Your notes

GCSE Physics: revision notes

Electrical power and energy transfer

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Power in circuits

- **Power** is the rate of energy transfer, measured in **watts** (W).
- P = V I: **power** = potential difference × current.
- P = I^2 R: **power** = current^2 × resistance.

Energy transferred

- The energy an appliance transfers depends on how long it is switched on and its **power**: E = P t.
- Work is done when charge flows in a circuit: E = Q V, energy (J) = charge (C) × potential difference (V).
- Everyday appliances transfer energy electrically to, for example, the kinetic store of a motor or the thermal store of a **heating element**.

Paying for electricity

- Energy used by appliances is often measured in **kilowatt-hours** (kWh): energy (kWh) = **power** (kW) × time (h).
- Cost = number of kWh × price per kWh.
- One kWh is 3 600 000 J.

Appliance ratings

- The **power rating** tells you how much energy the appliance transfers each second.
- Appliances with **heating elements**, such as kettles and heaters, have high **power ratings**.

Worked examples

A heater takes a current of 2 A from the 230 V mains. Find its power.

Choose the equation linking power, current and potential difference. **$P = I \times V$**

Put the numbers in. **$P = 2 \times 230$**

Answer: 460 W

A 2 kW kettle is on for 3 minutes. How much energy does it transfer?

Change the power to watts and the time to seconds first. **2 kW = 2000 W; 3 minutes = 180 s**

Use energy = power × time. **$E = P \times t = 2000 \times 180$**

Answer: 360 000 J

Key terms

Power	The rate of energy transfer, measured in watts.
Watt	The unit of power; 1 W = 1 J/s.
Kilowatt-hour	The energy transferred by a 1 kW appliance in one hour.
Power rating	The maximum power at which an appliance transfers energy.
Heating element	A resistor designed to transfer energy to the thermal store of the surroundings.

Quick questions

Cover the answers and test yourself: remembering is what makes it stick.

1. What is the power of a heater with 230 V across it and 10 A through it?
2. What is the power in a 50 Ω resistor with 2 A through it?
3. How much energy does a 2000 W kettle transfer in 5 minutes?
4. How much energy is transferred when 10 C of charge moves through a pd of 12 V?
5. Which equation links power, current and resistance?
6. What does the power rating of an appliance tell you?
7. How many kWh does a 3 kW heater use in 2 hours?
8. Electricity costs 30p per kWh. What does 6 kWh cost?

Answers

1. 2300 W
2. 200 W
3. 600 000 J
4. 120 J
5. $P = I^2 R$
6. How much energy it transfers each second

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7. 6 kWh
8. £1.80

What to do next

Practise 10 questions on this topic

Try 7 exam questions, with mark schemes

Read the lesson, one step at a time

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