近代物理期中考

Oct 2023

1. Consider the decay of a particle at rest of mass into a particle of mass and a massless neutrino, . Due to momentum conservation, the magnitude of the momentum equals that of Denote their momentum magnitude as Write down the energies of and in terms of . Use energy conservation to solve in terms of . (20)

提示：Use the formula we solve in the homework,

A black text on a white background

Description automatically generated

解答：. , *.*

Energy conservation:

Move to the left and square both sides and can solved

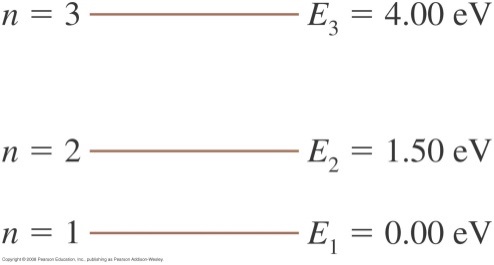
1. In a photoelectric effect experiment, we can measure the stopping voltage of the photoelectrons versus the frequencies of the light applied. Assume that at frequency , the measured stopping voltage is . Calculate the stopping voltage corresponding to the frequency 2. The answer can be expressed in terms of . (15)

解答：, ，兩式相減：。

A graph of a function

Description automatically generated

1. Consider a quantum system with only three stable energy states：

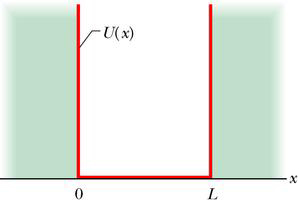


The emitting spectrum of this system consists of 3 lines corresponding to the frequencies: . Assume the energy of the ground state is zero. Calculate the energies of the highest stable states。。(15)

解答：

而

1. Consider an infinite potential, with boundaries at and : and .



A particle is known to be localized inside the box, with an instantaneous 瞬間 wavefunction at as:

Calculate the constant . Use your result to write down the probability density at at . (25)

解答：

，

1. Consider an electron moving from left to right and is scattered by a step potential at . The step potential is: and .

A diagram of a square with a square and a square with a square with a square with a square with a square with a square with a square with a square with a square with a square with

Description automatically generated

A solution of the Schrodinger Eq in this potential can be written as:

A diagram of lines and curves

Description automatically generated with medium confidence

and are calculatable constants. Calculate the probability density at as a function of in terms of . (25)

提示：,,

解答：at

。

at