LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

B.Sc. DEGREE EXAMINATION – **CHEMISTRY**

THIRD SEMESTER – NOVEMBER 2007

CH 3504 - THERMODYNAMICS

AD9

Date : 07/11/2007
Time : 9:00 - 12:00

Dept. No.

Max. : 100 Marks

PART – A

(10 x 2 = 20 marks)

Answer ALL the questions.

1. Why C_P is always greater than C_V ?

2. Distinguish between isothermal and adiabatic processes.

3. State and explain Hess's law.

4. Define heat of neutralization. Why heat of neutralization of a strong acid by a strong base is a constant?

5. What are the limitations of first law of thermodynamics?

6. Which of the following pairs will have a high value of entropy?

      a) CO_2 or dry ice

      b) Sulphur monoclinic or sulphur rhombic

7. State Le Chatelier principle.

8. What is the unit of K_p for the dissociation of nitrogen tetroxide?

9. Equimolar concentrations of H_2 and I_2 are taken in a flask and allowed to attain equilibrium. At equilibrium, the concentration of HI is 0.8 mol lit^{-1}. Find the value of K_p.

10. What is meant by residual entropy?

PART – B

(8 x 5 = 40 marks)

Answer any EIGHT questions.

11. a) What are extensive properties? Give examples.
   b) Write the mathematical form of first law of thermodynamics and explain the terms.

12. One mole of an ideal gas expands isothermally and reversibly from a volume of 10 lit to a volume of 20 lit at 27^0C. Calculate the work done, ΔE and heat of absorption.

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

14. Define heat of formation. If the heat of formation of methane at constant pressure at 27^0C is –75 kJ mol^{-1}, what is its value at constant volume?

15. Derive any two Maxwell's relationships.

16. What is Gibb's free energy? Show that $-\Delta G = W_{net}$.

17. Derive Gibbs – Helmholtz equation. What are its applications?

[PTO]

18. Derive vant Hoff isochore in terms of K_p.

19. Show that $\Delta G^o = - RT \ln K_p$.

20. Derive the relationship between K_P and K_C.

21. What is bond energy? Calculate the bond energy of F-Cl bond from the following date:
    Bond energies of F_2 and Cl_2 are 36.6 and 580 K Cal respectively.
    Heat liberated in the reaction $F_2 + Cl_2 \rightarrow 2FCl$ is 26.6 K.Cal.

22. Explain Nernst heat theorem.

PART – C

(4 x 10 = 40 marks)

Answer any FOUR questions.

23. a) What is Joule-Thomson effect?
    b) Why does hydrogen show heating during Joule-Thomson experiment?
    c) What is Joule-Thomson coefficient? Deduce the relationship between μ_{JT} and C_p.

24. What is meant by heat of combustion? How is it determined experimentally using a bomb calorimeter?

25. a) What is Carnot cycle? Calculate the efficiency of a Carnot engine.
    b) Heat supplied to a carnot engine is 2000 kJ. How much useful work can be done by the engine, which works between 27^0C and 127^0C?

26. a) Discuss the effect of change of temperature, pressure and concentration in Haber process.
    b) K_c for the reaction $2 SO_2 + O_2 \leftrightarrows 2SO_3$ is 400 at 527^0C.
    Calculate K_c for the reaction $SO_3 \leftrightarrows SO_2 + \frac{1}{2} O_2$ at the same temperature.

27. Apply law of mass action and find K_p and K_c for the dissociation of PCl_5.

28. a) State the third law of thermodynamics.
    b) Discuss the application of third law of thermodynamics in the determination of absolute entropy of a substance.

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