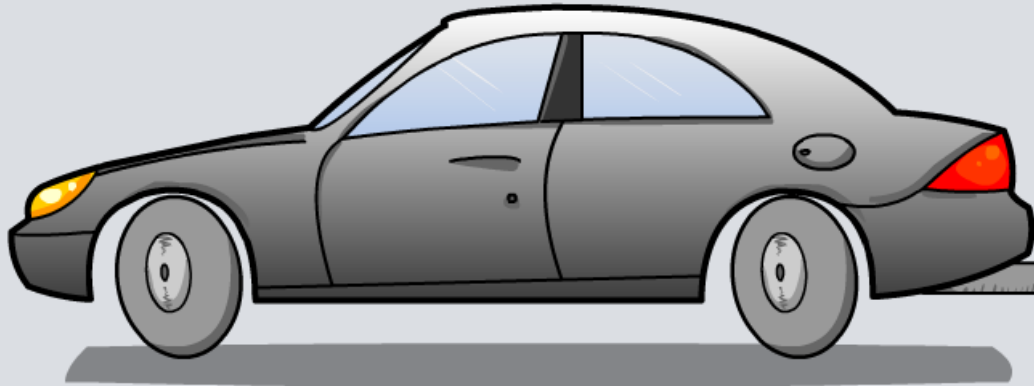# Kinetic Energy

What is kinetic energy?

The word 'kinetic' comes from the Greek word 'kinesis', meaning motion.

Kinetic energy is the energy an object has because it is moving.

All moving things have kinetic energy, but the amount of energy they have is not just dependent on how fast they are moving.

What other factors affect the kinetic energy of a moving object?

How is kinetic energy calculated?

The kinetic energy (*KE*) of an object can be calculated using this equation:

$$KE = \tfrac{1}{2} \times \text{mass} \times \text{velocity}^2$$
$$= \tfrac{1}{2}mv^2$$

- Mass is measured in **kilograms** (**kg**).

- Velocity is measured in **meters per second** (**m/s**).

- KE is measured in **joules** (**J**).

Calculating kinetic energy question

A truck with a mass of 1,500 kg travels at a velocity of 20 m/s.

What is the kinetic energy of the truck?

kinetic energy = ½ × mass × velocity^2

$$= ½ × 1{,}500 × 20^2$$

$$= \textbf{300{,}000 J} = \textbf{300 kJ}$$

Rearranging the KE equation

Sometimes it is necessary to rearrange the kinetic energy equation in order to calculate the **mass** or the **velocity** of a moving object.

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

What are the rearranged versions of this equation for calculating mass and velocity?

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

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

Calculating velocity question

A truck has a mass of 20,000 kg.
If its kinetic energy is 2.25 mJ,
at what velocity is it traveling?

$$KE = ½ × mass × velocity^2$$

$$velocity = \sqrt{\frac{2KE}{mass}}$$

$$= \sqrt{\frac{2 × 2,250,000}{20,000}}$$

$$= 15\,m/s$$

You will need this equation to answer the following questions about KE, mass and velocity

