

Energy is the ability to do work.

Energy is measured in Joules (J).

Energy can be stored.

Energy can be transferred.

Note Booklet #4: Energy

Energy is the ability to do work. Energy is measured in Joules (J). Energy can be stored. Energy can be transferred.

Energy

Work

In physics work means that force is applied to an object and that object moves.

$$\text{Work} = Fd \quad \leftarrow \text{Work is force} \times \text{displacement}$$

The unit for work is $\text{Joule} = \text{N} \cdot \text{m} = \frac{\text{kg} \cdot \text{m}}{\text{s}^2} \times \text{m} = \frac{\text{kg} \cdot \text{m}^2}{\text{s}^2}$

Work is always done from one thing to another thing.

Example: A person pushes a block 25m across a floor with an applied force of 45N.

$$W = Fd = 45\text{N} \times 25\text{m} = 1125\text{J}$$

Person did 1100J of work on the block

Example: A person pushes a block 15m across a floor with an applied force of 62N.

Person did 930 J of work on block.

Example: A person pushes a block 15m across a floor with an applied force of 46N while friction pushes against the motion with a force of 25N.

<p>Person</p> $ \begin{aligned} W &= Fd \\ &= 46\text{N} \times 15\text{m} \\ &= 690\text{J} \end{aligned} $	<p>Floor</p> $ \begin{aligned} W &= Fd \\ &= 25\text{N}(-15\text{m}) \\ &= -375\text{J} \approx -380\text{J} \end{aligned} $
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Example: A person pushes a block 45m across a floor at a constant velocity with an applied force of 56N.

<p><u>Person</u></p> $ \begin{aligned} W &= Fd \\ &= 56\text{N} \times 45\text{m} \\ &= 2520\text{J} \\ &= 2500\text{J} \end{aligned} $	<p><u>Floor</u></p> -2500J
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Example: A person pushes on a wall with a force of 26 N for 2.5 seconds but the wall does not move.

0 work

Example: A puck slides 26m over a frictionless surface at a constant velocity of 2.9 m/s.

0 work

Example: A 26 kg block is lifted by a person at a constant velocity to a height of 3.0m.

$$\uparrow F_{app} = 254.8 \text{ N}$$



$$\downarrow F_g = mg \\ = 254.8 \text{ N}$$

$$\text{Person does } 254.8 \text{ N} \times 3.0 \text{ m} = 764.4 \text{ J work} \\ \approx 760 \text{ J}$$

$$\text{Earth does } -764.4 \text{ J work} \\ \approx -760 \text{ J}$$

Example: A 6.2 kg block is lifted by a person at a constant velocity to a height of 91.2m.

$$\text{Person does } 5500 \text{ J}$$

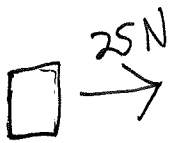
$$\text{Earth does } -5500 \text{ J}$$

What Work Does

Consider a block which is pushed 10.0 m by a force of 25N.

$$W = Fd = \cancel{10.0\text{ m}} \cdot 25\text{ N} \times 10.0\text{ m} = 250\text{ J}$$

Situation 1: The block was pushed over a frictionless surface.



Block accelerates

Block gains Kinetic energy
250J

Situation 2: The block was pushed up a frictionless ramp at a constant velocity.

Block will be higher

Block gains 250J of potential energy

Situation 3: The block was pushed over a surface where friction equals the applied force.

250 J of heat was produced