

# Power Rate of Energy Transfer

GCSE Physics · Written to the shared content for AQA, Edexcel and OCR

Name \_\_\_\_\_ Class \_\_\_\_\_ Date \_\_\_\_\_

## 1. Worked example

**An 800 W microwave oven runs for 90 s. Calculate the energy it transfers. (2 marks)**

Step 1 · Rearrange  $P = E \div t$

$$E = P \times t$$

Step 2 · Substitute and calculate

$$E = 800 \times 90 = 72\,000 \text{ J}$$

**Answer: 72 000 J (72 kJ)**

Check: Watts  $\times$  seconds gives joules.

## 2. Now try one with the steps

**A lamp transfers 5400 J in 1.5 minutes. Calculate its power. (3 marks)**

Step 1 · Convert the time

Step 2 · Write the equation

Step 3 · Calculate

**Answer:**

## 3. Practice

Show your working. The marks tell you how much is expected.

1. Define power. [1]

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2. State the unit of power and what it means. [2]

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3. A motor transfers 3000 J in 10 s. Calculate its power in watts. [2]

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4. Convert 2.4 kW into watts. [1]

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5. A 1500 W hairdryer is used for 120 s. Calculate the energy transferred in joules. [2]
6. Two kettles each boil the same mass of water from the same starting temperature. Kettle A takes 3 minutes and kettle B takes 4 minutes. Explain which kettle has the higher power. [2]
7. A crane does 450 kJ of work in 30 s. Calculate its power in kW. [3]
8. A 60 W lamp transfers 7200 J. Calculate how long it was switched on. [2]
9. Priya (mass 55 kg) runs up stairs 3.0 m high in 4.0 s. Calculate her useful power.  $g = 9.8 \text{ N/kg}$ . Give your answer in watts to 2 significant figures. [4]
10. Explain why Priya's power is greater when she runs up the stairs than when she walks up them. [2]
11. Motor A lifts a 200 N load through 5.0 m in 8.0 s. Motor B lifts the same load through the same height in 5.0 s. Calculate how much more power motor B has, in watts. [3]
12. A car engine has an output power of 90 kW. Calculate the energy it transfers in 1 minute. Give your answer in MJ. [2]

13. A 6.0 kW lift motor raises an 800 kg lift through 15 m. Calculate the minimum time taken.  $g = 9.8$  N/kg. Give your answer to 2 significant figures. [4]

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14. Explain why the real lift in question 13 takes longer than the time you calculated. [2]

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#### 4. Before you hand it in

**$P = 5400 \div 1.5 = 3600$  W for 5400 J in 1.5 minutes**

Watts are joules per second: convert 1.5 minutes to 90 s, giving 60 W.

**"A 2 kW heater uses 2 kW of energy."**

Power is how fast energy is transferred. A 2 kW heater transfers 2000 J every second; the total energy depends on how long it is on.

**$P = E \times t$**

Power = energy  $\div$  time. Check with units:  $J \div s = W$ .

**Forgetting to change kW into W**

Convert to base units first: 6.0 kW = 6000 W, 450 kJ = 450 000 J.