

Science I (Quiz 2) [21 marks]

- (1) Define action. What is the principle of least action? Why do we need it? [2]
- (2) Write the Lagrangian for a system of N ideal gas atoms confined in a cubic box of volume V and kept at a temperature T . Determine the Lagrange's equation of motion for the i^{th} atom in this system. [2]
- (3) Using the Lagrangian function, discuss the law of conservation of angular momentum. [4]
- (4) State at least four properties of a wave function. [2]
- (5) Starting from the one-dimensional random walk model, derive the diffusion equation. [3]
- (6) The solution $P(x,t)$ of the one-dimensional diffusion equation was discussed in the class. Using the normalized $P(x,t)$, calculate the following averages: $\langle x \rangle$ and $\langle x^2 \rangle$ [4]
- (7) Draw the ground state and first excited state wave functions and probability densities of a quantum particle confined in a one-dimensional? [3]
- (8) Write the time-independent Schrodinger equation for a one-dimensional quantum system. [1]