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 **Simple Harmonic Motion**

![j0322389[1]]()period, *T*: frequency, *f*: #

![j0307362[1]]()

 wall equilibrium position

 frictionless floor

period of a mass-spring system:

 m = mass (kg)

![an03341_[1]]() k = spring constant (N/m)

EX. A 5.5 kg cat is attached to a fixed horizontal spring of stiffness 22.8 N/m

 and is set in motion on a frictionless surface. Find the period of motion of…

 …the cat.

 …a 240 g mouse, with the same spring and surface.

 What stiffness must a spring have so that the period of the mouse’s motion is the

 same as that of the cat?

EX. A 1275 kg car carries two passengers with a combined mass of 153 kg. The

 car has four shock absorbers, each with a spring constant of 2.0 x 104 N/m.

![j0411396[1]]() Find the frequency of the vehicle’s motion after it hits a pothole.

restoring force:

simple harmonic motion (SHM):

 For a mass-spring system, Hooke’s law applies:

![pe05729_[1]]()energy:

 kinetic energy, *KE*: energy of mass *m* having velocity *v*

 *m* (kg); *v* (m/s)

![j0319934[1]]() potential energy, *PE*: stored energy

 For a spring with spring constant *k* and “stretch” *x*:

![tn01106_[1]]() *k* (N/m); *x* (m)

 For a mass *m* at a height *h* above a reference line:

 *m* (kg); *h* (m); g = 9.81 m/s2

amplitude, *A*: maximum displacement from equilibrium

 frictionless

Energy of a Mass-Spring System

 Energy (J)

* ***The Pendulum***

 For < 15o, a simple pendulum

 approximates SHM.

Energy of a Simple Pendulum

 Energy (J)

period of a simple pendulum:

EX. The period of a pendulum is 5.2 s. Find…

 A. …its length

 B. …the mass of the bob

period of a mass-spring system

In a simple harmonic motion:

The body of a 1275 kg car is supported on a frame by four springs. Two riders mass is 153 kg. The frame vibrates with a period of 0.840 s

A. …its spring constant