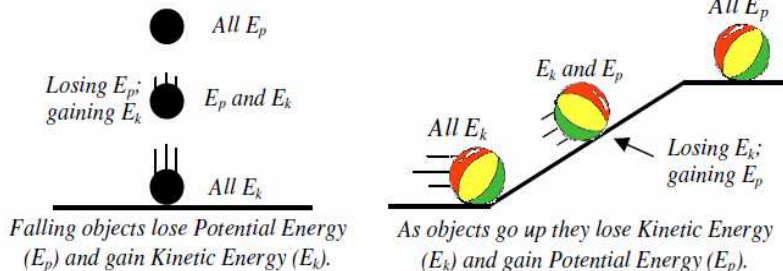


Name: _____
 Period: _____

Energy Transfers: Work and Power

Energy Transfers

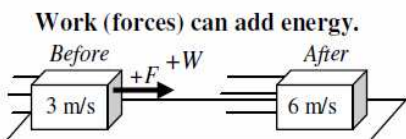
Energy has to come from somewhere. Energy comes from other forms of energy. This is known as **energy transfer**.



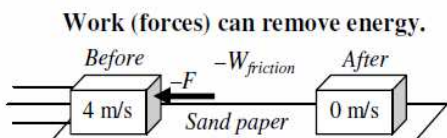
In fire, chemical energy becomes thermal energy (heat) and radiant energy (light).

Work

Work is energy transferred by forces. Any force that changes an object's energy is doing work.



A force can do positive work, increasing an object's kinetic energy.



Friction can do negative work, decreasing an object's kinetic energy.

Work (in Joules) → $W = Fd$

Force (in Newtons) ↙
 distance (in meters) ↘

Work equals force times distance.

Ex: A 1000 Newton force pushes a car 5 meters. How much work was done?

$F = 1000 \text{ N}$ $d = 50 \text{ m}$ $W = \underline{\hspace{2cm}}$	$W = Fd$ $W = (1000 \text{ N})(50 \text{ m})$ $= 5,000 \text{ J (joules)}$ (5,000 J of work gives 5,000 J of E_k to the car.)
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Work is Energy
 Sometimes you don't know the work done, but you know the result of the work. The work done = the change of energy.



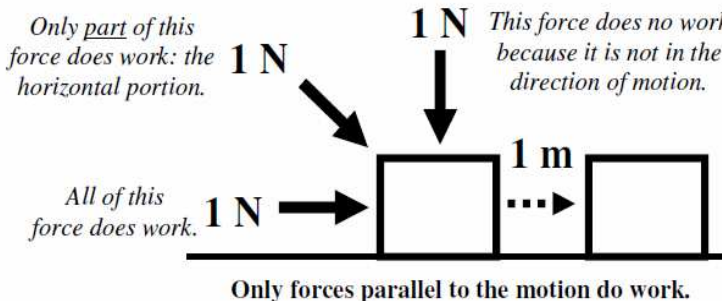
If we calculate the potential energy of the weights, we know the work done to lift them.

$W_{\text{done}} = E_{\text{gained}}$
 $W = E_p$

If the object is not moving no work is being done.



If the person does not move the nail, $d = 0$, so $W = 0$. No work is done on the nail and the nail's energy doesn't change.



Power

Power is how fast you do work or transfer energy. If you work faster, you use more power.

Power (in watts) → $P = \frac{W}{t}$

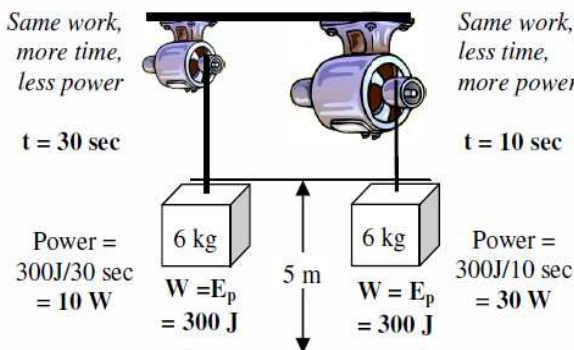
Work (in joules) ↙
 Time (in seconds) ↘

Power equals work (or energy) divided by time.

Ex: A force does 120 joules of work in 2 seconds. How much power did it use?

