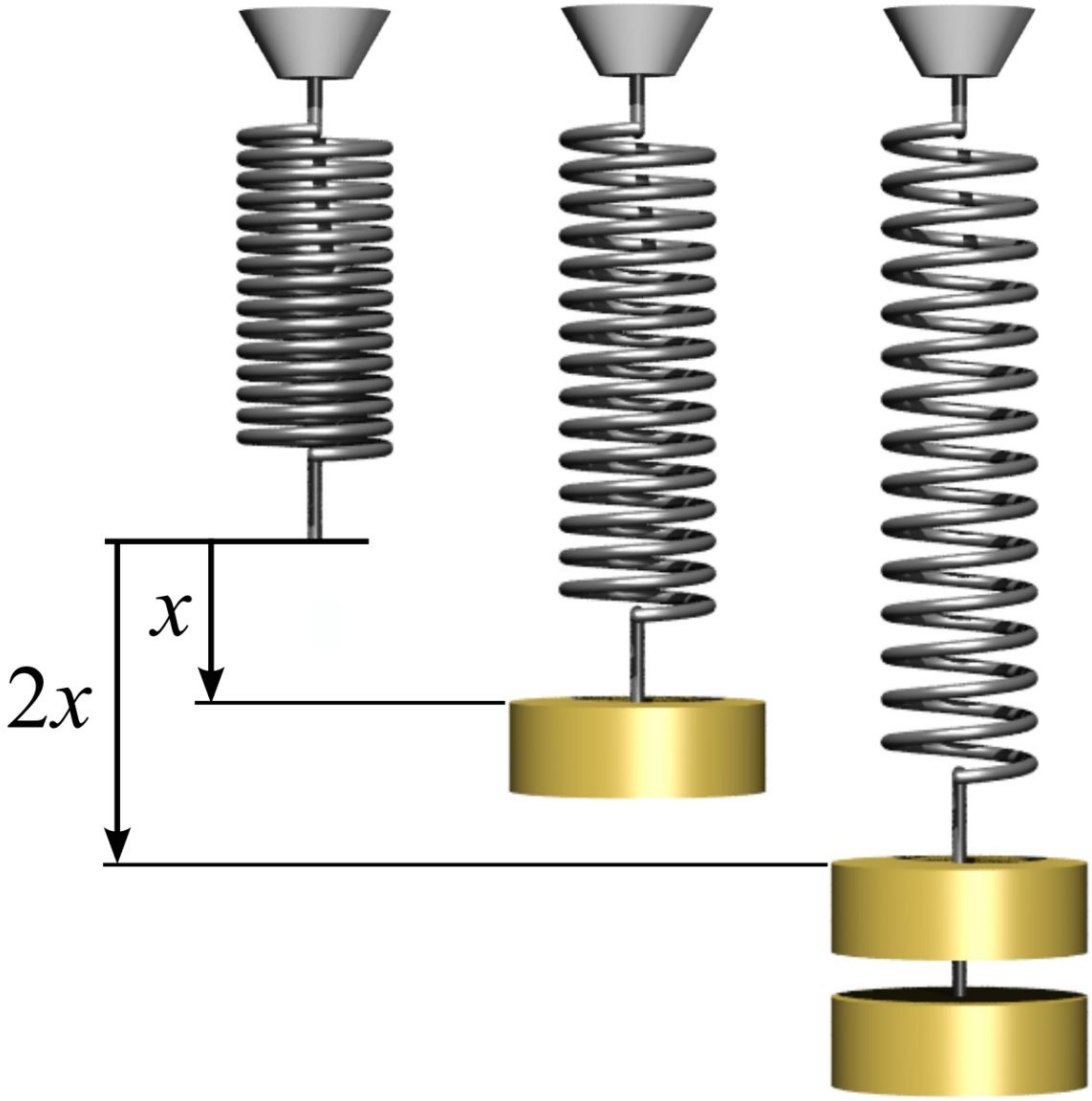
Booklet # 46

Unit: Work || Topic: Hooke's Law (Day 2)
Date: Dec 15, 2015 || Name:

1	Do-now.
	What is Hooke's Law? **Hooke's law** is a principle of Physics that states that the Force (F) needed to extend or compress a Spring by some distance *X* is proportional to that distance. That is: $F = kX$, where k is a constant factor characteristic of the spring: its Stiffness The law is named after 17th-century British physicist Robert Hooke.

