

Kinetic Energy Quiz 2.3

Fill in the blanks.

- The energy of motion is called kinetic energy.
- In order to calculate kinetic energy you need to know mass and velocity.
 - The kinetic energy of a 10.0 N rock on a 30.0 m high cliff is 0 J.
 - In an elastic collision, the total kinetic energy of the objects before the collision is equal to the total kinetic energy of the bodies after the collision.
 - If positive work is done the kinetic energy has increased.

Problems

- Calculate the kinetic energy of a 2000 kg helicopter that is traveling at a speed of 320 km/h?

$$\begin{aligned}
 m &= 2000 \text{ kg} \\
 v &= 320 \frac{\text{km}}{\text{h}} \times \frac{1 \text{ h}}{3600 \text{ s}} \times \frac{1000 \text{ m}}{1 \text{ km}} \\
 &= 88.9 \text{ m/s}
 \end{aligned}$$

$$\begin{aligned}
 E_k &= \frac{1}{2} m v^2 \\
 &= \frac{1}{2} (2000 \text{ kg}) (88.9 \frac{\text{m}}{\text{s}})^2 \\
 E_k &= 7.9 \times 10^6 \text{ J}
 \end{aligned}$$

- How much work must be done to accelerate a 980 kg car from 25 m/s to 48 m/s?

$$\begin{aligned}
 m &= 980 \text{ kg} \\
 v_i &= 25 \text{ m/s} \\
 v_f &= 48 \text{ m/s} \\
 W &= \Delta E_k
 \end{aligned}$$

$$\begin{aligned}
 \Delta E_k &= E_{kf} - E_{ki} \\
 &= \frac{1}{2} m v_f^2 - \frac{1}{2} m v_i^2 \\
 &= \frac{1}{2} (980 \text{ kg}) (48 \frac{\text{m}}{\text{s}})^2 - \frac{1}{2} (980 \text{ kg}) (25 \frac{\text{m}}{\text{s}})^2 \\
 &= 1128960 - 306250 \\
 &= 8.2 \times 10^5 \text{ J} \quad W = 8.2 \times 10^5 \text{ J}
 \end{aligned}$$

- A sled with a mass of 15.0 kg moves west along a frictionless surface at a constant velocity of 8.0 m/s. Its velocity changes to 5 m/s west when a net force of 15.0 N acted on the sled.

- In what direction was the net force applied?

Toward the east since the sled slowed down

- What was the change in kinetic energy of the sled?

$$\begin{aligned}
 m &= 15.0 \text{ kg} \\
 v_i &= 8.0 \text{ m/s} \\
 v_f &= 5 \text{ m/s}
 \end{aligned}$$

$$\begin{aligned}
 \Delta E_k &= E_{kf} - E_{ki} \\
 &= \frac{1}{2} m v_f^2 - \frac{1}{2} m v_i^2 \\
 &= \frac{1}{2} (15.0 \text{ kg}) (5 \frac{\text{m}}{\text{s}})^2 - \frac{1}{2} (15.0 \text{ kg}) (8.0 \frac{\text{m}}{\text{s}})^2 \\
 &= 188 \text{ J} - 480 \text{ J} \\
 &= -292 \text{ J}
 \end{aligned}$$

The kinetic energy of the sled decreased by 292 J.