CBSE board
Class XII Chemistry

Time Allowed: 3 Hrs Maximum Marks: 70

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1. All questions are compulsory.
2. Question nos. **1 to 8** are very short answer questions and carry 1 mark each
3. Question nos. **9 to 18** are short answer questions and carry 2 marks each. Use of calculator is not permitted.
4. Question nos. **19 to 27** are also short answer questions and carry 3 marks each
5. Question nos**. 28 to 30** are long answer questions and carry 5 marks each
6. Use log tables if necessary, use of calculators is not allowed.

Q 1. What is the cause of adsorption?

Q 2. Write the reaction of HCHO with Tollen's reagent.

Q 3. What product is formed which acetic acid reacts with PCl_5?

Q 4. Explain why alkyl halides though polar are immiscible with water?

Q 5. Give IUPAC name of the compound $CH_3OCH_2CH_2OCH_3$

Q 6. What is oxidation state of Co in complex $[Co(NH_3)_2(NO_2)Cl]Cl$

Q 7. Name the enzyme which converts sucrose into glucose and fructose.

Q 8. The specific rate of a reaction is 6.2×10^{-3} mol $L^{-1}s^{-1}$. What is the order of the reaction?

Q 9. Time required to decompose SO_2Cl_2 to half of its initial amount is 60 minutes. If the decomposition is a first order reaction, calculate the rate constant of the reaction.

Q 10. What happens when:

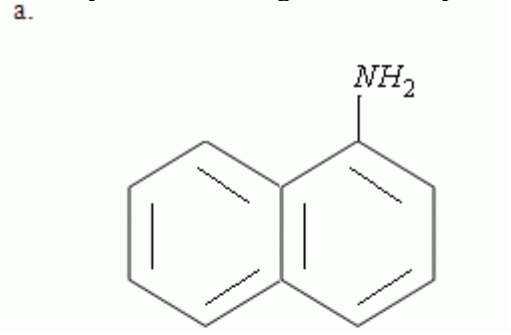
(i) Nitroethane is treated with $LiAlH_4$

(ii) Diazonium chloride reacts with phenol in basic medium.

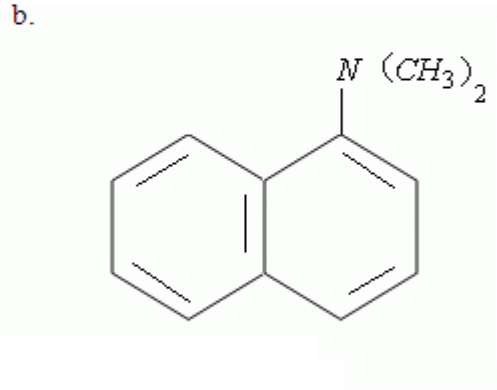
Q 11. A first order decomposition reaction takes 40 minutes for 30% decomposition. Calculate its $t_{½}$.

Q 12. Classify the following amines as primary, secondary or tertiary amines:

a.



b.



c. $(C_2H_5)_2CH_3N$

d. $(C_2H_5)_2NH$

Q 13. Gold (atomic radius = 0.144 nm) crystallises in a face-centred unit cell. What is the length of a side of the unit cell in meter?

OR

Aluminium crystallises in a cubic close-packed structure. Its metallic radius is 125 pm. How many unit cells are there in 1.0 cm3 of aluminium?

Q 14.

(a) Though nitrogen exhibits +5 oxidation state, it does not form pentahalide. Give reason?

(b) PH_3 has lower boiling point than NH_3 .Why?

Q 15. If a current of 0.5 ampere flows through a metallic wire for 2 hours, then how many electrons would flow through the wire?

Q 16. Explain the valencies in coordination compounds given by Werner.

Q 17.State two differences between Schottky and Frenkel defects?

Q 18.Complete the following reactions:

(i) $C_2H_4 + O_2 \rightarrow$

(ii) $Al + O_2 \rightarrow$

Q 19.

(i) Why are deltas formed at places where river meets sea?

(ii) List two characteristics of catalysts.

(iii) What are macromolecular colloids? Give an example.

OR

Explain the following terms:

(i) Lyophilic sols

(ii) Lyophobic sols

(iii) Emulsions

Q 20. Write the name and structure of monomer/s of each. Give a use of each polymer.

(i) Nylon-6, 6

(ii) Buna-S

Q 21.

