CBSE EXAMINATION PAPER-2023

CHEMISTRY

(Solved)

Time allowed : 3 hours | Maximum Marks : 83

General Instructions :

Read the following instructions carefully and follow them :

i. This question paper contains **42 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 21** are multiple choice questions

v. **Section C** – questions number **22 to 30** are very short answer

vi. **Section D** – questions number **31 to 36** are short answer

vii. **Section E** – questions number **37 to 42** 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 carbon – oxygen double bond is polarised in aldehydes and ketones due to higher electronegativity of oxygen relative to carbon. Therefore they undergo nucleophilic addition reactions with a number of nucleophiles such as HCN, NaHSO3, alcohols, ammonia derivatives and Grignard reagents. Aldehydes are easily oxidised by mild oxidising agents as compared to ketones. The carbonyl group of carboxylic acid does not give reactions of aldehydes and ketones. Carboxylic acids are considerably more acidic than alcohols and most of simple phenols.

Question 2.

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

The carbon – oxygen double bond is polarised in aldehydes and ketones due to higher electronegativity of oxygen relative to carbon. Therefore they undergo nucleophilic addition reactions with a number of nucleophiles such as HCN, $NaHSO_3$, alcohols, ammonia derivatives and Grignard reagents. Aldehydes are easily oxidised by mild oxidising agents as compared to ketones. The carbonyl group of carboxylic acid does not give reactions of aldehydes and ketones. Carboxylic acids are considerably more acidic than alcohols and most of simple phenols.

(1)

Write the name of the product when an aldehyde reacts with excess alcohol in presence of dry HCl.

[1 Marks]

(2)

Why carboxylic acid is a stronger acid than phenol ?

[1 Marks]

(3)

(i) Arrange the following compounds in increasing order of their reactivity towards CH_3MgBr :

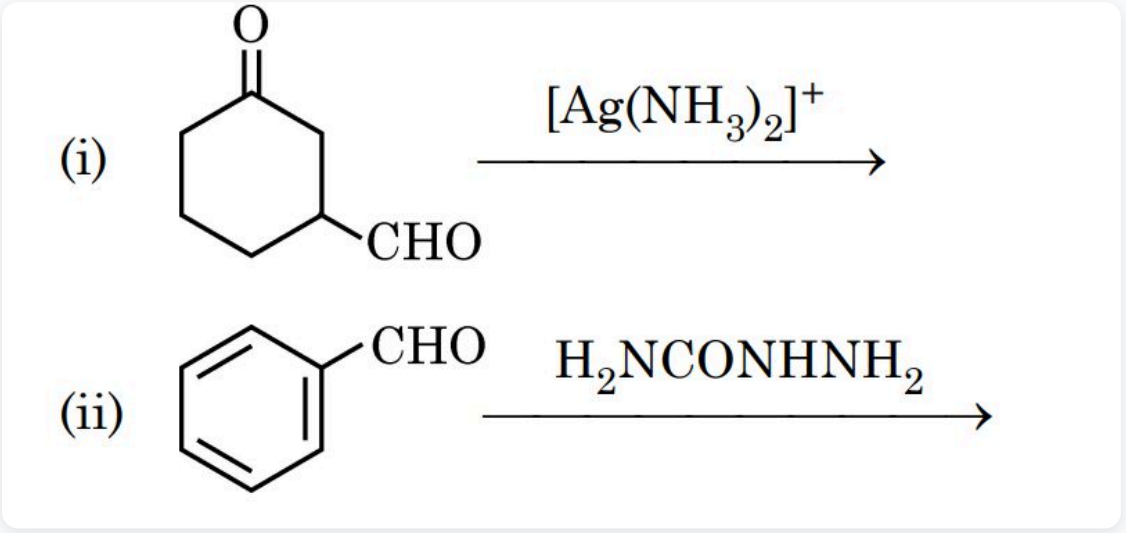
(ii) Write a chemical test to distinguish between propanal and propanone.

$$CH_3CHO,\ (CH_3)_3C-\overset{\overset{O}{\|}}{C}-CH_3,\ CH_3-\overset{\overset{O}{\|}}{C}-CH_3$$

[2 Marks]

(4)

Write the main product in the following :



[2 Marks]

Question 3.

Carbohydrates are optically active polyhydroxy aldehydes and ketones. They are also called saccharides. All those carbohydrates which reduce Fehling's solution and Tollen's reagent are referred to as reducing sugars. Glucose, the most important source of energy for mammals, is obtained by the hydrolysis of starch. Vitamins are accessory food factors required in the diet. Proteins are the polymers of α-amino acids and perform various structural and dynamic functions in the organisms. Deficiency of vitamins leads to many diseases.

