CBSE EXAMINATION PAPER-2025

CHEMISTRY

(Solved)

Time allowed : 3 hours | Maximum Marks : 82

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 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 33** are short answer

vii. **Section E** – questions number **34 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. According to the generally accepted definition of the ideal solution there are equal interaction forces acting between molecules belonging to the same or different species. (This is equivalent to the statement that the activity of the components equals the concentration.) Strictly speaking, this condition is fulfilled only in exceptional cases for mixtures (optical isomers, isotopic mixtures of an element, hydrocarbon mixtures). It is still usual to talk about ideal solutions as limiting cases in reality since very dilute solutions behave ideally with respect to the solvent. This view is further supported by the fact that Raoult’s law empirically found for describing the behaviour of the

solvent in dilute solutions can be deduced thermodynamically via the assumption of ideal behaviour of the solvent.

Question 2.

According to the generally accepted definition of the ideal solution there are equal interaction forces acting between molecules belonging to the same or different species. (This is equivalent to the statement that the activity of the components equals the concentration.) Strictly speaking, this condition is fulfilled only in exceptional cases for mixtures (optical isomers, isotopic mixtures of an element, hydrocarbon mixtures). It is still usual to talk about ideal solutions as limiting cases in reality since very dilute solutions behave ideally with respect to the solvent. This view is further supported by the fact that Raoult's law empirically found for describing the behaviour of the solvent in dilute solutions can be deduced thermodynamically via the assumption of ideal behaviour of the solvent.

Answer the following questions :

(1)

Give one example of miscible liquid pair which shows negative deviation from Raoult's law. What is the reason for such deviation ?

[2 Marks]

(2)

Raoult's law is a special case of Henry's law. Comment.

[1 Marks]

(3)

State Raoult's law for a solution containing volatile components.

[1 Marks]

(4)

Write two characteristics of an ideal solution.

[1 Marks]

Question 3.

Ribose and 2-deoxyribose have an important role in biology. Among the most important derivatives are those with phosphate groups attached at the 5 position. Mono-, di- and tri-phosphate forms are important, as well as 3-5 cyclic monophosphates. Purines and pyrimidines form an important class of compounds with ribose and deoxyribose. When these purine and pyrimidine derivatives are coupled to a ribose sugar, they are called nucleosides.

Answer the following questions :

(1)

Differentiate between nucleotide and nucleoside.

[1 Marks]

(2)

Mention two important functions of nucleic acid.

[1 Marks]

(3)

What products would be formed when DNA is hydrolysed ? How is DNA different from RNA with reference to a structure ?

[2 Marks]

(4)

Name the linkage which joins two nucleotides. Name the base that is found in nucleotide of RNA but not in DNA.

[1 Marks]

Section B

Question 4.

In an electrochemical cell, the following reaction takes place :

$2Cu^{+}(aq) + Zn(s) \rightarrow 2Cu(s) + Zn^{2+}(aq)$

$E°cell = 1{\cdot}28\ V$

As the reaction progresses, what will happen to the overall voltage of the cell?

[1 Marks]

(A) It will decrease as $[Zn^{2+}]$ increases.

(B) It will increase as $[Cu^{+}]$ increases.

(C) Voltage will remain constant.

(D) It will increase as $[Zn^{2+}]$ increases.

Question 5.

Out of Fe^{3+}, Sc^{3+}, Cr^{3+} and Co^{3+} ions, the one which is colourless in aqueous solution is:

[Atomic number : Fe = 26, Sc = 21, Cr = 24, Co = 27]

[1 Marks]

(A) Sc^{3+}

(B) Fe^{3+}

(C) Cr^{3+}

(D) Co^{3+}

Question 6.

