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Reg. No. : .....

Name : .....

Fifth Semester B.Sc. Degree Examination, December 2022

First Degree Programme under CBCSS

Chemistry

Core Course

CH 1541 : PHYSICAL CHEMISTRY – I

(2013-2016 Admission)

Time : 3 Hours Max. Marks : 80

SECTION – A

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

1. Calculate the RMS velocity of hydrogen gas at 27ºC.

2. Give the value of the compressibility factor for an ideal gas.

3. State the law of constancy of interfacial angles.

4. Find the number of atoms present in a unit cell of a monatomic substance of a face centred cubic crystal system.

5. Why is the Helmholtz free energy called maximum work function?

6. State the zeroth law of thermodynamics.

7. How is surface tension of a liquid affected by temperature?

8. What do you mean by isotonic solutions?

P.T.O.

9. Write the expression for the inversion temperature.

10. Specify the point group of $BF:_1$ molecule.

(10 × 1 = 10 Marks)

SECTION – B

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

11. What is collision frequency? What is the effect of temperature and pressure on it?

12. What is the Boyle temperature? How is it related to the Vander Waals constants?

13. How viscosity of a liquid varies with temperature?

14. What are the Miller indices? Calculate the Miller indices of crystal plane, which cut through the crystal axes at (3a2bc).

15. Distinguish between isotropy and anisotropy.

16. What are proper and improper axes of rotation?

17. List the symmetry elements of (a) H_2O (b) NH_3.

18. Deduce the relationship between heat capacities at constant volume and pressure.

19. Distinguish between extensive and intensive properties.

20. Explain the concept of fugacity.

21. Discuss the physical significance of entropy.

22. Dissolution of 0.440 g of an unknown substance in 22.2 g of benzene reduced the freezing point of benzene by 0.567 K. Calculate the molecular mass of the unknown substance. The molal freezing point depression constant for benzene is 5.12 $Kmol^{-1}kg^{-1}$.

(8 × 2 = 16 Marks)

SECTION – C

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

23. List the postulates of kinetic molecular theory of gases.

24. Write the van't Hoff equation for osmotic pressure of a solution. How can it be modified to determine molecular mass of polymers?

25. Outline any one experimental method used in X-ray diffraction study of crystals.

26. Evaluate the effects of temperature and pressure on the Gibbs free energy.

27. Briefly describe the structural characteristics of nematic and cholesteric phases of liquid crystals.

28. Derive the Gibbs — Duhem equation. Explain its significance.

29. Explain the terms (a) the Joule — Thomson effect (b) the Joule-Thomson coefficient. Show that the Joule — Thomson process is an isenthalpic process.

30. Briefly describe the method of determination of viscosity by Ostwald's viscometer.

31. Elaborate on the elements of symmetry.

(6 × 4 = 24 Marks)

SECTION – D

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

32. (a) Derive the Vander Waals equation of state and illustrate how this equation satisfactorily explains the departure of real gases from ideal behaviour.

    (b) Discuss the important features of the Maxwell-Boltzmann distribution of molecular velocities. (10+5)

33. (a) Elaborate on various types of point defects exhibited by crystalline solids.

    (b) Discuss the structure of (a) NaCl (b) Zinc blende (10+5)

34. Describe the Carnot reversible cycle for establishing the maximum convertibility of heal into work, and obtain an expression for the efficiency of the Carnot engine. Explain the Carnot theorem.

35. (a) What are surface tension and surface energy? Describe one method for the determination of surface tension of a liquid.

(b) Illustrate Hess's law. Give its applications. (8+7)

($2 \times 15 = 30$ Marks)

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