(1)

The penta-acetate of glucose does not react with Hydroxylamine. What does it indicate ?

[1 Marks]

(2)

Why cannot vitamin C be stored in our body ?

[1 Marks]

(3)

Define the following as related to proteins :

(i) Peptide linkage

(ii) Denaturation

[2 Marks]

(4)

Define the following as related to carbohydrates :

(i) Anomers

(ii) Glycosidic linkage

[2 Marks]

Section B

Question 4.

The conversion of an alkyl halide into an alkene by alcoholic KOH is classified as

[1 Marks]

(A) a dehydrohalogenation reaction

(B) an addition reaction

(C) a dehydration reaction

(D) a substitution reaction

Question 5.

The oxidation state of Fe in $[Fe(CO)_5]$ is

[1 Marks]

(A) +5

(B) +3

(C) +2

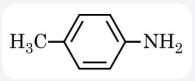
(D) 0

Question 6.

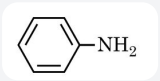
Among the following, which is the strongest base?

[1 Marks]

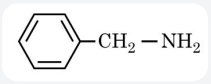
(A)



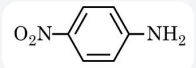
(B)



(C)



(D)



Question 7.

The slope in the plot of ln[R] vs. time for a first order reaction is

[1 Marks]

(A) + k

(B) – k

(C) + k/2.303

(D) – k/2.303

Question 8.

An α-helix is a structural feature of

[1 Marks]

(A) Nucleotides

(B) Starch

(C) Polypeptides

(D) Sucrose

Question 9.

Racemisation occurs in

[1 Marks]

(A) S_n1 reaction

(B) S_n2 reaction

(C) S_n2 reaction as well as S_n1 reaction

(D) Neither S_n1 nor S_n2 reaction

Question 10.

Value of Henry's constant K_h:

[1 Marks]

(A) decreases with increase in temperature.

(B) remains constant.

(C) increases with increase in temperature.

(D) increases with decrease in temperature.

Question 11.

Which of the following solutions of KCl will have the highest value of molar conductivity?

[1 Marks]

(A) 1 M

(B) 0.1 M

(C) 0.5 M

(D) 0.01 M

Question 12.

Which of the following reactions are feasible?

[1 Marks]

(A) Both (a) and (b)

(B) $CH_3CH_2Br + Na^+ O–C(CH_3)_3 \rightarrow CH_3CH_2–O–C(CH_3)_3$

(C) Neither (a) nor (b)

(D) $(CH_3)_3C–Cl + Na^+ O–CH_2CH_3 \rightarrow CH_3CH_2–O–C(CH_3)_3$

Question 13.

Which of the following is most reactive in nucleophilic addition reactions?

[1 Marks]

(A) $CH_3COC_2H_5$

(B) CH_3CHO

(C) CH_3COCH_3

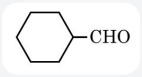
(D) HCHO

Question 14.

Which of the following does not give aldol condensation reaction?

[1 Marks]

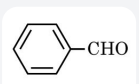
(A)



(B) $CH_3–CHO$

(C) CH_3COCH_3

(D)



Question 15.

For the reaction $3A \rightarrow 2B$, rate of reaction + d[B]/dt is equal to

[1 Marks]

(A) +(2d[A]/dt)

(B) –(3/2)d[A]/dt

(C) –(2/3)d[A]/dt

(D) –(1/3)d[A]/dt

Question 16.

Which of the following characteristics of transition metals is associated with their catalytic activity?

[1 Marks]

(A) High enthalpy of atomisation

(B) Variable oxidation states

(C) Paramagnetic nature

(D) Colour of hydrated ions

Question 17.

The formula of the complex dichloridobis(ethane–1, 2-diamine) platinum(IV) nitrate is

[1 Marks]

(A) $[Pt(en)_2(NO_3)_2]Cl_2$

(B) $[Pt\ Cl_2(en)_2\ (NO_3)]NO_3$

(C) $[Pt\ Cl_2(en)_2](NO_3)_2$

(D) $[Pt\ Cl_2(en)_2\ (NO_3)_2]$

Question 18.

Assertion (A) : Osmotic pressure is a colligative property.

Reason (R) : Osmotic pressure is proportional to the molality.

