MODEL QUESTION PAPER-II

CHEMISTRY

Class XII

Time : 3 Hours *Maximum Marks : 70*

General Instructions :

(i) *All the questions are compulsory.*
(ii) *Questions 1 to 4, carry one mark each and questions 5 to 6, carry 2 marks each.*
(iii) *Questions 7 to 10 are short answer questions carrying 1 mark each.*
(iv) *Questions 11 to 16 are short answer questions carrying 2 mark each.*
(v) *Questions 17 to 25 are also short answer questions carrying 3 marks each.*
(vi) *Questions 26 to 27 are assertion- reason questions carrying 2 marks each.*
(vii) *Questions 28 to 30 are long answer questions carrying 5 marks each.*
(viii) *Use log tables for calculations if necessary.*

Note : Choose one correct option for questions 1 to 4.

1. Which of the following statements is **not** true for hexagonal close packing? **(1)**

(i) The coordination number is 12

(ii) It has 74% packing efficiency

(iii) Octahedral voids of second layer are covered by spheres of the third layer.

(iv) In this arrangement third layer is identical with the first layer.

2. Brine is electrolysed using inert electrodes. The reaction at anode is _____. **(1)**

(i) $Cl^-(aq.) \longrightarrow \frac{1}{2} Cl_2(g) + e^-$; $E^{\ominus}_{Cell} = 1.36V$

(ii) $2H_2O(l) \longrightarrow O_2(g) + 4H^+ + 4e^-$; $E^{\ominus}_{Cell} = 1.23V$

(iii) $Na+(aq.) + e^- \longrightarrow Na(s)$; $E^{\ominus}_{Cell} = 2.71V$

(iv) $H^+(aq.) + e^- \longrightarrow \frac{1}{2} H_2(g)$; $E^{\ominus}_{Cell} = 0.00V$

3. In a qualitative analysis when H_2S is passed through the solution of a salt acidified with HCl, a black precipitate is obtained. On boiling the precipitate with dil. HNO_3, it forms a solution of blue colour. Addition of excess of aqueous solution of ammonia to this solution will give _____. **(1)**

(i) Deep blue precipitate of $Cu(OH)_2$.

(ii) Deep blue solution of $[Cu(NH_3)_4]^{2+}$.

(iii) Deep blue solution of $Cu(NO_3)_2$.

(iv) Deep blue solution of $Cu(OH)_2.Cu(NO_3)_2$.

4. What is the IUPAC name of the compound $CH_3—CH_2—CH_2—CH_2—\underset{\displaystyle CH_3}{\overset{\displaystyle |}{N}}—CH_3$? **(1)**

(i) N, N-Dimethylaminobutane

(ii) N, N-Dimethylbutan-1-amine

(iii) N, N-Dimethylbutylamine

(iv) N-methylpentan-2-amine

Note : Choose two correct options for questions 5 and 6.

5. $E^{\ominus}_{Cell}$ for some half cell reactions are given below. On the basis of these mark the correct answer. **(2)**

(a) $H^+ (aq.) + e^- \longrightarrow \frac{1}{2} H_2 (g)$; $E^{\ominus}_{Cell} = 0.00V$

(b) $2H_2O (l) \longrightarrow O_2 (g) + 4H^+ (aq.) + 4e^-$; $E^{\ominus}_{Cell} = 1.23V$

(c) $2SO_4^{2-} (aq.) \longrightarrow S_2O_8^{2-} (aq.) + 2e^-$; $E^{\ominus}_{Cell} = 1.96\ V$

(i) In dilute sulphuric acid solution, hydrogen will be reduced at cathode.

(ii) In concentrated sulphuric acid solution, water will be oxidised at anode.

(iii) In dilute sulphuric acid solution, SO_4^{2-} ion will be oxidised to tetrathionate ion at anode.

(iv) In dilute sulphuric acid solution, water will be oxidised at anode.

