2023
B.A./B.Sc.
Third Semester
CORE – 7
CHEMISTRY
Course Code: CHC 3.31
(Physical Chemistry - III)

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

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

UNIT–I

1. (a) Draw a well labelled diagram for water system. Discuss its salient features. 7
   (b) Define incongruent melting point. Draw and explain the features of NaCl-H_2O system. 7

2. (a) Derive the Gibb's phase rule for non-reactive system taking a specific example. 5
   (b) Write short notes on the application of Clausius-Clapeyron equation for liquid-vapour equilibria. 2
   (c) Vapour pressure of water at 95° C and 100° C is 634 mm and 760 mm respectively. Calculate the molar heat of vaporization ΔH_v of water between 95° C and 100° C. 3
   (d) Define the following terms: 2×2=4
      (i) Reduce phase rule
      (ii) Eutectic point

UNIT–II

3. (a) Draw and discuss the salient features of the phase diagram for lead-silver system. 4
   (b) State and explain the lever rule. Apply it to illustrate the principle of fractional distillation. 3+4=7
   (c) Derive Gibbs-Duhem-Margules equation. 3

4. (a) Explain Nernst distribution law and state the conditions for the validity of the law. 4+2=6
   (b) With the help of a diagram explain the features of triethylamine-water system. 4
   (c) What are azeotropes? Explain the two types of azeotropes. 4

UNIT–III

5. (a) Derive an expression for the rate constant of a second order reactions. 4
   (b) Prove that if the half life period of first order reaction is 30 minutes, that reaction will be 75% complete in 60 minutes. 4
   (c) Differentiate between molecularity and order of reactions citing an example. 4
   (d) Name four factors affecting rate of a reactions. 2

6. (a) Derive the integrated expression for first order reactions. From this expression derive the equation for half life of a first order reactions. 7
   (b) Show how to test the rate law graphically from $t_{½}$-values. 4
   (c) Explain differential method for determining the order of reactions. 3

UNIT–IV

7. (a) Discuss in detail the activated complex theory (ACT) of bimolecular reactions. 6
   (b) Explain the concept of activation energy in chemical reactions. 4
   (c) Can the activation energy of a reaction be zero or even negative? Why? 4

8. (a) Discuss the kinetics of opposing or reversible reactions. 5
   (b) Explain the collision theory of a bimolecular gaseous reactions. 5
   (c) The rate constant of a second order reaction is 5.70×10^{-5} $dm^3mol^{-1}S^{-1}$ at 25° C and $1.64 \times 10^{-4} dm^{-3}mol^{-1}S^{-1}$ at 40° C. Calculate the activation energy. 4

UNIT–V

9. (a) Derive the Michaelis-Menten equation for enzyme catalysed reaction. 7

(b) Explain four factors affecting adsorption of gaseous on solid surfaces. 4

(c) What is meant by the term sorption? Give one example. 3

10. (a) With the help of one example each, discuss the specificity and the selectivity of a catalyst. 6

(b) Draw the graphical representation of Freundlich adsorption isotherm and interprete it. 4

(c) Explain the efficiency of nano particles as catalyst. 4

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