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

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

(C) (A) is true, but (R) is false

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

Question 19.

Assertion (A) : Conductivity decreases with decrease in concentration of electrolyte.

Reason (R) : Number of ions per unit volume that carry the current in a solution decreases on dilution.

[1 Marks]

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

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

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

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

Question 20.

Assertion (A) : Copper is a non-transition element.

Reason (R) : Copper has completely filled d-orbitals in its ground state.

[1 Marks]

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

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

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

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

Question 21.

Assertion (A) : Nucleophilic substitution of iodoethane is easier than chloroethane.

Reason (R) : Bond enthalpy of C-I bond is less than that of C-Cl bond.

[1 Marks]

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

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

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

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

Section C

Question 22.

The vapour pressure of pure liquid X and pure liquid Y at 25 °C are 120 mm Hg and 160 mm Hg respectively. If equal moles of X and Y are mixed to form an ideal solution, calculate the vapour pressure of the solution.

[2 Marks]

Question 23.

Give reasons :

(i) Mercury cell delivers a constant potential during its life time.

(ii) In the experimental determination of electrolytic conductance, Direct Current (DC) is not used.

[2 Marks]

Question 24.

Define fuel cell with an example. What advantages do the fuel cells have over primary and secondary batteries ?

[2 Marks]

Question 25.

(a) The conversion of molecule A to B followed second order kinetics. If concentration of A increased to three times, how will it affect the rate of formation of B ?

(b) Define Pseudo first order reaction with an example.

[2 Marks]

Question 26.

Write the IUPAC names of the following :

(i) $[Co(NH_3)_5(ONO)]^{2+}$

(ii) $K_2[NiCl_4]$

[2 Marks]

Question 27.

(i) What is a chelate complex ? Give one example.

(ii) What are heteroleptic complexes ? Give one example.

[2 Marks]

Question 28.

Write the chemical equation involved in the following reactions :

(a) Reimer-Tiemann reaction

(b) Acetylation of Salicylic acid

[2 Marks]

Question 29.

Do the following conversions in not more than two steps :

[2 Marks]

(a) CH_3CN to $CH_3 - \underset{\underset{O}{\|}}{C} - CH_3$

(b)  to

Question 30.

Write two differences between DNA and RNA.

[2 Marks]

Section D

Question 31.

(i) Write the mechanism of the following reaction :

(ii) Why ortho-nitrophenol is steam volatile while para-nitrophenol is not ?

[3 Marks]

$$2CH_3CH_2OH \xrightarrow[413\ K]{H^+} CH_3 - CH_2 - O - CH_2 - CH_3 + H_2O$$

Question 32.

Answer any 3 of the following:

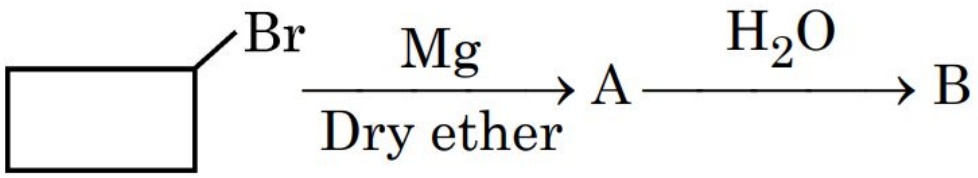
(a) Which isomer of C_5H_{10} gives a single monochloro compound C_5H_9Cl in bright sunlight ?

(b) Arrange the following compounds in increasing order of reactivity towards SN2 reaction : 2-Bromopentane, 1-Bromopentane, 2-Bromo-2-methylbutane

(c) Why p-dichlorobenzene has higher melting point than those of ortho and meta-isomers ?

(d) Identify A and B in the following :

[3 Marks]



Question 33.

A first order reaction is 50% complete in 30 minutes at 300 K and in 10 minutes at 320 K. Calculate activation energy (E_a) for the reaction. [R = 8.314 J K^{-1} mol^{-1}]

[Given : log 2 = 0.3010, log 3 = 0.4771, log 4 = 0.6021]

[3 Marks]

Question 34.

When 19.5 g of F – CH_2 – COOH (Molar mass = 78 g mol^{-1}), is dissolved in 500 g of water, the depression in freezing point is observed to be 1°C. Calculate the degree of dissociation of F – CH_2 – COOH.

[Given : Kf for water = 1.86 K kg mol^{-1}]

[3 Marks]

Question 35.