Hoffmann Bromamide degradation reaction is given by:

[1 Marks]

(A) $ArCH_2NH_2$

(B) $ArNO_2$

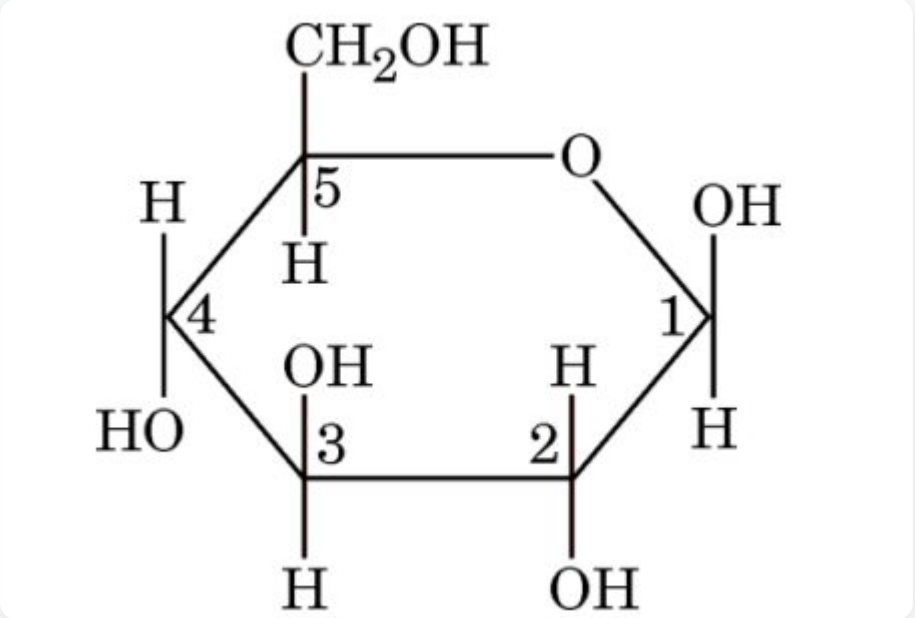
(C) $ArNH_2$

(D) $ArCONH_2$

Question 7.

In the Haworth structure of the following carbohydrate, various carbon atoms have been numbered. The anomeric carbon is numbered as:

[1 Marks]



(A) 5

(B) 3

(C) 1

(D) 2

Question 8.

The value of Henry's constant K_h is:

[1 Marks]

(A) greater for gases with higher solubility

(B) not related to the solubility of gases

(C) greater for gases with lower solubility

(D) constant for all gases

Question 9.

Out of the following statements, the incorrect statement is:

[1 Marks]

(A) Lanthanoids are radioactive in nature.

(B) La is actually an element of transition series.

(C) Ionic radius decreases from La^{3+} to Lu^{3+} ion.

(D) Zr and Hf have almost identical atomic radii because of lanthanoid contraction.

Question 10.

Out of 2-Bromobutane, 1-Bromobutane, 2-Bromopropane and 1-Bromopropane, the molecule which is chiral in nature is:

[1 Marks]

(A) 1-Bromobutane

(B) 1-Bromopropane

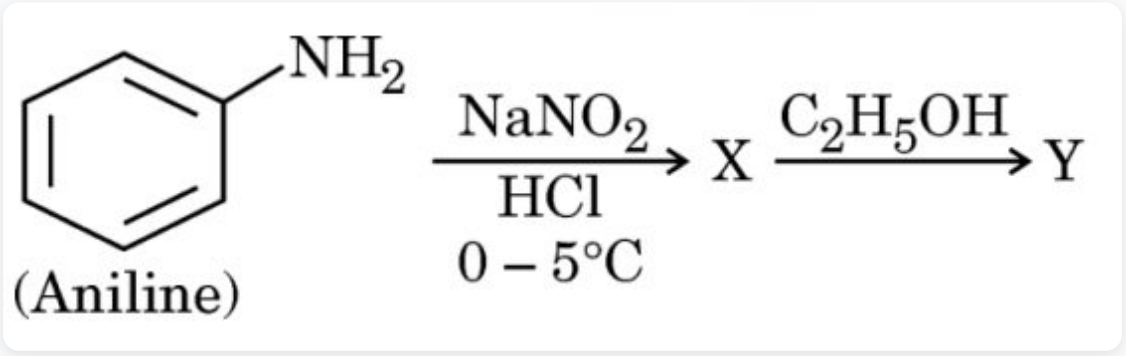
(C) 2-Bromopropane

(D) 2-Bromobutane

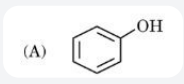
Question 11.

