Simple Harmonic Motion - Introduction

Tuesday, February 4, 2014 10:09 AM

- Gary Stewart set a pogo stick record in 1990 by jumping 1777.737 times. If the pogo stick he used had a force constant of 6000. N/m and was compressed 0.12 m on each jump, what force must Gary have exerted on the pogo stick upon each jump? What force would be exerted back up on Gary each time he went up? → 720 N b/c of Newtons 3rd law

$K = 6000.\ N/m$
$X = 0.12\ m$
$F = ?$

$F = -Kx$

$F = -kx$
$= -6000 \cdot .12$
$= -720\ N$
− b/c opposes displacement (opposite displacement)

- Sam, a butcher, puts 3.0 kg of chopped beef on the 1.0 kg pan of his scale, which has a spring whose spring constant is 400. N/m.
  - What is the period of vibration of the pan as it comes to rest?
  - If Sam adds more beef to the scale, what will this do to the period of vibration?

$m_b = 3.0\ kg$ } add together
$m_p = 1.0\ kg$
$k = 400.\ N/m$
$T = ?$

$T = 2\pi\sqrt{\frac{m}{k}}$ ← increase

$= 2\pi\sqrt{\frac{4.0}{400}}$

$= 2\pi\sqrt{\frac{1}{100}}$

$= 2\pi \cdot .1 = 0.628\ sec$

more beef
T is bigger
longer period

- A toy bobs up and down over a crib with a period of 1.0 s. The toy hangs from the end of a spring whose spring constant is 20.0 N/m. What is the mass of the toy?

$T = 1.0\,s$

$k = 20.0\,N/m$

$m = ?$

$T = 2\pi\sqrt{\frac{m}{k}}$

$\frac{T}{2\pi} = \sqrt{\frac{m}{k}}$

$\frac{T^2}{4\pi^2} = \frac{m}{k}$

$\frac{T^2 \cdot k}{4\pi^2} = m$

$\frac{1.0^2 \cdot 20}{4 \cdot \pi^2} = 0.506\,kg$

- A pendulum has a period of 1.0s on Earth. What would its period be on Mars, where g = 3.4 m/s/s?

$T_E = 1.0\,s$

$T_M = ?$

$g_E = 9.8\,m/s^2$

$g_M = 3.4\,m/s^2$

L of pend

$T = 2\pi\sqrt{L/g}$

$\frac{T}{2\pi} = \sqrt{\frac{L}{g}}$

$\frac{T^2}{4\pi^2} = \frac{L}{g}$

$\frac{T^2 g}{4\pi^2} = L = \frac{1.0^2 \cdot 9.8}{4\pi^2} = 0.248\,m$

$T_M = ?$

$T_M = 2\pi\sqrt{L/g}$

$= 2\pi\sqrt{\frac{0.248}{3.4}}$

$= 1.7\,s$