(a) Why is the reduction of a metal oxide easier if the metal formed is in liquid state at the temperature of reduction?

(b) Explain liquation method?

(c) Explain Mond's process for refining nickel?

Q 22. What happens when:

(a) Concentrated H_2SO_4 is added to calcium fluoride

(b) SO_3 is passed through water

(c) PCl_3 is reacted with moisture

Q.23.

(i) Name the forces that are involved in holding the drugs to the active site of enzymes?

(ii) Name the drug used for treatment of typhoid. What type of drug it is?

(iii) What are the consequences of using non-biodegradable detergents?

Q 24. Write the equations for the preparation of 1-iodobutane from:

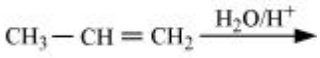
(i) 1-butanol

(ii) 1-chlorobutane

(iii) but-1-ene

Q 25. Write structures of the products of the following reactions:

(i)



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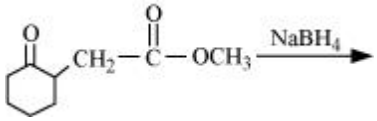

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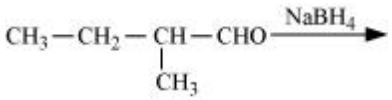


Q 26.

(i) The two strands in DNA are not identical but are complementary. Explain.

(ii) Define essential amino acids and non- essential amino acids. Give one example of each?

Q 27.

(i) Give one example of primary and secondary battery each.

(ii) Wrie the reactions taking place at anode and cathode in a mercury cell.

Q 28. How will you bring about the following conversions in not more than two steps?

(i) Propanone to propene

(ii) Benzoic acid to benzaldehyde

(iii) Ethanol to 3-hydroxybutanal

(iv) Benzene to *m*-nitroacetophenone

(v) Benzaldehyde to benzophenone

OR

Q 28.

(i) What is meant by the following terms? Give an example.

(a) Acetal

(b) Aldol

(ii) Explain by giving the reactions of the following:

(a) Benzoyl chloride is hydrogenated over catalyst palladium on barium sulphate.

(b) Carboxylic acid when treated with bromine in presence of $FeBr_3$

(c) Acidic hydrolysis of ethyl benzoate.

Q 29.

(a) Will the elevation in boiling point be same if 0.1 mole of sodium chloride or 0.1 mole of sugar is dissolved in 1 L of water? Explain.

(b) 0.5 g KCl was dissolved in 100 g of water and the solution originally at 200 °C, froze at 0.240 °C Calculate the percentage ionization of salt. Kf per 1000g water = 1.86 K kg mol^{-1}, Atomic mas of K = 39, Cl = 35.5

OR

Q 29.

(a) Which colligative property is preferred for the molar mass determination of macromolecules? Give two reasons.

(b) What is the mass of non-volatile solute which should be dissolved in 114 g octane to reduce its vapour pressure to 80%. Molar mass of solute is 40.

Q 30.

(a) Which out of $Lu(OH)_3$ and $La(OH)_3$ is more basic and why?

(b) In the series Sc (Z = 21) to Zn (Z = 30), the enthalpy of atomization of zinc is the lowest, i.e., 126 kJ mol^{-1}. Why?

(c) The E^0 (M^{2+}/M) value for copper is positive (+0.34V). What is possibly the reason for this? (Hint: consider its high $\Delta_a H^0$ and low $\Delta_{hyd} H^0$)

OR

Q 30.

(a) Write the steps involved in the preparation of:

(i) $K_2Cr_2O_7$ from Na_2CrO_4

(ii) $KMnO_4$ from K_2MnO_4

(b) Explain how the colour of $K_2Cr_2O_7$ solution depends on the pH of the solution?

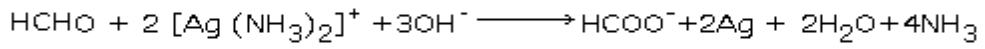
CBSE Board Class
XII Chemistry
Solution

Time : 3 Hrs Total Marks: 70

Solution

1. Adsorption is caused due to the unbalanced or residual attractive forces on the surface of the adsorbent. [1 Mark]

2.



