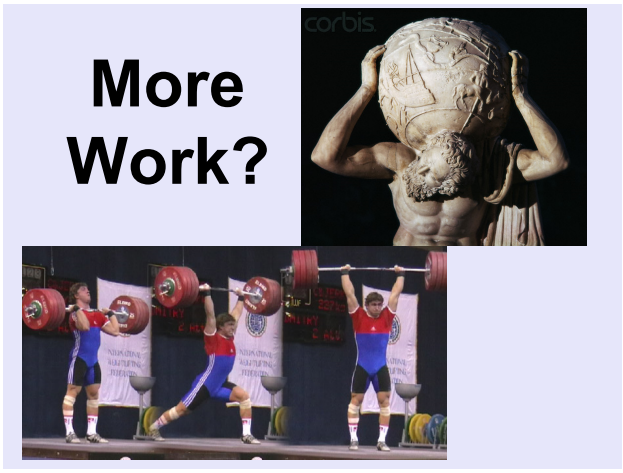
Kinetic Energy and The Work-Energy Theorem

Learning Target	Description
10.1	I can define, analyze, and calculate the amount of work done by a force in a closed system.
10.2	I can define, analyze, and solve problems involving kinetic energy.



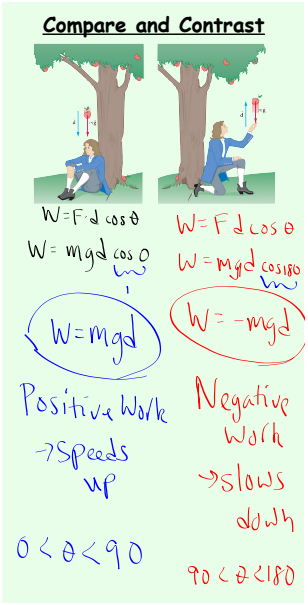
Work

$W = F\,d\cos\theta$

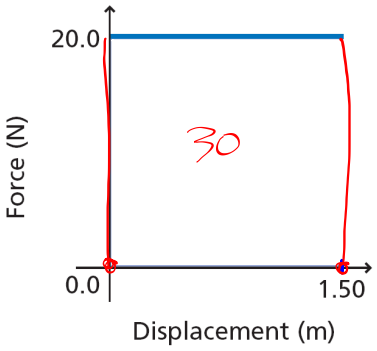
Vector or Scalar?

Units? 1 N m = 1 J (Joule)

Relationship? Directly Proportional

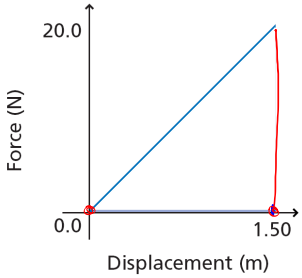


Interpret the Graph



$W = F \cdot d = 30\,J$

What About This One?



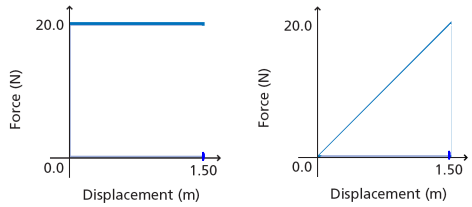
$W = \text{area} = \frac{1}{2}bh$

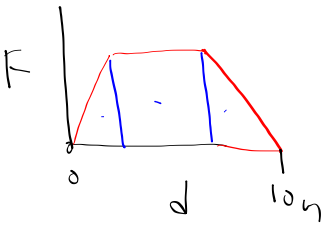
$= \frac{1}{2}(1.5)(20\,N)$

$W = 15\,J$

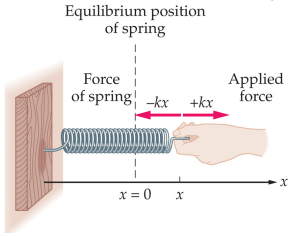
Work Done By A Variable Force

Work can be obtained graphically by finding the area under a force-displacement graph.

