

Name _____

Class _____

Date _____

By the end of this worksheet I can...

- ☐ calculate kinetic energy using $E_k = \frac{1}{2}mv^2$
- ☐ rearrange the formula to find mass or velocity
- ☐ find a speed from distance ÷ time
- ☐ link kinetic and potential energy when no energy is lost

I DO**Key ideas and worked example** Read this first

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

Kinetic energy = $\frac{1}{2} \times \text{mass} \times \text{velocity}^2$

- Mass m in kilograms (kg)
- Velocity v in metres per second (m/s or m s^{-1})
- Energy E_k in joules (J)

RememberSquare the velocity before you multiply. Rearranged: $m = 2E_k \div v^2$ and $v = \sqrt{2E_k \div m}$.*A go-kart and driver have a total mass of 90 kg and travel at 40 m/s.***Example Calculate the kinetic energy.****Worked answer** set out every step like this

$$E_k = \frac{1}{2}mv^2 = 0.5 \times 90 \times 40^2$$

$$E_k = 0.5 \times 90 \times 1600$$

$E_k = 72\,000 \text{ J (72 kJ)}$

Why marks are not awarded

- ✗ Forgetting to square the velocity
- ✗ Squaring the whole of $\frac{1}{2}mv$

WE DO**Guided practice** Follow the steps to help you*A plane of mass 9000 kg flies at 100 m/s.***1 Calculate the kinetic energy of the plane.** (2 marks)**Steps**

1. Square the velocity: $100^2 = \dots$
2. $E_k = 0.5 \times 9000 \times \dots$
3. Give the answer in J, then in MJ

YOU DO

On your own Give answers to two significant figures. Show your working.

2 A go-kart driver of mass 50 kg travels at 40 m/s. A second driver of mass 70 kg travels at the same speed.

a) Calculate the kinetic energy of each driver.

b) Explain the difference.

3 A crane raises a 200 kg load 30 m in one minute. Calculate the kinetic energy of the load while it is moving.

4 A racing car travels at a constant 50 m/s and has 500 kJ of kinetic energy. Calculate its mass.

5 A runner crosses the line at 7 m/s with 1862 J of kinetic energy. Calculate the runner's mass.

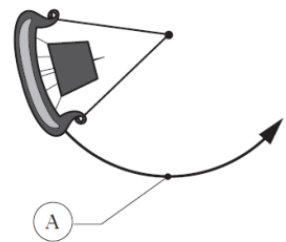
6 A remote-controlled car travels at 1.2 m/s with 0.216 J of kinetic energy. Calculate its mass.

7 A 2800 kg lorry has 132 kJ of kinetic energy. Calculate its speed.

8 A 250 kg motorbike travels at 18 m/s and a 950 kg car at 12.5 m/s. Which has more kinetic energy? Show your working.

9 An 850 kg car slows from 20 m/s to 12 m/s. Calculate the change in its kinetic energy.

10 A fairground swing and its passengers have a combined mass of 2500 kg.



a) Calculate the kinetic energy at the lowest point, where the velocity is 15 m/s. (2 marks)

b) Calculate the maximum height the swing reaches, assuming no energy is lost. (Use $E_p = mgh$.) (3 marks)

c) State one cause of energy loss in the swing. (1 mark)

d) State how this energy loss could be reduced. (1 mark)

Check and reflect

Mark your answers with the answer sheet. Which “I can” statement above still needs work? Look back at the notes for that topic on the site.
