2024

B.A./B.Sc.

Fourth Semester

GENERIC ELECTIVE – 4

CHEMISTRY

Course Code: CHG 4.11

(Physical Chemistry for Biosciences)

Total Mark: 70 *Pass Mark: 28*

Time: 3 hours

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

UNIT–I

1. (a) What do you understand by first law of thermodynamics? 2
   (b) Write a short note on standard enthalpy of formation. 2
   (c) Derive Kirchoff's equation for the effect of temperature on heat of reaction. 5
   (d) State and explain the third law of thermodynamics in terms of absolute entropies of substance. 5

2. (a) Write short notes on the following: 2×3=6
      (i) Integral enthalpy of solution
      (ii) Standard enthalpy of reaction
      (iii) Enthalpy of dilution
   (b) State and explain the term bond energy. Discuss the application of bond energies. 5
   (c) The standard heat of formation (ΔH°_f) of C_2H_5OH (l), CO_2 (g) and H_2O (l) are: –277.0, –393.5 and 285.5 kJ/mol respectively.
   Calculate the standard heat change for the reaction (ΔH°) for the given reaction.
   $C_2H_5OH\ (l) + 3O_2(g) \longrightarrow 2CO_2\ (g) + 3H_2O\ (l)$ 3

UNIT–II

3. (a) State and explain Le Chatelier principle the effect of temperature and pressure taking the reaction given below: 5
   $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g) \qquad \Delta H = -99.38$ kJ.

(b) "Chemical equilibrium is dynamic in nature." Explain with example. 4

(c) Explain and derive the law of chemical equilibrium thermodynamically. 5

4. (a) What is rate of reactions? Explain the factors which affects the rate of reactions. 5

(b) Define zero order reaction. Derive the integrated rate expression for zero order reaction. 5

(c) Write short notes on the following: 2×2=4

(i) Activation energy

(ii) Molecularity of a reaction

UNIT–III

5. (a) Explain the degree of ionization. Discuss the factors which affects the degree of ionization. 3+3=6

(b) What do you understand by the ionization of weak acid and weak bases? Explain. 4

(c) Write short notes on the following: 2×2=4

(i) Common ion effect

(ii) Strong and weak electrolytes

6. (a) What is hydrolysis of salts? Taking the examples of weak bases and strong acid, explain the hydrolysis constant, relation between Kh, Kb, and Kw and degree of hydrolysis. 6

(b) What is buffer action? Explain the buffer action of an acidic buffer and basic buffer. 5

(c) The solubility of silver chloride in water at 25°C is 0.00179 g/l. Calculate its solubility product at 25° C. 3

UNIT–IV

7. (a) Determine the number of components and phases in the following system: 2+2=4

(i) $H_2O\,(s) \rightleftharpoons H_2O\,(l) \rightleftharpoons H_2O\,(g)$

(ii) $CaCO_3\,(s) \rightleftharpoons CaO\,(s) \rightleftharpoons CO_2\,(g)$

(b) Explain and derive the Gibbs phase rule. 5

(c) Write notes on the following: 2½×2=5
(i) Metastable equilibrium
(ii) Azeotropes

8. (a) Draw and discuss in detail the phase diagram for the sulphur system. 6
(b) What is Pattinson's process for the desilverization of lead. Explain with diagram. 4
(c) Explain Nernst distribution law. What are the conditions for the validity of the distribution law? 4

UNIT–V

9. (a) State and explain Kohlrausch law. 3
(b) The speed ratio of the Ag^+ and NO_3^- ion in a solution of silver nitrate electrolysed between silver electrode is 0.916. Find the transport number of the two ions. 3
(c) What are the postulates of Arrhenius theory of an electrolytic dissociation? Give its limitations if any. 5
(d) Define the following terms: 1½×2=3
(i) Transport number
(ii) Equivalent conductance

10. (a) Give the difference between photochemical reaction and thermochemical reactions. 3
(b) What is quantum yield? Explain with specific examples the types of quantum yield. 5
(c) Briefly explain the types of photochemical reactions. Support your answer with examples. 3
(d) What are the main causes of low quantum yield? 3