April 2025
B.A./B.Sc.
Second Semester
MINOR – 2
CHEMISTRY
Course Code: CHN 2.11
(States of Matter & Ionic Equilibria)

Total Mark: 50 *Pass Mark: 20*
Time: 2 hours

I. Answer the following questions.

1. (a) What do you meant by collision frequency? 2
   (b) If collision diameter of N_2 molecules is 374 pm at 300 K. Find the collision number of Nitrogen at this temperature.
   Given: R = 8.314 J/K/mole, $n^* = 2.447\times10^{24}$ molecules/m^3 2
   (c) Derive the kinetic gas equation, $PV = 1/3\ mNc^2$. 5
   (d) What do you understand by viscosity of gas? Explain. 3

2. (a) Write a short note on the structure of liquids. 2
   (b) What is surface tension? Determine the surface tension of a liquid by capillary rise method. 5
   (c) Write a note on the effect of addition of various solutes on surface tension and viscosity. 2
   (d) Calculate the number of atoms contained in 3
   (i) a primitive cubic unit cell
   (ii) a body centered cubic unit cell

3. (a) What do you mean by degree of ionization? Explain the factors affecting the degree of ionization. 4
   (b) At 25°C, the ionization constant of anilinium hydride is 4.6×10^{-10}. Taking ionic product of water as 1×10^{-14}, Calculate the following:
   (i) Hydrolysis constant of anilinium chloride
   (ii) Degree of hydrolysis
   (iii) pH value in 0.02 molar solution of the salt 3

(c) What is hydrolysis of salt? Explain the behavior of salt of weak acid and strong base and give the expression of hydrolysis constant for the said salt. 4

(d) What is ionic product of water? 1

II. Answer any two *of the following questions.*

4. (a) State and explain the law the law corresponding state. 4

(b) For hydrogen gas at 0°C, calculate the following: 3

(i) Root mean square velocity

(ii) Average velocity

OR

(a) Calculate the degrees of freedom for the following: 1×2=2

(i) CO_2

(ii) H_2O

(b) Explain and derive how van der Waals corrected the general equation of state for real gas. 5

5. (a) Explain law of constancy of interfacial angles. 3

(b) Derive Bragg's equation for determination of crystal structure. 4

OR

(a) Define Miller indices. Calculate the Miller indices of crystal planes which cut through the crystal axes at 3

(i) 2a, 2b, 3c

(ii) a, b, c

(b) What do you understand by Schottky and Frenkel defects? Explain. 4

6. (a) Derive the Henderson-Hasselbalch equation for the calculation of pH of buffer solution. 4

(b) A buffer solution contains 0.20 mole of NH_4OH and 0.25 mole of NH_4Cl per liter. Calculate the pH of the solution. The dissociation constant of NH_4OH at the room temperature is 1.81×10^{-5}. 3

OR

(a) Explain common ion effects with example. 3

(b) Discus the Ostwald's theory of acid-base indicators. 4