

Unit 5: Forces

Hooke's Law

F_{Elastic}: A force that works to return a distorted object to its equilibrium (rest) position

Examples: elastics, springs, bouncy ball, trampoline, bungee cord, hockey stick

Hooke's Law:

The amount of restoring (elastic) force is proportional to the amount of distortion

$$F_E = k \Delta x$$

Where:

k (N/m) = spring constant
= how stiff the spring is

Δx (m) = distortion from equilibrium

Ex:

A student stretches an elastic band with a spring constant of 50.0 N/m by 15 cm. How much force are they applying?

$$\begin{aligned} F_E &= k \Delta x \\ &= (50.0 \text{ N/m})(0.15 \text{ m}) \\ &= 7.5 \text{ N} \end{aligned}$$

make sure it is in metres

Ex:

Al McInnis uses a wooden stick with a spring constant of 850 N/m. What is the distortion on the stick if he exerts 525 N while taking a slapshot?

$$\begin{aligned} F_E &= k \Delta x \\ \Delta x &= \frac{F_E}{k} = \frac{525 \text{ N}}{850 \text{ N/m}} \\ &= 0.62 \text{ m} \end{aligned}$$

Ex:

A 65 kg girl sits in a redneck sling shot that has a spring constant of 10.5 N/m. If the sling is stretched by 45 m, what is her initial acceleration when released?



$$\begin{aligned} F_E &= k \Delta x \\ &= (10.5 \text{ N/m})(45 \text{ m}) \\ &= 472.5 \text{ N} \end{aligned}$$

$$\begin{aligned} F_{\text{net}} &= F_E = ma \\ a &= \frac{F_E}{m} = \frac{472.5 \text{ N}}{65 \text{ kg}} \\ &= \boxed{7.3 \text{ m/s}^2} \end{aligned}$$