6. What happens when a lyophilic sol is added to a lyophobic sol? **(2)**

(i) Lyophobic sol is protected.

(ii) Lyophilic sol is protected.

(iii) Film of lyophilic sol is formed over lyophobic sol.

(iv) Film of lyophobic sol is formed over lyophilic sol.

7. How do emulsifying agents stabilise emulsion? **(1)**

8. On what principle is the zone refining based? **(1)**

9. Why cross links are required in rubber to have practical applications? **(1)**

10. Name an artificial sweetener which has dipeptide linkage between two aminoacids. **(1)**

11. Why does electrical conductivity of semiconductors increase with rise in temperature? **(2)**

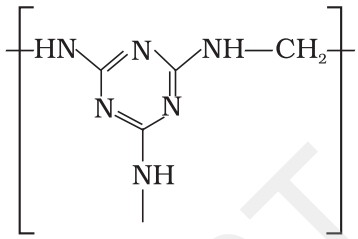
12. In the ring test of NO_3^- ion, Fe^{2+} ion reduces nitrate ion to nitric oxide, which combines with Fe^{2+} (aq.) ions to form brown complex. Write reactions involved in the formation of brown ring. **(2)**

13. Arrange the following complex ions in increasing order of crystal field splitting energy Δ_0.

$[Cr(Cl)_6]^{3-}$, $[Cr(CN)_6]^{3-}$, $[Cr(NH_3)_6]^{3+}$ **(2)**

14. Explain why allyl chloride is hydrolysed more readily than *n*-propylchloride? **(2)**

15. Write name(s) of starting materials for the following polymer and identify its monomer unit. **(2)**



16. What is the advantage of using antihistamines instead of antacids in the treatment of hyperacidity. **(2)**

17. When 1 mol of NaCl is added to 1 litre of water, the boiling point of water increases. On the other hand, addition of 1 mol of methyl alcohol to one litre of water decreases the boiling point of water. Explain why does this happen. **(3)**

18. Value of standard electrode potential for the oxidation of Cl^- ion is more positive than that of water, even then in the electrolysis of aqueous sodium chloride solution, why is Cl^- oxidised at anode instead of water? **(3)**

19. How copper is extracted from low grade copper ores? **(3)**

20. Calculate the volume of 0.1 M NaOH solution required to neutralise the products formed by dissolving 1.1 g of P_4O_6 in H_2O. **(3)**

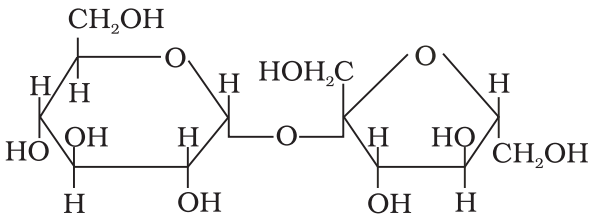
21. A complex of the type $[M(AA)_2X_2]^{n+}$ is known to be optically active. What does this indicate about the structure of the complex? Give one example of such complex. **(3)**

22. Predict the major product formed on adding HCl to isobutylene and write the IUPAC name of the product. Explain the mechanism of the reaction. **(3)**

23. Explain why rate of reaction of Lucas reagent with three classes of alcohols different? Give chemical equations wherever required. **(3)**

24. A primary amine, $R—NH_2$ can be reacted with alkyl halide, RX, to get secondary amine, R_2NH, but the only disadvantage is that 3° amine and quaternary ammonium salts are also obtained as side products. Can you suggest a method where CH_3NH_2 forms only 2° amine? **(3)**

25. Label the glucose and fructose units in the following disaccharide and identify anomeric carbon atoms in these units. Is the sugar reducing in nature? Explain. **(3)**



Note : In question 26 and 27. A statement of assertion followed by a statement of reason is given. Choose the correct answer out of the option given below each equation.

26. **Assertion** : When NaCl is added to water a depression in freezing point is observed.

