

LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

B.Sc. DEGREE EXAMINATION – CHEMISTRY

THIRD SEMESTER – APRIL 2010

CH 3504/CH 3500 - THERMODYNAMICS

Date & Time: 19/04/2010 / 1:00 - 4:00

Dept. No.

Max. : 100 Marks

PART – A

Answer ALL questions

(10 x 2 = 20 marks)

1. Define state function and path function with an example.
2. Define Joule Thomson effect.
3. Explain the standard enthalpy change for the neutralization reaction of a strong acid by a strong base.
4. Give the equation which relates H,U and W .
5. Write any two limitations of 1st law and the need for the 2nd law of thermodynamics.
6. Why is 100% efficiency not obtained in any process?
7. Define the Law of Mass action.
8. Define LeChatlier-Braun Principle.
9. Explain the effect of concentration in the formation of HI.
10. What does absolute entropy of solid, liquid and gas mean?

PART – B

Answer any EIGHT questions

(8 x 5 = 40 marks)

11. a) Explain the postulates of the kinetic theory of gases. (4)
b) Write the van der waals equation. (1)
12. a) Derive $C_p - C_v$ for an ideal gas. (4)
b) Write Grahams law of diffusion (1)
13. Calculate the pressure exerted by one mole of $\text{CO}_2(\text{g})$ in a 1.32dm^3 vessel at 48°C using ideal gas equation and Van der waals gas equation, where $a = 3.59\text{dm}^6\text{atm/mol}^2$; $b = 0.0427\text{dm}^3/\text{mol}$. (2+3)
14. a) 6 moles of an ideal gas expands isothermally and reversibly from a volume of 1dm^3 to 10dm^3 at 27°C . What is the maximum work done? (2)
b) Write the Euler Reciprocal equation. (3)
15. a) 10 moles of an ideal gas expand isothermally and reversibly from a pressure of 10atm to 2atm at 300K . Calculate the work done. (2)
b) Calculate q , w , ΔH and ΔU for the isothermal expansion of an ideal gas at 27°C from a volume of 10dm^3 to 20dm^3 at a constant pressure of 1atm . (3)

16. a) Calculate the standard enthalpy of combustion of methane at 25°C and 1atm pressure.
 $\Delta H^{\circ}_f(\text{CO}_2) = -393.5\text{KJ/mol}$
 $\Delta H^{\circ}_f(\text{H}_2\text{O}) = 285.9\text{KJ/mol}$ (3)
- b) Define standard enthalpy of reaction and standard enthalpy of formation. (2)
17. a) Derive Gibbs Helmholtz equation. (3)
- b) Calculate the maximum efficiency of an engine operating between 110°C and 25°C. (2)
18. a) Explain the physical significance of entropy. (2)
- b) Derive the variation of free energy change with temperature. (3)
19. a) Derive the relationship between K_P and K_C . (4)
- b) Calculate ΔG° for the water gas reaction where $K_p = 1.06 \times 10^5$ at 25°C (1)
20. Derive the Vant Hoff isotherm. (5)
21. a) Explain the effect of temperature using Le-Chatlier principle for the formation of NH_3 . (4)
- b) What is the catalyst used in the process of formation of NH_3 . (1)
22. a) Write the Carnots theorem. (2)
- b) Explain the Nernst heat theorem. (3)

PART – C

Answer any FOUR questions

(4 x 10 = 40 marks)

23. Derive an expression for Joule Thomson Co-efficient and explain its significance. (10)
24. a) How will you measure the enthalpy of combustion experimentally. (8)
- b) Define Hess's law. (2)
25. Explain carnot cycle. (10)
26. Explain the effect of temperature on the equilibrium constant. (10)
27. a) What are the factors which alter the state of equilibrium. (2)
- b) Explain the effect of pressure in the dissociation of N_2O_4 and in the formation of ammonia. (4+4)
28. a) Explain the third law of thermodynamics. (2)
- b) How will you determine the absolute entropy of a gas? (8)

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