$W = 120 \text{ J}$ $t = 2 \text{ sec}$ $P = \underline{\hspace{2cm}}$	$P = W/t$ $= 120/2$ $= 60 \text{ watts}$ (same as a light bulb)
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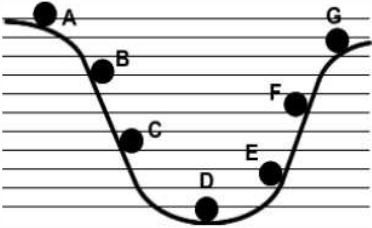
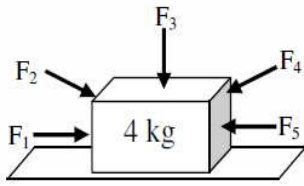

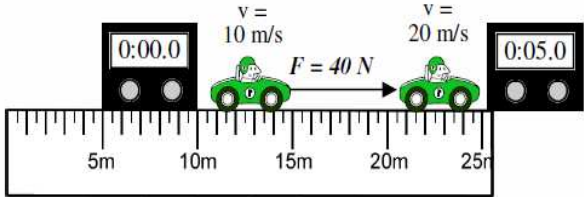
A machine that works faster (in less time) is more powerful.



Both of these motors do the same amount of work: lifting a 6 kg object up 5 m. The work the motors performed gives potential energy to the objects:

$W = E_p = mgh$
 $= 6(5)(10)$
 $= 300 \text{ J.}$

A more powerful motor can do the same amount of work, it just does it faster.

<p>1. Energy</p> <p>2. Joules</p> <p>3. Work</p> <p>4. Power</p> <p>5. Energy Transfer</p>	<p>A. The units for work and energy.</p> <p>B. Stored or gained work.</p> <p>C. Energy changing from one form to another.</p> <p>D. Energy transferred by forces. Product of force and distance.</p> <p>E. How fast work is done.</p>	<p><i>Is energy increased or decreased?</i></p> <p><input type="checkbox"/> An object speeds up.</p> <p><input type="checkbox"/> An object is lowered back to the ground.</p> <p><input type="checkbox"/> Friction slows down an object.</p> <p><input type="checkbox"/> An object sits motionless on a table.</p> <p><input type="checkbox"/> An object is lifted up from the ground.</p>
<p><i>Potential Energy (E_p), Kinetic (E_k) Energy, or Work (W)</i></p>		<p><i>Figure out the Energy Transfers.</i> <i>Thermal; Nuclear; Radiant; Mechanical; Chemical; Electrical</i></p>
<p><input type="checkbox"/> An object is pushed for 3 m.</p> <p><input type="checkbox"/> An object is going 6 m/s.</p> <p><input type="checkbox"/> Slowing down an object.</p> <p><input type="checkbox"/> An object on top of a 3 meter table.</p> <p><input type="checkbox"/> Friction stopping an object from moving.</p>		<p>Eating food allows you to move.</p> <p>A gas stove boiling water.</p>
<p>What kind of energy is lost from A to D?</p> <p>What kind of energy is lost from D to G?</p>		<p>Which forces are doing work on the object?</p> <p>Which forces are not doing work on the object?</p> 
<p>To help a bicyclist get to the top of a hill, they speed up. Using energy, explain why this helps.</p> <p>If the bicyclist starts at rest, how do they get up the hill?</p>		<p>A person holds onto a 25 N object for 2 minutes 3 m above the ground. How much work is done on the object?</p> <p>A 30 N force pushes a 20 kg box 5 m across the floor. How much work is done on the box?</p>
 <p>What kind of energy will it have at the top? Calculate it.</p> <p>Where does this energy come from?</p>		<p>What did the above work become?</p> <p>A 25 N force pushes a box up a ramp to the back of a truck. If the force does 200 J of work, how long is the ramp?</p> <p>Where does the work go?</p>
<p>Motor A does 240 J of work in 24 seconds. Calculate power.</p> <p>Motor B does 240 J of work in 8 seconds. Calculate power.</p> <p>Which motor did more work?</p> <p>Which motor was more powerful?</p> <p>True or false: "A more powerful motor does more work"?</p>		 <p>Calculate the work done on the car.</p> <p>Calculate the power of the force.</p> <p>What did the work become?</p>