Reason : The lowering of vapour pressure of a solution causes depression in the freezing point. **(2)**

(i) Assertion and reason both are correct statements and reason is correct explanation for assertion.

(ii) Assertion and reason both are correct statements but reason is not correct explanation for assertion.

(iii) Assertion is correct statement but reason is wrong statement.

(iv) Assertion and reason both are incorrect statements.

(v) Assertion is wrong statement but reason is correct statement.

27. **Assertion** : Bond angle in ethers is slightly less than the tetrahedral angle.

Reason : There is repulsion between the two bulky (—R) groups. **(2)**

(i) Assertion and reason both are correct statements and reason is correct explanation for assertion.

(ii) Assertion and reason both are correct statements but reason is not correct explanation for assertion.

(iii) Assertion is correct statement but reason is wrong statement.

(iv) Assertion and reason both are incorrect statements.

(v) Assertion is wrong statement but reason is correct statement.

28. Explain why does the enthalpy change of a reaction remain unchanged even when a catalyst is used in the reaction. **(5)**

or

With the help of an example explain what is meant by pseudo first order reaction.

29. When a chromite ore (A) is fused with sodium carbonate in free excess of air and the product is dissolved in water, a yellow solution of compound (B) is obtained. After treatment of this yellow solution with sulphuric acid, compound (C) can be crystallised from the solution. When compound (C) is treated with KCl solution, orange crystals of compound (D) crystallise out. Identify compounds A to D and also explain the reactions. **(5)**

or

An oxide of mangnese (A) is fused with KOH in the presence of an oxidising agent and dissolved in water. A dark green solution of compound (B) is obtained. Compound (B) disproportionates in neutral or acidic solution to give purple compound (C). Alkaline solution of (C) oxidises potassium iodide solution to a compound (D) and compound (A) is also formed. Identify compounds A to D and also explain the reactions involved. **(5)**

30. An aromatic compound 'A' (Molecular formula C_8H_8O) gives positive 2, 4-DNP test. The compound gives a yellow precipitate of compound 'B' on treatment with iodine and sodium hydroxide solution. It does not give Tollen's or Fehling's test. On drastic oxidation with potassium permanganate it forms a carboxylic acid 'C' (Molecular formula $C_7H_6O_2$) which is also formed along with the yellow compound in the above reaction. Identify compounds A, B and C and write all the reactions involved. **(5)**

or

An organic compud 'A' (C_3H_4) on hyration in presence of $H_2SO_4/HgSO_4$ gives compound 'B' (C_3H_6O). Compound 'B' gives white crystalline product (D) with sodium hydrogensulphite. It gives negative Tollen's test and positive iodoform's test. On drastic oxidation 'B' gives compound 'C' ($C_2H_4O_2$) along with formic acid. Identify compounds 'A', 'B' and 'C' and explain all the reactions.

Guidelines for Evaluation (Marking Scheme)

1. (iii) (1)

2. (i) (1)

3. (ii) (1)

4. (ii) (1)

5. (i), (iv) (2)

6. (i), (iii) (2)

7. Emulsifying agent forms an interfacial film between suspended particles and the particles of dispersion medium. (1)

8. Zone refining is based on the principle that impurities are more soluble in melt than in the solid state of metals. (1)

9. Cross links bind the polymer chains. These help the polymer to come to the original position after the stretching force is released. Thus, increase its elastomeric properties. (1)

10. Aspartame (1)

11. In semiconductors, the gap between the valence band and the conduction band is small. On increasing temperature, more electrons can jump from valence band to conduction band and conductivity increases. (2)

12. $NO_3^- + 3Fe^{2+} + 4H^+ \longrightarrow NO + 3Fe^{3+} + 2H_2O$

$[Fe(H_2O)_6]^{2+} + NO \longrightarrow [Fe(H_2O)_5(NO)]^{2+} + H_2O$

Distribution of marks

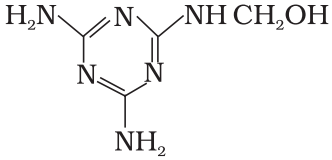
- 1 mark for each equation (1 × 2 = 2 marks)

