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 **39 questions.** All questions are **compulsory.**

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

iii. **Section A** – questions number **1 to 5** are case based questions

iv. **Section B** – questions number **6 to 21** are multiple choice questions

v. **Section C** – questions number **22 to 27** are very short answer

vi. **Section D** – questions number **28 to 34** are short answer

vii. **Section E** – questions number **35 to 39** 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. 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 2.

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Question 4. The following questions are case-based questions. Read the case carefully and answer the questions that follow 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 $C_6H_{12}O_6$. After reacting with different reagents like HI, H_2N -OH, Bromine water, $(CH_3CO)_2O$, etc. its structure was found to contain one aldehyde group, one primary alcoholic group, (- CH_2OH) 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, $NaHSO_3$ 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. Answer the following questions:

(1) What are reducing sugars ?

[1 Marks]

(2) Name the polysaccharide which is known as 'animal starch'. Why is it called 'animal starch'?

[2 Marks]

(3)

(i) Name the isomers of glucose which in the cyclic form differ only in the configuration of the OH group at C-1.

(ii) Presence of which functional group was detected when glucose reacted with Br_2 water?

[2 Marks]

(4) Classify the following into monosaccharide and disaccharide : Fructose, Sucrose, Lactose, Galactose

[1 Marks]

Question 5. Transition metals have incomplete d-subshell either in neutral atom or in their ions. The presence of partly filled d-orbitals in their atoms makes transition elements different from that of the non-transition elements. With partly filled d-orbitals, these elements exhibit certain characteristic properties such as display of a variety of oxidation states, formation of coloured ions and entering into complex formation with a variety of ligands. The transition metals and their compounds also exhibit catalytic properties and paramagnetic behaviour. The transition metals are very hard and have low volatility. An examination of the $E°M^{2+}/M$ shows the varying trends : Answer the following questions:

$E^{o}_{M^{2+}/M}$	
V	– 1·18
Cr	– 0·91
Mn	– 1·18
Fe	– 0·44
Co	– 0·28
Ni	– 0·25
Cu	+ 0·34
Zn	– 0·76

(1) On what basis can we say that Cu is a transition element but Zn is not ? (Atomic number : Cu = 29, Zn = 30)

[1 Marks]

(2) On what basis can we say that Cu is a transition element but Zn is not ? (Atomic number : Cu = 29, Zn = 30)

[1 Marks]

(3)

(i) Why do E°M²⁺/M values show irregular trend from Vanadium to Zinc ?

(ii) How is the variability in oxidation states of transition metals different from that of the non-transition elements ?

[2 Marks]

(4)

(i) Of the d^4 species, Cr^{2+} is strongly reducing while Mn^{3+} is strongly oxidizing. Why ? (Atomic number : Cr = 24, Mn = 25)

(ii) Complete the following ionic equation :

$2Mno_4^- + H_2O + I^- \rightarrow$

[2 Marks]

Section B

Question 6.

When MnO_2 is fused with KOH in air, it gives :

[1 Marks]

(A) K_2MnO_4

(B) Mn_2O_7

(C) Mn_2O_3

(D) $KMnO_4$

Question 7.

Ligand $EDTA^{4-}$ is an example of a :

[1 Marks]

(A) Monodentate ligand

(B) Didentate ligand

(C) Tridentate ligand

(D) Polydentate ligand

Question 8.

Which of the following ligand forms chelate complex ?

[1 Marks]

(A) $C_2O_4^{2-}$

(B) Cl^-

(C) NH_3

(D) NO_2-

Question 9.

Which of the following contains sp^2 hybridised carbon bonded to X ?

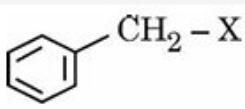
[1 Marks]

(A) CH_3 -CH_2 -X

(B) CH_2=CH-X

(C) CH_2=CH-CH_2 -X

(D)

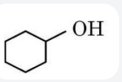


Question 10.

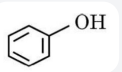
Which of the following is most acidic ?

