitrophenyl hydrazine and

(2) Fehling solution

(iii) Write the equation of compound (A) when it undergoes Cannizzaro reaction.

[5 Marks]

Question 37.

(i) Account for the following:

(1) The alpha (a)-hydrogens of aldehydes and ketones are acidic in nature.

(2) Oxidation of aldehydes is easier than ketones

(ii) Arrange the following in:

(1) Decreasing reactivity towards nucleophilic addition reaction propanal, acetone, benzaldehyde.

(2) Increasing order of boiling point:

Propane, Ethanol, Dimethylether, Propanal

(iii) Give simple chemical test to distinguish between Benzoic acid and Benzaldehyde.

[5 Marks]