

中央大學八十九學年度碩士班研究生入學試題卷

物理學系

不分組

科目:

近代物理

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每題 20 分

1. Please describe the photoelectrical effect in detail and explain why this effect demonstrates the quantum nature of light?
2. Describe Bohr's postulate of the atom. From the postulates try to derive the energy level of the electron in a hydrogen atom.
3. Calculate the de Broglie wavelength of a particle of charge e and rest mass m_0 after accelerated by a potential difference V . Treat it relativistically.
4. The wave function for a particle inside an infinite potential well $V(x)$ is given by $\Phi(x) = A \exp[-bx^2 + ikx]$, where $V(x)$ is

$$V(x) = \begin{cases} +\infty & x < -a/2 \\ 0 & -a/2 < x < a/2 \\ +\infty & x > a/2 \end{cases}$$

- (a) Find the normalization constant A .
 - (b) Find the probability of the particle between x and $x+dx$.
 - (c) Find the expectation value of its position x .
5. A particle of total energy $9V$ is incident from the $-x$ axis on a potential given by

$$V(x) = \begin{cases} 8V & x < 0 \\ 0 & 0 < x < a \\ 5V & x > a \end{cases}$$

Find the probability that the particle will be transmitted through to the positive side of the x axis $x > a$.