LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

B.Sc. DEGREE EXAMINATION – CHEMISTRY

THIRD SEMESTER – November 2009

CH 3504 - THERMODYNAMICS

Date & Time: 09/11/2009 / 9:00 - 12:00 Dept. No. | | Max. : 100 Marks

PART – A

Answer ALL questions. (10 x 2 = 20 marks)

01. What are State functions? Give examples.

02. What are intensive and extensive properties?

03. Define bond energy. What does a positive value of bond energy indicate?

04. Explain heat of transition with a suitable example.

05. State Trouton's rule.

06. What is Gibbs free energy?

07. State the law of mass action.

08. At a given temperature, the equilibrium constant K_c for the reaction $3C_2H_{2(g)} \leftrightarrow C_6H_{6(g)}$ is 4, If the equilibrium concentration of C_2H_2 is 0.5 mol lit^{-1}, what is the equilibrium concentration of C_6H_6 ?

09. How would the equilibrium reaction of dissociation of PCl_5 is affected by

(a) addition of Cl_2 (b) decreasing the volume of the container

10. What is meant by recidual entropy?

PART – B

Answer any EIGHT questions. (8 x 5 = 40 marks)

11. (a) Differentiate between reversible and irreversible processes.

(b) Write the mathematical form of first law of thermodynamics and explain the terms.

12. One mole of an ideal gas (mono-atomic) at 27^{o}C expands adiabatically against a constant external pressure of 1 atm from a volume of 10 dm^3 to a volume of 20 dm^3. Calculate (i) q (ii) w (iii) ΔU and (iv) ΔH for this process. Also calculate the final temperature of the gas. Assume that C_v = 3/2 R.

13. Derive the Kirchoff's equation and mention its applications.

14. The enthalpy of combustion of glucose $C_6H_{12}O_6$(s) is -2816 kJ mol^{-1} at 25^{o}C. ΔH^o_f values for CO_2(g) and H_2O(l) are -393.5 and -285.9 kJ mol^{-1}, respectively. Calculate the enthalpy of formation of glucose.

15. How will you determine the calorific value of a substance using bomb calorimeter?

16. Derive any two Maxwell's relationships.

17. Derive Gibbs – Helmholtz equation. Give its application.

18. Derive thermodynamic equation of state.

19. Explain why it is permissible to omit the concentrations of pure solids and liquids in calculating K_c for a heterogeneous reaction.

20. Discuss the effect of change of temperature, pressure and concentration in the contact process of manufacture of sulphuric acid.

21. Show that $\Delta G^o = - RT \quad K_p$.

22. Explain the Nernst heat theorem.

PART – C

Answer ANY FOUR questions. **(4 x 10 = 40 marks)**

23. a) Explain the Hess law of constant heat summation. Discuss its applications.

    b) Define C_p and C_v. Derive the relationship between them for an ideal system.

24. a) What is Joule-Thomson coefficient ? Deduce the relationship between μ_{JT} and C_p.

    b) Explain the integral heat of solution and dilution.

25. a) Discuss the Carnot's cycle for establishing the maximum convertibility of heat into work.

    b) Heat supplied to a Carnot engine is 1897.8 kJ. How much useful work can be done by the engine which works between 0^oC and 100^oC ?

26. a) Discuss the effect of change of temperature, pressure and concentration in Haber process.

    b) The dissociation of PCl_5 was studied at 229^oC at a total pressure of 1 atm. The value of K_p was found to be 0.460 atm. Calculate the degree of dissociation of PCl_5. If keeping the temperature constant, the pressure on the system is raised to 10 atm, what will be the degree of dissociation ?

27. Derive Van't Hoff equation showing the variation of equilibrium constant with temperature.

28. a) State the third law of thermodynamics.

    b) How absolute entropy of a substance is determined using third law of thermodynamics?

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