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M – 1489

Reg. No. : .....

Name : .....

Fifth Semester B.Sc. Degree Examination, December 2021

First Degree Programme under CBCSS

Chemistry

Core Course V

CH 1541 : PHYSICAL CHEMISTRY I

(2017 Admission)

Time : 3 Hours

Max. Marks : 80

SECTION – A

Answer all the questions. Each question carries 1 mark

1. State Hess's Law.
2. Differentiate crystalline and amorphous solids.
3. What is meant by most probable velocity? Explain.
4. What are nematic liquid crystals?
5. What are the conditions required to behave real gas as ideal gas?
6. Explain Clausius inequality.
7. Explain improper rotation axis of symmetry.

P.T.O.

8. Write down the mathematical expression for Maxwell Boltzmann distribution of molecular velocities.
9. Write down the critical constants  $T_c$  in terms of van der Waals coefficients.
10. What is meant by extensive property? Give examples.

(10 × 1 = 10 Marks)

### SECTION – B

Answer any eight questions. Each question carries 2 marks.

11. Calculate temperature at which root mean square velocity of helium is equal to that of Argon, Argon is kept at 298 K.
12. Write down the group multiplication table for  $H_2O$ .
13. What is meant by surface tension of a liquid?
14. Prove Joule Thomson experiment is an isoenthalpic process.
15. Find the number of atoms per unit cell in fcc crystal.
16. State postulates of kinetic theory of gases.
17. Define chemical potential. Comment on the chemical potential at equilibrium condition.
18. What is compressibility factor?
19. Define mean free path.
20. What is meant by residual entropy?
21. Write Van't Hoff equation.
22. What are cholesteric liquid crystals.

(8 × 2 = 16 Marks)

### SECTION – C

Answer any six questions. Each question carries 4 marks.

23. Derive and explain temperature dependence of Gibbs Free energy.

24. Briefly discuss working principle of Carnot engine.

25. What is the standard enthalpy change at 298.15 K for the following reaction.

$\text{CO}_2 (\text{g}) + \text{C} (\text{graphite}) = \text{CO} (\text{g})$ . Standard enthalpy of formation of CO and  $\text{CO}_2$  is  $-110.527 \text{ kJmol}^{-1}$  and  $-393.522 \text{ kJmol}^{-1}$  respectively.

26. Explain briefly any one of the method to characterize liquid Crystal.

27. Explain briefly about various type of defects in crystals.

28. When argon gas at 100 atm expands reversibly and adiabatically to twice its initial volume. What will be the final pressure. ( $\gamma$  gamma) =  $\frac{5}{3}$

29. Determine and represent the point groups of  $\text{NH}_3$  molecule.

30. What is meant by colligative property? Explain the relation between depression in freezing point and molality.

31. Write down the mathematical expression and explain the terms

(a) mean velocity

(b) most probable velocity

(6 × 4 = 24 Marks)

SECTION – D

Answer any two questions. Each question carries 15 marks.

32. (a) How would you find point group of  $\text{BF}_3$  by systematic analysis? Discuss.
- (b) How viscosity of liquid can be determined experimental?
- (c) Derive mathematical form of Braggs law.
33. (a) Entropy of the universe is increasing explain.
- (b) How  $\Delta G$  can be used to predict spontaneous process
- (c) Explain briefly about the powder XRD method and its use to identify the Crystal structure.
34. (a) Derive virial equation of state and explain it's significance.
- (b) Discuss the difference of XRD pattern observed in NaCl and KCl.
35. (a) Explain the determination of viscosity of liquids by Ostwald's viscometer
- (b) Discuss briefly nonstoichiometric defects.
- (c) Explain Boyles temperature.

(2 × 15 = 30 Marks)