Work & Kinetic Energy

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Work

- **Definition**
  - **The transfer of energy from one object to another**
  - **Done by applying a force over a distance**
  - **distance must be parallel to the force**
  - **SI Unit of Joules**
- **Equation**
  - **Work = Force x Distance**
  - **W = F x D**
- **If the object doesn't move, then no work is done.**

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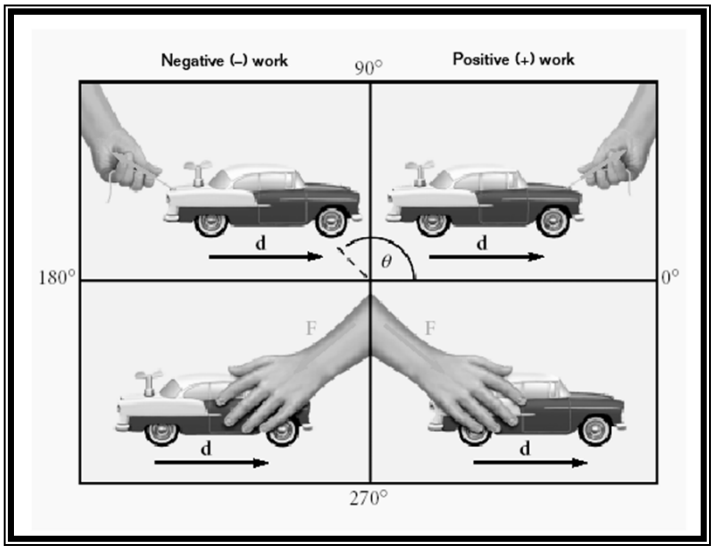
The Sign of Work

Negative work
- Force and distance are in opposite directions.
- Takes energy from the object
- Slows it down



Positive work
- Force and distance are in the same direction.
- Gives energy to the object
- Speeds it up

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Work – Sample Problem 1

- **Jamie lifts a 5.0 kg box from the ground to a shelf 2.3 m above the ground. How much work did Jamie do on the box?**

$$W = Fd$$

$$W = F_g d$$

$$W = mgd$$

$$W = (5.0\ kg)(9.8)(2.3m)$$

$$W = 112.7\ J$$

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Energy

- **Definition**
  - **The ability of an object to do work**
- **Relation of energy and work**
  - **When you work, you are transferring energy to the object that you are working on.**
- **Unit of Measure**
  - **Joule (J)**

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Kinetic Energy

- **Object's energy due to its motion or velocity**

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

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Kinetic Energy - Sample

- **A 7.00 kg bowling ball moves across the floor. If the ball has a kinetic energy of 31.5 J, how fast is it moving?**

$$K = {}^{1}/_{2}\, mv^2$$

$$31.5 = {}^{1}/_{2}\,(7.00)v^2$$

$$9 = v^2$$

$$v = 3\ m/s$$

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Work-Kinetic Energy Theorem

- **The net work done on an object is equal to the change in the kinetic energy of the object.**

$$\mathrm{W} = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$$

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Sample Problem

- **You apply a force of 7.3 N to a stationary toy car over a distance of 25 cm. If the mass of the car is 135 g, what is the velocity of the car after you apply the force?**

$$W = {}^{1}/_{2}\, mv_f^2 - {}^{1}/_{2}\, mv_i^2$$

$$(7.3\ N)(0.25m) = {}^{1}/_{2}\,(0.135)v_f^2 - {}^{1}/_{2}\,(0.135)(0^2)$$

$$1.825 = 0.0625v_f^2$$

$$27.04 = v_f^2$$

$$v = \quad 5.2\ m/s$$

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