

Worksheet 4.1: Energy & Power ($E = P \times t$)

Specification: GCSE Physics (AQA / Edexcel / OCR Gateway)

PhysicsSheets

Core Equation: $E = P \times t$

Rearranged Forms: $P = \frac{E}{t}$ | $t = \frac{E}{P}$

Units: E (Energy transferred, Joules, J) | P (Power, Watts, W) | t (Time, seconds, s)

Section A: Units, Rearrangement & Conversions

1. Complete the table below with the correct SI unit and symbol for each variable in the formula $E = P \times t$.

Variable	SI Unit	Symbol
Energy transferred (E)	_____	_____
Power (P)	_____	_____
Time (t)	_____	_____

2. Rearrange the formula $E = P \times t$ to make the following variables the subject:

a) Power (P): $P =$ _____

b) Time (t): $t =$ _____

3. Convert the following values into their standard SI units:

a) 500 J = _____ kJ

b) 2.5 kJ = _____ J

c) 15 minutes = _____ s

d) 0.5 hours = _____ s

e) 2.2 kW = _____ W

f) 750 W = _____ kW

Section B: Practice Calculations

4. Answer the following questions, showing your full working and stating the correct units.

a) A light bulb has a power of 60 W. How much energy does it transfer in 10 s?

b) A heater transfers 1200 J of energy in 2 minutes. What is its power?

c) A microwave oven has a power rating of 800 W. How long does it take to transfer 40000 J of energy?

- d) A motor transfers 15 kJ of energy in 30 s. Calculate its power in Watts.

Section C: Challenge & Contextual Problems

5. A crane lifts a 500 kg concrete block through a vertical height of 12 m. The crane's motor has a power output of 1.5 kW. (Assume $g = 9.8 \text{ N/kg}$).

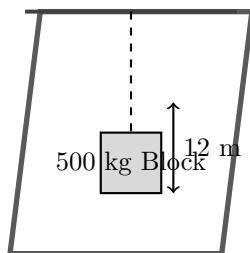


Figure 1: Crane lifting a concrete block

- a) Calculate the gravitational potential energy (GPE) gained by the block and the minimum time it would take for the crane to lift the block. Give the time to 2 significant figures.

- b) An electric kettle has a power rating of 2.4 kW. It is used for 5 minutes each day. Calculate the total energy transferred by the kettle in one day, in Joules, and explain why the actual useful energy transferred to heat the water will be less than this value.