13. Increasing order is $[Cr(Cl)_6]^{3-} < [Cr(NH_3)_6]^{3+} < [Cr(CN)_6]^{3-}$

Distribution of marks

- Correct order (2 marks)

14. Allyl chloride shows high reactivity as the carbocation formed by hydrolysis is stabilised by resonance where as no resonance stabilisation of carbocation formed by *n*-propyl chloride is possible. (2 makrs)

15. 

(Monomer, an intermediate)

Distribution of marks

- Monomer unit (1 mark)
- Starting material melamine and formaldehyde (½ × 2 = 1 mark)

16. Antacids control only the symptoms and not the cause. They work by neutralising the acid produced in the stomach. Antihistamines control the cause of production of more acid. These suppress the action of histamine which stimulates of secretion of pepsin and HCl in the stomach. Antihistamines prevent the binding of histamine with its receptors present in the stomach wall. As a result acid production is lowered and are thus better treatment. (2 marks)

17. NaCl is a non volatile solute. Addition of NaCl in water therefore lowers the vapour pressure of water. As a result boiling point of water increases. Methyl alcohol on the other hand is more volatile than water. Therefore, its addition increases the total vapour pressure over the solution and a decrease in boiling point of water results. (3 marks)

18. Under the conditions of electrolysis of aqueous sodium chloride, oxidation of water at anode requires overpotential hence Cl^- is oxidised instead of water.

Distribution of marks

- Explanation (2 marks)
- Reaction (1 mark)

19. Copper is extracted by hydrometallurgy from low grade copper ores. It is leached out using acid or bacteria. The solution containing Cu^{2+} is treated with scrap iron, Zn or H_2.

$Cu^{2+}(aq) + H_2(g) \longrightarrow Cu(s) + 2H^+(aq)$

$Cu^{2+} + Fe(s) \longrightarrow Fe^{2+}(aq) + Cu(s)$

Distribution of marks

- Reactions (1 × 2 = 2 marks)
- Explanation (1 mark)

20. $P_4O_6 + 6H_2O \longrightarrow 4H_3PO_3$

$[H_3PO_3 + 2NaOH \longrightarrow Na_2HPO_3 + 2H_2O] \times 4$

$P_4O_6 + 8NaOH \longrightarrow 4Na_2HPO_4 + 2H_2O$

1mol 8 mol

Product formed by 1 mol P_4O_6 is neutralised by 8 mol NaOH

$\therefore$ Product formed by $\frac{1.1}{220}$ mol P_4O_6 will be neutralised by $\frac{1.1}{220} \times 8$ mol NaOH

Molarity of NaOH solution is 0.1M

$\Rightarrow$ 0.1 mol NaOH is present in 1 L solution

$\therefore$ $\frac{1.1}{220} \times 8$ mol NaOH is present in $\frac{1.1 \times 8}{220 \times 0.1}$ L = $\frac{88}{220}$ L = $\frac{4}{10}$ L

= 0.4 L

= 400 mL NaOH solution

Distribution of marks

- Correct chemical euqations (½ × 3 = 1½ mark)
- Correct method of calculation (1 mark)
- Correct answer (½ mark)

21. Since complex of the type $[M(AA)_2 X_2]^{n+}$ is optically active it indicates that complex has cis-octahedral structure. e.g. *cis*-$[Pt(en)_2(Cl)_2]^{2+}$ or *cis*-$[Cr(en)_2(Cl)_2]^{+}$.