[1 Marks]

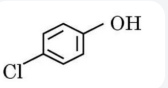
(A)



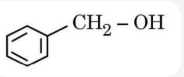
(B)



(C)



(D)

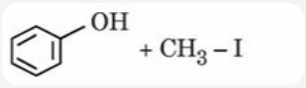


Question 11.

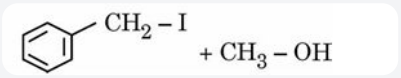
Anisole reacts with HI to give :

[1 Marks]

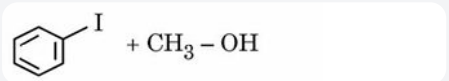
(A)



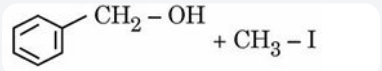
(B)



(C)



(D)



Question 12.

Ethanol on heating with conc. H_2SO_4 at 413 K gives :

[1 Marks]

(A) C_2H5 -O -CH_3

(B) CH_2=CH_2

(C) C_2H_5- O- C_2H_5

(D) $C_2H_5OSO_3H$

Question 13.

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

Question 14.

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

Question 15.

During electrolysis of aqueous solution of NaCl :

[1 Marks]

(A) $O_2(g)$ is liberated at anode

(B) Na is formed at cathode

(C) $Cl_2(g)$ is liberated at cathode

(D) $H_2(g)$ is liberated at cathode

Question 16.

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

Question 17.

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

Question 18.

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.

Question 19.

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).

Question 20.

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).

Question 21.

Assertion (A) : p-nitroaniline is a weaker base than p-toluidine.

Reason (R) : The electron withdrawing effect of NO_2 group in p-nitroaniline makes it a weaker base.

[1 Marks]

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

(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 false, but Reason (R) is true.

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

Section C

Question 22.

A 6% solution of glucose (molar mass = 180 g mol^{-1}) is isotonic with 25% solution of an unknown organic substance. Calculate the molecular weight of the unknown organic substance.

[2 Marks]

Question 23.

A first order reaction has a rate constant 1.25 x 10^{-3} s^{-1}. How long will 5 g of this reactant take to reduce to 2.5 g ?

| log2=0.301, log 3-0.4771, log 4 = 0.6021]

[2 Marks]

Question 24.

What is lanthanoid contraction ? Actinoid contraction is greater from element to element than lanthanoid contraction. Why ?

[2 Marks]

Question 25.

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

[2 Marks]

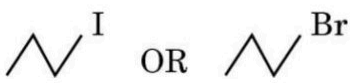
Question 26.

(a) In the following pair of compounds, which compound undergoes SN_2 reaction faster and why ?

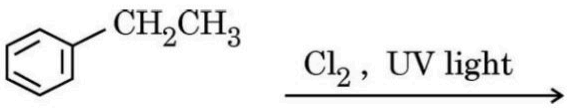
(b) Write the major product in the following:

[2 Marks]

(a) In the following pair of compounds, which compound undergoes S_N2 reaction faster and why ?



(b) Write the major product in the following :



Question 27.

Define the following terms :

(a) Denaturation of protein

(b) Invert sugar

[2 Marks]

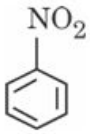
Section D

Question 28.

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

[3 Marks]

(a) $CH_3 - CH_2 - Br \xrightarrow{KCN} A \xrightarrow[\text{Partial hydrolysis}]{OH^-} B \xrightarrow{NaOH + Br_2} C$

(b)  $\xrightarrow{Fe + HCl} A \xrightarrow[273 - 278\ K]{NaNO_2 + HCl} B \xrightarrow{C_2H_5OH} C$

Question 29.

Write the reaction involved in the following :

(a) Wolff-Kishner reduction

(b) Decarboxylation reaction

(c) Cannizzaro reaction

[3 Marks]

Question 30.

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]

Question 31.

The rate of a gaseous reaction triples when temperature is increased from 17ºC to 27ºC. Calculate the energy of activation for this reaction.

[Given : 2.303 R = 19.15 JK^{-1} mol^{-1}, log 3 = 0.48]

[3 Marks]

Question 32.

