Vibrations and Waves

Math Skills

Measuring Simple Harmonic Motion

1. A spring-mass system vibrates exactly 10 times per second. Find its period and its frequency.

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2. A pendulum swings with a period of 0.20 seconds.

   a. What is its frequency?

   _____

   b. How many times does it pass the lowest point on its path in 1.0 second? in 7.0 seconds?

   _____

3. A spring-mass system completes 20.0 vibrations in 5.0 seconds, with a 2.0 cm amplitude.

   a. Find its frequency and its period.

   _____

   b. The same mass is pulled 5.0 cm away from the equilibrium position, then released. What will the period, the frequency, and the amplitude be?

   _____

4. A pendulum completes 30.0 oscillations per minute. Find its frequency, its period, and its length.

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5. A spring has a 2.000×10^3 N/m spring constant.

   a. What mass will make it oscillate 5.0 times per second? 10.0 times per second?

   _____

   b. You want the mass-spring system to operate at a higher frequency. Should you increase or decrease the mass?

   _____

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Concept Review

Simple Harmonic Motion

1. A clown is rocking on a rocking chair in the dark. His glowing red nose moves back and forth a distance of 0.42 m exactly 30 times a minute, in a simple harmonic motion.

   a. What is the amplitude of this motion?

   _____

   b. What is the period of this motion?

   _____

   c. What is the frequency of this motion?

   _____

   d. The top of the clown's hat contains a small light bulb that shines a narrow light beam. The beam makes a spot on the wall that goes back and forth between two dots placed 1.00 m apart as the clown rocks. What are the amplitude, period, and frequency of the spot's motion?

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   _____

   _____

2. A 5.00 kg block hung on a spring causes a 10.0 cm elongation of the spring.

   a. What is the restoring force exerted on the block by the spring?

   _____

   b. What is the spring constant?

   _____

   c. What force is required to stretch this spring 8.50 cm horizontally?

   _____

   d. What will the spring's elongation be when pulled by a force of 77.7 N?

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