

D 31573

(Pages : 3)

Name.....

Reg. No.....

**THIRD SEMESTER (CUCBCSS—UG) DEGREE EXAMINATION  
NOVEMBER 2022**

Chemistry

CHE 3B 03—PHYSICAL CHEMISTRY—I

(2017—2018 Admissions)

Time : Three Hours

Maximum : 80 Marks

**Section A**

*Answer all questions.  
Each question carries 1 mark.*

1. Write the equation for calculating RMS velocity.
2. What is Boyle temperature of gas ?
3. Which among the following is an intensive property; temperature, volume, heat capacity ?
4. Give the mathematical statement of First law of thermodynamics.
5. State Kirchhoff equation.
6. Enthalpy of neutralization of any strong acid by a strong base will be a constant. Why ?
7. What is the unit of surface tension ?
8. Define specific refractivity.
9. State the relation between  $K_p$  and  $K_x$ .
10. At  $300^\circ\text{C}$ , the equilibrium constant for the synthesis of HI is 20. What is the equilibrium constant value for the decomposition of HI ?

(10 × 1 = 10 marks)

**Section B**

*Answer any ten questions.  
Each question carries 2 marks.*

11. Define collision frequency and mean free path.
12. Calculate the temperature at which the average velocity of oxygen equals that of hydrogen at  $-253^\circ\text{C}$ .

**Turn over**

13. Comment on the effect of temperature on Maxwell's distribution of velocities.
14. Calculate the critical constant values of a gas where, van der Waal's constants are :  $a = 0.751 \text{ dm}^6 \text{ atmosphere mol}^{-2}$  and  $b = 0.0226 \text{ dm}^3 \text{ mol}^{-1}$ .
15. Distinguish between state and path functions.
16. Formulate the relation between  $C_p$  and  $C_v$ .
17. What is inversion temperature ?
18. How will you determine molecular mass from viscosity measurements ?
19. What is Stirling's approximation?
20. Calculate the molar refraction of acetic acid when density =  $1,046 \text{ g/cc}$  and refractive index is  $1.3715$ .
21. Comment on the uniqueness of water as a solvent.
22. How can we prove that chemical equilibrium is dynamic?

(10 × 2 = 20 marks)

### Section C

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

23. Derive van der Waal's equation of state.
24. Explain the concept of entropy and compare the entropy change in the case of reversible and irreversible processes.
25. What is chemical potential ? Derive expression for the variation of chemical potential with temperature.
26. Explain mathematically the work done in a reversible isothermal expansion and that in a reversible adiabatic expansion of an ideal gas.
27. Derive the expression for Joule Thompson coefficient.
28. What is residual entropy ? Calculate the residual entropy of CO.
29. Explain parachor. Establish the Kekule's structure of benzene based on parachor values (parachor values of C, H, double bond and six membered ring are 4.78, 17.1, 23.1 and 6.1 respectively ; the experimental parachor value is 206.7).
30. Provide the thermodynamic derivation of law of chemical equilibrium.

(5 × 6 = 30 marks)

**Section D**

*Answer any two questions.  
Each question carries 10 marks.*

31. Postulate the kinetic theory of gases. Derive the Kinetic gas equation.
32. Derive Clausius Clapeyron equation and discuss its applications.
33. (a) Explain Nernst Heat theorem.  
(b) Describe Hess's law with suitable examples.
34. Discuss the Le Chatelier's principle with suitable examples.

(2 × 10 = 20 marks)