

## CHEMISTRY

*Time Allowed: 3 hours**Maximum Marks: 70***General Instructions:**

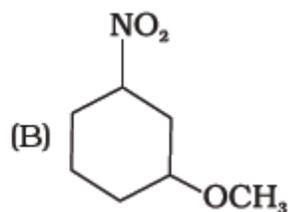
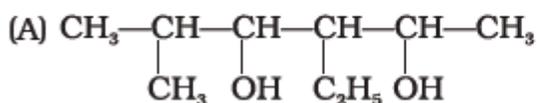
- (i) *All questions are compulsory.*
- (ii) *Questions No. 1 to 5 are very short answer type questions and carry 1 mark each.*
- (iii) *Questions No. 6 to 10 are short-answer questions and carry 2 marks each.*
- (iv) *Questions No. 11 to 22 are also short-answer questions and carry 3 marks each.*
- (v) *Questions No. 23 is a value based question and carry 4 marks.*
- (vi) *Questions No. 24 to 26 are long-answer questions and carry 5 marks each.*
- (vii) *Use Log Tables, if necessary. Use of calculators is **not** allowed.*

1. Give an example of an amorphous solid. 1
2. Considering the formation, breaking and strength of hydrogen bond, predict an example of a mixture that will show a positive deviation from Raoult's law. 1
3. When does physical adsorption of a gaseous species change into chemical adsorption? 1
4. Brine is electrolysed by using inert electrodes. What is the reaction at anode? 1

5. How many single and double bonds are present in cyclotrimetaphosphoric acid molecule? 1
6. How does sprinkling of salt help in clearing the snow covered roads in hilly areas? Explain the phenomenon involved in the process. 2
7. A first order reaction is 50% completed in  $1.26 \times 10^{14}$  s. How much time would it take for 100% completion? 2
8. How is copper extracted from low grade copper ores? 2

**OR**

- What is the role of flux in metallurgical processes? 2
9. Write the IUPAC name of the following compounds.



10. Name the sugar present in milk. How many monosaccharide units are present in it? What are such oligosaccharides called? 2
11. What is the role of  $\text{HNO}_3$  in the nitrating mixture used for nitration of benzene? 3

12. 4l of 0.02 M aqueous solution of NaCl was diluted by adding one litre of water. What will be the molality of the resultant solution? 3
13. In Kolbe's reaction, instead of phenol, phenoxide ion is treated with carbon dioxide. Why? 3
14. Under what reaction conditions (acidic/basic), the coupling reaction of aryldiazonium chloride with aniline is carried out? 3
15. How do you explain the presence of all the six carbon atoms in glucose in a straight chain? 3
16. Explain why does conductivity of germanium crystals increase on doping with gallium. 3
17. Explain the difference between instantaneous rate of a reaction and average rate of a reaction. 3
18. How does it become possible to cause artificial rain by spraying silver iodide on the clouds? 3

**OR**

- Gelatin which is a peptide is added in icecreams. What can be its role? 3
19.  $\text{PH}_3$  forms bubbles when passed slowly in water but  $\text{NH}_3$  dissolves. Explain why? 3

20.  $\text{SF}_6$  is known but  $\text{SCl}_6$  is not. Why? 3
21. A coordination compound  $\text{CrCl}_3 \cdot 4\text{H}_2\text{O}$  precipitates silver chloride when treated with silver nitrate. The molar conductance of its solution corresponds to a total of two ions. Write structural formula of the compound and name it. 3
22. Aryl chlorides and bromides can be easily prepared by electrophilic substitution of arenes with chlorine and bromine respectively in the presence of Lewis acid catalysts. But why does preparation of aryl iodides requires presence of an oxidising agent? 3
23. An innovative washer woman while washing a copper miner's clothes found that sand and similar dirt particle fell to the bottom, while the ore particles stuck to the soapsuds and came to the top. The washer woman discussed this matter with a client who was a chemist.
- a. What do you think the chemist explained to the woman about this observation?
- b. What moral is hidden in this incident? 4
24. a. What is electrode potential?
- b. Aqueous copper sulphate solution and aqueous silver nitrate solution are electrolysed by 1 ampere current for 10 minutes in separate electrolytic cells.

