HOOKE'S LAW PROBLEMS – Ideal Springs

For all questions assume that the **positive x** direction is to the **right**. $F_s = -kx$

Basic Problems

1. Describe what the k value of spring represents. If a spring was "loose/weak" spring how would the k value compare to a spring the is "stiff/strong?" Give some examples of springs with small k values and large k values.

2. Give some "real life" examples of where springs are used and how they are used. Give at least 5 examples. How is the energy stored in them used in each case?

3. Calculate the spring force when the following ideal springs are stretched to *0.3 m* from the equilibrium position.
   a) *k = 5 N/m* b) *k = 15 N/m* c) *k = 1000 N/m*

4. Calculate the spring force when an ideal spring with a spring constant of 500 N/m is compressed by 60 cm. Calculate the spring force when the spring is stretched by 60 cm.

5. The equilibrium position for an ideal spring, with a spring constant of 400 N/m, that is attached to a wall is 1.3 m. A force of 2000 N is applied to the spring. What is the new position of the end of the spring?

6. An ideal spring with a spring constant of 600 N/m has a force of 120 N acting upon it. Calculate the amount that the spring is compressed/stretched?

7. An ideal spring is stretched by 23 cm. The person that was stretching the spring exerts a force of 280 N. Calculate the spring constant?

8. A 65 kg box of bananas is resting on a spring loaded scale. The scale is calibrated such that a compression of 0.5 cm occurs when a 10 N force is placed on it. What is the compression of the scale when the box of bananas is on it?

9. A 1000 kg car is parked in an underground parking garage. Four people (masses of 73 kg, 65 kg, 71 kg and 92 kg) get into the car. The car lowers due to the weight by 2.5 cm. Calculate the k values of the shocks in the car. Assume the shocks are ideal springs and that they all compress by the same amount (i.e. the force is evenly distributed).

Spring Energy Problems

$$E_s = \frac{1}{2}kx^2$$

1. A spring with a spring constant of 400 N/m is stretched 40 cm. Calculate the energy stored in the spring.

2. A spring is compressed by 20 cm storing 1000 J of energy in the spring. Calculate the k (spring constant) value of the spring.

3. A rubber band (which obeys Hooke's law) has a spring constant of 5 N/m and is stretched so that 89 J of energy is stored in it. Calculate the amount of stretch.

4. A spring requires 20 N of force to compress it by 3 cm.
   a) Calculate the spring constant.
   b) Calculate the amount of energy stored in the spring if the spring it stretched by 11 cm.

5. A spring has a spring constant of 450 N/m and is at an initial compression of 8 cm from its equilibrium position. Calculate how much stored energy there is in the spring at this point. A person now compresses the spring further such that it is now compressed 12 cm from its equilibrium position. Calculate how much stored energy there is in the spring at this point. Calculate the work done ($W = \Delta E$) to compress the spring this extra 4 cm.