



LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

B.Sc. DEGREE EXAMINATION – CHEMISTRY

THIRD SEMESTER – APRIL 2019

16/17UCH3MC01– THERMODYNAMICS

Date: 24-04-2019
Time: 01:00-04:00

Dept. No.

Max. : 100 Marks

PART – A

Answer ALL questions

(10 X 2= 20)

1. Write the mathematical statement of Ist law of Thermodynamics.
2. What is the virial equation of state for real gases?
3. Define Bond Energy.
4. 0.50 g of benzoic acid is subjected to combustion in a bomb calorimeter, when the temperature of the calorimeter system (including water) is found to rise by 0.55⁰ C. Calculate the enthalpy of combustion of Benzoic acid at constant volume. The thermal capacity of the system Z is 23.85 kJK⁻¹.
5. State the need for Second law of Thermodynamics.
6. Calculate the entropy of mixing of one mole of Oxygen gas and two moles of Hydrogen gas, assuming that no chemical reaction occurs and the gas mixture behaves ideally.
7. Write the integrated form of Van't Hoff's equation.
8. Define entropy of a system.
9. State the third law of Thermodynamics
10. What is Sackur-Tetrode Equation?

PART – B

Answer any EIGHT questions

(8 X 5= 40)

11. Derive the vanderWaal's equation for describing the P-V-T relationship in real gases.
12. Mention the importance of internal energy and enthalpy of a system.
13. Show that for one mole of an ideal gas $C_p - C_v = R$.
14. Discuss the application of Bond energy.
15. Calculate q and w for the reversible isothermal expansion of one mole of an ideal gas at 27⁰C from a volume of 10 dm³ to a volume of 20 dm³.
16. Describe the carnot reversible cycle for establishing the maximum convertibility of heat into work.

17. What is Stirling's approximation? Mention its advantages.
18. Derive an expression for Van't Hoff reaction isotherm.
19. The free energy change (ΔG) accompanying a given process is -85.77 kJ at 25°C and -83.68 kJ at 35°C . Calculate the change in enthalpy (ΔH) for the process at 30°C .
20. Explain the formation of ammonia using Le- Chateliers –Braun Principle.
21. How will you verify the third law of thermodynamics?
22. Calculate the translational partition function for Hydrogen atom at 3000 K confined to move in a box of volume of $2.494 \times 10^5 \text{ cm}^3$.

PART- C

Answer any FOUR questions

(4 X 10= 40marks)

23. (a) Derive Maxwell's distribution of Molecular velocities.
(b) State and explain the principle of equipartition of energy. **(6+4)**
24. (a) State and explain the Hess's law of constant heat summation.
(b) What is inversion temperature? Calculate the inversion temperature of hydrogen, if the vanderWaals constants a and b are 0.246 & 0.0267 respectively. **(5+5)**
25. (a) Derive an expression for the variation of enthalpy of reaction with temperature.
(b) Enlist the physical significance of entropy. **(6+4)**
26. (a) Derive thermodynamically the Gibbs Helmholtz equation.
(b) Derive an expression for the entropy of mixing of ideal gases. **(6+4)**
27. (a) Calculate K_p for the reaction $3/2\text{O}_{2(g)} \rightleftharpoons \text{O}_{3(g)}$ at 298 K . ΔG^0 for the reaction is $163.43 \text{ kJmol}^{-1}$
(b) Derive Van't Hoff isochore. **(4+ 6)**
28. (i) Explain the Nernst heat theorem. How does it lead to the enunciation of third law of thermodynamics?
(ii) Derive an expression for rotational partition function. **(6+4)**
