NORTHERN ILLINOIS UNIVERSITY

PHYSICS DEPARTMENT

Physics 283 – Modern Physics Spring 2026

Problem Set #4

Problem Set Due: Thurs., Feb. 19, 2026
Read Krane: Chapter 5.1-5.4, Lecture Notes #1

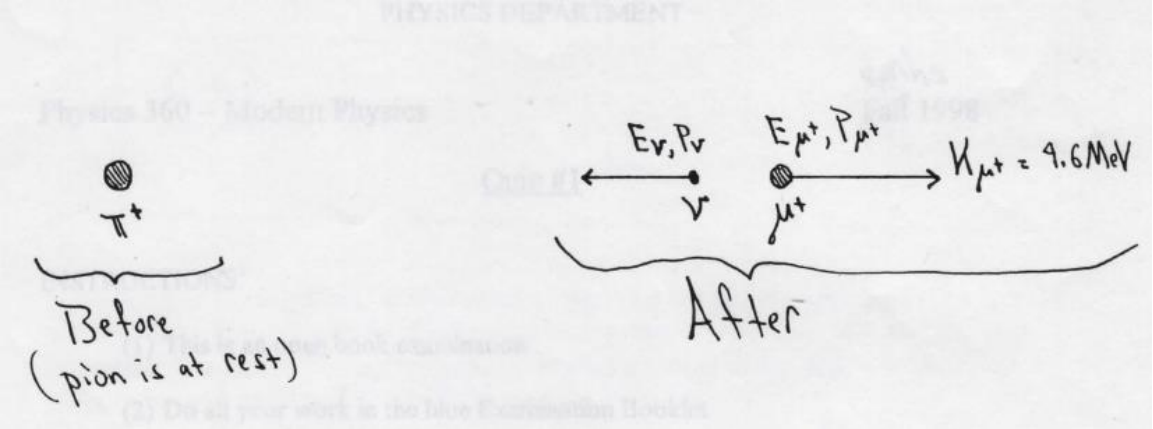
1. **OpenStax University Physics Vol. 3: Section 4.4:** Problem 41
2. **OpenStax University Physics Vol. 3: Section 4.5:** Problem 55
3. **OpenStax University Physics Vol. 3: Section 4.6:** Problem 73 **(Let d = 0.120 nm)**

4. **Krane: Problem 2** **page 174**
5. **Krane: Problem 5** **page 174**(draw energy level diagram) (see Fig. 5.13)
6. **Krane: Problem 7** **page 174** (draw figure)
7. **Krane: Problem 9** **page 174** (sketch wavefunction)
8. **Krane: Problem 15** **page 174** (just show calculation)
9. **Krane: Problem 16** **page 174** (just show calculation)

Quiz #1 ReDo Problem on the Next Page

It is worth 25 Quiz #1 points

10.



Measuring the mass of the π^+ *meson*: The π^+ meson (also called the pion) is a subatomic particle responsible for the strong nuclear force between protons and neutrons. It is observed to decay at rest into a μ^+ meson (muon) and a neutrino, denoted ν. Because the neutrino has no charge or mass (talk about elusive!), it leaves no track in a bubble chamber. (A bubble chamber is a large chamber filled with liquid hydrogen that shows the tracks of charged particles as a series of tiny bubbles.) However, the track of the charged muon is visible as it loses kinetic energy and comes to rest. If the mass of the muon is known to be 106 MeV/c^2, and the kinetic energy, *K*, of the muon is measured to be 4.6 MeV from its track length, find the mass of the π^+. To do this first:

(a) Write down the conservation of energy relation for this system

(b) Write down the conservation of momentum for this system

(c) Determine the mass of the π^+ in MeV/c^2.