

Massachusetts Institute of Technology

Physics 8.09 Fall 2006

Homework 2

due Wednesday, September 20, 2006 at 12:30 PM

Suggested Reading

Goldstein Sections 1.1-1.2 and 2.1-2.5

Problems

Problem 2.1 (20 pts)

Goldstein, Problem 6, Chapter 2, Page 64

Problem 2.2 (20 pts)

Goldstein, Problem 7, Chapter 2, Page 65

Problem 2.3 (20 pts)

Goldstein, Problem 10, Chapter 2, Page 65

Problem 2.4 (20 pts)

Consider a region of space divided by a plane. The potential energy of a particle in region 1 is U_1 and in region 2 is U_2 . If a particle of mass m and with speed v_1 in region 1 passes from region 1 to region 2 such that its path in region 1 makes an angle θ_1 with the normal to the plane of separation and an angle θ_2 with the normal to the plane when in region 2, show that

$$\frac{\sin \theta_1}{\sin \theta_2} = \sqrt{1 + \frac{U_1 - U_2}{T_1}}$$

where $T_1 = \frac{1}{2}mv_1^2$. What is the optical analog of this problem ?

Problem 2.5 (20 pts)

A pendulum consists of a mass m suspended by a massless spring with unextended length b and spring constant k . Find Lagrange's equations of motion.