

Core Equation: Work Done = Force $\times$ Distance moved in the direction of the force

$$W = F \times s$$

Rearranged Forms: $F = \frac{W}{s}$ | $s = \frac{W}{F}$

Units: W (Work Done) in Joules (J) | F (Force) in Newtons (N) | s (Distance) in metres (m)

Section A: Formula Recall & Unit Conversions

1. Complete the table below by stating the correct SI unit and its symbol for each variable in the work done

	Variable	SI Unit Name	SI Unit Symbol
equation ($W = F \times s$).	Work Done (W)	_____	_____
	Force (F)	_____	_____
	Distance (s)	_____	_____

2. Rearrange the formula $W = F \times s$ to make F and s the subject:

a) $F =$ _____

b) $s =$ _____

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

a) 2.5 kJ to Joules (J)

b) 45 cm to metres (m)

c) 0.8 kN to Newtons (N)

d) 1.2 MJ to Joules (J)

e) 250 mm to metres (m)

Section B: Practice Calculations

1) A student pushes a box with a force of 50 N across a floor for a distance of 3.0 m.

a) Calculate the work done by the student on the box. Show your working and state the unit.

b) If the student pushes the box with the same force for a distance of 5.5 m, calculate the new work done.

2) A car's engine does 24000 J of work to move the car a distance of 60 m.

- a) Calculate the average force exerted by the engine. Show your working and state the unit.

- b) If the engine exerted a force of 500 N instead, but still did 24000 J of work, calculate the distance the car would have moved.

Section C: Challenge Context & Multi-step Problems

- 1) A crane lifts a 1500 kg concrete block vertically upwards by 8.0 m. The gravitational field strength (g) is 9.8 N/kg.

- a) Calculate the work done by the crane to lift the concrete block. Give your answer in kilojoules (kJ) to 2 significant figures.

- b) Explain why the actual work done by the crane's motor would be greater than the value calculated in part (a).

- 2) A cyclist applies the brakes to slow down. The braking force is 2.5 kN and the bicycle travels 15 m before coming to a complete stop.

- a) Calculate the work done by the brakes. Show your working and state the unit.

- b) Describe the energy transfer that occurs as the brakes do work to stop the bicycle.
