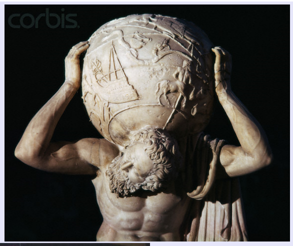
Kinetic Energy and The Work-Energy Theorem

LEARNING TARGET	DESCRIPTION
9.1	I can define, analyze, and calculate the amount of work done by a force in a closed system.
9.2	I can define, analyze, and solve problems involving kinetic energy.

More Work?



Work

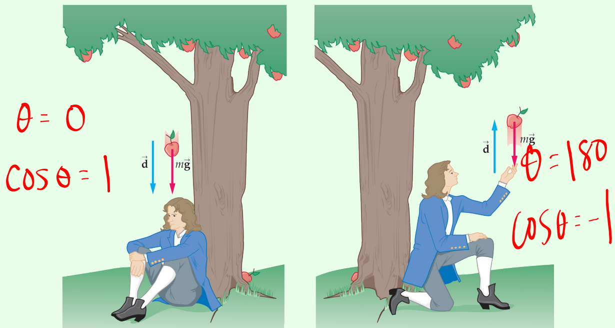
$$W = F_{\|}d = Fd\cos\theta$$

Vector or Scalar?

Units? 1 N m = 1 J (Joule)

Relationship? Directly Proportional

Compare and Contrast

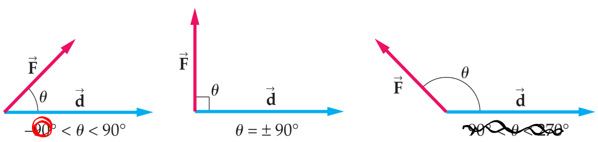


Positive Work
Speeds Up

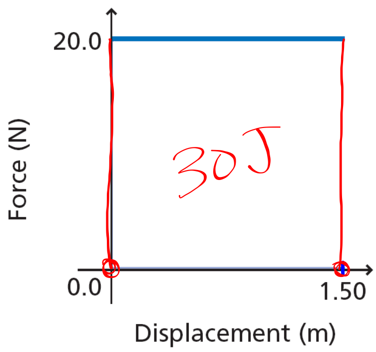
Negative Work
Slows down

Negative Work and Total Work

Work depends on the angle between the force, $\vec{F}$, and the displacement (or direction of motion), $\vec{d}$.

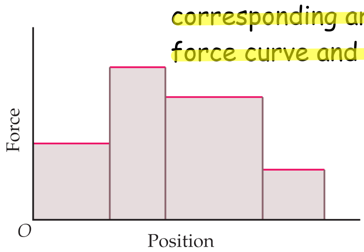


Interpret the Graph



Work Done By A Variable Force

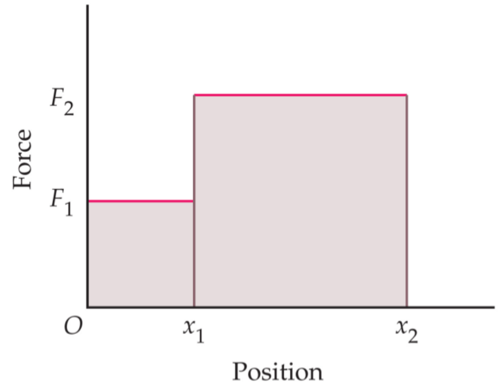
The work done by a force moving an object from x_1 to x_2 is equal to the corresponding area between the force curve and the x axis.



(b)

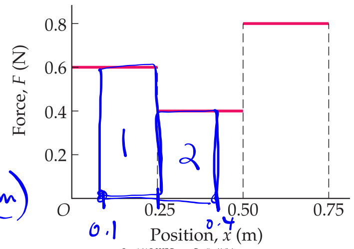
area under the curve

Interpret the Graph



Variable Force Example

The force shown in the figure moves from x = 0 to x = 0.75 m. How much work is done by the force if the object moves from x = 0.10 m to x = 0.40 m?