	Hooke's law: the force is proportional to the extension
	 a. Springs have a restorative force. b. Larger distortion = larger force c. F= kx, X= L-L

	Example # 1
	A mass m stretches a spring a distance X. How far will 3m stretch it?

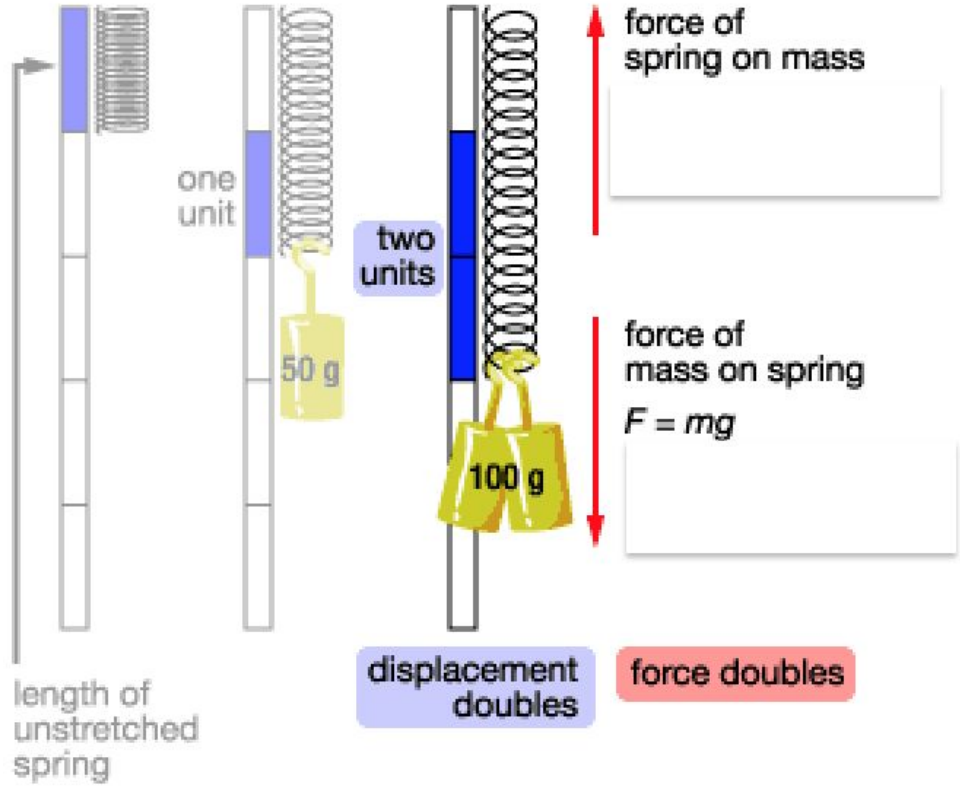
	A 200 g mass stretches a spring 50 cm. What is the spring constant?

	How far will a force of 600 N stretches a spring with Spring constant 30000 N/m?