In the given reaction sequence, the structure of Y would be:

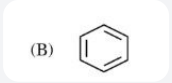
[1 Marks]



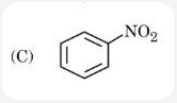
(A)



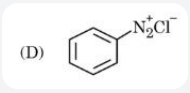
(B)



(C)



(D)



Question 12.

The product of the oxidation of I^- with MnO_4^- in alkaline medium is:

[1 Marks]

(A) IO^-

(B) IO_3^-

(C) IO_4^-

(D) I_2

Question 13.

Polyhalogen compounds have wide application in industries and agriculture. DDT is also a very important polyhalogen compound. It is a:

[1 Marks]

(A) fertilizer

(B) greenhouse gas

(C) biodegradable insecticide

(D) non-biodegradable insecticide

Question 14.

What amount of electric charge is required for the reduction of 1 mole of MnO_4^- into Mn^{2+}?

[1 Marks]

(A) 5 F

(B) 1 F

(C) 4 F

(D) 6 F

Question 15.

Alkenes are formed by heating alcohols with conc. H_2SO_4. The first step in the reaction is:

[1 Marks]

(A) protonation of alcohol molecule

(B) formation of carbocation

(C) formation of ester

(D) elimination of water

Question 16.

Assertion (A) : Cuprous salts are diamagnetic.

Reason (R) : Cuprous ion has completely filled 3d-orbitals.

[1 Marks]

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

(B) Both Assertion (A) and Reason (R) are true and Reason (R) is 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.

Question 17.

Assertion (A) : n-Butyl chloride has higher boiling point than n-Butyl bromide.

Reason (R) : C – Cl bond is more polar than C – Br bond.

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

Question 18.

Assertion (A) : Acetanilide is less basic than aniline.

Reason (R) : Acetylation of aniline results in decrease of electron density on nitrogen.

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

Question 19.

Assertion (A) : Electrolysis of aqueous NaCl gives H_2 at cathode and Cl_2 at anode.

Reason (R) : Chlorine has higher oxidation potential than H_2O.

[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 20.

Reactant ‘A’ underwent a decomposition reaction. The concentration of ‘A’ was measured periodically and recorded in the table given below :

Based on the above data, predict the order of the reaction and write the expression for the rate law.

[2 Marks]

Time / Hours	[A]/M
0	0·40
1	0·20
2	0·10
3	0·05

Question 21.

The reaction between H_2 (g) and I_2 (g) was carried out in a sealed isothermal container. The rate law for the reaction was found to be :

Rate =Rate = $k[H_2][I_2]$

If 1 mole of H_2 (g) was added to the reaction chamber and the temperature was kept constant, then predict the change in rate of the reaction and the rate constant.

[2 Marks]

Question 22.

$PtCl_4$. 2KCl doesn't give precipitate of AgCl with $AgNO_3$ solution. Write the structural formula and IUPAC name of the complex.

[2 Marks]

Question 23.

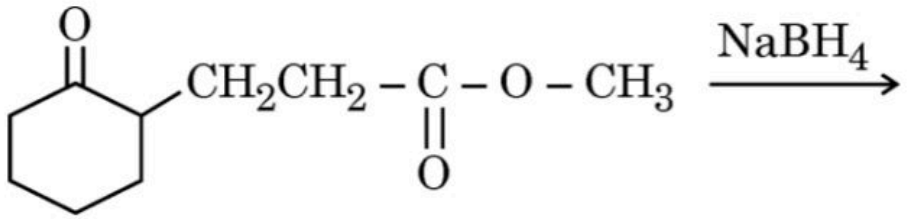
Define fuel cell. Give two advantages of fuel cell over ordinary cell.