[1 Mark]

3. $CH_3COOH + PCl_5 \rightarrow CH_3COCl + POCl_3 + HCl$ [1 Mark]

4. Alkyl halides are polar molecules and therefore, their molecules are held together by dipole – dipole forces. On the other hand, the molecules of H_2O are held together by hydrogen bonds. When alkyl halides are added to water, the new forces of attraction between water and alkyl halide molecules are weaker than the forces of attraction already exisiting between alkyl halide – alkyl halide molecules and water – water molecules. Hence, alkyl halides are immiscible in water. [1 Mark]

5. 1, 2-Dimethoxyethane. [1 Mark]

6. Cobalt has +3 oxidation state. [1 Mark]

7. Invertase is the enzyme which converts sucrose into glucose and fructose. [1 Mark]

8. Zero order reaction [1 Mark]

9. We know that for a 1st order reaction,

$$t_{1/2} = \frac{0.693}{k}$$ [1 Mark]

It is given that $t_{1/2}$ = 60 min

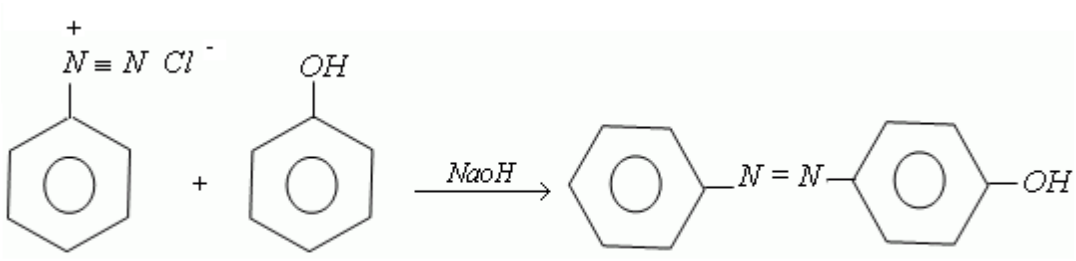
$$k = \frac{0.693}{t_{1/2}}$$
$$= \frac{0.693}{60}$$
$$= 0.01155\,\text{min}^{-1}$$
$$= 1.155 \times 10^{-2}\,\text{min}^{-1}$$
$$\text{Or } k = 1.925 \times 10^{-4}\,\text{s}^{-1}$$ [1 Mark]

10.

(i)

$$C_2H_5NO_2 \xrightarrow{LiAlH_4} C_2H_5NH_2 + 2H_2O$$ [1 Mark]

(ii)



[1 Mark]

11.

$$k = \frac{2.303}{t}\log(A_0/A)$$ [1/2 mark]

$$k = \frac{2.303}{40}\log(100/70)$$

$$k = \frac{2.303}{40} \times 0.155$$

$$= 0.00892\,min^{-1}$$ [1/2 mark]

$$t_{1/2} = \frac{0.693}{k}$$ [1/2 mark]

$$t_{1/2} = \frac{0.693}{0.0892}\,min$$

$$t_{1/2} = 77.7\,min$$ [1/2 mark]

12. a. 1°

b. 3°

c. 3°

d. 2° [1/2*4=2 Mark]

13. For a face-centred unit cell: $a = 2\sqrt{2}\,r$ [1/2 Mark]

It is given that the atomic radius, r = 0.144 nm and $1m = 10^{-9}$ nm [1/2 Mark]

$$So, a = 2\sqrt{2} \times 0.144$$

$$= 0.407\,nm$$ [1/2 mark]

Hence, length of a side of the cell $= 0.407 \times 10^{-9}\,m$ [1/2 Mark]

OR

For the cubic closed-packed structure

Volume of one unit cell = (length of side)^3 = a^3

It is given that the atomic radius, r = 125 pm

$$So, a = 2\sqrt{2} \times 125\,pm$$

$$= 354\,pm$$ [1/2 Mark]

Volume of one unit cell = $(354)^3$ [1/2 Mark]

1 pm = 10^{-10} cm

Hence, $(354 \times 10^{-10}\ cm)^3$

$= (3.54 \times 10^{-8}\ cm)^3$

$= 4.419 \times 10^{-23}\ cm^3$ [1/2 Mark]

Total number of unit cell in 1.00 cm^3
= total volume / size of each cell
= (1.00 cm^3)/(4.419 x 10^{-23} cm^3)
= 2.27×10^{22} unit cell [1/2 Mark]

14.

a) Nitrogen with n=2, has s and p orbitals only. It does not have d orbitals to expand its covalence beyond four. That is why it does not form pentahalide. [1 Mark]

b) Unlike NH_3, PH_3 molecules are not associated through hydrogen bonding in liquid state. That is why the boiling point of PH_3 is lower than NH_3. [1 Mark]

