NAME Key Ch11 DATE _____ CLASS _____

HOLT PHYSICS

MODULE 11

Hooke's Law

Fill each blank below with the word or phrase that completes the statement.

1. Objects oscillate back and forth when subjected to a Restoring force.
2. A restoring force is always directed toward a central Equilibrium force.
3. The net force at the equilibrium position is 0 N.
4. The magnitude of the restoring force is proportional to the displacement or Distance from the equilibrium position.
5. Hooke's Law describes the relationship between the restoring force and displacement from the Equilibrium position.
6. If the free end of a spring is stretched or compressed, a restoring force acts in the opposite direction.
7. The Spring Constant is a ratio of the restoring force to the displacement, so its units are N/m.
8. The spring constant is an indicator of a spring's stiffness. As values for the spring constant increase, the stiffness Increase, and more force is needed to stretch or compress the spring.
9. A certain spring has a force constant equal to one-half the force constant of a second spring. Which spring requires the least force to compress it? Which is stiffer?

1st Spring needs ½ As much force to compress As 2nd Spring because it has the larger force Constant

NAME _____ DATE _____ CLASS _____

MODULE 11

10. Which will provide a softer bed, a box-spring set containing springs with greater or lesser spring constants?

less Spring constants for softer Beds

11. A spring with an equilibrium position at 12.0 cm hangs vertically. When a 7.50 kg mass is attached to the spring, it stretches the spring to 17.0 cm. What would be the length of the spring with a 4.50 kg mass attached to it?

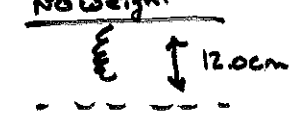
Given:

A) $m = 7.50\,kg$

$\Delta x = -.050\,m$

$K = ?$

No weight



1st find K

$F = -Kx$

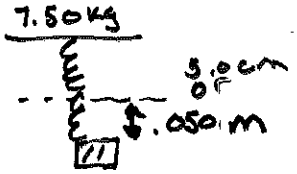
$F = mg$

$K = \frac{mg}{-x}$

$K = \frac{(7.50kg)(9.81 m/s^2)}{-(-.050m)}$

$K = 1500\,N/m$

7.50 kg



B) Now using

$m = 4.50\,kg$

$K = 1500\,N/m$

$\Delta x = ?$

$F = -Kx$

$F = mg$

$\Delta x = \frac{-mg}{K}$

$= \frac{(4.50kg)(9.81 m/s^2)}{1500\,N/m}$

$\Delta x = -.029\,m = 2.9\,cm$

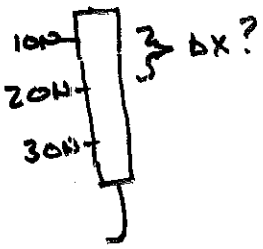
Total $x = 12.0cm - 2.9cm$

Total x = 14.9cm

12. If the spring in item 11 were in a scale and that scale were marked every 10 N, what would be the distance between markings?

Given:

Scale



$K = 1500\,N/m$

$\Delta x = ?$

$F = 10N$

Soln:

$F = -Kx$

$x = -\frac{F}{K}$

$= -\frac{10N}{1500\,N/m}$

$x = 6.7 \times 10^{-3}\,m$

x could be either − or +

13. A certain spring has a force constant of 5.0 N/m. Find the mass in grams that must be hung from the spring to stretch it 20 cm. How much more mass is needed to stretch it 20 cm more?

Given:

$K = 5.0\,N/m$

$m = ?g$

$x = 20cm = .2\,m$

– because stretched

A) $F = -Kx$

$F = mg$

$m = \frac{-Kx}{g}$

$= \frac{-(5.0\,N/m)(-.20m)}{9.81\,m/s^2}$

$m = .0102\,kg$

$m = 100\,g$

B) Stretch another 20cm?

To stretch another 20cm, & spring constant same would need additional 10g