

2. If the linear triatomic molecule is stretched asymmetrically the absorption band will appear in the

- (a) microwave region
- (b) infrared region
- (c) ultraviolet region
- (d) visible region.

3. Symmetric linear molecules can have

- (a) only odd values of J
- (b) only even values
- (c) both values of J
- (d) either odd or even values.

4. The condensation temperature is also called as

- (a) transition temperature
- (b) critical temperature
- (c) degeneracy temperature
- (d) Fermic temperature.

5. Two Lorentz transformations carried out in succession are equivalent to

- (a) an orthogonal transformation
- (b) one Lorentz transformation
- (c) a Galilean transformation
- (d) none of the above.

Answer the following questions in ONE or TWO sentences:

$$(u, v)_{q, p} = \sum_j \left(\frac{\partial q_j}{\partial u} \frac{\partial p_j}{\partial v} - \frac{\partial p_j}{\partial u} \frac{\partial q_j}{\partial v} \right)$$

- 6. Distinguish Lagrange and Poisson brackets. $\rightarrow [x, y]_{q, p} = \left[\sum_j \left(\frac{\partial x_j}{\partial q_j} \frac{\partial y_j}{\partial p_j} - \frac{\partial x_j}{\partial p_j} \frac{\partial y_j}{\partial q_j} \right) \right]$
- 7. What are Euler's angles?
- 8. Explain partition functions.
- 9. State Pauli's exclusion principle. \rightarrow there cannot be more than one particle simultaneously in each quantum state.
- 10. What do you mean by metric tensor?

SECTION B — (5 × 4 = 20 marks)

Answer ALL questions, choosing either (a) or (b)

11. (a) If $[\phi, \psi]$ be the Poisson bracket of ϕ or ψ , show that $\frac{\partial}{\partial t} [\phi, \psi] = \left[\frac{\partial \phi}{\partial t}, \psi \right] + \left[\phi, \frac{\partial \psi}{\partial t} \right]$.

Or

(b) Explain action-angle variables. Bring out the significance of their use.

12. (a) Explain moments and products of inertia.

Or

(b) Explain normal coordinates and normal modes.