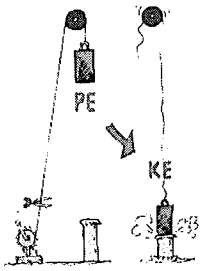
Lesson 6: Kinetic Energy



What is Kinetic Energy?

Kinetic energy is the energy of motion. KE is the symbol for kinetic energy.

Kinetic energy can be calculated by:

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

Where m is the mass of an object measured in kg

v is the velocity of the object measured in m/s

KE has the unit of measure of Joules (J)

Example: What is the kinetic energy of a 6.0kg curling stone sliding at 4.0m/s?

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

$$E_k = \frac{1}{2}\ 6.0\text{kg} \times (4.0\text{m/s})^2$$

$$E_k = 48\text{J}$$

Example: The kinetic energy of a boat is calculated at 52,000 J. If the boat has a mass of 39,000 kg, with what velocity is it moving?

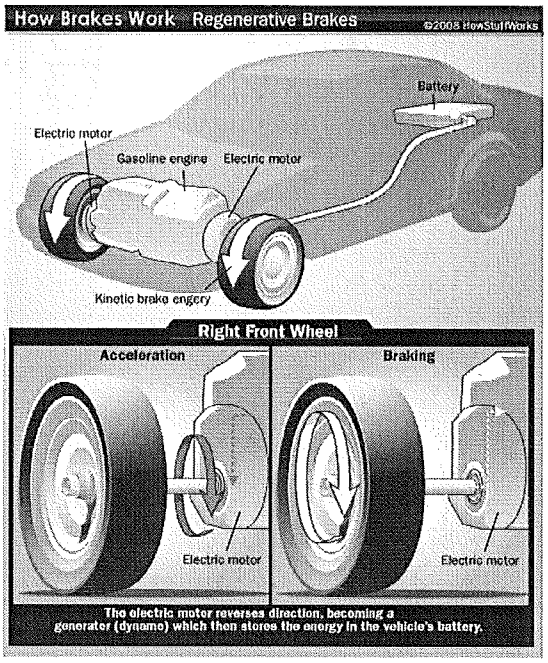
$$KE = \frac{1}{2} m v^2$$

$$\frac{2KE}{m} = v^2$$

$$v = \sqrt{\frac{2KE}{m}}$$

$$v = \sqrt{\frac{2(52{,}000\text{ J})}{39000\text{ Kg}}}$$

$$= 1.63\text{ m/s}$$

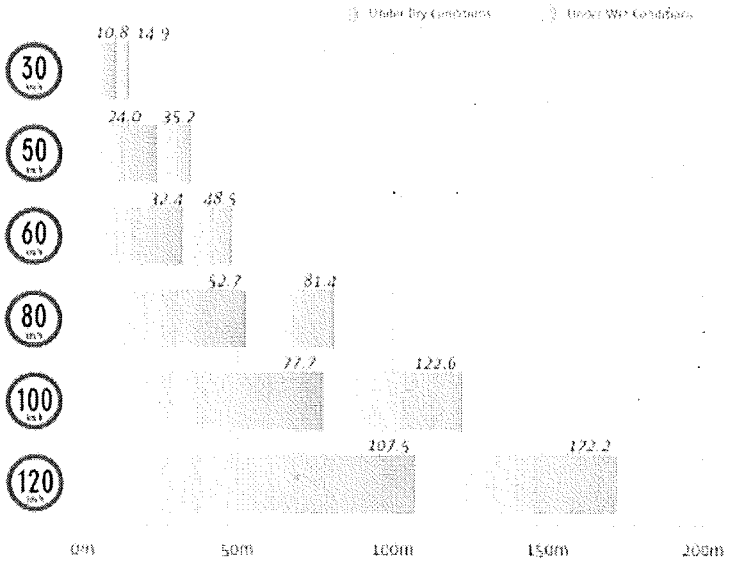


Looking at the kinetic energy equations reveals the dominance of velocity on the kinetic energy. If the velocity is doubled or tripled then the kinetic energy increases four or nine times, respectively.

The total mechanical energy (TME) of a system is KE + PE. When energy is transferred or transformed in our Universe, TME remains constant.

Additional Practice

Write the formula for Kinetic energy here:



1. What is the Kinetic Energy of a 150 kg object that is moving with a speed of 15 m/s?

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

$= \frac{1}{2} \times 150\,kg \times (15\,m/s)^2$

$= 16,875\,J$

2. An object has a kinetic energy of 25 J and a mass of 34 kg , how fast is the object moving?

$KE = \frac{1}{2}mv^2$ $\quad v = \sqrt{\frac{2 \times 25}{34}}$

$v^2 = \frac{2KE}{m}$ $\quad = 1.21\,m/s$

3. An object moving with a speed of 35 m/s and has a kinetic energy of 1500 J, what is the mass of the object.

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

$m = \frac{2KE}{v^2} = \frac{2 \times 1500\,J}{35^2} = 2.45\,kg$

4. What is the Kinetic Energy of a 1200 kg object that is moving with a speed of 24 m/s?

$KE = \frac{1}{2}mv^2 = \frac{1}{2} \times 1200kg \times (24m/s)^2$

$= 345,600\ J$

5. An object has a kinetic energy of 14 J and a mass of 17 kg , how fast is the object moving?

$KE = \frac{1}{2}mv^2$ $\quad v = \sqrt{\frac{2KE}{m}}$

$= \sqrt{\frac{(2 \times 14)}{17kg}} = 1.28\ m/s$

6. An object moving with a speed of 67 m/s and has a kinetic energy of 500 J, what is the mass of the object.

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

$m = \frac{2KE}{v^2} = \frac{2(500J)}{67^2} = 0.22\ kg$

7. What is the Kinetic Energy of a 478 kg object that is moving with a speed of 15 m/s?

$KE = \frac{1}{2}mv^2 = \frac{1}{2} \times 478\ kg \times (15\ m/s)^2$

$= 53,775\ J$

8. An object has a kinetic energy of 88 J and a mass of 45 kg , how fast is the object moving?

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

$v = \sqrt{\frac{2KE}{m}} = \sqrt{\frac{(2 \times 88\ J)}{45kg}} = 1.98\ m/s$

9. An object moving with a speed of 21 m/s and has a kinetic energy of 140 J, what is the mass of the object.

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

$m = \frac{2KE}{v^2} = \frac{(2 \times 140\ J)}{(21\ m/s)^2} = 0.63\ kg$

10. What is the Kinetic Energy of a 100 kg object that is moving with a speed of 12.5 m/s?

$KE = \frac{1}{2}mv^2 = \frac{1}{2} \times 100kg \times (12.5\ m/s)^2 = 7812.5\ J$