Distribution of marks

- Electronic configuration in the presence of weak field ligand (1 marks)
- Electronic configuration in the presence of strong field ligand (1 mark)
- Explanation (1 mark)

22. $CH_3—\underset{\displaystyle CH_3}{\overset{\displaystyle CH_3}{\overset{|}{\underset{|}{C}}}}=CH_2 + HCl \longrightarrow CH_3—\underset{\displaystyle CH_3}{\overset{\displaystyle Cl}{\overset{|}{\underset{|}{C}}}}—CH_3$

Isobutylene *2-Chloro-2-methylpropane*

The mechanism involved in this reaction is as follows :

Step I :

$CH_3—\underset{\displaystyle CH_3}{\overset{\displaystyle CH_3}{\overset{|}{\underset{|}{C}}}}=CH_2 \xrightarrow{H^+} CH_3—\underset{\displaystyle CH_3}{\overset{\displaystyle CH_3}{\overset{|}{\underset{|}{\overset{+}{C}}}}} + CH_3—\underset{\displaystyle CH_3}{\overset{|}{CH}}—\overset{+}{CH_2}$

Isobutylene *3° Carbocation (More stable)* *1° Carbocation (Less stable)*

Step II:

$CH_3—\underset{\displaystyle CH_3}{\overset{\displaystyle CH_3}{\overset{|}{\underset{|}{\overset{+}{C}}}}} \xrightarrow{Cl^-} CH_3—\underset{\displaystyle CH_3}{\overset{\displaystyle Cl}{\overset{|}{\underset{|}{C}}}}—CH_3$

Distribution of marks

- Structure of isobutylene (½ mark)

- IUPAC name of the product (½ mark)
- 2 steps of mechanism (2 marks)

23. The reaction of alochol with Lucas reagent proceeds through carbocation formation. More stable is the carbocation, faster is the reaction. Carbocation formed by 1° alochol is least stable hence reaction is slow.

Distribution of marks

- Reaction (½ × 3 = 1½ mark)
- Reason (1½ mark)

24. $H_3CNH_2 \xrightarrow{KOH/CHCl_3} H_3CNC \xrightarrow{H_2/Pd} H_3CNHCH_3$

Carbylamine reaction is shown by 1° amine only which results in the formation of isocyanide. The isocynide on catalytic reduction will give a methyl group containing secondary amine.

Distribution of marks

- Writing correct reagent (½ + ½ = 1 mark)
- 1 mark for each step (1 × 2 = 2 marks)

25. C1 of glucose unit and C2 of fructose unit are anomeric carbon atoms in this disaccharide. The disaccharide is non reducing sugar because —OH groups attached to anomeric carbon atoms are involved in the formation of glycoside bond.

Distribution of marks

- Recognising glucose and fructose units correctly (½ mark)
- Identification of anomeric carbon (½ × 2 = 1 mark)
- Proper explanation for non reducing nature (1½ marks)

26. (i) (1)

27. (v) (1)

28. **Distribution of marks**

- Correct diagram (2 marks)
- Correct explanation (3 marks)

or

Distribution of marks

- Correct example (2 marks)
- Correct explanation (3 marks)

29. A = $FeCr_2O_4$ B =. Na_2CrO_4 C = $Na_2Cr_2O_7.2H_2O$ D = $K_2Cr_2O_7$

$4FeCr_2O_4 + 8Na_2CO_3 + 7O_2 \longrightarrow 8Na_2CrO_4 + 2Fe_2O_3 + 8CO_2$

$2NaCrO_4 + 2H^+ \longrightarrow Na_2Cr_2O_7 + 2Na^+ + H_2O$

$Na_2Cr_2O_7 + 2KCl \longrightarrow K_2Cr_2O_7 + 2NaCl$

or

A = MnO_2 (B) K_2MnO_4 (C) $KMnO_4$ (D) KIO_3

$2\ MnO_2 + 4KOH + O_2 \longrightarrow 2K_2MnO_4 + 2H_2O$
(A) (B)