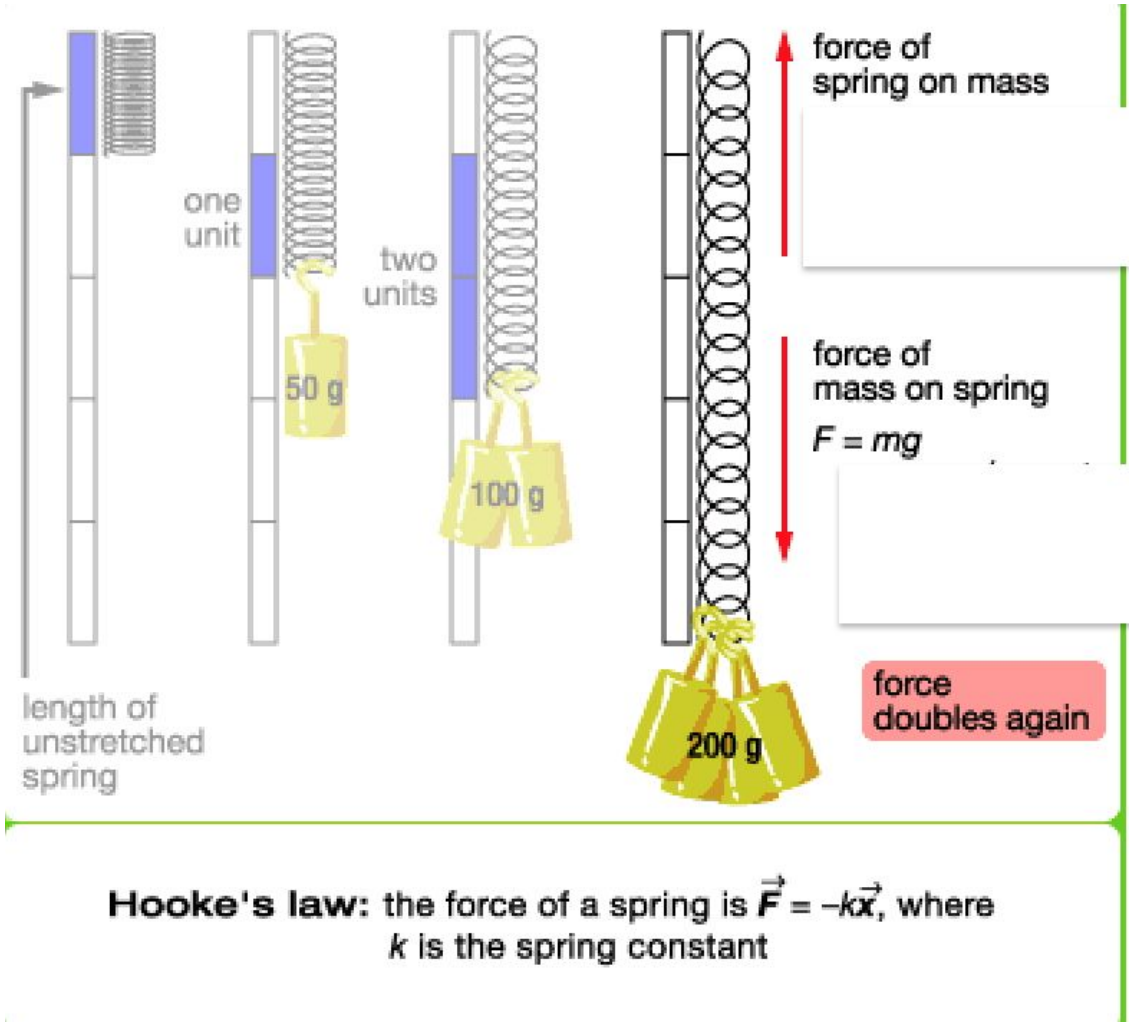
	A force of 16 N is required to stretch a spring a distance of 40 cm from its rest position. What force (in Newtons) is required to stretch the same spring … a. … twice the distance? b. … three times the distance? c. … one-half the distance?

length of unstretched spring

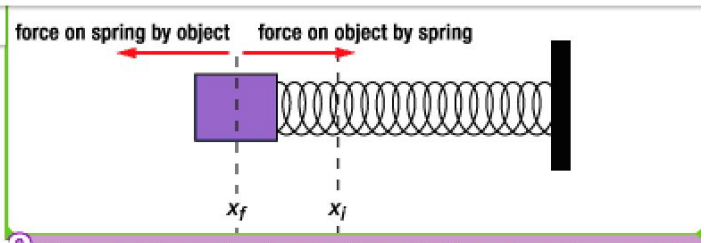
Hooke's law: the force of a spring is $\vec{F} = -k\vec{x}$, where k is the spring constant



Hooke's law: the force of a spring is $\vec{F} = -k\vec{x}$, where k is the spring constant


one unit
two units
50 g
100 g
200 g
force of spring on mass
force of mass on spring
F = mg
force doubles again
length of unstretched spring
Hooke's law: the force of a spring is $\vec{F} = -k\vec{x}$, where k is the spring constant

$$W_{SPRING} = \int_{x_i}^{x_f} -kx\,dx = -\left(\frac{kx_f^2}{2} - \frac{kx_i^2}{2}\right)$$



If you stretch a spring, how much work is the spring doing on you?

$W_{spring} = \int_{x_i}^{x_f} -kx\,dx$ $\quad W_{spring} = \int_{x_i}^{x_f} F_{spring}dx$

(1) QID: 327

The force applied by a spring is given by Hooke's law, $F = -kx$, where k is the spring constant. The force F is a constant force.

- true
- false

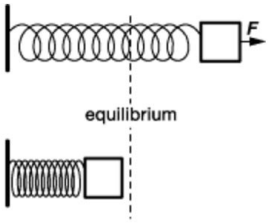
(2) QID: 328

Consider a spring-mass system. The F in Hooke's law, $F = -kx$, indicates _____.

- the force on the spring by the object
- the distance the spring is stretched
- the force by both the spring and the object on each other
- the force on the object by the spring

(3) QID: 329

If an object attached to a spring is released after being stretched, the object moves to the left and passes the equilibrium point. What is the direction of the force applied by the spring when the object is to the left of the equilibrium point?



