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

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

I. Answer the following questions.

1. (a) State Maxwell law for distribution of velocities among the molecules of a gas. How does a change in the temperature of a gas influence this distribution?   2+4=6
    (b) Discuss the following: 3×2=6
        (i)   Principle of equipartition of energy
        (ii) Significance of van der Waals constant *a* and *b*

2. (a) Define the term viscosity and coefficient of viscosity. Describe the principle and apparatus used for the measurement of coefficient of viscosity.   2+4=6
    (b) Explain the determination of crystal structure using Laue's and Powder method.   6

3. (a) What is meant by protic acids? Derive the dissociation constant of mono-, di- and tri-protic acids, considering the exact treatment.   1+5=6
    (b) Establish the relation between K_a, K_b, and K_w, degree of hydrolysis *h* and pH for salt of strong acid and weak base.   6

II. Answer <u>any two</u> of the following questions.

4. (a) State the postulates of kinetic molecular theory. Derive the kinetic gas equation $PV = \dfrac{1}{3}mNC^2$.   2+5=7

OR

    (b) Explain collision frequency. Point out the effect of temperature and pressure on collision frequency.   4+3=7

5. (a) What are liquid crystals? With the help of suitable diagram, explain the structural differences between smectic and nematic liquid crystals. $\qquad$ 1+6=7

OR

(b) Write a note each on the following: $\qquad$ 3½×2=7
   (i) Schottky defects and Frenkel defects in solids
   (ii) Law of constancy of interfacial angles and law of rational indices

6. (a) What is meant by degree of ionisation? Mention six factors affecting degree of ionisation. $\qquad$ 1+3=4
   (b) Ionisation constant of acetic acid and ionic product of water at 25°C are 1.75×10^{-5} and 1×10^{-14} respectively. Calculate the hydrolysis constant of sodium acetate and its degree of hydrolysis in 0.1 molar solution. $\qquad$ 3

OR

   (a) Derive Henderson-Hasselbatch equation for calculation of pH of acidic buffer mixture. $\qquad$ 4
   (b) What would be the pH of a solution obtained by mixing 5 gram of acetic acid and 7.5 gram sodium acetate and making the volume equal to 500ml? Dissociation constant of acetic acid at 25°C is 1.75×10^{-5}. $\qquad$ 3

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