15. I = 0.5 A
t = 2 hours = 2 × 60 × 60 s = 7200 s [1/2 Mark]
Thus, $Q = It$ [1/2 Mark]
= 0.5 A × 7200 s
= 3600 C
We know that 96487 C = 6.023 x 10^{23} number of electrons. [1/2 Mark]
Then,

$$3600\,\text{C} = \frac{6.023\times10^{23}\times3600}{96487}$$

$$= 2.25\times10^{22}\ \text{number of electrons}$$

Hence, 2.25×10^{22} number of electrons will flow through the wire.

16.

(i) A metal exhibits two types of valencies namely, Primary and Secondary valencies. Primary valencies are ionisable and are satisfied by negative ions. The primary valency gives the oxidation number of the metal. [1/2 Mark]
Secondary valencies are non-ionisable .They are satisfied by both negative and neutral ions. They represent the co-ordination number of the metal. [1/2 Mark]
(ii) A metal ion has a definite number of secondary valencies around the central atom. Also, these valencies project in a specific direction in the space assigned to the definite geometry of the coordination compound. [1 Mark]

17.

Schottky defect	**Frenkel defect**
1. Equal number of positive and negative ions are missing from their sites. [1/2 Mark]	1. The smaller ion is dislocated from its normal site to an interstitial site. [1/2 Mark]
2. It lowers the density of solid. [1/2 Mark]	2. The density of solid remains unaffected. [1/2 Mark]

18.

(i) $C_2H_4 + 3O_2 \rightarrow CO_2 + 2H_2O$ [1 Mark]

(ii) $4Al + 3O_2 \rightarrow 2Al_2O_3$ [1 Mark]

19.

(i) River water is muddy and contains charged colloidal particles of clay, sand and many other materials. Sea water contains in it a number of dissolved electrolytes. When sea water and river water come in contact with each other, the electrolytes present in the sea water coagulate the suspended colloidal particles which ultimately settle down at the point of contact. Thus, there is a formation of delta at the point where river enters the sea. [1 Mark]

(ii)

1. Catalysts are highly selective. A catalyst is able to direct a reaction to give a particular product. [1/2 Mark]

2. Catalysts are highly active. A catalyst is able to increase the rate of a chemical reaction. [1/2 Mark]

(iii) A colloid in which the particles of dispersed phase are sufficiently big in size to be of colloidal dimensions is called a macromolecular colloid. Example: Starch. [1 Mark]

OR

(i) Colloidal sols that are formed by mixing substances such as gum, gelatin, starch, etc. with a suitable liquid (dispersion medium) are called lyophilic sols. These sols are reversible in nature. [1 Mark]

(ii) When substances such as metals and their sulphides etc. are mixed with the dispersion medium, they do not form colloidal sols. Their colloidal sols can be prepared only by special methods. Such sols are called lyophobic sols. These sols are irreversible in nature. [1 Mark]

(iii) Emulsions are liquid – liquid colloidal systems in which the dispersed phase and dispersion medium both are liquids. Example: milk [1 Mark]

20. Nylon-6,6

Monomer: Hexamethylenediamine (NH_2 $(CH_2)_6$ NH_2) [1/2 Mark]

and

Adipic acid ($HOOC(CH_2)_4COOH$) [1/2 Mark]

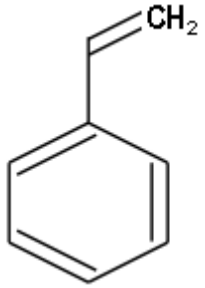
Use: It is used in making bristles of brushes. [1/2 Mark]

ii) Buna-S

Monomer: 1, 3-Butadiene ($CH_2=CH-CH=CH_2$) [1/2 Mark]

and

Styrene



[1/2 Mark]

Use: It is used in automobile tyres, cable insulation.

