

Question Paper

Conducted by the Central Board of Secondary Education (CBSE)



Time Allowed: 3 Hours

Maximum Marks: 70

General Instructions

- (i) This question paper contains **27 questions**. All questions are compulsory.
- (ii) Section A: Questions 1 to 5 are very short answer questions, carrying 1 mark each.
- (iii) Section B: Questions 6 to 12 are short answer questions, carrying 2 marks each.
- (iv) Section C: Questions 13 to 24 are short answer questions, carrying 3 marks each.
- (v) Section D: Questions 25 to 27 are long answer questions, carrying 5 marks each.
- (vi) Attempt one alternative where an internal choice is provided. Follow the instructions within each question.
- (vii) Use of calculators is not allowed.

Section A

1. What is the coordination number of atoms in a (i) bcc structure, and (ii) fcc structure?

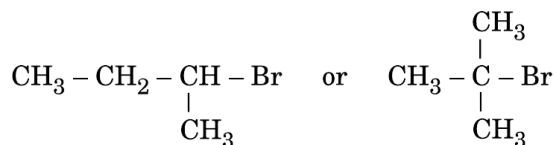
2. Why are powdered substances more effective adsorbents than their crystalline forms?

3. When a coordination compound $\text{CrCl}_3 \cdot 6\text{H}_2\text{O}$ is mixed with AgNO_3 , two moles of AgCl are precipitated per mole of the compound. What is the structural formula of the coordination compound?

OR

What is the difference between a complex and a double salt?

4. Which alkyl halide from the following pair would you expect to react more rapidly by an $\text{S}_{\text{N}}2$ mechanism?



5. Write the reaction involved in the Hoffmann bromamide degradation reaction.

OR

Propanamine and N,N-dimethylmethanamine contain the same number of carbon atoms, even though Propanamine has higher boiling point than N,N-dimethylmethanamine. Why?

Section B

6. When dilute ferrous sulphate solution is added to an aqueous solution containing nitrate ion followed by careful addition of concentrated sulphuric acid along the sides of test tube, a brown ring is formed at the interface between the solution and sulphuric acid layers. Which anion is confirmed by the appearance of brown ring? What is the composition of the brown ring?

OR

How can you prepare Cl_2 from HCl and HCl from Cl_2 ? Write reactions only.

7. Define electrochemical cell. What happens when applied external potential becomes greater than E_{emf} of electrochemical cell?

8. Give reasons for the following:

- (a) Aquatic species are more comfortable in cold water than warm water.
- (b) At higher altitudes people suffer from anoxia resulting in inability to think.

OR

What type of azeotropic mixture will be formed by a solution of acetone and chloroform? Justify on the basis of strength of intermolecular interactions that develop in the solution.

9. Write the equations involved in the following reactions:

- (a) Kolbe's reaction
- (b) Friedel-Crafts alkylation of anisole

10. Use the data to answer the following and also justify giving reason:

	Cr	Mn	Fe	Co
$E^\circ_{\text{M}^{2+}/\text{M}}$	-0.91	-1.18	-0.44	-0.28
$E^\circ_{\text{M}^{3+}/\text{M}^{2+}}$	-0.41	+1.57	+0.77	+1.97

- (a) Which is a stronger reducing agent in aqueous medium, Cr^{2+} or Fe^{2+} and why?
- (b) Which is the most stable ion in +2 oxidation and why?

11. Classify the following as addition and condensation polymers giving reason:

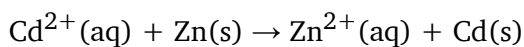
- (a) Teflon
- (b) PHBV

12. Write the structures of monomers of the following polymers:

- (a) Terylene
- (b) Buna-N

Section C

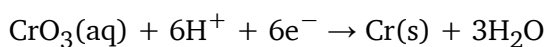
13. Calculate $\Delta_r G^\circ$ and $\log K_c$ for the following reaction:



Given: $E^\circ_{\text{Cd}^{2+}/\text{Cd}} = -0.403 \text{ V}$; $E^\circ_{\text{Zn}^{2+}/\text{Zn}} = -0.763 \text{ V}$

OR

Chromium metal is electroplated using an acidic solution containing CrO_3 according to the following equation:



Calculate how many grams of chromium will be electroplated by 24,000 coulombs. How long will it take to electroplate 1.5 g chromium using 12.5 A current?

[Atomic mass of Cr = 52 g mol^{-1} , $1 \text{ F} = 96500 \text{ C mol}^{-1}$]

14. At 300 K, 30 g of glucose present in a litre of its solution has an osmotic pressure of 4.98 bar. If the osmotic pressure of a glucose solution is 1.52 bar at the same temperature, what would be its concentration?

15. Give reasons for the following:

- (a) Brownian movement provides stability to the colloidal solution.
- (b) True solution does not show Tyndall effect.
- (c) Addition of alum purifies the water.

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17. Explain the method of preparation of sodium dichromate from chromite ore. Give the equation representing oxidation of ferrous salts by dichromate ion.

OR

Complete the following reactions:

- (a) $\text{MnO}_2 + \text{KOH} + \text{O}_2 \rightarrow$
- (b) $\text{I}^- + \text{MnO}_4^- + \text{H}^+ \rightarrow$
- (c) $\text{Cr}_2\text{O}_7^{2-} + \text{Sn}^{2+} + \text{H}^+ \rightarrow$

18. What is the role of

- (a) Depressants in froth floatation?
- (b) Carbon monoxide in Mond's process?
- (c) Concentrated sodium hydroxide in leaching of alumina from bauxite?

