Exam. Code : 103203
Subject Code : 8032

B.A./B.Sc. 3rd Semester (Old Sylb 2017)

CHEMISTRY

(Physical Chemistry—II)

Time Allowed—3 Hours] [Maximum Marks—35

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

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

Log Tables may be asked for.

PART—A

Note :— All questions are compulsory.

1. Enlist the limitations of first law of thermodynamics that lead to the emergence of second law of thermodynamics.
2. While E is a definite property, q and w are not definite properties. Comment on this statement.
3. Differentiate between reaction isotherm and reaction isochore.
4. State and explain third law of thermodynamics.
5. Comment on the statement that neither the heat of reaction alone nor the randomness alone can determine the feasibility of a reaction.

6. Define Le-Chatelier principle and give its significance.

7. The eutectic is a mixture and not a compound. Justify the statement.

8. If there is no triple point in the phase diagram of one-component system, then what inference do you draw ?

8×1

PART—B

Note :— Attempt **SIX** questions in all, selecting **TWO** questions from each section. Each question carries **4½** marks.

SECTION—I

9. (a) Show that for isothermal expansion of an ideal gas, work done in a reversible process is greater than in an irreversible process.

   (b) State and explain Hess's law. How is this law a special case of first law of thermodynamics ?

2.5,2

10. (a) Establish a relationship between heat capacities at constant volume and pressure.

    (b) Derive Kirchoff's equation. 3,1.5

11. Four moles of an ideal gas expand reversibly and isothermally at 300° K from a volume of 0.5 dm^3 to 2.0 dm^3. Calculate q, w, ΔU and ΔH for the process. ($R = 8.314\ JK^{-1}\ mol^{-1}$) 4.5

SECTION—II

12. (a) Derive an expression for Gibbs-Helmholtz equation.

(b) Show that :

(i) $\left(\frac{\partial S}{\partial V}\right)_T = \left(\frac{\partial P}{\partial T}\right)_V$

(ii) $\left(\frac{\partial \Delta G/T}{\partial T}\right)_P = \frac{-\Delta H}{T^2}$ 1.5,3

13. (a) Explain Nernst heat theorem. How does it lead to the third law of thermodynamics ?

(b) Explain how the absolute entropy can be evaluated from heat capacity data with the help of third law of thermodynamics. 2.5,2

14. Find the molar increase in E, H, S, G and A in expanding one litre of an ideal gas at 27° C to 100 litres at the same temperature. 4.5

SECTION—III

15. (a) Show that in a non-ideal solution, if one component obeys Raoult's law over a certain range of composition, the other component obeys Henry's law over the same composition range.

(b) Calculate the equilibrium constant (K) for the reaction :

$2NOCl(g) \rightleftharpoons 2NO(g) + Cl_2(g)$ at 400° K

Given : $\Delta H° = 80$ kJ mol^{-1}, $\Delta S° = 120$ kJ mol^{-1} at 400° K. 2,2.5

16. (a) Outline the principle of steam distillation. How will you find the molecular mass of a liquid by means of it ?

    (b) State Nernst distribution law. How it is used in the process of extraction ? 2.5,2

17. Explain the following terms giving suitable examples :

    (a) Eutectic point

    (b) Triple point

    (c) Peritectic point. 4.5