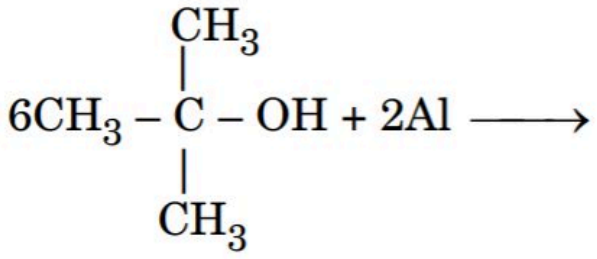
[2 Marks]

Question 24.

Write the structures of the main products of the following reactions :

[2 Marks]

(a) 

(b) 

Question 25.

What is meant by essential amino acids ? Why are amino acid amphoteric in nature ?

[2 Marks]

Section D

Question 26.

Account for the following :

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

(ii) Isocyanides are formed when alkyl halides are treated with silver cyanide.

(iii) Methyl chloride reacts faster with $\bar{O}H$ ion in S_{n}^{2} reaction than t-butyl chloride.

[3 Marks]

Question 27.

Complete the following reactions by writing the structural formulae of 'A' and 'B' :

[3 Marks]

(i) $CH_3CH = CH_2 \xrightarrow[\text{Peroxide}]{HBr}$ 'A' $\xrightarrow{\text{aq. KOH}}$ 'B'

(ii) $CH_3CH_2\underset{\displaystyle Cl}{\underset{|}{C}}HCH_3 \xrightarrow[\Delta]{\text{alc. KOH}}$ 'A' $\xrightarrow{HBr}$ 'B'

(iii) 'A' $\xrightarrow{Mg}$ $CH_3CH_2MgCl \xrightarrow[H^+]{H_2O}$ 'B' (Main product)

Question 28.

Calculate the cell voltage of the voltaic cell which is set up by joining following half-cells at $25^{o}C$: Al/Al^{3+} (0·001 M) and Ni/Ni^{2+} (0·1 M)

Given : $E^{o}Ni^{2+}/ Ni = – 0·25$ V, $E^{o}Al^{3+}/Al = – 1·66$ V

[3 Marks]

Question 29.

Give explanation for each of the following observations :

(a) With the same d-orbital configuration (d4), Mn3+ ion is an oxidising agent whereas Cr2+ ion is a reducing agent.

(b) Actinoid contraction is greater from element to element than that among lanthanoids.

(c) Transition metals form large number of interstitial compounds with H, B, C and N.

[3 Marks]

Question 30.

An aqueous solution of NaOH was made and its molar mass from the measurement of osmotic pressure at $27^{o}C$ was found to be 25 g mol^{-1}. Calculate the percentage dissociation of NaOH in this solution.

[Atomic mass : Na = 23 u, O = 16 u, H = 1 u]

[3 Marks]

Question 31.

Arrange the following compounds as asked : 3

(a) in decreasing order of pKb values $C_2H_5NH_2$, $(C_2H_5)_2NH$, $C_6H_5NHCH_3$, $C_6H_5NH_2$

(b) increasing order of boiling point C_2H_5OH, $C_2H_5NH_2$, $(CH_3)_2NH$

(c) increasing order of solubility in water $C_6H_5NH_2$, $(C_2H_5)_2NH$, $C_2H_5NH_2$

[3 Marks]

Question 32.

An aromatic compound ‘A’ with molecular formula C_8H_8O gives positive 2,4-DNP test. It gives yellow precipitate. of compound ‘B’ on treatment with sodium hypoiodite. Compound ‘A’ does not react with

Tollen's or Fehling's reagent; on drastic oxidation with $KMnO_4$ it forms a carboxylic acid 'C'. Elucidate the structures of A, B and C. Also give their IUPAC names.