[1/2 Mark]

21.

a)The entropy is higher if the metal is in liquid state than when it is in solid state. The value of entropy change (ΔS) of the reduction process is more on +ve side when metal formed is in liquid state and the metal oxide being reduced is in solid state. Thus the value of ΔG^{θ} becomes more on negative side and the reduction becomes easier. [1 Mark]

b) In this method a low melting metal like tin can be made to flow on a sloping surface. In this way it is separated from higher melting impurities. [1 Mark]

c) In this process nickel is heated in a stream of carbon monoxide forming a volatile complex, nickel tetracarbonyl:

$$Ni + 4CO \xrightarrow{330\text{-}350K} Ni(CO)_4$$ [1/2 Mark]

The carbonyl is subjected to higher temperature so that it is decomposed giving the pure metal.

$$Ni(CO)_4 \xrightarrow{450\text{-}470K} Ni + 4CO$$ [1/2 Mark]

22.

a) It forms hydrogen fluoride

$CaF_2 + H_2SO_4 \rightarrow CaSO_4 + 2HF$ [1 Mark]

b) It dissolves SO_3 to give H_2SO_4

$SO_3 + H_2O \rightarrow H_2SO_4$ [1 Mark]

c) PCl_3 hydrolysis in the presence of moisture giving fumes of HCl.

$PCl_3 + 3H_2O \rightarrow H_3PO_3 + 3HCl$ [1 Mark]

23.

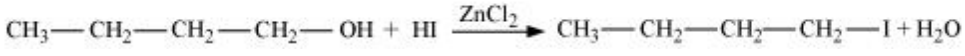
(i) The forces are ionic bonding, hydrogen bonding, Van der Waals' forces of attraction or dipole-dipole attraction. [1 Mark]

(ii) Chloramphenicol. It is broad-spectrum antibiotic. [1 Mark]

(iii)Non-biodegradable detergents will lead to pollution. These detergents have branched alkyl chains and are thus not easily decomposed by micro-organisms. [1Mark]

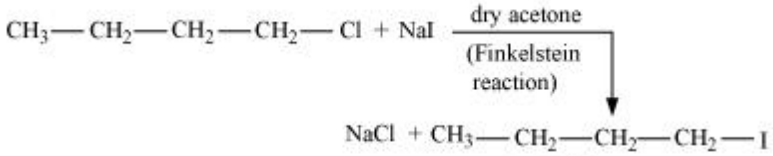
24.

(i)



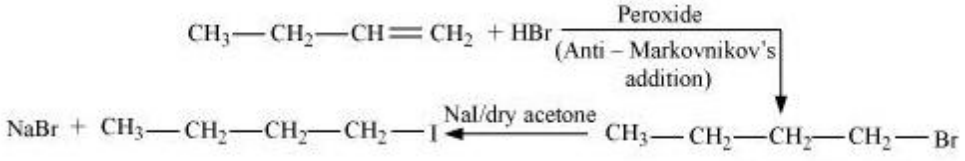
[1mark]

(ii)



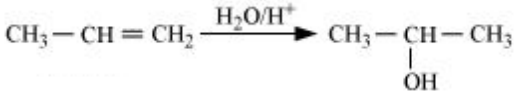
[1 mark]

(iii)



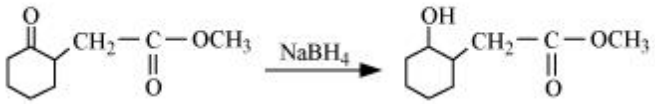
[1 mark]

25. (i)



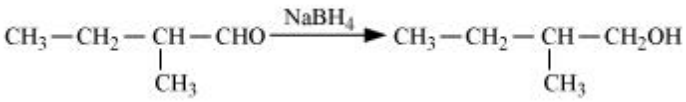
[1 Mark]

(ii)



[1 Mark]

(iii)



[1 Mark]

26.

(i)

In the helical structure of DNA, the two strands are held together by hydrogen bonds between specific pairs of bases. Cytosine forms hydrogen bond with guanine, while adenine forms hydrogen bond with thymine. As a result, the two strands are complementary to each other. [1 Mark]

ii) Essential amino acids:- Essential amino acids are those which cannot be synthesised in the body and must be obtained through diet is known as essential amino acid. For example Lysine [1/2 + 1/2 Mark]

Non-essential amino acid:- The amino acid which can be synthesised in the body are known as Non –essential amino acid. For example - Serine [1/2 + 1/2 Mark]

27.

i) Example of primary battery – Dry cell [1/2 Mark]

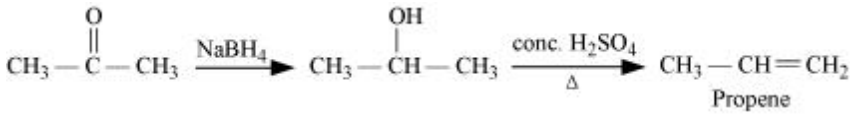
Secondary battery –Lead storage cell [1/2 Mark]

ii) Anode: $Zn(Hg) + 2OH^- \rightarrow ZnO\ (s) + H_2O + 2e^-$ [1 Mark]

