Worksheet: Kinetic Energy ($E_k = 0.5 \times m \times v^2$)

PhysicsSheets

Specification: GCSE Physics (AQA 4.1.1.1 / Edexcel SP3)

Kinetic Energy Formula: $E_k = \frac{1}{2}mv^2$

Rearranged Forms: $m = \frac{2E_k}{v^2}$ | $v = \sqrt{\frac{2E_k}{m}}$

Units: E_k (Kinetic energy, Joules, J), m (Mass, kilograms, kg), v (Speed, metres per second, m/s)

Section A: Formula Recall, Rearranging & Unit Conversions

1. Complete the table below with the correct SI unit and its symbol for each variable in the kinetic energy formula:

Variable	SI Unit Name	SI Unit Symbol
Kinetic Energy (E_k)	_____	_____
Mass (m)	_____	_____
Speed (v)	_____	_____

2. Rearrange the formula $E_k = \frac{1}{2}mv^2$ to make:

a) Mass (m) the subject: $m =$ _____

b) Speed (v) the subject: $v =$ _____

3. Convert the following values into their standard SI units. Show your working where appropriate.

a) 250 g = _____ kg

b) 1.5 kJ = _____ J

c) 72 km/h = _____ m/s (*Hint:* 1 $km = 1000$ m, 1 $h = 3600$ s)

d) 50 cm/s = _____ m/s

Section B: Practice Calculations

Show all your working clearly, including the equation, substitution, and final answer with units. Round your final answers to an appropriate number of significant figures.

1. A car of mass 1200 kg travels at a speed of 25 m/s.

a) Calculate the kinetic energy of the car.

2. A tennis ball has a kinetic energy of 15 J when moving at 30 m/s.

a) Calculate the mass of the tennis ball.

3. A bullet of mass 0.01 kg has 2000 J of kinetic energy.

a) Calculate the speed of the bullet. Give your answer to 3 significant figures.

4. A cyclist and their bike have a combined mass of 80 kg. They are travelling at 10 m/s.

a) If the cyclist doubles their speed, what happens to their kinetic energy? Calculate the new kinetic energy.

Section C: Challenge Context

Figure 1 shows a car and a lorry.

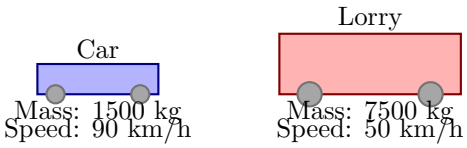

Figure 1: A car and a lorry

1.

a) Calculate the kinetic energy of the car. Show all working, including unit conversions. Give your answer in kilojoules (kJ) to 3 significant figures.

b) Compare the kinetic energy of the lorry to that of the car. Explain which vehicle has more kinetic energy and why, referring to the formula $E_k = \frac{1}{2}mv^2$.