[3 Marks]

Question 33.

(a) Can sodium ethoxide and t-butyl chloride be used for the preparation of t-butyl ethyl ether ? Give suitable explanation. Justify your answer by suggesting the appropriate starting material required for preparation of t-butyl ethyl ether.

(b) Give the IUPAC name of above mentioned ether.

[3 Marks]

Section E

Question 34.

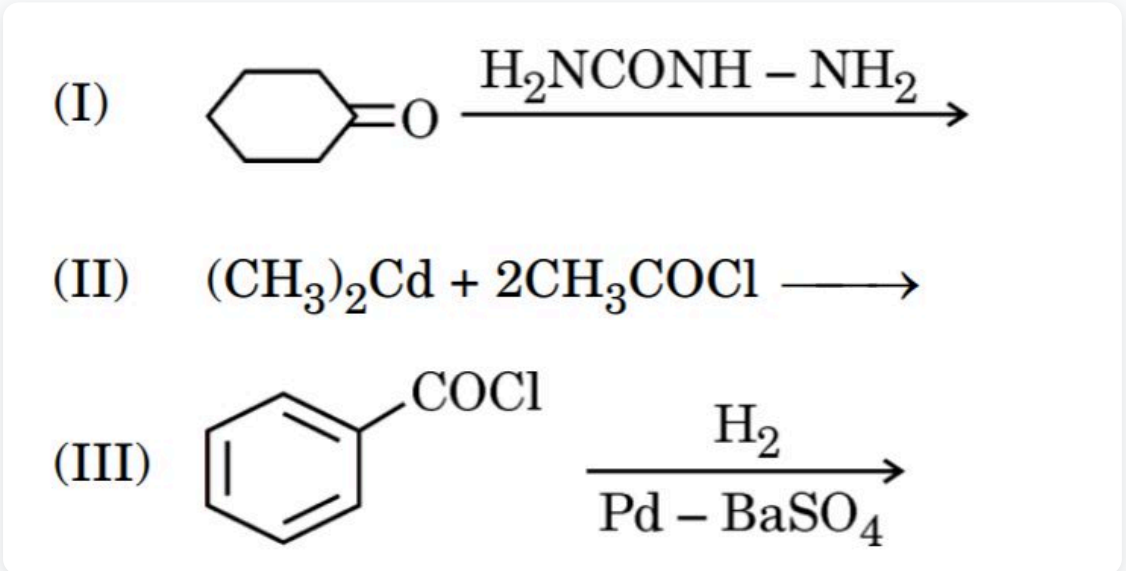
(i) Complete the following reactions by writing the structure of the main products:

(ii) Give simple chemical test to distinguish between the following pairs of compounds :

(I) Ethyl benzoate and benzoic acid

(II) Propanal and propanone

[5 Marks]



Question 35.