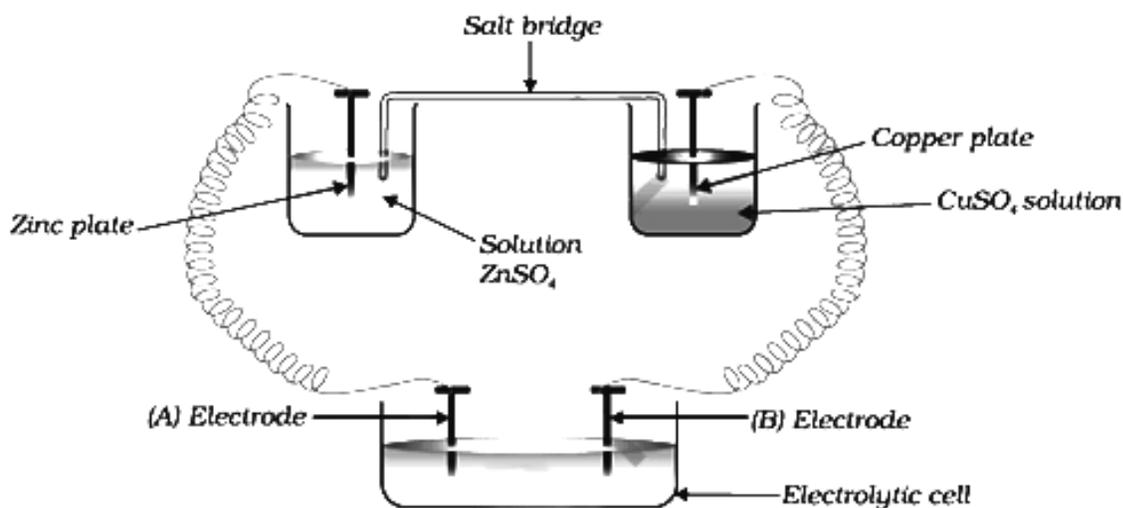
Will the mass of copper and silver deposited on the cathode be same or different? Explain your answer.

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OR

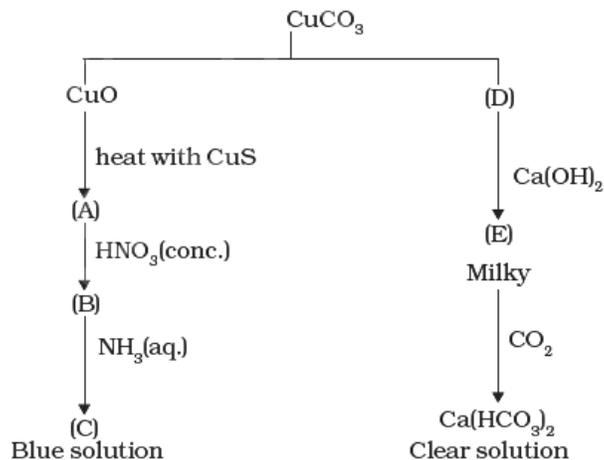
- a. Depict the galvanic cell in which the cell reaction is  
b.  $\text{Cu} + 2\text{Ag}^+ \longrightarrow 2\text{Ag} + \text{Cu}^{2+}$

Consider the following diagram in which an electrochemical cell is coupled to an electrolytic cell. What will be the polarity of electrodes 'A' and 'B' in the electrolytic cell?



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25. Identify A to E and also explain the reactions involved.



