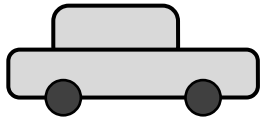
Kinetic Energy

Essential Question

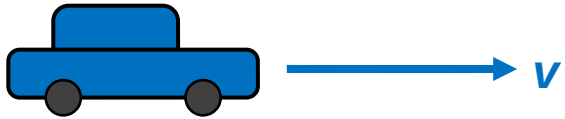
How much energy does a moving object have?

Kinetic Energy

- Energy of motion
- Anything moving has *KE*
- Measured in joules (J)



parked: *KE* = 0



moving: *KE* > 0

The Kinetic Energy Equation

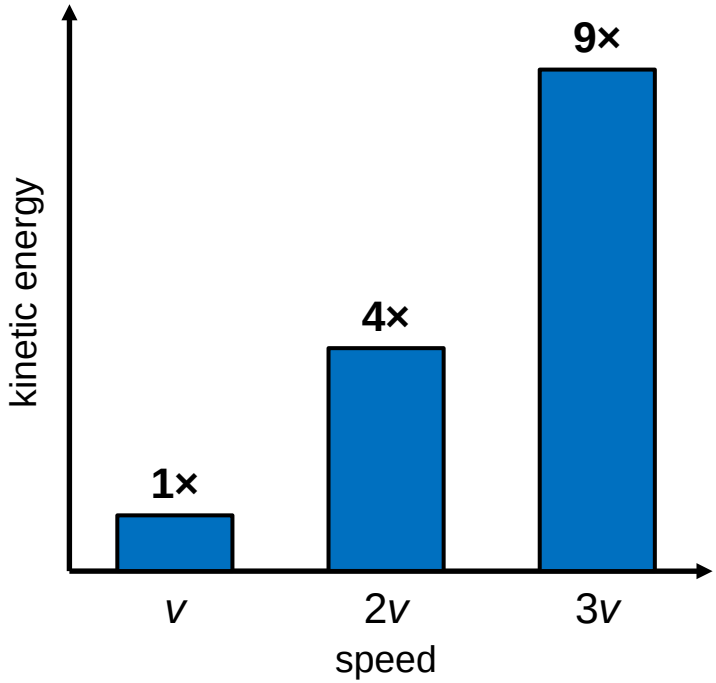
$$KE = \tfrac{1}{2}mv^2$$

KE	***m***	***v***
kinetic energy (J)	mass (kg)	speed (m/s)

$1\ J = 1\ kg \cdot m^2/s^2$

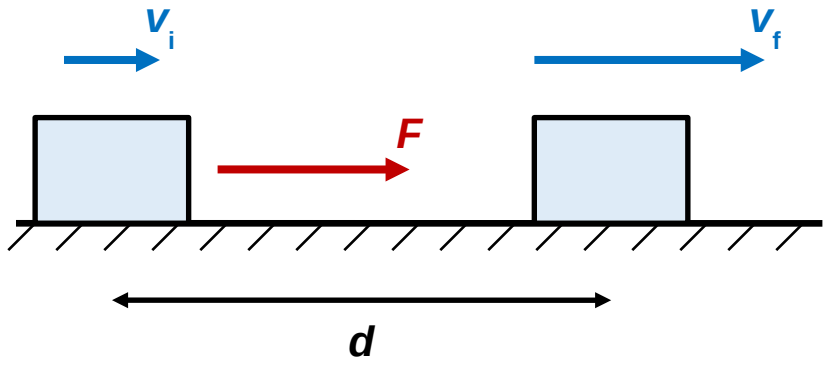
Speed Matters Most

- Double the mass: 2× the *KE*
- Double the speed: 4× the *KE*
- Triple the speed: 9× the *KE*



The Work-Energy Theorem

- Net work changes *KE*
- $W_{net} = KE_f - KE_i$
- Positive work speeds it up



$$W_{net} = \Delta KE$$

Solving for Any Variable

- Write the equation first
- Undo steps in reverse order
- Square root last for *v*

$$KE = \tfrac{1}{2}mv^2$$

× 2, ÷ *m*

$$v^2 = 2KE / m$$

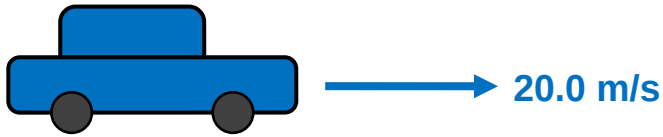
square root

$$v = \sqrt{(2KE / m)}$$

also: $m = 2KE / v^2$

Example: A Moving Car

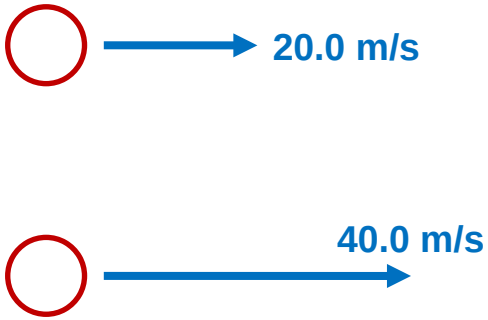
A 1,500 kg car drives down the highway at 20.0 m/s. What is its kinetic energy?



1,500 kg

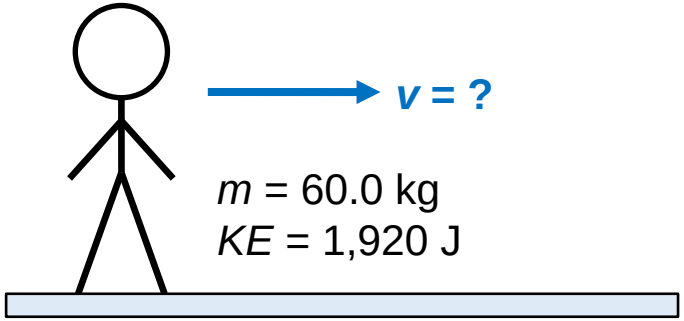
Example: Doubling the Speed

A 0.145 kg baseball is thrown at 20.0 m/s, then at 40.0 m/s. Find its kinetic energy at each speed. How do they compare?



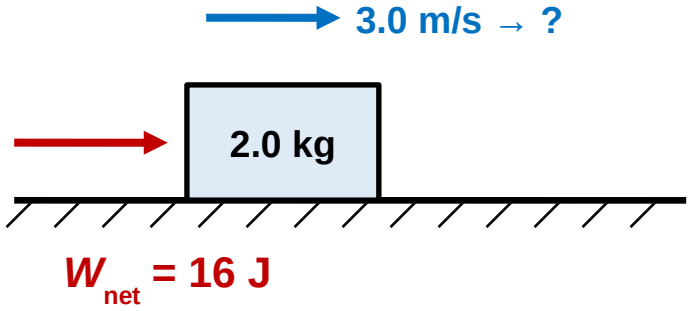
Example: Finding Speed

A 60.0 kg skater glides across the ice with 1,920 J of kinetic energy. How fast is she moving?



Example: Work-Energy Theorem

A 2.0 kg cart rolls at 3.0 m/s. A push does 16 J of net work on it in the direction of motion. What is the cart's new speed?



Kinetic Energy

Big Ideas

- $KE = \frac{1}{2}mv^2$: the energy of motion
- Double the speed: 4× the kinetic energy
- Work-energy theorem: $W_{net} = \Delta KE$
- Find speed: $v = \sqrt{(2KE/m)}$