(a) Draw the geometrical isomers of $[Co(en)_2Cl_2]^{2+}$. Which geometrical isomer of $[Co(en)_2Cl_2]^{2+}$ is not optically active and why ?

(b) Write the hybridisation and magnetic behaviour of $[CoF_6]^{3-}$.

[Given : Atomic number of Co = 27]

[3 Marks]

Question 36.

What happens when:

(i) Anisole is treated with CH_3Cl/anhydrous $AlCl_3$?

(ii) Phenol is oxidised with $Na_2Cr_2O_7/H^+$?

(iii) $(CH_3)_3$ C - OH is heated with Cu/574K?

Write chemical equation in support of your answer.

[3 Marks]

Section E

Question 37.

Account for the following :

(i) Eo value for Mn^{3+}/ Mn^{2+} couple is much more positive than that for Cr^{3+}/ Cr^{2+}.

(ii) Sc^{3+} is colourless whereas Ti^{3+} is coloured in an aqueous solution.

(iii) Actinoids show wide range of oxidation states.

[5 Marks]

Question 38.

Write the chemical equations for the preparation of $KMnO_4$ from MnO_2.

[5 Marks]

Question 39.

(I) Account for the following :

(i) Transition metals form alloys.

(ii) Ce^{4+} is a strong oxidising agent.

(II) Write one similarity and one difference between chemistry of Lanthanoids and Actinoids.

(III) Complete the following ionic equation : $Cr_2O_7^{2-} + 2OH^- \rightarrow$

[5 Marks]

Question 40.

(I) Give reasons :

(i) Aniline on nitration gives good amount of m-nitroaniline, though – NH2 group is o/p directing in electrophilic substitution reactions.

(ii) $(CH_3)_2$ NH is more basic than $(CH_3)_3N$ in an aqueous solution.

(iii) Ammonolysis of alkyl halides is not a good method to prepare pure primary amines.

(II) Write the reaction involved in the following :

(i) Gabriel phthalimide synthesis

(ii) Carbyl amine test

[5 Marks]

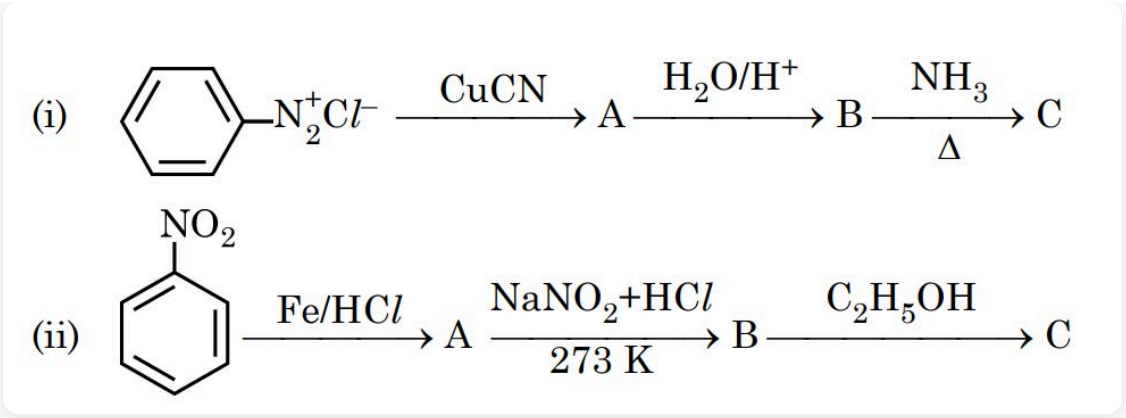
Question 41.

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

(II) Why aniline does not undergo Friedal-Crafts reaction ?

(III) Arrange the following in increasing order of their boiling point : C_2H5OH, $C_2H_5NH_2$, $(C_2H_5)_3N$

[5 Marks]



Question 42.

(a) Conductivity of 2* 10^{-3} M methanoic acid is 8 * 10^{-5} S cm^{-1}. Calculate its molar conductivity and degree of dissociation if Λ°_m m for methanoic acid is 404 S cm^2 mol^{-1}.

(b) Calculate the Δ_rG° and log Kc for the given reaction at 298 K :

$Ni_{(s)} + 2Ag^+(aq) \rightleftharpoons Ni^{2+}(aq) + 2Ag_{(s)}$

Given: $E^\circ\ Ni^{2+}/Ni$ = -0.25 V, $E^\circ\ Ag^+/Ag$ = +0.80V

1F = 96500 C mol^{-1}.

[5 Marks]