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**OR**

When an oxide of manganese (A) is fused with KOH in the presence of an oxidising agent and dissolved in water, it gives a dark green solution of compound (B). Compound (B) disproportionates in neutral or acidic solution to give purple compound (C). An alkaline solution of compound (C) oxidizes potassium iodide solution to a compound (D) and compound (A) is also formed. Identify compounds A to D and also explain the reactions involved.

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26. a. Illustrate the following reactions giving a suitable chemical equation for each:
1. Aldol condensation
  2. Cannizaro's reaction
- b. Draw the structures of the following compounds:
1. Phenyl acetaldehyde
  2. 2-Hydroxycyclopentanecarbaldehyde
  3. 2-Nitropropiophenone

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**OR**

An alkene 'A' (Mol. formula  $C_5H_{10}$ ) on ozonolysis gives a mixture of two compounds 'B' and 'C'. Compound 'B' gives positive Fehling's test and also forms iodoform on treatment with  $I_2$  and  $NaOH$ . Compound 'C' does not give Fehling's test but forms iodoform. Identify the compounds A, B and C. Write the reaction for ozonolysis and formation of iodoform from B and C.

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## ANSWERS

1. Quartz glass ( $\text{SiO}_2$ )-
2. Methanol and acetone
3. With increase in temperature
4.  $\text{Cl}^-(\text{aq}) \rightarrow \frac{1}{2} \text{Cl}_2(\text{g}) + \text{e}^-$ ;  $E^\theta_{\text{cell}} = 1.36 \text{ V}$
5. 3 double bonds and 9 single bonds.
6. When salt is spread over snow covered roads, snow starts melting from the surface because of the depression in freezing point of water and it helps in clearing the roads.
7. Infinite
8. Copper is extracted by hydrometallurgy from low grade copper ores. It is leached out using acid or bacteria. The solution containing  $\text{Cu}^{2+}$  is treated with scrap iron, Zn or  $\text{H}_2$ .  
$$\text{Cu}^{2+}(\text{aq}) + \text{H}_2(\text{g}) \rightarrow \text{Cu}(\text{s}) + 2\text{H}^+(\text{aq})$$
$$\text{Cu}^{2+} + \text{Fe}(\text{s}) \rightarrow \text{Fe}^{2+}(\text{aq}) + \text{Cu}(\text{s})$$

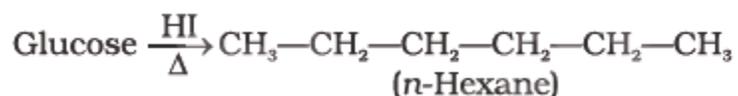
**OR**

Flux is used to make the molten mass more conducting.