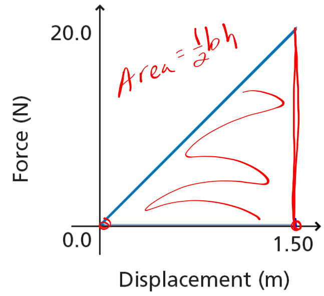


F d

$W = (0.6N)(0.15m) + (0.4N)(0.15m)$

$W = 0.15\ J$

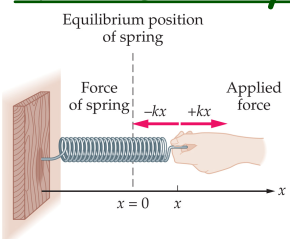
Interpret the Graph



$W = \frac{1}{2}(1.5m)(20\ N)$

$W = 15\ J$

Work Done By a Spring



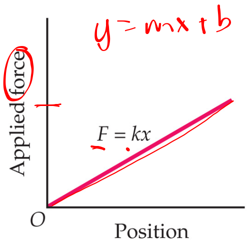
Hooke's Law

$F = kx$

Work Done by a Spring

$W = \frac{1}{2}kx^2$

$y = mx + b$



$\frac{1}{2}\ x \cdot kx$

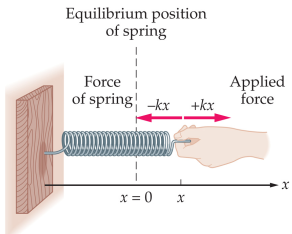
WORK DONE BY A SPRING EXAMPLE

How much work is done to stretch a spring of force constant 1.0 x 10^4 N/m, a distance of 0.15 m.

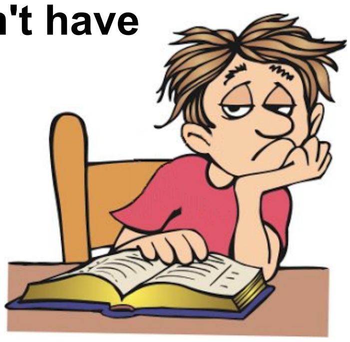
= k

" x

$W = \frac{1}{2}kx^2$

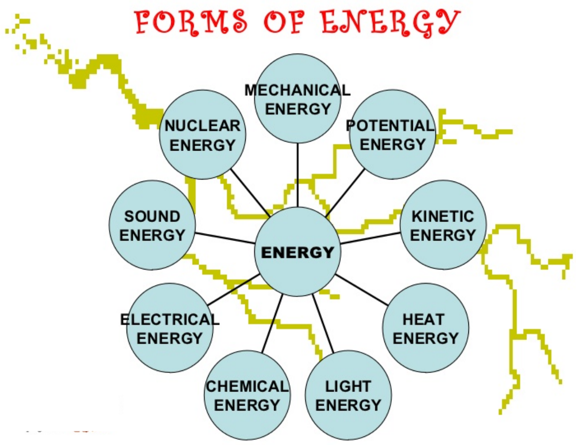


I'd love to continue talking about work, but I just don't have the energy.



Energy

The ability to do work and cause change.



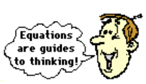
Kinetic Energy

Kinetic Energy is the energy of motion.

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

Vector or Scalar	Units	Relationship
Scalar (circled)	J	m - Direct Prop
		V - Direct. Quad

$$KE = \tfrac{1}{2} m v^2$$



1) What if mass is doubled?

2) What if the velocity is doubled?

3) What is the range of possible values for kinetic energy?

IN CLASS EXAMPLES

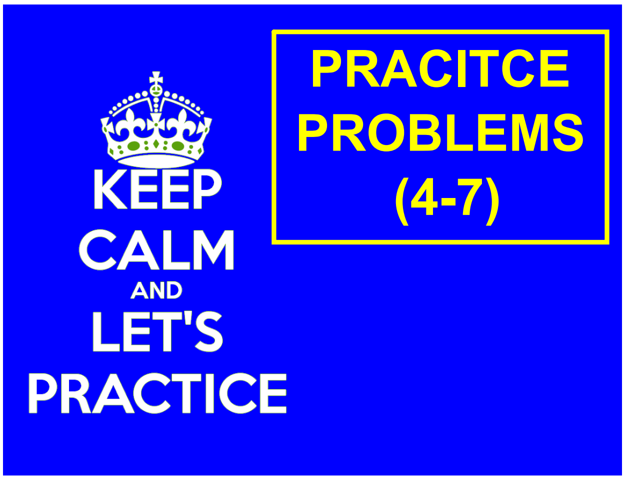
3. A 0.14 kg pinecone falls 16 m to the ground, where it lands with a speed of 13 m/s.

   (a) How much kinetic energy does the pinecone have when it hits the ground? $K = \frac{1}{2}mv^2 = 12\ J$

   (b) How much kinetic energy would it have if there is no air resistance?

   $v^2 = v_0^2 + 2a(y_f - y_0) = 17.7\ m/s$ $\quad K = \frac{1}{2}mv^2 = 22\ J$

   (c) Did air resistance do positive work, negative work (circled), or zero work on the pinecone. Explain.


KEEP
CALM
AND
LET'S
PRACTICE
PRACITCE
PROBLEMS
(4-7)