

Chemistry 2006 (Outside Delhi)

General Instructions:

1. All questions are compulsory.
2. Marks for each question are indicated against it
3. Question numbers 1 to 5 are very short answer questions, carrying 1 mark each. Answer these in one word or about one sentence each.
4. Question numbers 6 to 12 are short answer questions, carrying 2 marks each. Answer these in about 30 words each.
5. Question numbers 13 to 24 are a/so short answer questions, carrying 3 marks each. Answer these in about 40 words each.
6. Question numbers 25 to 27 are long answer questions, carrying 5 marks each. Answer these in about 70 words each.
7. Use Log Tables, if necessary. Use of calculators is not permitted.

Q. 1. Name the non-stoichiometric point defect responsible for colour in alkali halides. (1)

Q. 2. Define 'mole fraction' of a substance in a solution. (1)

Q. 3. A reaction is 50% complete in 2 hours and 75% complete in 4 hours. What is the order of the reaction? (1)

Q. 4. Write the IUPAC name of $\text{CH}_3\text{COCH}_2\text{COCH}_3$. (1)

Q. 5. Give a chemical test to distinguish between a primary and a secondary amine. (1)

Q. 6. Account for the following:

i. N_2 has higher bond dissociation energy than NO . (1)

ii. N_2 and CO both have same bond order but CO is more reactive than N_2 (1)

Q. 7. At absolute zero, an exothermic reaction is always spontaneous but at temperatures above absolute zero, we have to consider both enthalpy and entropy before we can predict spontaneity. Why? (2)

Q. 8. Write the chemical equations involved in the preparation of the following: (2)

i. XeF_4

ii. H_3PO_3

Q 9 Why is the +2 oxidation state of manganese quite stable, while the same is not true for iron? [Mn = 25, Fe = 26] (2)

Q. 10. Differentiate between conformation and configuration in open chain molecules by giving one example each. **(2)**

Q. 11. Give reasons for the following:

- a. Ortho-nitrophenol is more acidic than ortho-methoxyphenol. **(1)**
- b. Glycerol is used in cosmetics. **(1)**

Q. 12. Write the structures of monomers used and one use of each of the following polymers: **(1)**

- a. Teflon
- b. Buna-N

Or

What are biodegradable polymers? Give two examples.

Q. 13. What is meant by dual nature of electrons? Calculate the energy and wavelength of the photon emitted by hydrogen atom when the electron makes a transition from $n = 2$ to $n = 1$. Given that the ionization potential is 13.6 eV. [$1 \text{ eV} = 1.6 \times 10^{-19} \text{ J}$]

Q. 14. Calculate the distance between Na^+ and Cl^- ions in NaCl crystal if its density is 2.165 g cm^{-3} . [Molar mass of NaCl = 58.5 g mole^{-1} ; $N_A = 6.02 \times 10^{23} \text{ mol}^{-1}$] **(3)**

Q. 15.

- a. Urea forms an ideal solution in water. Determine the vapour pressure of an aqueous solution containing 10% by mass of urea at 40°C .
(Vapour pressure of water at $40^\circ \text{C} = 55.3 \text{ mm of Hg}$) **(2)**
- b. Why is freezing point depression of 0.1 M sodium chloride solution nearly twice that of 0.1 M glucose solution? **(1)**

Q. 16. How is the concept of coupling reactions useful in explaining the occurrence of non-spontaneous thermochemical reactions? Explain giving an example. **(3)**

Q. 17. A certain reaction is 50% complete in 20 minutes at 300 K and the same reaction is again 50% complete in 5 minutes at 350 K. Calculate the activation energy, if it is a first order reaction. [$R = 8.314 \text{ JK}^{-1} \text{ mol}^{-1}$; $\log 4 = 0.602$] **(3)**

Q. 18.

- a. In which of the following does adsorption take place and why? **(1)**
 - i. Silica gel placed in the atmosphere saturated with water.
 - ii. Anhydrous CaCl_2 placed in the atmosphere saturated with water.
- b. How does BF_3 act as a catalyst in industrial process? **(1)**
- c. Give an example of shape-selective catalysis. **(1)**