9. a. 3-Ethyl-5-methylhexane-2,4-diol

b. 1-Methoxy-3-nitrocyclohexane

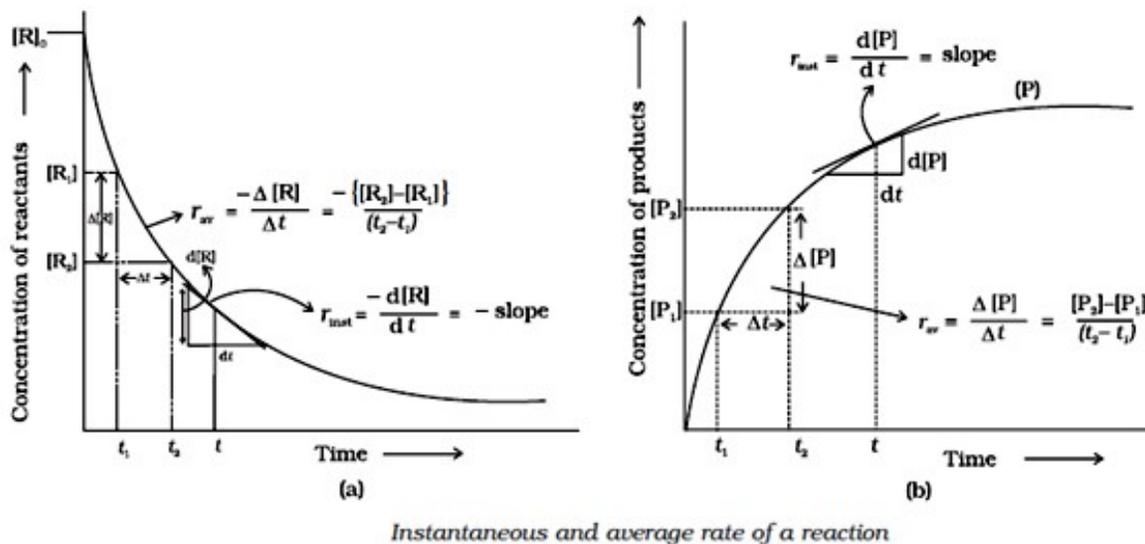
10. Lactose, two monosaccharide units are present. Such oligosaccharides are called disaccharides.
11.  $\text{HNO}_3$  acts as a base in the nitrating mixture and provides the electrophile,  $\text{NO}_2^+$
12. 0.016
13. Phenoxide ion is more reactive than phenol towards electrophilic aromatic substitution and hence undergoes electrophilic substitution with carbon dioxide which is a weak electrophile.
14. Reaction is done in mild basic conditions.
15. On prolonged heating with HI, glucose gives n-hexane.



16. On doping germanium with gallium some of the positions of lattice of germanium are occupied by gallium. Gallium atom has only three valence electrons. Therefore, fourth valency of nearby germanium atom is not satisfied. The place remains vacant. This place is deficient of electrons and is therefore called electron hole or electron vacancy. Electron from neighbouring atom comes and fills the gap, thereby creating a hole in its original position. Under the influence of electric field electrons move

towards positively charged plates through these holes and conduct electricity. The holes appear to move towards negatively charged plates.

17.



18. Clouds are colloidal in nature and carry charge. Spray of silver iodide, an electrolyte, results in coagulation leading to rain.

OR

Ice-creams are emulsions which get stabilised by emulsifying agents like gelatin.

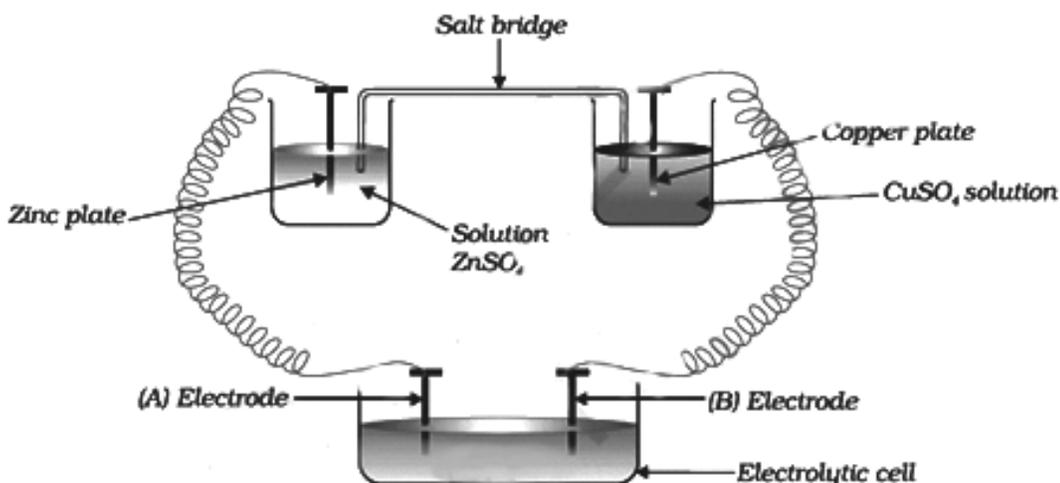
19. It has trigonal bipyramidal geometry

20. Due to small size of fluorine, six  $F^-$  ion can be accommodated around sulphur whereas chloride ion is comparatively larger in size, therefore, there will be interionic repulsion.