Cathode: $HgO + H2O + 2e^- \rightarrow Hg\ (l) + 2OH^-$ [1Mark]

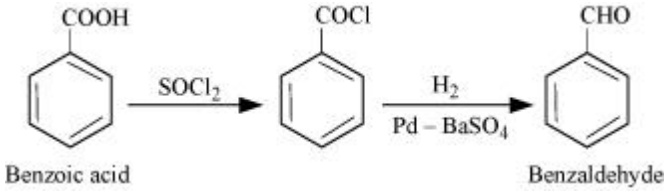
28.

(i)



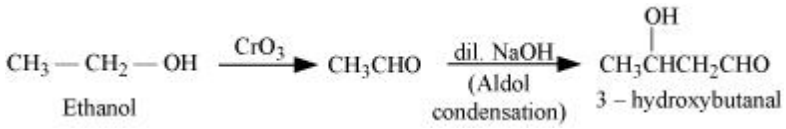
[1 Mark]

(ii)



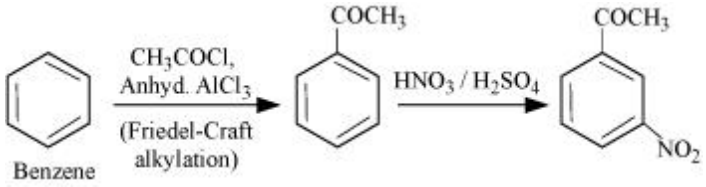
[1 Mark]

(iii)



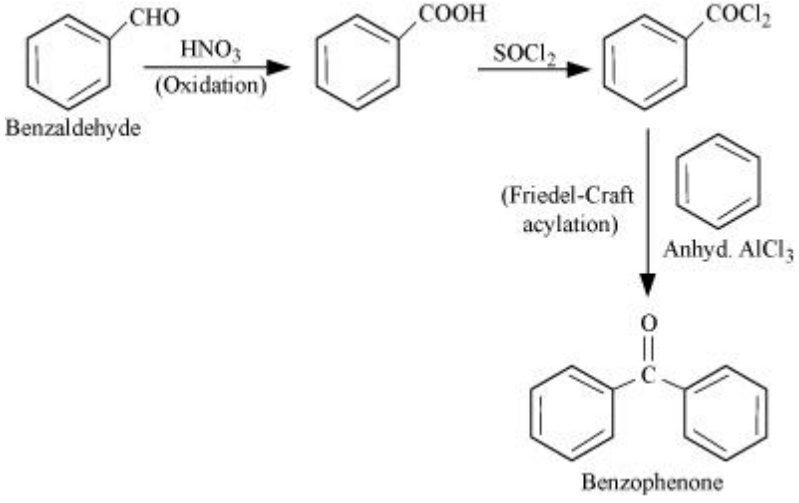
[1 Mark]

(iv)



[1 Mark]

(v)



[1 Mark]

OR

29.

(a) The elevation in boiling point will not be same if 0.1 mole of sodium chloride or 0.1 mole of sugar is dissolved in 1 L of water. [1 Mark]

This is because elevation in boiling point is a colligative property and depends upon the number of solute particles. NaCl is ionic and give more number of particles due to ionisation than sugar which consists of molecules.

(b) [1 Mark]

Given:

Mass of solute(w) = 0.5 g

Mass of solvent(w)=100 g

T = 0° C - (-0.24° C)

= 0.24 °C

K_f = 1.86 K kg mol^{-1}

So, the observed molar mass of the solute (KCl)

$$M_B = \frac{1000 \times K_f \times w_B}{\Delta T_f \times w_A}$$ [1/2Mark]

$$= \frac{1.86 \times 0.5 \times 1000}{0.24 \times 100}$$

$$= 38.75$$ [1/2Mark]

Now, normal molar mass of KCl= 39+35.5 = 74.5

So, vant Hoff's factor (i)

$$i = \frac{\text{Normal molar mass}}{\text{Observed molar mass}} = \frac{74.5}{38.75} = 1.92$$ [1/2 Mark]

