

PS1, SHM, Light, & Color

Simple Harmonic Motion: Springs & Pendulums

- Terry jumps up and down on a trampoline with a frequency of 1.5 Hz. What
1. is the period of Terry's jumping?

- Gary Stewart of Reading, Ohio set a pogo stick record in 1990 by jumping 177,737 times. a) 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? b) What force would be exerted back up
2. on Gary each time he went up?

- At the post office, Cliff, a postal worker, places a 0.60-kg package on a scale, compressing the scale by 0.03 m. a) What is the force constant of the spring in the postal scale? b) What happens to the force constant if Cliff weighs a heavier package?
- 3.

- A jack-in-the-box lid will pop open when a crank is turned on the outside of the box. If Jack pushes against the inside of the box with a force of 3.00 N when the lid is closed, and the spring is compressed 10.0 cm from equilibrium, what is the force constant of the spring?
- 4.

- Sam, a butcher, puts 3.0 kg of chopped beef on the 1.0-kg pan of his scale, which has a spring whose force constant is 400. N/m. a) What is the period of vibration of the pan as it comes to rest? b) If Sam adds more beef to the scale, what will this do to the period of vibration?
- 5.

- A toy bobs up and down over Campbell's crib with a period of 1.0 s. The toy hangs from the end of a spring whose force constant is 20.0 N/m. What is the mass of the toy?
- 6.

A spider swings in the breeze from a silk thread with a period of 0.6 s. How long is the spider's strand of silk?

7.

A metronome is a device used by many musicians to get the desired rhythm for a musical piece. If a metronome is clicking back and forth with a frequency of 0.5 Hz, what is the period of the metronome?

8.

Many amusement parks feature a ride in which a giant ship swings back and forth. If the period of the ship is 8.00 s, what is the frequency of the swinging ship?

9.

Tegan, a trapeze artist, swings from a 2.5-m-long trapeze, high above the three-ring circus. a) What is Tegan's period of swing? b) Would Tegan's period of swing change if she were more massive? If so, how?

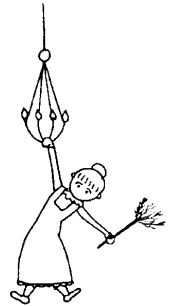
10.

Danielle is pushing her twin Daniel on a swing that hangs from a tree branch by 2.0-m-long ropes. With what frequency will Danielle have to push Daniel as he swings?

11.

12.

Marla, a maid, is standing on the Vanderbilt's dining room table dusting the chandelier. While Marla is reaching up, she slips and grabs hold of the chandelier to catch her balance. When she lets go, the chandelier begins to swing with a period of 1.6 s. How long is the cable connecting the chandelier to the ceiling?



13.

You have been commissioned by NASA to travel to Jupiter's innermost Galilean satellite, Io, to learn more about this volcanic moon. As you board the spacecraft, you are handed a rock tied to a 10.0-cm string, and a stopwatch, and are asked to derive an experiment that would allow you to determine the acceleration due to gravity on Io. You must use both pieces of equipment and nothing more. a) Describe how you would calculate Io's gravitational acceleration. b) If the pendulum swings with a period of 1.48 s, what is the gravitational acceleration on Io? (Read more about Jupiter's moon, Io, at <http://www.planetaryexploration.net/jupiter/io>)