

Practice Report

Name: _____

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

Multiple-choice questions

Mark the answer that you think is closest to the correct answer.

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

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

- 1 GeV 4 GeV 1 TeV 6.5 TeV 13 TeV

Which one of these machines is not a collider?

- AdA Main Injector BEPC Tevatron LHC

What is the typical order of magnitude of the largest nuclear cross sections?

- 10^{-42} m² femtobarn 10^{-34} m² 10^{-31} m² barn

Definitions

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

Problem

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

Within these two pages, discuss the main aspects of luminosity: concept, definitions, typical values, ways to optimize it, limitations.

