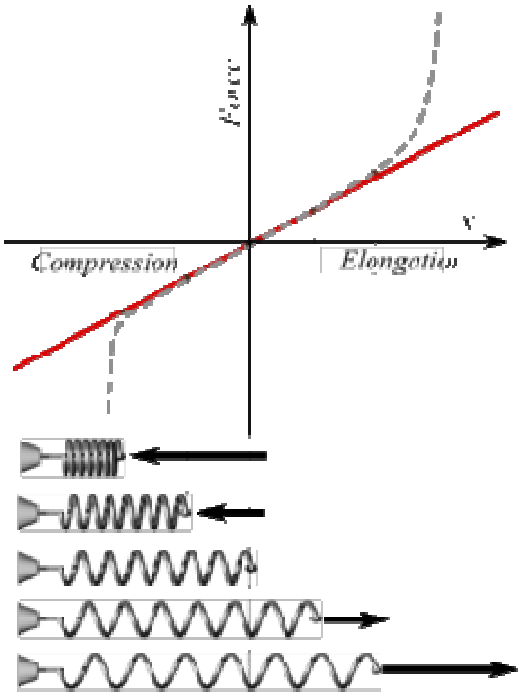
Hookes Law

March 2, 2017 10:52 AM

Hookes Law describes the force created by a spring due to it's compression or Elongation.

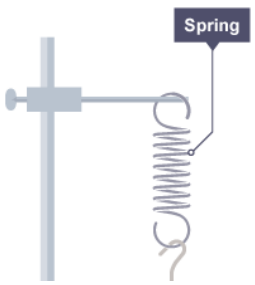


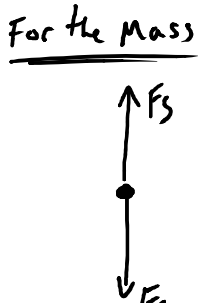
The force created by the spring can be approximated for small deviations from rest state with a linear function.

$$F_s = kx$$

F_s (N): Force from the spring
K (N/m): Spring constant (Unique for different springs)
X (m): the displacement from the rest state (can be negative or positive)

Example: A spring suspends an 50g object in the air on earth. The spring stretches 11cm from it's rest state. Calculate the spring constant for this spring.



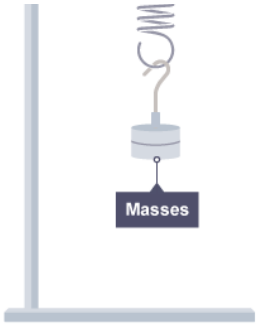


Vertical (a=0)

$F_s - F_g = ma$

$F_s = F_g$

$kx = mg$



F_g

$F_s = F_g$

$kx = mg$

$k(0.11) = (0.05)(9.8)$

$k = \frac{(0.05)(9.8)}{0.11}$

$k = 4.45$

A 500kg object traveling at 30km/hr on a frictionless surface crashes into a giant spring. In 0.2seconds the object comes to a complete stop.

a) Calculate the average force being exerted by the spring on the object.

Find acceleration

$v_i = 30 km/hr = 8.33 m/s$

$v_f = 0 m/s$

$d =$

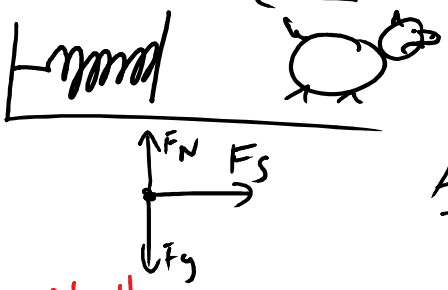
$a =$

$t = 0.2 sec$

$v_f = v_i + at$

$0 = 8.33 + a(0.2)$

$a = \frac{-8.33}{0.2} = -41.7 m/s^2$



$F_s = kx$

initially

Finally

Horizontal $a = (-41.7 m/s)$

$-F_s = ma$

$-kx = (500)(-41.7)$

$\frac{-k(0.833)}{-0.833} = \frac{(500)(-41.7)}{-0.833}$

$k = 25,030 N/m$

$d = \frac{v_f + v_i}{2} t = \frac{8.33}{2}(0.2)$

$d = 0.833 m$ ← This is also X

b) ~~If the spring constant of the spring is 9.27N/m, then how much does the spring compress?~~

c) Describe what will happen after the object comes to a complete stop.

The Spring will decompress and send the object back @ 30 km/hr in the opposite direction.