Reg. No. : ....

Name : ....

Fifth Semester B.Sc. Degree Examination, December 2021

First Degree Programme under CBCSS

Core Course

CH 1541 : PHYSICAL CHEMISTRY – I

(2018 and 2019 Admission)

Time : 3 Hours   Max. Marks : 80

SECTION – A

Answer **all** questions. one word type. **Each** question carries **1** mark.

1. What is the average distance travelled by a molecule between two successive collision is called?

2. What is the value of compressibility factor for an ideal gas?

3. Name the temperature at which second virial coefficient vanishes.

4. What is the relationship between inversion temperature and Van-der Waals constants?

5. What is the Bravais lattice of KCI called?

6. What is the SI unit of coefficient of viscosity?

7. What are Isotonic solutions?

8. Which concept is introduced by Zeroth law of thermodynamics?

9. Which type of thermodynamic property is the density of a substance?

10. What is the point group of Trans-butadiene?

(10 × 1 = 10 Marks)

SECTION – B

Answer any **eight** questions. Short answer type. **Each** question carries **2** marks.

11. Define Van't Hoff's factor.

12. Write down the expression for interplanar spacing (d_{hkl}) of a cubic unit cell.

13. Explain compressibility factor.

14. Explain the different symmetry elements in crystals.

15. Define Joule-Thomson effect.

16. Depression in freezing point of water observed for the same amount of acetic acid, trichloroacetic acid and trifluro-acetic acid increases in the order given above. Explain.

17. What is chemical potential?

18. Explain why the addition of a non-volatile solute increases the boiling point of a liquid?

19. What is the relationship between q_p and q_v?

20. Define efficiency of heat engine.

21. State the second law of thermodynamics in terms of entropy.

22. List out the symmetry elements of the C_{2h} point group.

23. Define Graham's law of diffusion.

24. Sketch the Bravies lattices for cubic unit cell.

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25. What is molal elevation constant?

26. What is fugacity?

SECTION – C

Answer any **six** questions. Short Essay type. **Each** question carries **4** marks.

27. Explain Frenkal and Schottky defects in crystals.

28. What are Miller indices? Explain the process for determining them using suitable example.

29. A metallic element exist as a cubic unit cell with a = 2.85 Å, d = 7.20 gm/cm^3. How many unit cells will be present in 100 gm of the metal?

30. Briefly explain reverse osmosis.

31. Explain the determination of viscosity using the Ostwald viscometer.

32. Show that $C_p - C_v = R$ for one mole of an ideal gas.

33. Derive the Gibbs Helmholtz relation and its significance.

34. Obtain an expression for entropy change in the Isothermal reversible expansion of an ideal gas.

35. Explain the Hesse's law of constant heat summation and its application.

36. Explain the different types of semiconductors and their uses.

37. Explain the different types of liquid crystals with examples.

38. Construct the group multiplication table for C_{2v} point group.

(6 × 4 = 24 Marks)

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SECTION – D

Answer any **two** questions. Long Essay Type, **Each** question carries **15** marks.

39. (a) Describe the Carnot's cycle and derive an expression for the efficiency of a heat engine.

    (b) Explain the entropy and free energy criteria for spontaneity of a process.

40. Discuss the significance of Maxwell's equation for distribution of molecular velocities and effect of temperature on such distributions.

41. (a) Define the term Gibbs free energy? What is its physical significance?

    (b) Calculate the standard free energy change for the reaction.

    $4NH_3$ (g) + $5O_2$(g) $\rightarrow$ 4NO (g) + $6H_2O$ (l), given that the standard free energies of formation of NH_3 (g), NO (g) and H_2O (l), are respectively −16.65, 86.61 and −237.20 KJ. per mole. Predict whether the reaction is spontaneous or not at 25 C and 1 atm, pressure.

42. (a) Define refractive index. How is it determined using Abbe refractometer?

    (b) Derive the expression for Raoult's law. Calculate the vapour pressure of a solution containing equal masses of benzene and toluene at 313 K, if the vapour pressure of pure benzene and toluene are 160 mm and 60 mm of Hg respectively.

43. (a) Define viscosity and fluidity. Explain the determination of viscosity by Ostwald viscometer.

    (b) Explain the Maxwell's relations in thermodynamics.

44. (a) Explain the rotating crystal method for the determination of crystal structure.

    (b) Derive the expression for Joule-Thomson coefficient. Explain the significance of the sign and magnitude of this.

    (2 × 15 = 30 Marks)

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