9. (a) (i) What is the difference between point group and space group? (3)

(ii) Construct the character table for C_3V point group. (7)

Or

(b) (i) Define the term irreducible representation. (3)

(ii) Discuss the salient features of the great orthogonality theorem. (7)

10. (a) (i) Discuss the effect of isotopic substitution on Rotation spectra. (5)

(ii) Write the salient features of Frank-Condon principle. (5)

Or

(b) What is Raman effect? Compare and explain rotational and vibrational spectra.

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PART A — (5 × 5 = 25 marks)

Answer ALL questions.

1. (a) Derive Gibb's Duhem equation.

Or

(b) Give any one method of determination of chemical potential.

2. (a) Write a notes on probability factor.

Or

(b) Give the method of determination of free energy. Discuss its significances.

3. (a) Deduce an expression De-Broglies equation of matter waves.

Or

(b) Discuss the postulates of quantum mechanis.

4. (a) Explain with suitable examples of symmetry operations and symmetry elements

Or

(b) Write a notes on direct product representation.

5. (a) Write a notes on :

(i) Overtones. (2)

(ii) Fermi Resonance. (3)

Or

(b) Discuss the theory of Raman Spectra.

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PART B — (5 × 10 = 50 marks)

Answer ALL questions.

6. (a) (i) Derive the relation between Cp-Cv.

(ii) Deduce and expression for Maxwell's relations. (5+5)

Or

(b) What is chemical potential? How it varies with temperature and pressure. Explain.

7. (a) Write a notes on the following :

(i) Arrhenius theory. (5)

(ii) Reaction cross section. (5)

Or

(b) (i) Write a brief account on potential energy surfaces (PES). (7)

(ii) State and explain Eyring equation. (3)

8. (a) (i) What is black body radiation? Discuss its experimental results. (7)

(ii) What are commutating operators? Explain with suitable examples. (3)

Or

(b) Setup and solve schordinger wave equation for Harmonic oscillator.

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