

Reg. No. :

Name :

Fifth Semester B.Sc. Degree Examination, December 2023

First Degree Programme under CBCSS

Chemistry

Core Course V

CH 1541 : PHYSICAL CHEMISTRY I

(2020 Admission Onwards)

Time : 3 Hours

Max. Marks : 80

SECTION – A

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

1. What is meant by Critical Pressure of a gas?
2. Define an Ideal gas.
3. Define Unit cell.
4. State the law of constancy of interfacial angles.
5. Explain Van't Hoff factor.
6. What are isotonic solutions?
7. What is meant by the term transport number?
8. Give any two differences between electronic and electrolytic conduction.

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9. What is a galvanic cell?
10. Give an example for a cation reversible electrode.

(10 × 1 = 10 Marks)

SECTION – B (Short answer)

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

11. What are the causes for the deviations of real gases from ideal behavior?
12. The Van der Waal's constants for nitrogen are : $a = 1.38 \text{ atm dm}^6 \text{ mol}^{-2}$ and $b = 0.0391 \text{ dm}^3 \text{ mol}^{-1}$. Find the critical temperature.
13. Why do crystals diffract X-rays?
14. Define Schottky defect. Give an example of a crystal showing this defect.
15. Calculate the molarity of an aqueous solution containing 15.9 g of anhydrous sodium carbonate in 3 litres.
16. What are azeotropes? Give one example.
17. State and explain Boyle-van't Hoff law for solutions.
18. Explain the term electrophoretic effect implied in the Debye-Huckel theory of strong electrolytes.
19. Discuss Wien effect.
20. How do the molar conductivities of strong and weak electrolytes vary with dilution?
21. Why is KCl commonly used in a salt bridge?
22. Why NaCl acquires a yellow colour when its crystal is heated in sodium vapour?

(8 × 2 = 16 Marks)

SECTION – C (Short essay)

Answer any **six** questions. Each question carries **4** marks.

23. Define Mean free path. How does it vary with (a) increase in temperature and (b) decrease of pressure.
24. Explain the features of the rock-salt structure.
25. First order diffraction was observed for X-rays of wavelength 0.0576 nm at an angle $6^{\circ}54'$ for a single crystal of a certain solid. Calculate the distance apart of consecutive planes.
26. What is reverse osmosis? Explain one important application of the method.
27. Discuss the variation of viscosity of a liquid with temperature.
28. State Kohlrausch's law of independent migration of ions. How is it useful in determining the molar conductivity at infinite dilution of a weak electrolyte.
29. At 298K, the molar conductivity of a 0.1 M solution of a weak acid HA is $1.2 \text{ S cm}^2 \text{ mol}^{-1}$. The limiting molar conductivity of HA is $90.90 \text{ S cm}^2 \text{ mol}^{-1}$. Calculate the dissociation constant of the acid at 298 K.
30. How is the pH of a solution determined using the hydrogen electrode?
31. What are concentration cells? How are they classified?

(6 × 4 = 24 Marks)

SECTION – D (Essay)

Answer any **two** questions. **Each** question carries **15** marks.

32. Discuss the significance of Maxwell's equation for the distribution of molecular velocities and the effect of temperature on such distribution.
33. (a) Explain the principle of conductometric titrations as an application of conductance measurements.
(b) What are the advantages of the method?

(c) Explain how the following titrations can be conducted conductometrically.

(i) Strong acid vs strong base

(ii) Weak acid vs strong base.

34. (a) What are fuel cells?

(b) Discuss the $\text{H}_2\text{-O}_2$ fuel cell. Mention its advantages.

(c) What is liquid junction potential? How can it be eliminated?

35. What are liquid crystals? How are they classified? Explain the structural features of each class.

(2 × 15 = 30 Marks)

St. Xavier's College