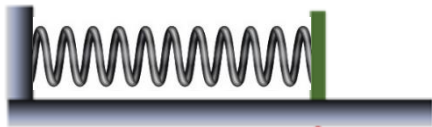


CONCEPT: Hooke's Law & Springs

- When you push/pull against a spring (F_A), spring pushes back in the _____ direction. (Action-Reaction!)

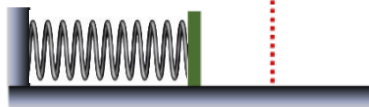
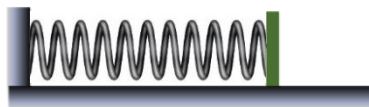


$$F_s = -F_A = \underline{\hspace{2cm}}$$

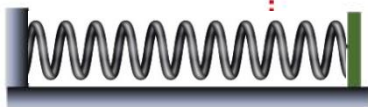
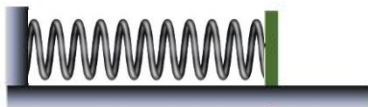
→

$$|F_s| = |F_A| = \underline{\hspace{2cm}}$$

Ex. 1: You push on a spring with a force of 120N. The spring constant k is 20. How much does it compress?



Ex. 2: How much force is required to pull a spring of length 10m out to 16m, if the spring constant k is 40N/m?



• $x = D$ _____

- Relaxed position → _____ ($x = \underline{\hspace{1cm}}$)

- NOT the spring's length → ($x = \underline{\hspace{1cm}}$)

• $k =$ spring's force constant

- Measures how _____ the spring is.

- Higher $k \rightarrow$ _____ to deform

- Ex. 1: $x =$ $k =$ $F =$

- Ex. 2: $x =$ $k =$ $F =$

- Units of k : _____

• $F_s = R$ _____ force, always opposes deformation

CONCEPT: WORK DONE BY SPRINGS

- For **CONSTANT** Forces only, we calculate Work using $W = Fd\cos\theta$

- For **VARIABLE** (i.e. not constant) Forces, we use the _____ of the Force instead $\Rightarrow W_{var} = \text{_____} \Delta x \cos\theta$

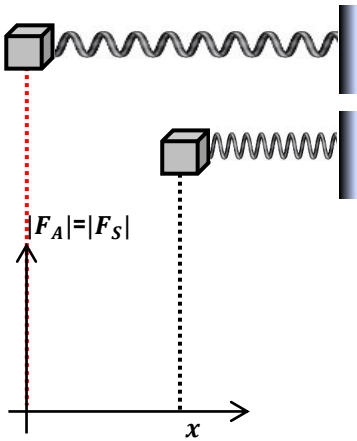
- The most common variable force you'll see is the **Spring** Force (Hooke's Law) $\Rightarrow$

$$F_s = -F_A = -kx$$

- Work Done BY SPRING when compressing: $W_s = -W_{F_A} = \text{_____}$

EXAMPLE: You push a light box attached on a spring with a spring constant $k = 500\text{N/m}$. If you compress the spring by 2m ,

(a) write an expression for the work done by your push and the spring; (b) Calculate the work done by you & the spring.



PROBLEM: It takes 200 J of energy to compress a 1.0 m-long spring to 70 cm. How much additional work would you have to do to compress this same spring from 70 cm to 50 cm?

WORK & ENERGY

$$KE = \frac{1}{2}mv^2$$

$$W = Fd\cos\theta$$

$$W_g = -mg\Delta y$$

$$W_{FA} = -W_s = -\frac{1}{2}k\Delta x^2$$

$$W_{NET} = \Sigma W = F_{NET}d\cos\theta = \Delta K$$

- In general, the work done ON or BY a spring between two points **A**→**B**:

$$W_{s,A \rightarrow B} = \underline{\hspace{2cm}}$$