

Kinetic Energy

Kinetic energy is the energy stored by a moving object.

The faster an object moves, the more kinetic energy it has.

The greater the mass of an object, the more kinetic energy it has.

The equation for kinetic energy is:

$$\text{kinetic energy} = 0.5 \times \text{mass} \times \text{speed}^2$$

$$E_k = 0.5 \times m \times v^2$$

E_k = kinetic energy in joules (J)

m = mass in kilograms (kg)

v = speed in metres per second (m/s)

Remember that speed is squared.

$$v^2 = v \times v$$

If the speed of an object increases, its kinetic energy increases.

If the speed doubles, the kinetic energy becomes four times greater because speed is squared.

When an object speeds up, energy is transferred to its kinetic energy store.

When an object slows down, energy is transferred away from its kinetic energy store.

The FIFA Method

Use FIFA to organise your calculations clearly.

F – Formula

Write down the equation you need.

I – Insert

Put the numbers from the question into the equation.

F – Figure out

Do the calculation.

A – Answer

Write your final answer with the correct unit.

Worked Example

A 4 kg object moves at 5 m/s. Calculate its kinetic energy.

F: $E_k = 0.5 \times m \times v^2$

I: $E_k = 0.5 \times 4 \times 5^2$

F: $E_k = 0.5 \times 4 \times 25 = 50$

A: 50 J

Examples to Do in Class

1. A rollercoaster carriage has a mass of 500 kg and is moving at 10 m/s. Calculate its kinetic energy.
2. A go-kart is travelling at 20 m/s and has 40000 J of kinetic energy. Calculate the mass of the go-kart.
3. A football has a mass of 0.5 kg and has 25 J of kinetic energy. Calculate its speed.

10 Ramped Questions

Use the **FIFA method** for each question.

F – Formula

I – Insert

F – Figure out

A – Answer

1. A football has a mass of 0.4 kg and is moving at 5 m/s. Calculate its kinetic energy.
2. A cyclist and bike have a total mass of 80 kg and are travelling at 6 m/s. Calculate their kinetic energy.

3. A rollercoaster carriage has a mass of 500 kg and is moving at 12 m/s. Calculate its kinetic energy.
4. A car has a mass of 1200 kg and is travelling at 20 m/s. Calculate its kinetic energy.
5. A runner has 2250 J of kinetic energy while moving at 10 m/s. Calculate the runner's mass.
6. A go-kart has 16000 J of kinetic energy while travelling at 20 m/s. Calculate its mass.
7. A 2 kg bowling ball has 36 J of kinetic energy. Calculate its speed.
8. A 50 kg skier has 3600 J of kinetic energy. Calculate the skier's speed.
9. A car has a mass of 1000 kg and 200000 J of kinetic energy. Calculate its speed.
10. A motorbike and rider have a combined mass of 250 kg and 125000 J of kinetic energy. Calculate their speed.