[This question paper contains 6 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 1498 **A**

Unique Paper Code : 42174404

Name of the Paper : Chemistry of s and p block Elements, States of Matter and Chemical Kinetics

Name of the Course : **B.Sc. Physical Science/Life Science**

Semester : IV

Duration : 3.5 Hours Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt **six** questions in all, three questions from **SECTION A** and **three** questions from **SECTION B**.
3. Use separate answer sheets for **Section A** and **Section B** and indicate the section you are attempting by putting a heading of Section.
4. The questions should be numbered in accordance to the number in the question paper.
5. Use of Scientific Calculator is permitted.

P.T.O.

SECTION A

(Inorganic Chemistry)

Attempt any **three** *questions from this section.*

1. (a) What is Ellingham's diagram? Draw it for metal oxides and give its salient features. (4.5)

   (b) List the three different scales of Electronegativity. Briefly describe the Pauling scale. (4)

   (c) Why first element in each of main groups differs from the rest of the group? Give anomalous behavior shown by Lithium. (4)

2. (a) Explain the hybridization in ortho-phosphoric acid. Give its structure and mechanism of its preparation from phosphorous pentoxide. (4.5)

   (b) Why graphite is a good conductor of electricity but diamond is not? (4)

   (c) Why first ionization enthalpy does not continue the decreasing trend from Al to Ga and In to Tl? (4)

3. (a) What are carbides? What happens when CaC_2, Al_4C_3 and Mg_2C_3 are hydrolysed? (4.5)

   (b) Using diborane, explain the concept of multi centre bonding. (4)

   (c) Complete any **four** reactions (4)

   (i) $SOCl_2 + H_2O \rightarrow$

   (ii) $P_4O_{10} + 6PCl_5 \rightarrow$

   (iii) $6HN_3 + 4\ Li \rightarrow$

   (iv) $4NH_3 + 3O_2 \rightarrow$

   (v) $SiC + 2NaOH + 2O_2 \rightarrow$

4. (a) Give the names of four different types of oxo acids of chlorine. Arrange them in order of increasing strength and give the justification in support of order. (4.5)

   (b) Short note on the following : (4×2)

   (i) van Arkel De Boer process

   (ii) Zone refining

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SECTION-B

(Physical Chemistry)

Attempt **Three** *questions from this section.*

$R = 8.314\ J\ K^{-1}\ mol^{-1}$ $\quad k = 1.38 \times 10^{-23}\ J\ K^{-1}$

$N_A = 6.023 \times 10^{23}$

5. (a) Write the postulates of kinetic theory of gases. Is it possible to liquify an ideal gas? (2.5)

(b) The van der Waals constant 'a' for N_2 and NH_3 are 1.39 and 4.17 dm^6 atm mol^{-2}, respectively. Which one of these two gases can be liquefied more easily and why? (2)

(c) In a crystal, the planes cut through the crystal axes at (2a, 3b, c) and (2a, –3b, –3c). Identify the Miller indices of these planes. (2)

(d) It is not possible to distinguish between K^+ and Cl^- ions by X-ray diffraction method. Explain. (2)

(e) Explain the effect of temperature on rate of a reaction. Give reasons for your answer. (2)

(f) The viscosity of liquids deceases while that of gases increases with rise in temperature. Explain. (2)

6. (a) Using the van der Waals equation, derive the relationships between critical constants and van der Waals constants of a real gas. (4)

(b) The viscosity of oxygen is at 7°C is 208 micropoise. Calculate the mean free path and collision diameter of oxygen molecules at STP. (4)

(c) What do you understand by the term surface tension? What are its units? Describe the stalagmometer method using water as reference for the measurement of surface tension of a liquid giving expression. (4.5)

7. (a) What are elements of symmetry in crystal systems? Describe number of various symmetry elements in cubic crystal system. (4)

(b) The density of $LiBH_4$ crystal is 0.668 g cm^{-3} and the unit cell dimensions are a = 6.81 Å, b = 4.43 Å and c = 7.17 Å. Determine whether the lattice is f.c.c. or b.c.c. The molar mass of $LiBH_4$ = 21.76 g mol^{-1}. (4)

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(c) Write expression of Maxwell distribution law molecular speeds. Name the terms involved in expression. Calculate the most probable, average and root mean square velocity of hydrogen gas molecules at 27°C. (4.5)

8. (a) Derive integrated rate expression for second order reaction assuming reactants to be different. (4)

(b) Derive expressions to determine order of reaction using half-life method and van't Hoff differential rate method. (4)

(c) What is the rate constant (k) of a reaction, $2N_2O_5 \longrightarrow 4NO_2 + O_2$ at 27°C? The activation energy and pre-exponential factor for the reaction are found to be 103.35 kJ mol^{-1} and 4.3×10^{13} s^{-1}, respectively. (4.5)