

B. Sc. DEGREE END SEMESTER EXAMINATION - OCTOBER 2025**SEMESTER 5 : CHEMISTRY****COURSE : 19U5CRCHE07 : PHYSICAL CHEMISTRY – I***(For Regular 2023 Admission and Supplementary 2022/ 2021/ 2020 / 2019 Admissions)*

Time : Three Hours

Max. Marks: 60

PART A**Answer All (1 mark each)**

1. Why do fine iron wires burst into flame when lighted, while an iron frying pan does not?
2. Give an example of reversible reaction with homogeneous equilibrium.
3. Define fugacity of a system.
4. What is the function of a heat engine?
5. What are the different modes of energy transfer between system and surroundings?
6. Dissociation of NH_4Cl in a closed vessel is a component system.
7. What is the relationship between K_c and K_p ?
8. Write down the thermodynamic first law expression as applied to an isothermal process.

(1 x 8 = 8)**PART B****Answer any 6 (2 marks each)**

9. Show that, $dU = TdS - PdV$.
10. Four phases of a heterogeneous system do not exist at equilibrium at a point. Explain.
11. Explain the thermodynamic basis of Hess's law.
12. Why ideal gases do not show Joule-Thomson effect?
13. Write a note on equilibration and degree of freedom along the fusion curves of rhombic and monoclinic sulphur in the phase diagram
14. State and explain zeroth law of thermodynamics.
15. Show that the entropy change of an ideal gas for an isochoric process is;
$$\Delta S = 2.303 \times n C_v \log \frac{T_2}{T_1}$$
16. Show that, $-(\Delta A)_{T,V} = -w_{rev}$

(2 x 6 = 12)**PART C****Answer any 4 (5 marks each)**

17. Derive Gibbs - Helmholtz equation and Explain its application
18. Derive van't Hoff reaction isotherm.
19. Calculate the entropy change involved when 2 moles of an ideal gas expands reversibly and isothermally from 0.05 m^3 to 0.5 m^3 at 300K.
20. A heat engine whose efficiency is 30%, absorbs 900 J from the high temperature reservoir at 450 K. Calculate a) the temperature of the sink b) maximum work done by the engine and c) the heat rejected to the sink.
21. Show that work done 'w' is a path function or an ideal gas. Given that V is a function of T and P.
22. Write a note on autocatalysis and induced catalysis with examples?

(5 x 4 = 20)

PART D

Answer any 2 (10 marks each)

23. a) Derive Kirchoff's equation and arrive at its integrated form.
b) Obtain expressions relating Inversion Temperature (T_i) and van der Waals constant.
24. Explain the phase equilibrium and components at (a) triple point in water system (b) eutectic point in Ag - Pb system, congruent melting point in FeCl_3 - H_2O system and incongruent melting point in Na_2SO_4 - H_2O system. Calculate the degrees of freedom in each case.
25. Define molar heat capacities C_p and C_v ; and derive an expression relating C_p and C_v for an ideal gas.
26. What do you mean by half life of a reaction? Derive the expression to calculate the half life period of a zero, first and second order reactions?

(10 x 2 = 20)