Or

- a. What are micelles? How do they differ from ordinary colloidal particles? Give two examples of micelles forming substances. (2)
- b. State Hardy-Schulze rule. (1)

Q. 19.

- a. Write the electronic configuration of the element with atomic number 102. (1)
- b. What is lanthanoid contraction? What is its effect on the chemistry of the elements which follow the lanthanoids? (2)

Q. 20.

- a. Using valence bond theory, predict the shape and magnetic character of $[\text{Ni}(\text{CO})_4]$. $[\text{Ni} = 28]$ (2)
- b. Give one example of application of coordination compounds in medicine. (1)

Q. 21.

- a. State Group Displacement Law. Calculate the number of α - particles and β -- particles emitted when ${}_{92}^{238}\text{U}$ changes to ${}_{82}^{206}\text{Pb}$. (2)
- b. What is meant by K-capture in nuclear chemistry? (1)

Q. 22.

- a. Write the steps and conditions involved in the following conversions: (1)
- i. Acetophenone to 2-phenyl-2butanol (1)
- ii. Propene to acetone. (1)
- b. Give a chemical test to distinguish between Methyl acetate and Ethyl acetate.

Q. 23.

- a. Explain the following giving suitable examples: (2)
- i. Sandmeyer's reaction
- ii. Coupling reaction of a diazonium salt
- b. Explain the observed K_b order: $\text{Et}_2\text{NH} > \text{Et}_3\text{N} > \text{EtNH}_2$ in aqueous solution (1)

Q. 24. Define the following and give one example of each: (3)

- a. Antipyretics
- b. Vat dyes
- c. Antibiotics

Q. 25.

- a. State two advantages of $\text{H}_2 - \text{O}_2$ fuel cell over ordinary cell. (2)

- b. Silver is electrodeposited on a metallic vessel of total surface area 900 cm^2 by passing a current of 0.5 amp for two hours. Calculate the thickness of silver deposited.
[Given: Density of silver = 10.5 g cm^{-3} ,
Atomic mass of silver = 108 amu , $F = 96,500 \text{ C mol}^{-1}$] (3)

Or

- a. Give reasons for the following: (2)
- Rusting of iron is quicker in saline water than in ordinary water.
 - Aluminium metal cannot be produced by the electrolysis of aqueous solution of aluminium salt.
- b. Resistance of a conductivity cell filled with 0.1 M KCl solution is 100 ohm . If the resistance of the same cell when filled with 0.02 M KCl solution is 520 ohms , calculate the conductivity and molar conductivity of 0.02 M KCl solution. Conductivity of 0.1 KCl solution is 1.29 S m^{-1} (3)

Q. 26. Give reasons for each of the following:

- SiF_6^{2-} is known but SiCl_6^{2-} is not known. (1)
- Sulphur in vapour state exhibits paramagnetic behaviour. (1)
- PbO_2 is a stronger oxidizing agent than SnO_2 (1)
- H_3PO_2 acts as a monobasic acid. (1)
- Bond dissociation energy of F_2 is less than that of Cl_2 (1)

Or

- a. Account for the following:
- Thermal stability of water is much higher than that of H_2S (1)
 - Anhydrous aluminium chloride acts as a catalyst. (1)
 - White phosphorus is more reactive than red phosphorus. (1)
- b. Draw the structures of
- H_3PO_3 and
 - XeOF_4 (2)

Q. 27.

- What are essential and non-essential amino acids? Give two examples of each. (2)
- What are the two types of photosynthesis in green plants? Give the basic equations of photosynthesis. (2)
- Mention the two products of glycolysis. (1)

Or

- a. Define the following terms: (3)
- Co-enzymes
 - Mutation in biomolecules
 - Nucleotides
- b. List four main functions of carbohydrates in organisms. (2)