

**THIRD SEMESTER (CUCBCSS—UG) DEGREE EXAMINATION
NOVEMBER 2020**

Chemistry

CHE 3B 03—PHYSICAL CHEMISTRY—I

Time : Three Hours

Maximum : 80 Marks

Section A

Answer all questions.

Each question carries 1 mark.

1. Write the kinetic gas equation
2. An ideal gas cannot be liquefied. Why ?
3. Write the expression for work done in isothermal reversible expansion of a gas.
4. What are standard state conditions ?
5. State third law of thermodynamics.
6. What is residual entropy ?
7. Why is a drop of liquid spherical ?
8. What is fluidity of a liquid
9. State the relation between K_p and K_c .
10. What is the unit of equilibrium constant of $H_2 + I_2 \rightleftharpoons 2HI$?

(10 × 1 = 10 marks)

Section B

Answer any ten questions.

Each question carries 2 marks.

11. What are the causes of deviation of real gases from ideal behaviour ?
12. The critical temperature and critical pressure of Cl_2 gas are $146^\circ C$ and 93.5 atmosphere respectively. Calculate the values of van der Waal's constants.

13. Write virial equation of state for real gases.
14. Calculate the temperature at which hydrogen molecules possess an average speed of $1.69 \times 10^3 \text{ ms}^{-1}$.
15. Define 'system' and 'surroundings' in thermodynamics.
16. State second law of thermodynamics and explain the need of the law.
17. Discuss the use of Gibbs Helmholtz equation in assessing the spontaneity of a chemical reaction.
18. How do lattice enthalpy and enthalpy of hydration determine the dissolution of an ionic compound?
19. What is molar refractivity?
20. How is viscosity of a liquid related to chemical constitution?
21. Explain Poiseuille's equation for determination of viscosity.
22. Give the relation between surface tension and density of a liquid.

(10 × 2 = 20 marks)

Section C

*Answer any five questions.
Each question carries 6 marks.*

23. Briefly describe Maxwell distribution of molecular velocities.
24. Derive the expression for work done in adiabatic reversible expansion of an ideal gas.
25. What is Joule Thompson effect? Derive the expression for Joule Thompson coefficient.
26. Describe Carnot cycle.
27. Define chemical potential and formulate Gibbs-Duhem equation.
28. Derive the equation for variation of heat of a reaction with temperature.
29. Explain Ostwald's method for determination of viscosity of a liquid.
30. Describe law of mass action and law of chemical equilibrium.

(5 × 6 = 30 marks)

Section D

*Answer any **two** questions.*

Each question carries 10 marks

31. Deduce the expression for van der Waal's constants in terms of critical constants. Explain the law of corresponding states and derive the reduced equation of state.
32. Explain the concept of entropy and compare the entropy changes in reversible and irreversible processes.
33. Discuss Nernst heat theorem and Hess's law of constant heat summation.
34. (a) Illustrate Van't Hoff equation for temperature dependence of equilibrium constant.
- (b) Explain Le Chatelier's principle taking the equilibria of SO_3 and NH_3 generation.

(2 × 10 = 20 marks)