Work \equiv \text{the product of force and distance}

*** distance MUST BE IN THE SAME DIRECTION AS THE

\text{equation: } \quad \text{Work} = \text{Force} \times \text{Distance}

\text{units: } (\text{Joule}) \times (\text{Newton}) \times (\text{meter})

SI unit of work is the Joule
1 Joule = 1 Newton-meter

* If a force acts on an object but the object does not move, then \text{WORK IS DONE}

\section*{Work}

Power \equiv \text{the rate of doing work}

\text{Power} = \text{Work} \div \text{Time}

SI unit of power is the watt (W)
1 watt = 1 Joule per second

* To increase power, you can:
  decrease time

\text{One horsepower} = 746 \text{ watts}

\section*{Power}
Machine ≡ a device that changes a force

Machines make work easier to do. They change:
1. the size of a force needed
2. the direction of a force
3. the distance over which a force acts

* The work done by a machine is always less than the work done on the machine because of friction:
  \[ W_{\text{in}} \gg W_{\text{out}} \]

A machine consists of two or more simple machines working together.

Mechanical Advantage ≡ the number of times a machine increases an input force

Actual MA
\[ \text{AMA} = \frac{\text{output force}}{\text{input force}} \]

Ideal MA
\[ \text{IMA} = \frac{\text{output force}}{\text{input force}} \]

Efficiency ≡ the percentage of work input that becomes work output
\[ \text{efficiency} = \left( \frac{\text{work output}}{\text{work input}} \right) \times 100\% \]

on back:

\[ W_{\text{out}} = F_{\text{out}} \times d_{\text{out}} \]
\[ W_{\text{in}} = F_{\text{in}} \times d_{\text{in}} \]
## Six Simple Machines

<table>
<thead>
<tr>
<th>Machine</th>
<th>Example</th>
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</thead>
<tbody>
<tr>
<td>Wheel and Axle</td>
<td>Crowbar</td>
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<tr>
<td>Inclined Plane</td>
<td>Axe</td>
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<tr>
<td>Screw</td>
<td>Machine screw</td>
</tr>
<tr>
<td>Pulley</td>
<td>Flag-raising pulley</td>
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## Simple Machines