

General Instructions

Chemistry

- (i) All questions are compulsory.
- (ii) Question numbers 1 to 5 are very short answer questions and carry 1 mark each.
- (iii) Question numbers 6 to 10 are short answer questions and carry 2 marks each.
- (iv) Question numbers 11 to 22 are also short answer questions and carry 3 marks each.
- (v) Question number 23 is a value based question and carries 4 marks.
- (vi) Question numbers 24 to 26 are long answer questions and carry 5 marks each.
- (vii) Use log tables if necessary. Use of calculator is not allowed.

Time Allowed : 3 Hours

Maximum Marks : 70

1. Write the structure of 4-tert-butyl-3-iodoheptane.
2. Ethers are soluble in water. Why?
3. Out of aldehydes and ketones which one is more reactive towards nucleophilic addition reaction?
4. What is the order of the reaction whose k value is $2.3 \times 10^{-5} \text{ L mol}^{-1} \text{ s}^{-1}$?
5. Why is bithionol added to soaps?
6. Draw a graph to show the variation of molar conductivity with concentration for weak and strong electrolytes.
7. A first order reaction has rate constant $1.15 \times 10^{-3} \text{ s}^{-1}$. How long will 5 g of this reactant take to reduce to 3.0 g?
8. Explain the following :
 - (i) Spectrochemical series
 - (ii) Crystal field splitting energy.
9. Calculate packing efficiency of *bcc* unit cell.
10. Write two differences between Frenkel and Schottky defects.

OR

Give reason

- (a) Why is Frenkel defect found in AgCl ?
- (b) What is the difference between phosphorus doped and gallium doped semiconductors?
11. All bonds in the molecule of PCl_5 are not equivalent. Explain.
12. Explain the following
 - (i) Ellingham diagram
 - (ii) Leaching
 - (iii) Use of cryolite in the extraction of aluminium.
13. Explain the following:
 - (i) Selectivity of a catalyst
 - (ii) Kraft temperature
 - (iii) Desorption.
14. Give reasons for the following
 - (i) Molecular nitrogen is chemically inert.

- (ii) BiH_3 is the strongest reducing agent among the hydrides of group-15 elements.
- (iii) NH_3 acts as a Lewis base.
15. The electrical resistance of a column of diameter 1 cm and length 50 cm containing 0.05 mol NaOH solution is 5.5×10^3 ohms. Calculate.
 - (i) Resistivity
 - (ii) Conductivity
 - (iii) Molar conductance.
16. Give the structures of products *A*, *B* and *C* in the following reactions:
 - (i) $\text{CH}_3\text{CH}_2\text{Br} \xrightarrow{\text{KCN}} \text{A} \xrightarrow{\text{LiAlH}_4} \text{B} \xrightarrow[0^\circ\text{C}]{\text{HNO}_2} \text{C}$
 - (ii) $\text{CH}_3\text{COOH} \xrightarrow[?]{\text{NH}_3} \text{A} \xrightarrow{\text{NaOH} + \text{Br}_2} \text{B} \xrightarrow{\text{CHCl}_3 + \text{alc. KOH}} \text{C}$
17. Write the structures of monomers of the following polymers.
 - (i) Bakelite
 - (ii) Teflon
 - (iii) Buna-N

OR

- (a) Give an example of a synthetic rubber and mention its main advantage.
- (b) Write the structures of the monomers of Dacron.
- (c) Arrange the following polymers in the increasing order of tensile strength. Nylon 6, Buna-S, Polythene
18. Discuss biological and industrial importance of osmosis.
19. (a) Write the mechanism of hydration of ethene to give ethanol.
- (b) Write the chemical equation for the reaction of HI with methoxy benzene.
20. What happens when
 - (i) glucose reacts with bromine water
 - (ii) sucrose boiled with dil. HCl or H_2SO_4 in alcoholic solution
 - (iii) glucose oxidised with nitric acid.

Explain the following with one suitable example of each

- (i) Tranquillizers (ii) Analgesics (iii) Antacids

How can you separate alumina from silica in a bauxite ore associated with silica? Give equations, if any.

One day Ankit and Gaurav were playing in school playground. While playing, Ankit fell down and got injured. Blood started oozing out of his knees and did not stop. Gaurav at once rushed to his games teacher and informed her. She took Ankit to the nearby hospital immediately. Doctor gave him first aid and then suggested him to include green leafy vegetables in his diet.

(i) W^{++} values were possessed by Gaurav?

(ii) Name the vitamin

- (a) responsible for blood clotting,
(b) present in green leafy vegetables.

Explain :

- (i) Out of the two $-NH_2$ groups in semi-carbazide only one involves in the formation of semicarbazone.
(ii) During ester formation water formed should be removed quickly.
(iii) Even though phenoxide ion has more resonating structures than carboxylate ion, carboxylic acids are more acidic than phenol.
(iv) α -hydrogens in aldehydes and ketones are acidic.
(v) Benzaldehyde does not give Fehling test.

OR

(a) An organic compound X undergoes acid hydrolysis to form two compounds Y and Z . Y reacts with sodium carbonate to form A . A is heated with soda lime to form B (CH_4). Y on reduction with $LiAlH_4$ form Z . Identify X , Y , Z , A and B and write the reactions involved.

(b) Account for the following :

- (i) Benzoic acid does not undergo Friedel-Craft reaction.
(ii) pK_a value of chloro acetic acid is lower than pK_a value of acetic acid.

5. (i) Mention one important application of Henry's law.
(ii) Calculate depression in freezing point when 1.225 g of chlorobutanoic acid is added to 250 g of water. Given $K_a = 1.4 \times 10^{-3}$, $K_f = 1.86 \text{ K kg mol}^{-1}$.
(iii) Osmotic pressure is more useful to calculate molecular mass than other colligative properties. Why?

OR

- (a) Define azeotropes and explain briefly minimum boiling azeotrope by taking suitable example.
(b) The vapour pressure of pure liquids A and B are 450 mm and 700 mm of Hg respectively at 350 K. Calculate the composition of liquid mixture if total vapour pressure is 600 mm of Hg. Also find the composition of the mixture in vapour phase.

26. (i) Name the lanthanoid element which stable well known +4 oxidation state.
(ii) Why are Mn^{2+} compounds more stable than Fe^{2+} towards their oxidation to +3 state?
(iii) What are the different oxidation states shown by actinoids?
(iv) Write the formula of the π compound formed by combination of lanthanoids with carbon.

OR

Explain the following :

- (a) Actinoids show large number of oxidation states.
(b) The transition metals form a large number of complex compounds.
(c) Chromium is a typical hard metal while mercury is a liquid.
(d) MnO is basic while Mn_2O_7 is acidic in nature.
(e) Silver is a transition metal but zinc is not.