

P. Pages : 2

Time : Three Hours

**AW - 3157**

Max. Marks : 80

- Notes :
1. Answer **Three** question from Section "A" and **three** question from Section "B".
 2. Due credit will be given to neatness and adequate dimensions.
 3. Assume suitable data wherever necessary.
 4. Diagram and Chemicals equations should be given wherever necessary.
 5. Illustrate your answer necessary with the help of neat sketches.
 6. Use of pen Blue/Black ink/refill only for writing the answer book.

SECTION - A

1. a) Define entropy, enthalpy and internal energy of a system. How much is the entropy change for a reversible process and irreversible process? 7
b) Explain the types of thermodynamic systems and thermodynamic processes with suitable examples. 7

OR

2. a) State and explain first law of thermodynamics and extensive and intensive properties of a system. 7
b) What do you mean by thermodynamic equilibrium? In a certain process, 350 Joules of heat is absorbed by a system, while 95 Joules of external work is done on the system. What is the change in internal energy of the process? 7
3. a) How is second law of thermodynamics stated by Clausius and Ludwig Boltzmann and how to evaluate performance of a heat engine? 7
b) State and explain Maxwell relations. One mole of a gas ($C_V = 12.55 \text{ J/mol K}$) at 300°C is compressed adiabatically and reversibly to one fourth of its original volume. What will be the final temperature of gas. $R = 8.314$. 6

OR

4. a) Explain the concept of free energy and residual entropy of a system with some example. 7
b) Explain coefficient of thermal expansion and the relationship between C_P and C_V . 3 moles of hydrogen gas is compressed isothermally and reversibly from 60 dm^3 to 20 dm^3 and 8.22 kJ of work is done on it. What will be the temperature of gas? $R = 8.314$ 6
5. a) Explain Gibbs Duhem equation and solubility law. 7
b) What are excess thermodynamic properties. 6

OR

6. a) Explain the term fugacity and chemical potential of a system. 7
b) What are partial molar and apparent molar properties? 6

SECTION - B

7. a) How to compare ideal and non-ideal systems? Also explain the construction of x-y diagram. 7
b) How to construct an equilateral triangle diagram? Explain with suitable example. 6

OR

8. a) What is phase rule? Explain the meaning of each term involved in phase rule. 7
b) Explain Raoult's law and Henry's law with suitable example. 6
9. a) What do you understand by partition function and how is it related with thermodynamic functions? 7
b) Derive Boltzmann distribution law and explain its application. 6

OR

10. a) Discuss thermodynamic probability and its relation with entropy. 7
b) Explain the techniques to search thermodynamic data of a system. 6
11. a) Explain various representations of equilibrium constant and the significance of free energy change. 7
b) 15 moles of H_2 and 5.2 moles of I_2 are mixed and allowed to attain equilibrium at $500^\circ C$. At equilibrium, the concentration of HI is found to be 10 mol. Calculate the equilibrium constant for the formation of HI. 7

OR

12. a) Explain the effect of temperature on equilibrium constant. 7
b) 1.6 moles of $PCl_5(g)$ is placed in 4 dm^3 closed vessel. When the temperature is raised to $500^\circ K$, it decomposes as: $PCl_5 \rightleftharpoons PCl_3 + Cl_2$
At equilibrium 1.2 moles of PCl_5 remains.
Calculate the value of equilibrium constant for the decomposition of PCl_5 . 7
