

Exam. Code : 103203

Subject Code : 1349

B.A./B.Sc. 3rd Semester

CHEMISTRY

(Physical Chemistry—II)

Time Allowed—3 Hours] [Maximum Marks—35

Note :—(1) **Part – A** : Attempt **ALL** the questions. Each question carries **1** mark.

(2) **Part – B** : Attempt **SIX** questions in all, selecting **TWO** questions from each section. Each question carries **4.5** marks.

PART—A

Note :—All questions are compulsory.

1. Differentiate between state and path functions.
2. State Joule's law and give its significance.
3. Write down Kirchoff equation and mention its importance.
4. Chemical equilibrium is also called dynamic equilibrium. Comment on this statement.
5. What is meant by driving force of a chemical reaction ? What is the nature of this driving force ?

6. State third law of thermodynamics. Is this law applicable to the supercooled liquids ?
7. Enlist limitations of the first law of thermodynamics.
8. What are lower and upper consolute temperatures ?

8×1=8

PART—B

Note :—Attempt **SIX** questions in all, selecting **TWO** questions from each section.

SECTION—I

9. Explain the difference between the following :—

(a) Isothermal and adiabatic processes.

(b) Open, closed and isolated systems.

(c) Isobaric and isochoric processes. 3×1.5

10. (a) For an ideal gas, show that

$PV^\gamma = \text{Constant}$ for adiabatic expansion.

(b) The van der Waal constants a and b for a gas are 0.21 and 0.017 in $\text{dm}^3 \text{ atm}$ units. Calculate the inversion temperature of the gas. 3,1.5

11. (a) Calculate the bond energy of HCl, if H – H and Cl – Cl bond energies are 433 and 242 kJ mol^{-1} , respectively and ΔH for formation of HCl is -91 kJ mol^{-1} .

- (b) Show that work done in adiabatic expansion is less than the work done in isothermal expansion.

2.5,2

SECTION—II

12. (a) Under what conditions A and G can be used as criteria for thermodynamic equilibrium and spontaneity ?

- (b) Show that

$$(i) \left(\frac{\partial G}{\partial P} \right)_T = V \quad (ii) \left(\frac{\partial G}{\partial T} \right)_P = -S \quad 2.5,2$$

13. (a) Describe in detail the Carnot reversible cycle for establishing the maximum convertibility of heat into work.

- (b) A Carnot engine working between 0°C and 100°C takes up 850 joules from the high temperature reservoir. Calculate the work done, heat rejected and the efficiency. 3,1.5

14. (a) Taking entropy as a function of T and V , show that

$$\left(\frac{\partial S}{\partial V} \right)_T = \frac{R}{V}$$

- (b) Explain how the absolute entropy of a substance can be determined with the help of the third law of thermodynamics ? 2.5,2

SECTION—III

15. Derive Clausius Clapeyron equation and discuss its applications. 4.5
16. Sketch and explain the phase-diagrams of the following systems :
- (a) CO_2
- (b) Magnesium – Zinc. 2,2.5
17. Write notes on the following :—
- (a) Steam distillation
- (b) Nernst distribution law
- (c) Azeotropes. 3×1.5