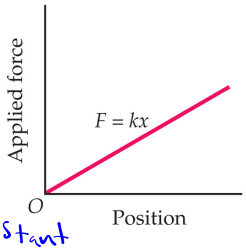




Work Done By a Spring



Hooke's Law

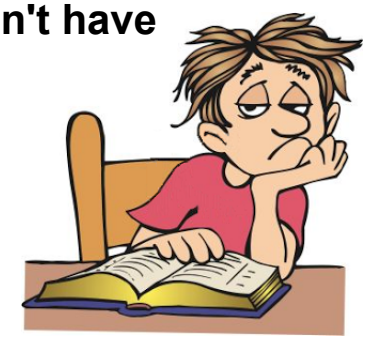


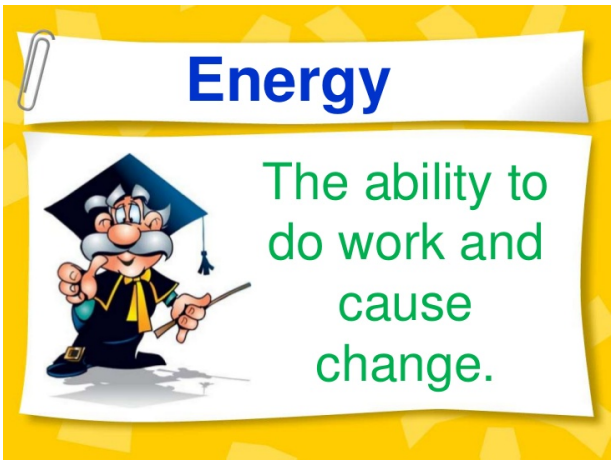
Work Done by a Spring

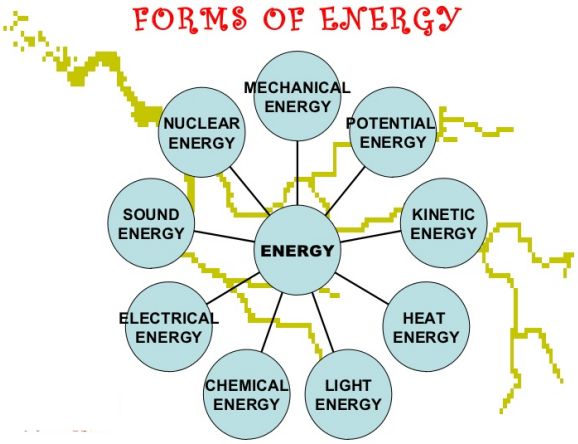
k = spring/force constant

x = stretch/compression length

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







Kinetic Energy

Kinetic Energy is the energy of motion.

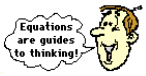
KE $K = \frac{1}{2}mv^2$

Vector or Scalar? Units Relationship

Joules m → Direct Prop.

v → Direct Quad.

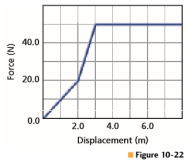
$$KE = \frac{1}{2} m v^2$$



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

IN CLASS EXAMPLES

3. A snowboarder is sliding across a flat section of snow and eventually comes to a rest. In this situation, does the kinetic friction force do positive, negative, or zero work. Explain.
4. The graph in Figure 10-22 shows the force and displacement of an object being pulled. Calculate the work done to pull the object 7.0 m.



5. How much work is done to stretch a spring of force constant 1.0×10^4 N/m, a distance of 0.15 m.
6. A 0.14 kg pinecone falls 16 m to the ground, where it lands with a speed of 13 m/s. How much kinetic energy does the pinecone have when it hits the ground?

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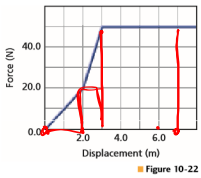


$W = 255$ J

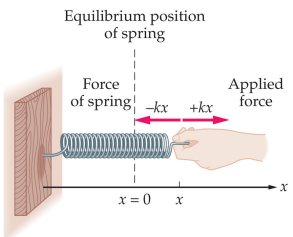
$20 + 20 + 15 + 200$

IN CLASS EXAMPLES

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

$W = \frac{1}{2} k x^2 = \frac{1}{2}\left(10{,}000 \frac{N}{m}\right)(0.15\,m)^2$

$W = 110$ J

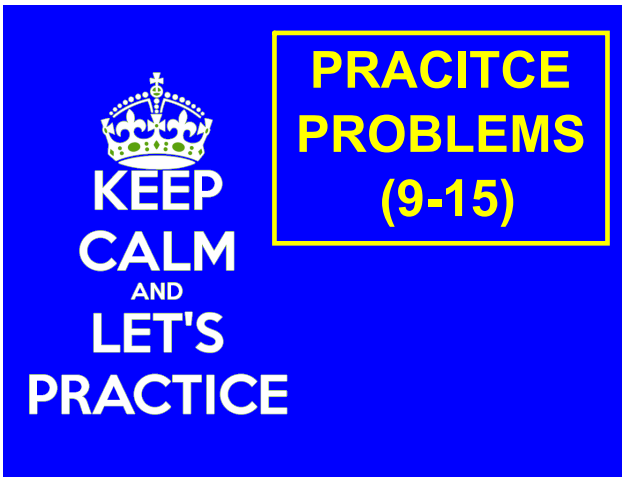


IN CLASS EXAMPLES

6. A 0.14 kg pinecone falls 16 m to the ground, where it lands with a speed of 13 m/s. How much kinetic energy does the pinecone have when it hits the ground?

$K = \frac{1}{2} m v^2 = \frac{1}{2}(0.14\,kg)(13\,m/s)^2$

$K = 12$ J


KEEP
CALM
AND
LET'S
PRACTICE
PRACITCE
PROBLEMS
(9-15)