

THE INTERNATIONAL UNIVERSITY

VIETNAM NATIONAL UNIVERSITY - HCMC

ASSIGNMENT

SUBJECT: PHYSICS 4

GROUP: 5-7 STUDENTS

Question 1 (25 pts) An electron ($m_e = 9.11 \times 10^{-31}$ kg) has a velocity of magnitude of 500 m/s, accurate to within 0.010 0%.

- (a) Within what limits could we determine the position of this electron along the direction of the velocity?
- (b) Is the measure of position of this electron accurate? Explain your answer.

Question 2 (25 pts) (a) Determine the ionization energy of hydrogen in eV (energy to take the electron to infinity) if the shortest wavelength in the Balmer series is found to be 0.365 nm.

- (b) How many different photons can be emitted by hydrogen atoms that undergo transitions to the ground state from the $n = 5$ state?

Question 3 (25 pts) Consider a particle moving in one dimension, which we shall call the x -axis.

- (a) What does it mean for the wave function of this particle to be normalized ?
- (b) Can the wave function, $\psi(x) = e^{ax}$ where a is a positive real number, be normalized ? Could this be a valid wave function ?

- (c) If the particle described by the wave function $\psi(x) = Ae^{-bx}$, where A and b are positive real numbers, is confined to the range $x \geq 0$, determine A (including its units) so that the wave function is normalized.

Question 4 (25 pts) A particle is in the ground level of a box that extends from $x = 0$ to $x = L$.

- (a) What is the probability of finding the particle in the region between 0 and $L/4$?
- (b) What is the probability of finding the particle in the region $x = L/4$ to $x = L/2$?
- (c) How do the results of parts (a) and (b) compare? Explain.
- (d) Add the probabilities calculated in parts (a) and (b). Explain the result.

– END OF QUESTIONS –