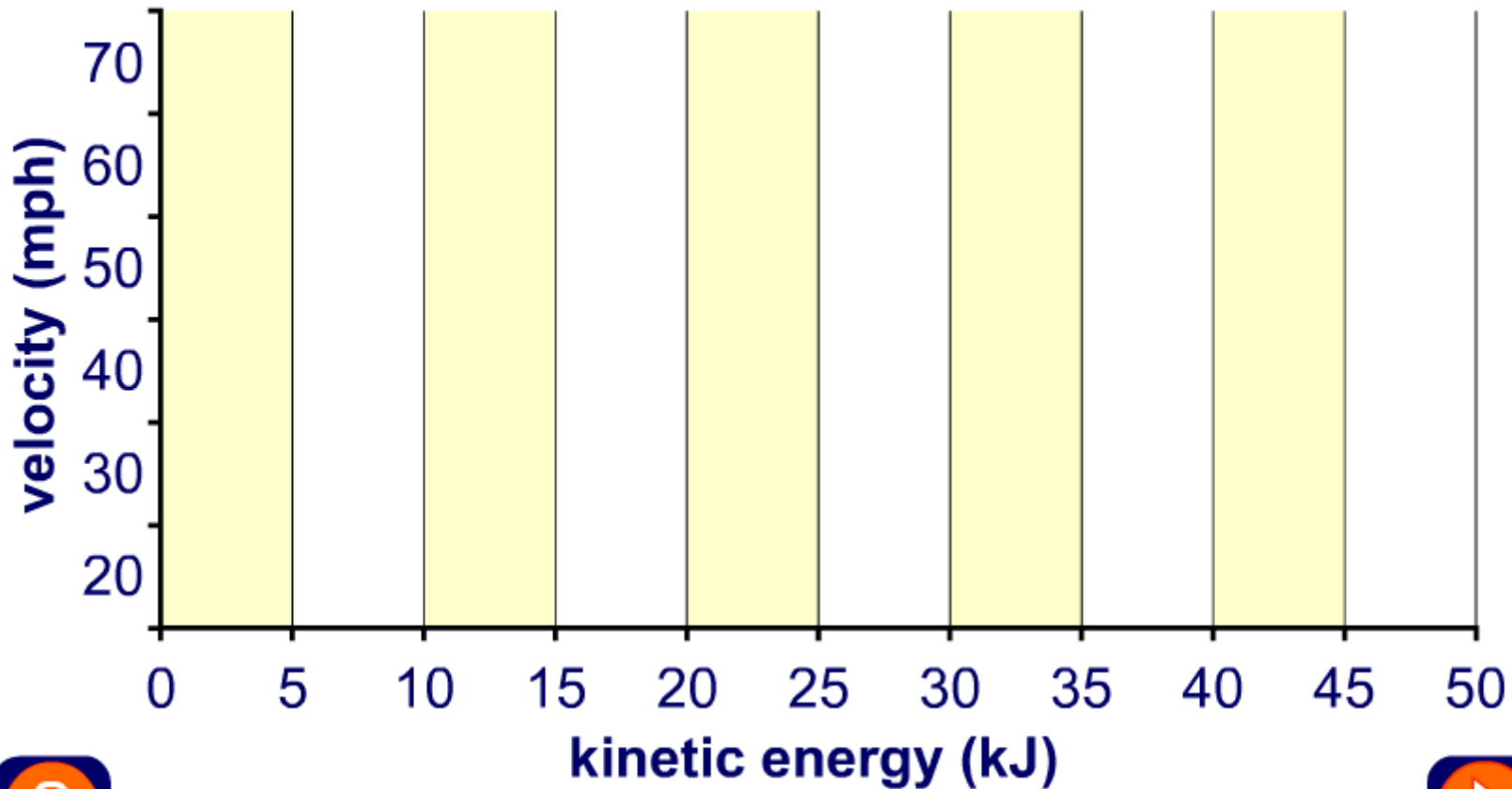$$KE = \tfrac{1}{2} \times mass \times velocity^2$$

Click "**start**" to begin.

start

The kinetic energy of cars

How does the kinetic energy of a car vary with its velocity?

Use the **$KE = \frac{1}{2}mv^2$** equation to fill in the kinetic energy values in the table below for two cars each traveling at two different velocities.

	1,000 kg	2,000 kg
20 mph	KE = 40 kJ	KE = 80 kJ
40 mph	KE = 160 kJ	KE = 320 kJ

What factor – **mass** or **velocity** – has the greatest effect on the kinetic energy of a moving object?

Doubling the mass of a moving object doubles its kinetic energy, but doubling the velocity **quadruples** its kinetic energy.

If the velocity of a car is slightly above the speed limit, its kinetic energy is much greater than it would be at the speed limit. This means that:

- It is more difficult to stop the car and there is more chance of an accident.

- It the car does collide with something, more energy will be transferred, causing more damage.