Give the equations of reactions for the preparation of :

(a) Phenol from chlorobenzene

(b) Salicylaldehyde from phenol

(c) 2-Methoxyacetophenone from anisole

(d) Picric acid from phenol

[3 Marks]

Question 33.

Give reasons for the following :

(a) Chlorine is ortho/para directing in electrophilic aromatic substitution reactions, though chlorine is an electron withdrawing group.

(b) Racemic mixture is optically inactive.

(c) Allyl chloride is hydrolysed more readily than n-propyl chloride.

[3 Marks]

Question 34.

Calculate emf of the following cell :

$Zn\ (s) \mid Zn^{2+}\ (0\ 1\ M) \parallel Sn^{2+}\ (0{\cdot}001\ M)\ Sn\ (s)$

Given: $E°_{zn^{2+}/zn} = -0.76V$, $E°_{sn^{2+}/sn} = -\ 0.14\ V$

[log 10 = 1]

[3 Marks]

Section E

Question 35.

Answer any five of the following:

(a) How is the crystal field splitting energy for octahedral complex (Δo) related to that of tetrahedral complex (Δ_t) ?

(b) Write the IUPAC name of the following complex : $[PtCl_2(en)_2]\ (NO_3)_2$

(c) Write the geometry and magnetic behaviour of the complex [Ni(CO)4] on the basis of Valency Bond Theory (VBT).

(d) What type of isomerism is shown by the complex $[Co(NH_3)_6]$ $[Cr(CN)_6]$?

(e) For the coordination compound on the basis of crystal field theory, write the electronic configuration for d^4 ion if $\Delta o < P$. Is the coordination compound a high spin or low spin complex ?

(f) Out of $[Co(NH_3)_6]_3^+$ and $[Co(NH_3)_4Cl_2]^+$, which complex is heteroleptic and why ?

(g) Draw the structures of optical isomers of $[PtCl_2(en)_2]^{2+}$.

[5 Marks]

Question 36.

(i) Draw structure of the 2,4-dinitrophenylhydrazone of benzaldehyde.

(ii) Arrange the following in increasing order of their reactivity towards HCN : CH3COCH3 , $(CH_3)_3C$-$COCH_3$, CH_3CHO

(iii) How can you convert phenyl magnesium bromide to benzoic acid ?

(iv) Give a simple chemical test to distinguish between ethanoic acid and ethanal.

(v) Write the main product in the following reaction:

[5 Marks]

(v) Write the main product in the following reaction :

$$CH_3 - \underset{\underset{O}{\|}}{C} - CH_2 - COOC_2H_5 \xrightarrow[(ii)\ H^+]{(i)\ NaBH_4} \ ?$$

Question 37.

(i) Account for the following:

(1) Oxidation of aldehydes is easier as compared to ketones.

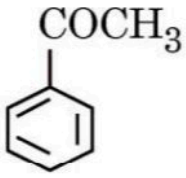
(2) The alpha (α) hydrogen atoms of aldehydes are acidic in nature.

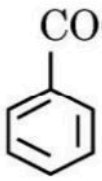
(ii) Write the main product in the following reaction :

(iii) Give a simple chemical test to distinguish between benzaldehyde and ethanal.

[5 Marks]

(ii) Write the products in the following reactions :

(1)  $\xrightarrow{NaOH / I_2}$? + ?

(2)  + $(CH_3)_2Cd \longrightarrow$? + $CdCl_2$

Question 38.

(i) The resistance of 0.05 M CH_3COOH solution is found to be 100 ohm. If the cell constant is 0.0354 cm^{-1}, calculate the molar conductivity of the acetic acid solution.

(ii) State faraday's first law of electrolysis. how much charge is Faraday is required for the reduction of 1 mol of MnO^-_4 to Mn^{2+} ?

[5 Marks]

Question 39.

(i) The conductivity of 0.0025 mol L^{-1} acetic acid is 5.25 *10 $^{-5}$ S cm^{-1}. Calculate its degree of dissociation if λ°_m for acetic acid is 390 S cm^2 mol^{-1}.

(ii) Write anode, cathode and overall reaction of lead storage battery.

[5 Marks]