

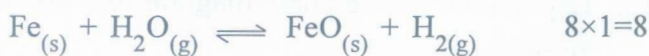
**B.Sc. Biotechnology 3<sup>rd</sup> Semester****PHYSICAL CHEMISTRY—A****Paper : BT-1**

Time Allowed—3 Hours] [Maximum Marks—40

**Note** :—Do **ALL** the questions of Section-A, **FIVE** questions from Section-B and **TWO** questions from Section-C. Log tables may be provided.

**SECTION—A**

1. Define intensive properties by citing examples.
2. Differentiate dependent and independent variables.
3. What is Nernst heat theorem ?
4. State the law of chemical equilibrium.
5. What is an ideal solution ? Cite one example.
6. Determine the osmotic pressure of an aqueous solution containing 1 gm each of glucose and sucrose per litre at 25°C.
7. What are cooling curves ?
8. Find the number of degrees of freedom in the following system;



## SECTION—B

9. One mole of  $H_{2(g)}$  contained in a cylinder at  $25^{\circ}C$ , is allowed to expand isothermally against external pressure of 6 atmospheres from a volume of  $1.0 \text{ dm}^3$  to a volume of  $2.8 \text{ dm}^3$ . If the gas behaves ideally, determine the values of  $q$ ,  $w$ ,  $\Delta E$  and  $\Delta H$ .
10. State and explain the bond energy. Discuss the various applications of bond energies.
11. Explain how the absolute entropy of a gas at  $25^{\circ}C$  is determined with the help of the 3rd law of thermodynamics.
12. Discuss the entropy changes in reversible and irreversible processes. Give reasons why the entropy of the universe is increasing day by day.
13. State and explain the Raoult's law for vapour pressure of binary solutions of volatile liquids.
14. Explain the conditions under which abnormal molar masses of solutes are obtained from the measurement of colligative properties of their solutions. What is van't Hoff factor ?
15. Give the derivation of Gibbs phase rule. Explain the various terms (e.g., phase, component, degrees of freedom, etc.) involved in phase rule.
16. Explain the Pb-Ag phase diagram for two-component systems.

 $5 \times 4 = 20$

## SECTION—C

17. (a) State and explain Hess's law of heat summation. What are its applications ?
- (b) Derive an expression for the work done in reversible isothermal expansion and reversible isothermal compression of an ideal gas. What is meant by maximum work ?
18. (a) Derive Gibbs-Helmholtz equation for a process at constant pressure and at constant volume.
- (b) A Carnot engine converts one-fourth of heat input into work. If the temperature of sink is reduced by  $50^{\circ}\text{C}$ , its efficiency is doubled. Find the temperature of source and sink.
19. (a) Derive Gibbs-Duhem-Margules equation for ideal and non-ideal mixtures.
- (b) A solution of A and B with 30 mole percent of A is in equilibrium with its vapour containing 60 mole percent of A. Assuming ideality, calculate the ratio of vapour pressure of pure A to that of pure B.
20. Draw and discuss the phase diagram of water system. Also discuss the importance of Clapeyron-Clausius equation for various equilibria in this system.

$$2 \times 6 = 12$$