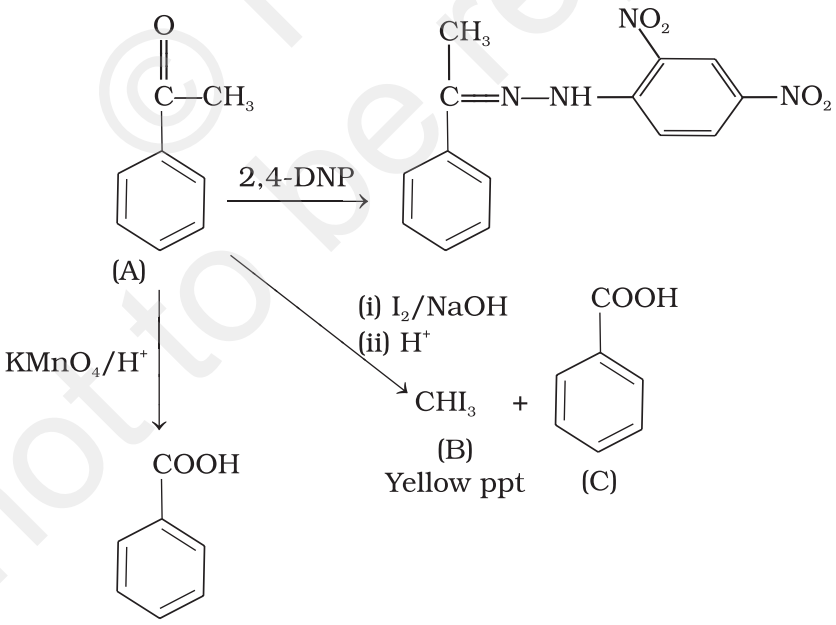
$3MnO_4^{2-} + 4H^+ \longrightarrow 2MnO_4^- + MnO_2 + 2H_2O$
(C)

$2MnO_4^- + H_2O + KI \longrightarrow 2MnO_2 + 2OH^- + KIO_3$
(A) (D)

Distribution of marks

- ½ mark for each correct identification (½ × 4 = 2 marks)
- 1 mark for each correct chemical equation with explanation (1 × 3 = 3 marks)

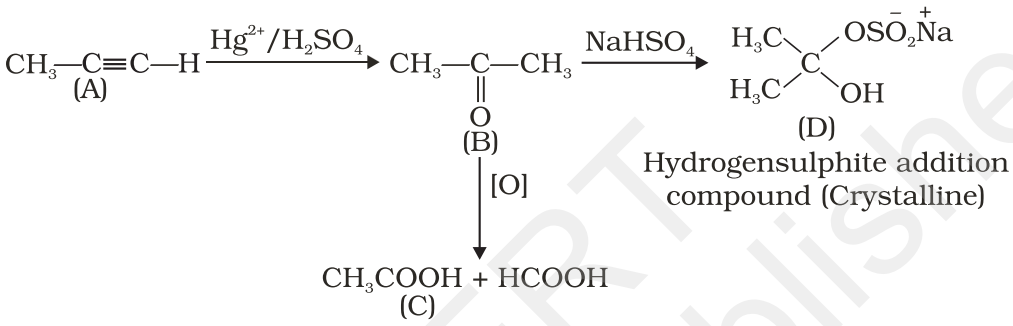
30. **Hint :**



Distribution of marks

- Recognising presence of carbonyl group (½ mark)
- Recognising presence of ketonic group (½ mark)
- Structure of 2,4–DNP derivative and benzoic acid (1 mark)
- Structures of compounds 'A', 'B' and 'C' (1 × 3 = 3 marks)

or



Compound B is a ketone therefore Fehling's test and tollens tests are negative.

Distribution of marks

- For identification of compounds 'A', 'B', 'C', 'D' half mark of each (½ × 4 = 2 marks)
- 1 Mark each for writing three chemical equation (1 × 3 = 3 marks)