Power

Name _____ Class _____ Date _____

Power tells you how **quickly** energy is transferred. Two machines can do the same job, but the more powerful one does it faster.

KEY EQUATION

$$P = E \div t$$

$$P = W \div t$$

P = power (W)
E = energy transferred (J)
W = work done (J)
t = time (s)
1 watt = 1 joule per second

WORKED EXAMPLE

A motor transfers 3000 J in 20 s.
P = E ÷ t = 3000 ÷ 20 = **150 W**

Section A · Recall and calculate

Grade 4–5

1 Define power. [1]

The rate at which energy is transferred (or the rate of doing work).

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

The watt (W).

1 W = 1 joule of energy transferred per second.

3 A lamp transfers 1200 J of energy in 20 s. Calculate its power. [2]

P = 1200 ÷ 20 = 60 W

Section B · Rearrange and apply

Grade 5–6

4 Complete the table. [4]

Energy (J)	Time (s)	Power (W)
5000	10	**500**
12 000	60	200
36 000	**12**	3000
450 000	300	**1500**

5 Two motors each lift a 20 kg box onto a shelf 1.5 m high. Motor A takes 4 s and motor B takes 6 s. (g = 9.8 N/kg)

a Calculate the work done on the box. [2]

W = Ep = mgh = 20 × 9.8 × 1.5

W = 294 J

b Calculate the power of each motor and state which is more powerful. [3]

A: P = 294 ÷ 4 = 73.5 W

B: P = 294 ÷ 6 = 49 W

Motor A is more powerful (same work in less time).

6 A 2.4 kW kettle is switched on for 3 minutes. Calculate the energy transferred. [3]

P = 2400 W, t = 3 × 60 = 180 s

E = Pt = 2400 × 180

E = 432 000 J

Section C · Stretch

Grade 7+

7 A 65 kg student runs up a flight of stairs 3.5 m high in 5 s. Calculate their useful power output. (g = 9.8 N/kg) [3]

Work done = mgh = 65 × 9.8 × 3.5 = 2229.5 J

P = 2229.5 ÷ 5

P = 446 W

Exam-style question

AQA style

8 An electric car's motor has a power output of 60 kW.

a Calculate the energy transferred by the motor in 2 minutes. [3]

E = Pt = 60 000 × 120

E = 7 200 000 J

b The car has a mass of 1500 kg. Starting from rest, all this energy goes into the car's kinetic store. Calculate its speed. [3]

½ × 1500 × v^2 = 7 200 000

v^2 = 9600

v = 98 m/s

c Suggest why the car's real speed would be much lower. [1]

Energy is dissipated by friction and air resistance (and heating in the motor).

Total: _____ / 27

How confident am I?

	Not yet	Nearly	Got it
I can define power and give its unit	☐	☐	☐
I can use P = E ÷ t and P = W ÷ t	☐	☐	☐
I can convert kW to W and minutes to seconds	☐	☐	☐