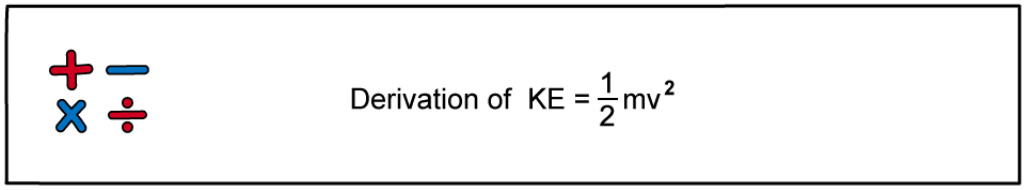
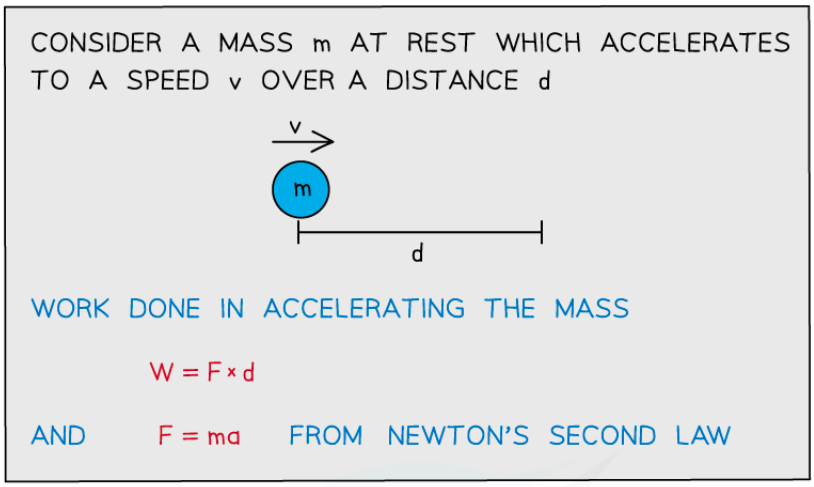
Kinetic Energy

Derivation of KE = 1/2mv2

- Kinetic energy is energy an object has due to its **motion** (or velocity)
- A force can make an object accelerate; work is done by the force and energy is transferred to the object
- Using this concept of work done and an equation of motion, the extra work done due to an object's speed can be derived
- The derivation for this equation is shown below:





RECALL THE SUVAT EQUATION

$$v^2 = u^2 + 2as$$

IF $u = 0$ AND $s = d$

$$v^2 = 2ad$$

REARRANGING FOR a

$$a = \frac{v^2}{2d}$$

SUBSTITUTE BACK INTO $F = ma$

$$F = ma = \frac{mv^2}{2d}$$

SUBSTITUTE THIS FORCE F INTO THE WORK DONE EQUATION

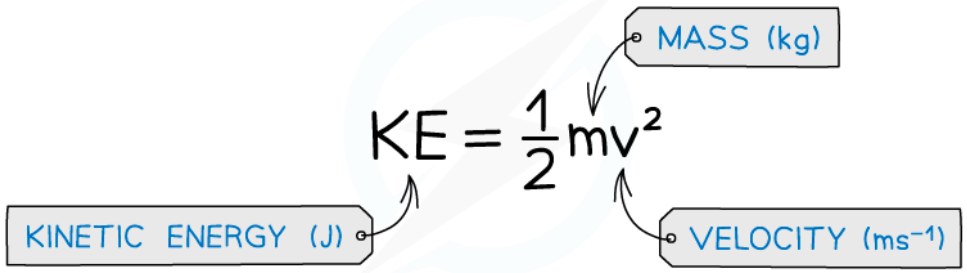
$$W = \frac{mv^2}{2d} \times d = \frac{1}{2}mv^2$$

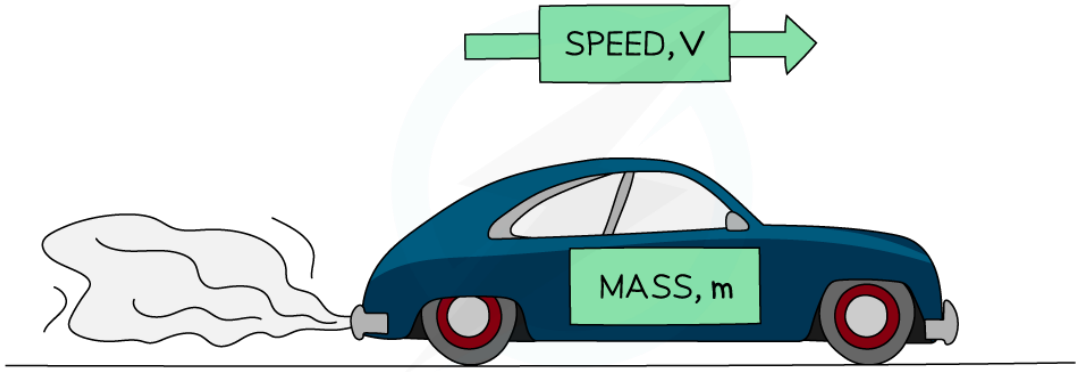
THE MASS IS NOW ABLE TO DO EXTRA WORK $= \frac{1}{2}mv^2$ DUE TO ITS SPEED

IT HAS KINETIC ENERGY $= \frac{1}{2}mv^2$

Kinetic Energy

- Kinetic energy is energy an object has due to its **motion** (or velocity)
  - The faster an object is moving, the greater its kinetic energy
- When an object is falling, it is **gaining** kinetic energy since it is gaining speed. This energy transferred from the gravitational potential energy it is losing
- An object will maintain this kinetic energy unless its speed changes





KE: The energy an object has when its moving

Worked example

A body travelling with a speed of 12 ms^{-1} has kinetic energy 1650 J.

If the speed of the body is increased to 45 ms^{-1}, what is its new kinetic energy?

STEP 1

EQUATION FOR KINETIC ENERGY

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

STEP 2

MASS WILL NOT CHANGE, SO CAN BE CALCULATED FROM ITS INITIAL KINETIC ENERGY

REARRANGE FOR MASS m

$$m = \frac{2 \times KE}{v^2} = \frac{2 \times 1650}{12^2} = 23 \text{ kg}$$

STEP 3

SUBSTITUTE INTO KINETIC ENERGY EQUATION

USING VALUE OF MASS AND NEW VALUE OF VELOCITY

$$KE = \frac{1}{2} \times 23 \times 45^2 = 23000 \text{ J} \quad (2 \text{ s.f})$$