KCl ionizes as

$KCl(aq) \leftrightarrows K^+(aq) + Cl^-(aq)$

Let α be the degree of ionisation

	KCl	K^+	Cl^-
Then initial moles	1	0	0
Moles after ionisation	1 – α	α	α

Total no. of moles after ionisation = 1- α + α + α =1+ α [1/2 Mark]

So

$$i = \frac{\text{Total number of moles of particles after dissociation}}{\text{Total number of moles of particles before dissociation}} = 1 + \alpha$$

$1 + \alpha = 1.92$ [1/2 mark]

$\alpha = 0.92$

Percentage ionisation = 92 % [1/2 mark]

OR

(a) Osmotic pressure is preferred for the molar mass measurement of macromolecules because:

[1 Mark]

(i) even in dilute solutions, the osmotic pressure values are appreciably high and can be measured accurately. [1/2 Mark]

(ii) osmotic pressure can be measured at room temperature. On the other hand, elevation in boiling point is measured at high temperature where the solute may decompose. The depression in freezing point is measured at low temperatures.

[1/2 Mark]

(b) Vapour pressure is reduced to 80% on the addition of a nonvolatile solute so that

$$\frac{p_A^\circ - p_A}{p_A^\circ} = \frac{100-80}{100} = \frac{1}{5}$$ [1 Mark]

Now,according to Raoult 's law

$$\frac{p_A^\circ - p_A}{p_A^\circ} = x_B$$ [1/2 Mark]

Let the mass of non volatile solute to be added= x g

Molar mass of octane = 114 g

$$\frac{p_A^\circ - p_A}{p_A^\circ} = \frac{x/40}{(114/114)+(x/40)} = \frac{x/40}{114/114}$$ [1 Mark]

$$\frac{1}{5} = \frac{x}{40} \times 1$$

$$x = 8\,g$$ [1/2 Mark]

30.

(a) $La(OH)_3$ is more basic than $Lu(OH)_3$. [1 Mark]

Due to lanthanoid contratcion the size of lanthanoid ions decreases regularly with increase in atomic size. As a result of decrease in size, their covalent character between lanthanoid ion and OH- ions increases from La^{3+} to Lu^{3+}. Therefore, the basic character of hydroxides decreases from $La(OH)_3$ to $Lu(OH)_3$. [1 Mark]

(b) The extent of metallic bonding an element undergoes decides the enthalpy of atomization. The more extensive the metallic bonding of an element, the more will be its enthalpy of atomization.

In all transition metals (except Zn, electronic configuration: $3d^{10}4s^2$), there are some unpaired electrons that account for their stronger metallic bonding. Due to the absence of these unpaired electrons, the inter-atomic electronic bonding is the weakest in Zn and as a result, it has the least enthalpy of atomization. [1 Mark]

c) The $E^0(M^{2+}/M)$ value of a metal depends on the energy changes involved in the following:

1. Sublimation: The energy required for converting one mole of an atom from the solid state to the gaseous state.

$M(s) \rightarrow M(g)$ $\Delta_s H$ (Sublimation energy)

2. Ionization: The energy required to take out electrons from one mole of atoms in the gaseous state.

$M(g) \rightarrow M^{2+}(g)$ $\Delta_i H$ (Ionization energy)

3. Hydration: The energy released when one mole of ions are hydrated.

$M^{2+}(g) \rightarrow M^{2+}(aq)$ $\Delta_{hyd} H$ (Hydration energy)

Now, copper has a high energy of atomization and low hydration energy. Hence, the $E°(M^{2+}/M)$ value for copper is positive. [2 Marks]

OR

a)

(i) $2Na_2CrO_4 + 2H^+ \rightarrow Na_2Cr_2O_7 + 2Na^+ + H_2O$ [1 Mark]

$Na_2Cr_2O_7 + 2KCl \rightarrow K_2Cr_2O_7 + 2NaCl$ [1 Mark]

(ii) $3MnO_4^{2-} + 4\ H^+ \rightarrow 2MnO4^- + MnO_2 + 2H_2O$ [1 Mark]

b)

In the solution, the following equilibrium exists:

$Cr_2O_7^{2-} + H_2O \rightleftarrows 2\ CrO_4^{2-} + 2\ H^+$ [1 Mark]

In acidic medium (pH <7), it exists as $Cr_2O_7^{2-}$ ions and hence has orange colour. In basic medium (pH>7), it exists as CrO_4^{2-} ions and therefore, has yellow colour. [1 Mark]