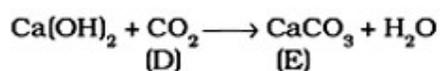
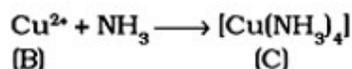
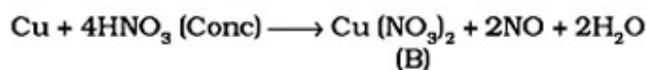
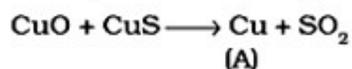
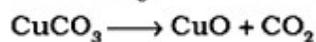
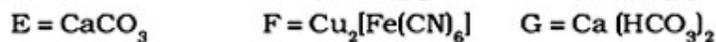
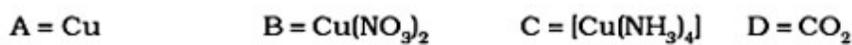
21.  $[\text{Co}(\text{H}_2\text{O})_4\text{Cl}_2]\text{Cl}$  (tetraaquadichloridocobalt(III) chloride)
22. Iodination reactions are reversible in nature. To carry out the reaction in the forward direction, HI formed during iodination is removed by oxidation.  $\text{HIO}_4$  is used as an oxidising agent.
23. a. The miner's clothes had particles of  $\text{CuS}$  /  $\text{Cu}_2\text{S}$  on it. This adhered to the froth and came up.  
b. Keen observation can lead to great discoveries.
24. a. A potential difference develops between the electrode and the electrolyte which is called electrode potential.  
b. Different

OR

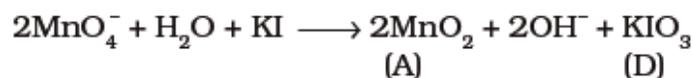
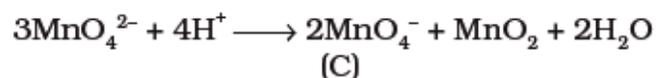
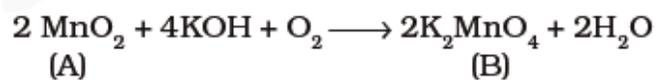
- a.  $\text{Cu} \mid \text{Cu}^{2+} \parallel \text{Ag}^+ \mid \text{Ag}$
- b. 'A' will have negative polarity  
'B' will have positive polarity



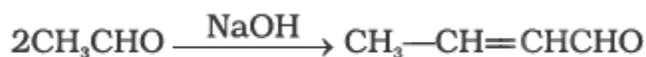
25.



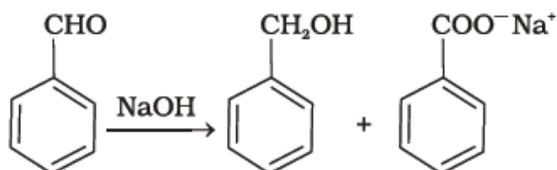
OR



26. a. 1. Aldol condensation

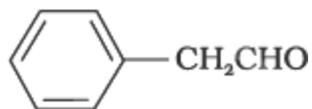


2. Cannizaro's reaction

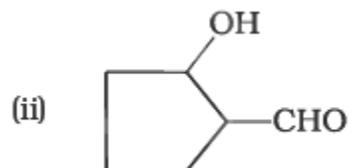


b. Draw the structures of the following compounds:

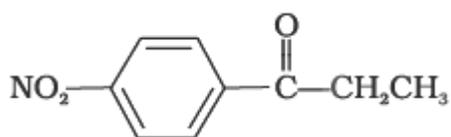
1. Phenyl acetaldehyde



2. 2-Hydroxycyclopentanecarbaldehyde



3. 2-Nitropropiophenone



OR