OR

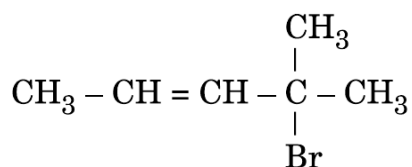
Write chemical reactions taking place in the extraction of Aluminium from Bauxite ore.

19. Give reasons for the following:

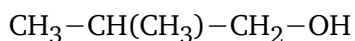
- (a) The presence of $-\text{NO}_2$ group at ortho or para position increases the reactivity of haloarenes towards nucleophilic substitution reactions.
- (b) p-dichlorobenzene has higher melting point than that of ortho or meta isomer.
- (c) Thionyl chloride method is preferred for preparing alkyl chloride from alcohols.

OR

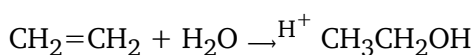
- (a) Write equation for preparation of 1-iodobutane from 1-chlorobutane.
- (b) Out of 2-bromopentane, 2-bromo-2-methylbutane and 1-bromopentane, which compound is most reactive towards elimination reaction and why?
- (c) Give IUPAC name of:



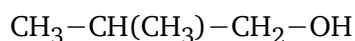
20. (a) Show how you will synthesise the following alcohol prepared by the reaction of a suitable Grignard reagent on methanal?



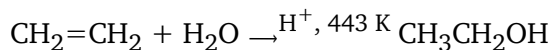
(b) Write the mechanism of the following reaction:



21. (a) Show how you will synthesise the following alcohol, prepared by the reaction of a suitable Grignard reagent on methanal:



(b) Write the mechanism of the following reaction:



22. (a) Give one chemical test to distinguish between the compounds of the following pairs:

- (i) CH_3NH_2 and $(\text{CH}_3)_2\text{NH}$
- (ii) Aniline and Ethanamine
- (b) Why aniline does not undergo Friedel-Crafts reaction?

23. What happens when D-Glucose is treated with the following reagents:

- (a) Br_2 water
- (b) HCN
- (c) $(\text{CH}_3\text{CO})_2\text{O}$

24. Define the following terms with a suitable example of each:

- (a) Antacids
- (b) Artificial sweeteners
- (c) Anionic detergents

Section D

25. (a) Carry out the following conversions:

(i) p-nitrotoluene to 2-bromobenzoic acid

(ii) Propanoic acid to acetic acid

(b) An alkene with molecular formula C_5H_{10} on ozonolysis gives a mixture of two compounds, B and C. Compound B gives positive Fehling test and also reacts with iodine and NaOH solution. Compound C does not give Fehling solution test but forms iodoform. Identify the compounds A, B and C.

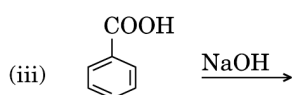
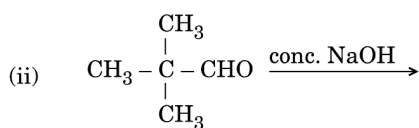
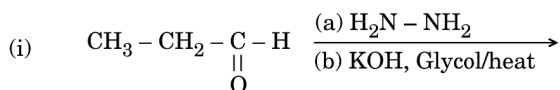
OR

(a) Carry out the following conversions:

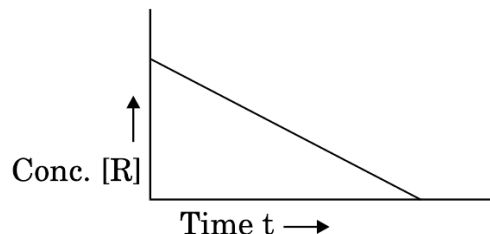
(i) Benzoic acid to aniline

(ii) Bromomethane to ethanol

(b) Write the structure of major product(s) in the following:



26. (a) Consider the reaction $R \rightarrow P$ for which the change in concentration of R with time is shown by the following graph:



(i) Predict the order of reaction.

(ii) What does the slope of the curve indicate?

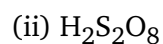
(b) The rate of reaction quadruples when temperature changes from 293 K to 313 K. Calculate E_a assuming that it does not change with time. [$R = 8.314 \text{ J K}^{-1} \text{ mol}^{-1}$]

OR

(a) Draw the plot of $\ln k$ vs $1/T$ for a chemical reaction. What does the intercept represent? What is the relation between slope and E_a ?

(b) A first order reaction takes 30 minutes for 20% decomposition. Calculate $t_{1/2}$. [$\log 2 = 0.3010$]

27. (a) Draw the structure of the following:



(b) Give reasons for the following:

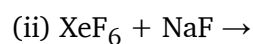
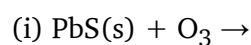
(i) Above 1000 K sulphur shows paramagnetism.

(ii) Although electron gain enthalpy of fluorine is less negative than that of chlorine, yet fluorine is a better oxidising agent than chlorine.

(iii) In solid state PCl_5 exists as an ionic compound.

OR

(a) Complete the following reactions:



(b) Arrange the following in increasing order of property indicated, giving reason:

(i) Hydrides of group 15 - boiling points

(ii) Hydrides of group 17 - acidic strength

(iii) Hydrides of group 16 - reducing character

- End of Question Paper -