[This question paper contains 8 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 1151 **I**

Unique Paper Code : 2172012303

Name of the Paper : DSC: Chemical Equilibrium, Ionic Equilibrium, Conductance and Solid State

Name of the Course : **B.Sc. (Hons.) Chemistry**

Semester : III

Duration : 3 Hours Maximum Marks : 90

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt any **Six** questions in all.
3. Use of scientific calculator is permitted.

1. (a) State the Le Chatelier's principle. For the equilibrium reactions given below, discuss how the equilibrium will shift with the change in temperature and pressure :

(b) What are Miller Indices? Determine the Miller indices of the planes that intersect the crystallographic axes at the distance given below:

(i) (1a, 3b, -c)

(ii) (2a, 3b, 4c).

(c) A first-order reflection from the (111) planes of a cubic crystal were observed at a glancing angle of 11.2° when Cu (K_α) X-rays of wavelength 154 pm were used. What is the length of the side of the unit cell? Calculate the angle at which the same crystal will give a reflection from the (123) planes. (5,5,5)

4. (a) What is the effect of temperature change on the equilibrium constant? Derive a relation between K_p and T starting from the Gibbs Helmholtz equation.

(b) Explain the following :

(i) The molar conductivities of the alkali metal ions increase on going from Li^+ to Cs^+.

(ii) Acetate ions have lowerconductivity than chloride ions.

(c) State and explain Kohlrausch's law. Illustrate how this law is used for the calculation of molar ionic conductance at infinite dilution of weak electrolytes. (5,5,5)

5. (a) Describe the powder method to determine the crystal structure. Explain why it is not possible to deduce the position of hydrogen atoms from X-ray diffraction.

(b) Draw the planes for which the Miller indices are (112) and (200).

(c) What are Weiss indices? What are the corresponding Miller indices of the Weiss indices of crystal planes given below :

(i) (2a, 2b, 2c)

(ii) (a, b, ∞c) (5,5,5)

6. (a) Deduce the relation between K_h, K_a and K_w for a salt of a weak acid and a weak base. Also, find the pH of the hydrolyzed salt solution.

(b) What is pH scale? Calculate the pH of a solution obtained by mixing 25 mL of 0.2 M HCl with 50 mL of 0.25M NaOH. Take $K_w=10^{-14}$.

Concentration of HCl solution = 0.100 N

Mass of silver deposited in the coulometer = 0.1209 g

Movement of the boundary = 7.50 cm

Cross-section of the tube = 1.24 cm^2

(c) Define ionic mobility and show that, the ionic mobility of a solution (1:1 Electrolyte) at infinite dilution is given by

$$u_+^\circ + u_-^\circ = \frac{\lambda_+^\circ}{F} + \frac{\lambda_-^\circ}{F}$$

Where, u° is ionic mobility and λ° is molar ionic conductance. (5,5,5)