

CH-119 Principles of Physical Chemistry

Credit Hours: 2-1

Pre-requisite: Nil

Course Objectives

1. This course aims to cover most of forthcoming topics of Physical Chemistry. It will include demonstration of physical states of matter with explanation at atomic interactions. Students will get introduction to Chemical Thermodynamics and Chemical Kinetics both theoretically and experimentally.
2. A provide a broader overview of important Physical Chemistry topics. It will also give students the hand on experimental determination of the basic physical chemistry laws.

Course Contents

3. Physical States of Matter: Gases, Gas laws, Ideal and real gases, Molecules in motion: collision diameter and mean free path. Physical properties of liquids: surface tension, viscosity, refractive index etc. and their applications.
4. Solutions: Introduction to solutions, types of solutions, colligative properties, vapor pressure lowering, boiling point elevation, freezing point depression, and osmotic pressure
5. Chemical Kinetics: Integrated Rate laws, Rate of reaction. Rate law, order and molecularity of the reactions. Zero, first and second order reactions. Determination of reaction order and its rate constant. Effect of temperature on the reaction rate. Third order reactions with same and different initial concentrations of reactants. Elementary and complex reactions: opposing, parallel, consecutive bimolecular reactions and chain reactions. Steady state approximation, Lindemann's theory of unimolecular reactions, Bimolecular collision theory, transition state theory.

Course Outcomes

On successful completion of the course the student will be able to:

6. Demonstrate knowledge of about physical states of matter at the atomic level.
7. Apply the basic concepts of Chemistry (e.g chemical thermodynamics, kinetics, and solution, electro etc.).

Relevant Experiments:

1. Determination of viscosity and parachor values of liquids.
2. Determination of percent composition of liquid solutions viscometrically.
3. Determination of refractive index and molar refractivity.
4. Determination of percent composition of liquid solutions by refractive index measurements.
5. Determination of molecular weight of a compound by elevation of boiling point (ebullioscopic method).
6. Determination of molecular weight of a compound by lowering of freezing point (cryoscopic method).
7. Determination of heat of solution by solubility method.
8. Determination of heat of neutralization of an acid with a base.
9. Kinetic study of acid catalyzed hydrolysis of ethyl acetate.
10. Determination of partition coefficient of a substance between two immiscible liquids.
11. Kinetics of saponification of ethyl acetate.
12. Study of the adsorption isotherms of acetic acid-charcoal system.
13. Determination of partial molar volumes.
14. Effect of concentration on rate of reactions.
15. Determining the rate of reaction by H_2SO_4 concentration
16. Determining the rate of reaction by KI concentration
17. Determining the rate of reaction by H_2O_2 concentration

Recommended Books

1. Atkins P.W., Physical Chemistry 6th ed., W.H. Freeman and Co. New York (1998).
2. T. Engel, P. Reid, Pearson New International Edition: Physical Chemistry, Pearson Education Ltd., (2014).

3. Atkins P.W., Physical Chemistry 6th ed., W.H. Freeman and Co. New York (1998).
4. T. Engel, P. Reid, Pearson New International Edition: Physical Chemistry, Pearson Education Ltd., (2014).
5. Laidler K.J., John H.M. and Bryan C.S. Physical Chemistry 4th ed., Houghton Mifflin Publishing Company Inc. (2003).
6. Brain S.E. Basic Chemical Thermodynamics 4th ed., E.L.B.S. Publishers (1990).
7. Barrow G.M. Physical Chemistry 5th ed., McGraw Hill (1992).
8. Levitt B.P. and Findlay's Practical Physical Chemistry 9th ed., Longman Group Limited (1978).
9. Shoemaker D. Experiments in Physical Chemistry 5th ed., McGraw Hill Publishing Company Limited (1989).

