LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

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

SECOND SEMESTER – APRIL 2017

CH 2507– THERMODYNAMICS

Date: 05-05-2017 Dept. No. Max. : 100 Marks
Time: 01:00-04:00

PART – A

Answer ALL the questions. **(10x2=20)**

1. Define state function and path function with an example.
2. Six moles of an ideal gas expand isothermally and reversibly from a volume of 1 dm^3 to 10 dm^3 at 27°C. What is the maximum work done?
3. Give the significance of Joule-Thomson coefficient.
4. Define standard enthalpy of neutralization.
5. Give the relation between enthalpy and internal energy.
6. Write one limitation of first law of thermodynamics.
7. Give the units of entropy and enthalpy.
8. Define standard free energy of formation.
9. Define Law of Mass action.
10. Define residual entropy.

PART – B

Answer any EIGHT questions. **(8x5=40)**

11. Derive the relation between Cp and Cv.
12. Derive an expression for the work done in a reversible, isothermal expansion. Process.
13. Derive Kirchoff's equation.
14. State Hess's law of constant heat of summation and explain its application.
15. Explain the standard heat of neutralisation.
16. How is the enthalpy of combustion measured? Explain.
17. (a) Calculate the maximum efficiency of an engine working between 110°C and 25°C. **(2)**
    (b) Calculate the entropy change in the melting of 1 Kg of ice at 0°C. Heat of fusion of ice is 334.72 J/g. **(3)**
18. One mole of N_2 gas is mixed with 3 moles of O_2 at 25°C to form a mixture at the final pressure of 1 atm. The initial pressure of each is also 1 atm. Calculate the molar entropy of mixing.
19. Derive the relation between Kp and Kc for a reaction.
20. Calculate Kp at 25°C and 325°C for the reaction $NO(g) + ½ O_2 \leftrightarrow NO_2(g)$ if at 25°C, $\Delta H = -56.48$ KJ/mol and $\Delta G = -34.85$ KJ/mol.
21. Derive Van't Hoff reaction isochore.
22. Explain the Nernst heat theorem.

PART – C

Answer any FOUR questions. **(4x10=40)**

23. (a) Explain the postulates of the kinetic theory of gases. **(5)**

    (b) Prove that dP is an exact differential using ideal gas equation. **(5)**

24. (a) State and explain Joule-Thomson effect. **(5)**

    (b) Derive Vander Walls equation of state. **(5)**

25. (a) Calculate the ΔH for the reaction $AgNO_3 + NaCl \rightarrow NaNO_3 + AgCl$.

    Given $\Delta H^o_f Ag^+_{(aq)} = 105.9$ kJ/mol, $\Delta H^o_f AgCl_{(s)} = 127.0$ KJ/mol,

    $\Delta H^o_f Cl^-_{(aq)} = 167.5$ KJ/mol. **(5)**

    (b) Differentiate bond energy from bond dissociation energy. **(5)**

26. (a) Derive Gibbs Helmholtz equation. **(5)**

    (b) Explain its application. **(5)**

27. (a) Discuss the dissociation of nitrogen tetraoxide by applying Lechatlier's principle. **(5)**

    (b) Calculate the equilibrium constant for a equilibrium reaction at 300K, whose

    ΔG^o value at this temperature is 29.29 kJ mol^{-1}. **(5)**

28. (a) For a water gas reaction at 1000K the standard Gibb's energy change is -8.1 $kJmol^{-1}$.

    Calculate the value of equilibrium constant. **(5)**

    (b) How will you determine the absolute entropy of oxygen gas? **(5)**

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