

Vibrations and Waves

Problem A**HOOKE'S LAW****PROBLEM**

Some bathroom scales work by stepping on a spring. Suppose a person steps on a scale, compressing the spring 1.5 cm. If the spring constant is 650 N/m, what is the spring force acting on the scale when the person steps off?

SOLUTION

Given: $k = 650 \text{ N/m}$ $x = 1.5 \text{ cm} \times 10^{-2} \text{ m}$

Unknown: $F = ?$

Choose the equation(s) or situation:

Use the equation for Hooke's law to determine the spring's restoring force.

$$F_{\text{elastic}} = -kx = -(650 \text{ N/m})(1.5 \times 10^{-2} \text{ m}) = \boxed{-9.8 \text{ N}}$$

ADDITIONAL PRACTICE

1. A shopper places some fruit in a spring scale at a supermarket. If the spring has a spring constant of 420 N/m and is compressed from its equilibrium position by 4.3 cm, what is the spring force on the scale at the moment it is released?
2. A fuzzy ball attached to an elastic cord is suspended from a ceiling to be a toy for a cat. As the cat plays, the toy is pulled 15 cm and released. If the toy has a spring constant of 65 N/m, what is the spring force acting on the toy at the moment it is released?
3. You see a pair of joke glasses at a toy store. Each lens is connected to a loosely coiled spring which, in turn, is connected to a plastic "eyeball." One spring is pulled 12 cm from its equilibrium position and released. If the spring constant is 49 N/m, what is the magnitude of the spring force acting on the toy at the moment it is released?
4. A lock tight curly hair is pulled a distance of 5.0 cm from its equilibrium position and released. If the lock of hair has a spring constant of 26 N/m, what is the magnitude of the spring force acting on the lock of hair at the moment it is released?
5. When a person weighing 669 N sits in a hanging chair, a giant spring suspending the load expands 6.5 cm. What is the spring constant?
6. A 550 N jumper attached to a bungee cord dives off a precipice. The bungee cord stretches 15 m beyond its equilibrium point before it bounces back. What is the spring constant?

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7. As a 620 N mountain biker rides across rough terrain, the spring in the seat compresses a distance of 7.2 cm. What is the spring constant?
8. A child exerts a force of 12 N to shoot a rubber band across the room. If the rubber band has a spring constant of 180 N/m, what is the rubber band's displacement?
9. An archer applies a force of 52 N on a bowstring to shoot an arrow. If the bow string has a spring constant of 490 N/m, what is the bow string's displacement?
10. A mass of 3.0 kg is attached to a spring scale with a spring constant of 36 N/m. What is the spring's displacement?