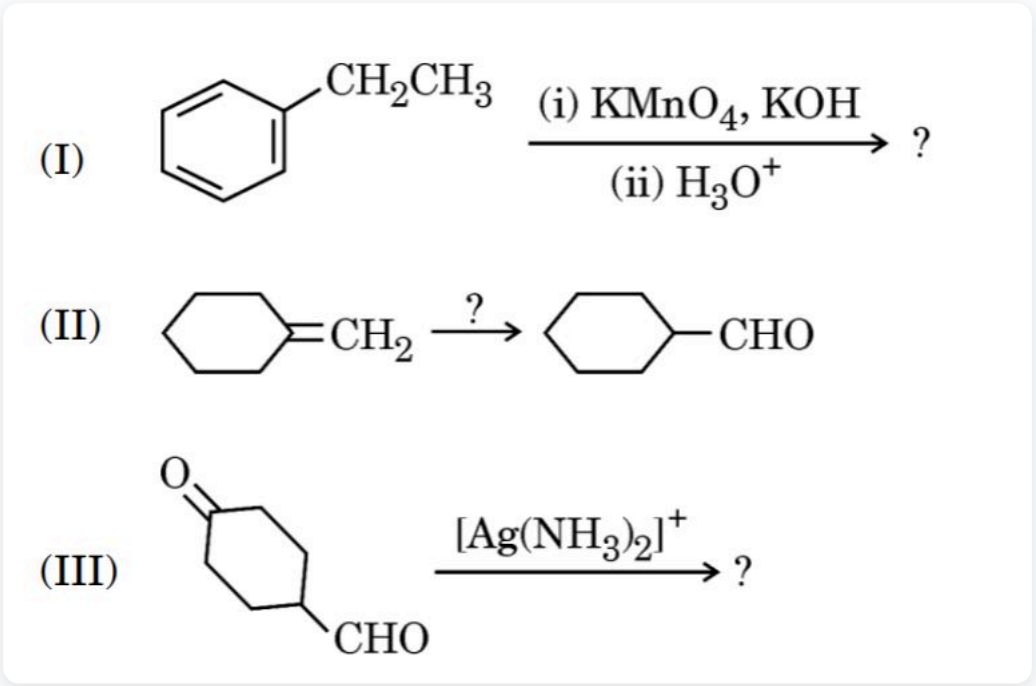
(i) Complete each synthesis by giving missing starting =material, reagent or products :

(ii) Carry out the following conversions :

(I) Benzaldehyde to Benzophenone

(II) Benzaldehyde to 3-phenyl propanol

[5 Marks]



Question 36.

Give reasons :

(I) [Ni(CO)4] is diamagnetic whereas $[NiCl4]^{2-}$ is paramagnetic. [Atomic number : Ni = 28]

(II) CO is a stronger complexing agent than NH_3.

(III) The trans isomer of complex $[Co(en)_2Cl_2]+$ is optically inactive.

(ii) Using Crystal Field theory, write the number of unpaired electrons in octahedral complexes of Fe3+ in the presence of :

(I) Strong field ligand

(II) Weak field ligand

[Atomic number : Fe = 26]

[5 Marks]

Question 37.

(i) Name the type of isomerism exhibited by the following compounds. Also draw their corresponding isomers.

(I) $[Co(NH_3)_6]$ $[Cr(CN)_6]$

(II) $[Co(en)_3]^{3+}$

(III) $[Co(NH_3)_3(NO_2)_3]$

(ii) Differentiate between weak field and strong field ligands. How does the strength of the ligand influence the spin of the complex ?

[5 Marks]

Question 38.

(i) The initial concentration of N_2O_5 in the first order reaction :

$N_2O_5(g) \rightarrow 2NO_2(g) + 1/2O_2(g)$

was $1{\cdot}2 \times 10^{-2}$ mol L^{-1}. The concentration of N_2O_5 after 60 minutes was $0{\cdot}2 \times 10^{-2}$ mol L^{-1}. Calculate the rate constant of the reaction at 318 K.

[log 6 = 0·778]

(ii) Account for the following :

(I) We cannot determine the order of a reaction by taking into consideration the balanced chemical equation.

(II) A bimolecular reaction may become kinetically of first order under a specified condition.

[5 Marks]

Question 39.

(i) The rate of the chemical reaction doubles for an increase of 10 K in absolute temperature from 298 K. Calculate activation energy (E_a).

[$2{\cdot}303\ R = 19{\cdot}15\ JK^{-1}\ mol^{-1}$, log 2 = 0·3]

(ii)

For a reaction :

$2H_2O_2\ (I^-) \square\square\square \rightarrow\ 2H_2O + O_2$

the proposed mechanism is as given below :

(I) $H_2O_2 + I^-\ \square\square \rightarrow\ H_2O + IO^-$ (slow)

(II) $H_2O_2 + IO^-\ \square\square \rightarrow\ H_2O + I^- + O_2$ (fast)

(1) Write rate law for the reaction.

(2) Write the overall order and molecularity of the reaction.

[5 Marks]