

Homework 5: Practice Test (due Mar 4)

Name: _____

Major: _____ ISU ID: _____

This tests consists of 4 parts: multiple-choice questions, definitions of terms, a problem, and a short essay.

Multiple-choice questions (6 points)

Mark the answer that you think is closest to the correct answer. Each correct answer is worth 1 point. Wrong answers are worth 0 points.

The Lagrangian function for a particle of mass m and generalized coordinate q is $\mathcal{L}(q, \dot{q}, t) = m\dot{q}^2/2 - mgq$, where g is a constant. The Hamiltonian function $\mathcal{H}(q, p, t)$ is

- $-p^2/(2m) - mgq$ $-p^2/(2m) + mgq$ mgq $p^2/(2m) + mgq$ $p^2/(2m) - mgq$

The magnetic rigidity of a 100-GeV electron is

- 334 T · m 3.34 T · m 100 T · m 10 T · m 1 T · m

Most of the accelerators in the world are used for

- research in nuclear physics research in biology industrial applications medical applications
 military applications

So far, the maximum energy ever reached in a proton synchrotron is

- 10 MeV 100 MeV 1 GeV 100 GeV 1 TeV

Which one of these machines is not a collider?

- AdA Cosmotron KEKB LHC Tevatron

Antiprotons were discovered by analyzing collisions of protons produced by the following machine:

- Cockcroft-Walton voltage multiplier 184-inch cyclotron CERN PS Bevatron Tevatron

Definitions (8 points)

Define the following terms using less than 100 words: (a) phase space; (b) resonant acceleration.

Problem (8 points)

Consider a beam of 6-GeV electrons hitting a hydrogen target.

- (a) Calculate the De-Broglie wavelength of the electrons. Compare it with the typical size of a nucleon.
- (b) Calculate the center-of-mass energy of the electron-proton system.

Short essay (8 points)

Discuss the different functions of the magnetic field in the betatron: acceleration, confinement, focusing.