- To the left
- To the right
- The same direction as the velocity.
- The object comes to rest at the equilibrium point.

(4) QID: 330

What does the minus sign in Hooke's law, $F = -kx$, indicate?

- The direction of the force is opposite to the displacement.
- The direction of the force is in the direction of the displacement.
- The sign is not connected to the direction of the force.
- The direction of the spring constant is opposite to the force.

(5) QID: 331

If we decrease the displacement of an object attached to a spring, the magnitude of the force on the object _____.

- doesn't change
- increases
- decreases
- is zero

(6) QID: 332

Two springs have spring constants k_1 and k_2, where $k_2 > k_1$. Which spring is stiffer?

- Spring 2
- Spring 1
- Springs 1 and 2 are equally stiff.
- It is not possible to know from the information given.

(7) QID: 333

If the work done on an object is negative, how is the object's speed affected?

- The object slows down.
- The object speeds up.
- The object's speed doesn't change.
- The object moves in the same direction as the force.

(8) QID: 334

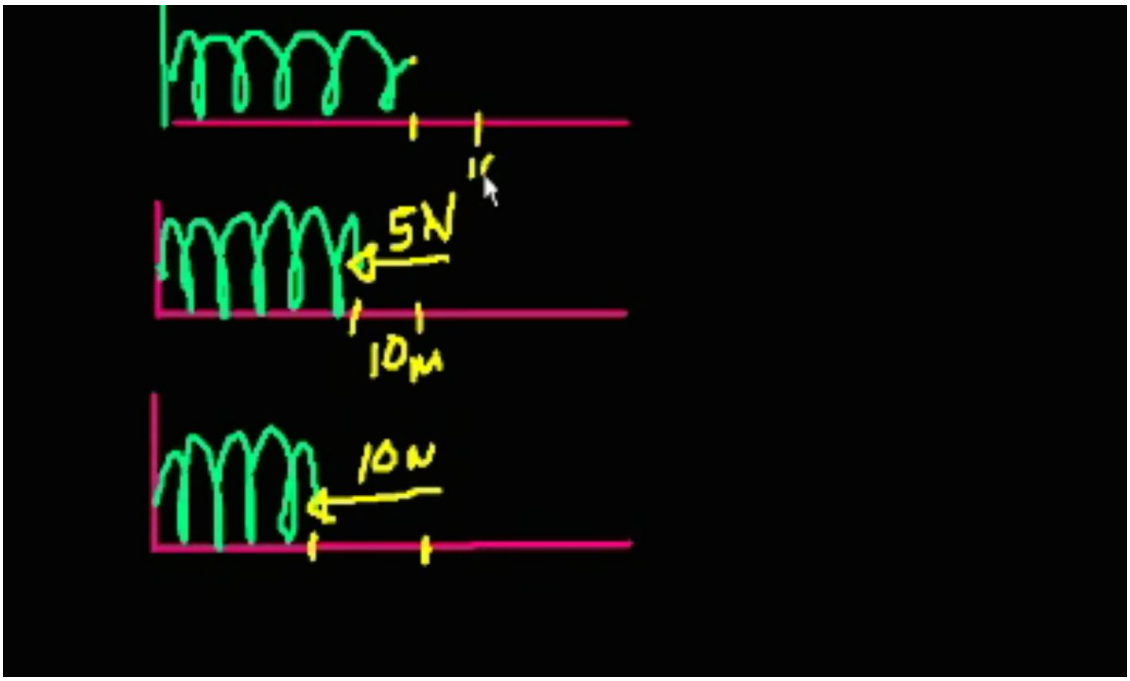
Which of the following expresses the work done by a spring on an object that moves from position x_i to x_f?

- $W = -k(\Delta x)^2$
- $W = \int_{x_i}^{x_f} kx\,dx$
- $W = \int_{x_i}^{x_f} (-kx)\,dx$
- $W = F\Delta x$

(9) QID: 335

What is the general formula for the work done by a spring in moving an object from an initial position x_i to a final position x_f?

- $W = -k\left(\frac{x_f}{2} - \frac{x_i}{2}\right)$
- $W = k\left(\frac{x_i^2}{2} - \frac{x_f^2}{2}\right)$
- $W = -k\left(\frac{x_f^2}{2} - \frac{x_i^2}{2}\right)$
- Answers B and C

	Homework
	Take some picture of you compressing or stretching a spring.