2022
B.A./B.Sc.
First Semester
CORE – 2
CHEMISTRY
Course Code: CHC 1.21
(Physical Chemistry – I)

Total Mark: 70 *Pass Mark: 28*
Time: 3 hours

Answer five *questions, taking* one *from each unit.*

UNIT–I

1. (a) What do you mean by collision diameter? 2
   (b) Based on kinetic molecular theory of gases, derive the kinetic gas equation. 5
   (c) State and explain equipartition of energy. 4
   (d) Calculate the root mean square velocity and average velocity for hydrogen gas at 0°C. (Given: R = 8.314 J K^{-1} $mole^{-1}$, Molar mass of H_2 = 2.016 × 10^{-3} Kg $mole^{-1}$) 3

2. (a) Define viscosity of gases. Explain how meant free path is related to the coefficient of viscosity of gases? 1+4=5
   (b) Discuss in detail Maxwell's distribution of molecular velocities. 4
   (c) Write a note on the following: 2½×2= 5
      (i) Collision frequency
      (ii) Degrees of freedom of gaseous molecule

UNIT–II

3. (a) What are real gas and ideal gas? How will you explain the deviation of real gas from ideal behaviour using compressibility factor? 2+3=5
   (b) What are the two faulty assumptions in the kinetic molecular theory of gases? 2
   (c) What do you mean by continuity of state? Explain continuity of state taking CO_2 as example. 1+3 =4

(d) Calculate the volumes of 10 moles of methane at 100 atm. Pressure and 0°C. The compressibility factor at this temperature and pressure is 0.75. 3

4. (a) Determine the surface tension of a liquid by capillary rise method. 4
   (b) What is vapour pressure? Explain two factors which affects the vapour pressure of the liquid. 1+3=4
   (c) Give the statement of van der Waals reduced equation of state. Explain how the statement can be verified. 1+3=4
   (d) The time of flow of water in an Ostwald viscometer is 59.2 s at 25 °C. If 46.2 s are required for the same volume of ethyl benzene to flow through the capillary tube, calculate the viscosity of ethyl benzene at 25 °C. (Given: Viscosity of water = 0.00595 poise, Density of ethyl benzene = 0.867 g/cm^3). 2

UNIT–III

5. (a) Define centre of symmetry. Explain the law of constancy of interfacial angles. 1+3=4
   (b) What are the seven different types of crystallographic system? Give their interfacial angles with example for each system. 4
   (c) What are liquid crystals? Write the uses of liquid crystals. 3
   (d) What are Miller indices? How are they determined? 3

6. (a) Discuss the Bragg's equation for the investigation of internal structure of a solid. 5
   (b) A compound formed by element X and Y crystallises in the cubic structure. X atoms are situated at the corners and Y atoms are the centre faces. What is the formula of the compound? 4
   (c) What are crystal defects? Explain the Schottky and Frenkel defects. 2+3=5

UNIT–IV

7. (a) What are electrolytes? Explain the different classes of electrolytes with examples. 1+3=4
   (b) Derive the expression of dissociation constant (Ka) of a weak acid taking acetic acid as example. 4

(c) Define ionization. Explain the factors which affects the degree of ionization. 1+3=4

(d) Calculate the pH of a 0.001 M HCl solution assuming it to be completely dissociated. 2

8. (a) What do you mean by salt hydrolysis? Explain how ionization constant of an acid (Ka), hydrolysis constant (Kh) and ionic product of water (Kw) are related. 1+3=4

(b) Explain the relation between pH and pOH. (Given: $Kw=[H^+][OH^-]=10^{-14}$ at 25 °C) 2

(c) What do you understand by salts of weak bases and weak acid? Derive the expression for the relationship between Kh, Kw, Ka and Kb for such salts. 2+3=5

(d) A solution of 0.100 M acetic acid is found to be dissociated to the extent of 1.33 percent at the room temperature. Calculate the dissociation constant of the acid at this temperature. 3

UNIT–V

9. (a) What is buffer solution? Explain the applications of buffers. 1+3=4

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

(c) Give the difference between solubility and solubility products. 3

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

10. (a) Define indicators. Explain the action of phenolphthalein as an indicator in an acid-base solution. 1+3=4

(b) Discuss the important applications of solubility product principle. 4

(c) What do you meant by buffer capacity and buffer index? 3

(d) The solubility of silver chloride in water at 25°C is 0.00179 g per litre. Calculate the solubility product of silver chloride at this temperature. 3