

# Solutions to Problems in Goldstein, *Classical Mechanics*, Second Edition

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## Chapter 1

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### Problem 1.1

A nucleus, originally at rest, decays radioactively by emitting an electron of momentum  $1.73 \text{ MeV}/c$ , and at right angles to the direction of the electron a neutrino with momentum  $1.00 \text{ MeV}/c$ . (The  $\text{MeV}$  (million electron volt) is a unit of energy, used in modern physics, equal to  $1.60 \times 10^{-6} \text{ erg}$ . Correspondingly,  $\text{MeV}/c$  is a unit of linear momentum equal to  $5.34 \times 10^{-17} \text{ gm-cm/sec.}$ ) In what direction does the nucleus recoil? What is its momentum in  $\text{MeV}/c$ ? If the mass of the residual nucleus is  $3.90 \times 10^{-27} \text{ gm}$ , what is its kinetic energy, in electron volts?

Place the nucleus at the origin, and suppose the electron is emitted in the positive  $y$  direction, and the neutrino in the positive  $x$  direction. Then the resultant of the electron and neutrino momenta has magnitude

$$|\mathbf{p}_{e+\nu}| = \sqrt{(1.73)^2 + 1^2} = 2 \text{ MeV}/c,$$

and its direction makes an angle

$$\theta = \tan^{-1} \frac{1.73}{1} = 60^\circ$$

with the  $x$  axis. The nucleus must acquire a momentum of equal magnitude and directed in the opposite direction. The kinetic energy of the nucleus is

$$T = \frac{p^2}{2m} = \frac{4 \text{ MeV}^2 c^{-2}}{2 \cdot 3.9 \cdot 10^{-27} \text{ gm}} \cdot \frac{1.78 \cdot 10^{-27} \text{ gm}}{1 \text{ MeV } c^{-2}} = 9.1 \text{ ev}$$

This is much smaller than the nucleus rest energy of several hundred  $\text{GeV}$ , so the non-relativistic approximation is justified.

# Goldstein Classical Mechanics Solutions Manual Scribd

**Lei Shi**



## **Goldstein Classical Mechanics Solutions Manual Scribd:**

## **Goldstein Classical Mechanics Solutions Manual Scribd** Book Review: Unveiling the Magic of Language

In a digital era where connections and knowledge reign supreme, the enchanting power of language has become more apparent than ever. Its capability to stir emotions, provoke thought, and instigate transformation is truly remarkable. This extraordinary book, aptly titled "**Goldstein Classical Mechanics Solutions Manual Scribd**," published by a very acclaimed author, immerses readers in a captivating exploration of the significance of language and its profound effect on our existence. Throughout this critique, we shall delve to the book's central themes, evaluate its unique writing style, and assess its overall influence on its readership.

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