Worksheet-Hooke's Law: Springs & Things

1. How much force would it take to stretch a steel bar with a spring constant of 21×10^6 N/m until it is 1.0mm longer?

$$F_E = K\Delta x$$
$$= \left(21\times10^6 \frac{N}{m}\right)(0.001 m)$$
$$= 21000\ N$$

2. What is the spring constant of a car spring if a 2500N force compresses it from a length of 50.cm to a length of 40.cm?

$$K = \frac{F_E}{\Delta x} = \frac{2500 N}{0.10 m} = 25000 \frac{N}{m}$$

3. a) What force would be required to compress a 20.cm long spring to 15cm if the spring constant is 30.N/m?

$$F_E = \left(30. \frac{N}{m}\right)(0.050 m)$$
$$= 1.5 N$$

b) What mass, when placed on top of the vertical spring, would cause the same compression?

$$m = \frac{F}{g} = \frac{1.5 N}{9.8 m/s^2} = 0.15 kg$$

4. A spring is compressed 10m when a force of 5N is applied. How far does it compress when 10N is applied?

$$K = \frac{5 N}{10 m} = 0.5 \frac{N}{m} \qquad \Delta x = \frac{F_E}{K} = \frac{10 N}{0.5 N/m}$$
$$\Delta x = 20 m$$

5. Peter (from Peter and the Wolf fame) is out hunting a possum with his spring loaded rock thrower. He pulls back on the spring with a force of 350 N and it stretches 10 cm.

a) Determine the spring's constant.

$$K = \frac{350 N}{0.10 m} = 3500 \frac{N}{m}$$

b) Peter puts a 50 g rock in the thrower and releases it. Calculate the rock's initial acceleration.

$$a = \frac{F_{net}}{m} = \frac{350 N}{0.050 kg} = 7000 \frac{m}{s^2}$$

6. Pedro Martinez is standing on the planet Baseball (r = 5000 km, m = 7.0×10^{24} kg) with his favorite spring (k = 100 N/m... it is spring training time after all) in his hand. If he puts a 1.2 kg mass on the end of the spring, how far does it stretch?

$$\Delta x = \frac{F_E}{K} = \frac{22.40 N}{100 N/m} = 0.22 m$$

$$g = \frac{(6.67\times10^{-11})(7.0\times10^{24})}{(5000000)^2}$$
$$g = 18.67 m/s^2$$
$$F_g = mg = (1.2)(18.67 m/s^2)$$
$$F_g = 22.40 N$$

Answers: 1) 2.1×10^4N 2)25000N/m 3)a)1.5N b)0.15kg 4) 20m 5) a) 3.5×10^3 N/m b) 7.0×10^3m/s^2 6). 0.22 m