B. Sc. DEGREE END SEMESTER EXAMINATION - MARCH 2018

SEMESTER – 6: B.Sc. CHEMISTRY (CORE COURSE)

15U6CRCHE11: PHYSICAL CHEMISTRY - III

Time: Three Hours   Max Marks: 60

SECTION - A

(Answer **all** questions. Each question carries 1 mark)

1. Infinitesimal quantity of a function (df) on integration gives a result that depends on the path followed by the system. The the df is said to be …………..

2. What is Zeroth law of thermodynamics?

3. Temperature dependence of enthalpy of reaction is known as …………………

4. How spontaneity relates to the free energy of the system?

5. The S. I. unit of entropy is ………..

6. Give the reduced phase rule.

7. Draw a plot of concentration of reactant (c) against time for a first order reaction.

8. Find the number of variables required to define the state of water system when three phases coexist.   (1 × 8 = 8)

SECTION - B

(Answer any **six** questions. Each question carries 2 marks)

9. Write the mathematical expression for first law of thermodynamics. Give the sign convention of heat and work.

10. Derive an expression for entropy change of an ideal gas with respect to temperature and volume.

11. What is meant by Joule Thomson effect? Give the sign of Joule Thomson coefficient (μ_{JT}) when temperature falls as pressure decreases.

12. Discuss on the effect of pressure on the melting point of ice using Claussius - Clapeyron equation for solid-liquid equlibria.

13. Write the integrated van't Hoff equation.

14. Describe any two methods to determine the order of a reaction.

15. Explain metastable equilibria in water system.

16. What is Pattinsons process?   (2 × 6 = 12)

SECTION - C

(Answer any **four** questions. Each question carries 5 marks)

17. One mole of perfect gas undergoes an isothermal reversible expansion at 20°C from 10 dm^3 to 40 dm^3. Calculate a) work done in the process   b) Heat absorbed by the system c) Entropy change of the system.

18. Discuss on the entropy change of the universe for a reversible and irreversible process. Why there is an inequality in the entropy change in these two processes

19. Show that change in Gibbs free energy of a system at constant temperature and pressure is equal to the maximum non expansion work done by the system.

20. Calculate the equilibrium constant at constant pressure for the reaction
    $2NO_{2(g)} \rightleftharpoons N_2O_{4(g)}$ if initially 1.0 mole of NO_2 and 1.0 mole of N_2O_4 are placed in a 1.0 dm^3 vessel. Equilibrium attained at 20°C and 0.75 mole of N_2O_4 is present in the vessel.

21. What is a cooling curve? Give the importance of these curves in the study of binary systems.

22. What is meant by isothermal evaporation. What changes are observed if a solution of Ferric Chloride is subjected to isothermal evaporation at 50°C. [Given: Congruent melting point dodeccahydrate, heptahydrate, pentahydrate, and tetrahydrate of $FeCl_3$ id 32.0, 32.5, 56 and 73°C respectively.]   (5 × 4 = 20)

SECTION - D

(Answer any **two** questions. Each question carries 10 marks)

23. a) Define and write a note on chemical potential. Give the expression for free energy change in terms of temperature, pressure and chemical potential of components in \ an ideal gas mixture of three components.   (6 marks)
    b) Derive Gibbs Duhem equation.   (4 marks)

24. a) Obtain the relation for the work done in a reversible isothermal expansion of an ideal gas.
    b) Describe Carnot's cycle and deduce the expression for the efficiency of heat engine.

25. a) Describe Lindemann theory of unimolecular reaction   (5 marks)
    b) What are chain reactions? Write the steps involved in $H_2 + Br_2 \longrightarrow 2HBr$ and the rate equation.   (5 marks)

26. Draw the phase diagram of sulfur system and explain.   (10 × 2 = 20)

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