Physics 1145: Homework for week 15: Oscillations

1. A toy figure of mass 2.0kg is at the end of a horizontal spring of spring constant 200N/m on a frictionless horizontal surface. The toy is pulled, stretching the spring a distance 6.0cm from equilibrium, and released from rest.
a) Find the frequency and the period of the oscillation.

b) What is the maximum speed reached by the toy?

2. The position of a 100g oscillating mass is given by 2.0cm cos(8t) where t is in seconds. Find amplitude, period, frequency, spring constant, maximum speed, total energy.

3. A 100g ball is tied to the end of a string. You observe that it swings with a period of 1.5 s.
a) How long is the string?
b) What would be the period of this pendulum on the Moon where the free fall acceleration is 1/6 the free fall acceleration on Earth?

4. A mass at the end of a spring is undergoing simple harmonic oscillations with amplitude A.

a) In terms of A, find the value of displacement x at which the potential energy equals 1/9 of the total mechanical energy.

b) What fraction of the total mechanical energy is kinetic if the displacement is ½ the amplitude?

5. A mass at the end of a massless string oscillates with a period of 2 seconds. What is the period if

a) the mass is doubled?

b) the string length is increased by a factor of four?

c) the string length is decreased by a factor of four?

d) the amplitude is doubled?