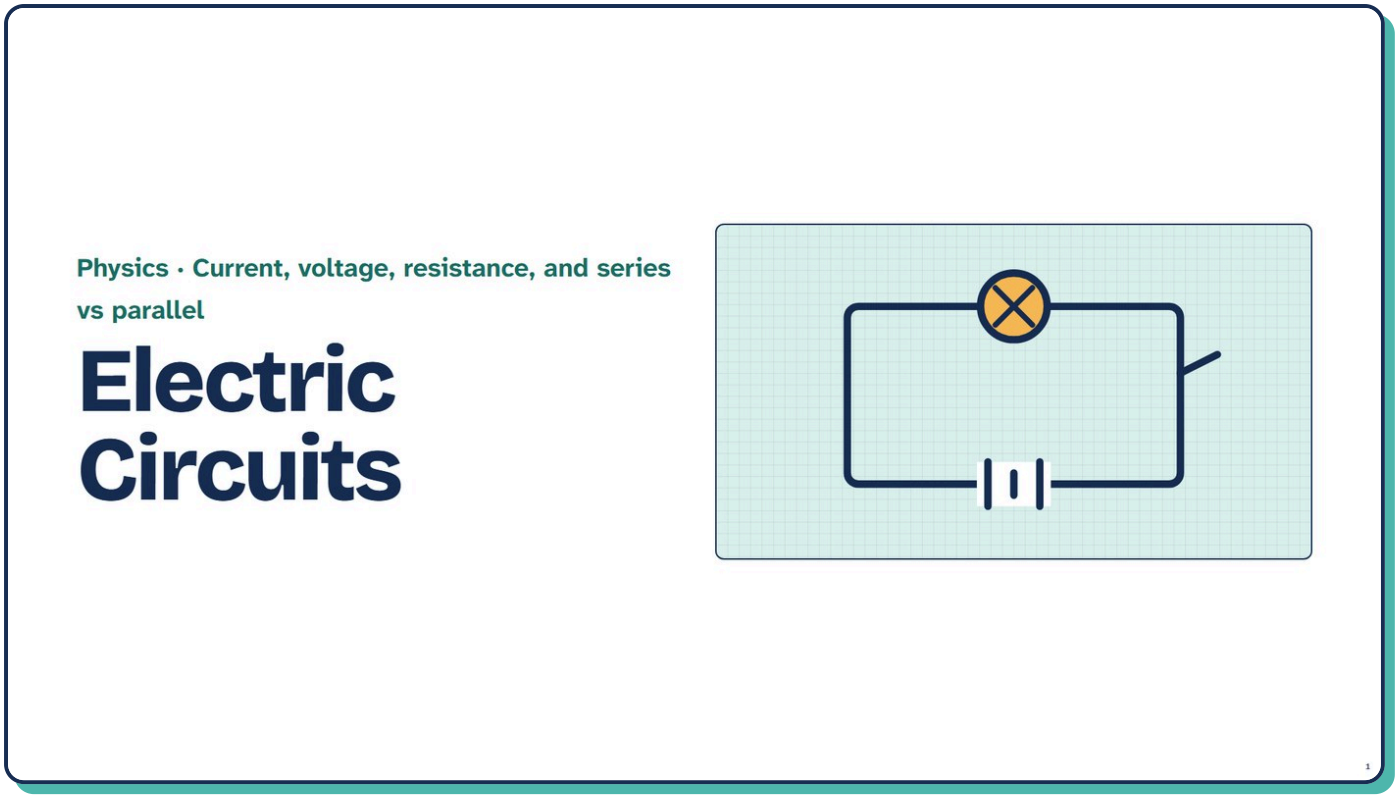

Electric Circuits

Teacher notes

Show a torch or a desk lamp and ask: what has to happen inside for the bulb to light? Collect ideas. Many students will say electricity 'flows into the bulb and gets used up'. Tell them the lesson will test that idea.

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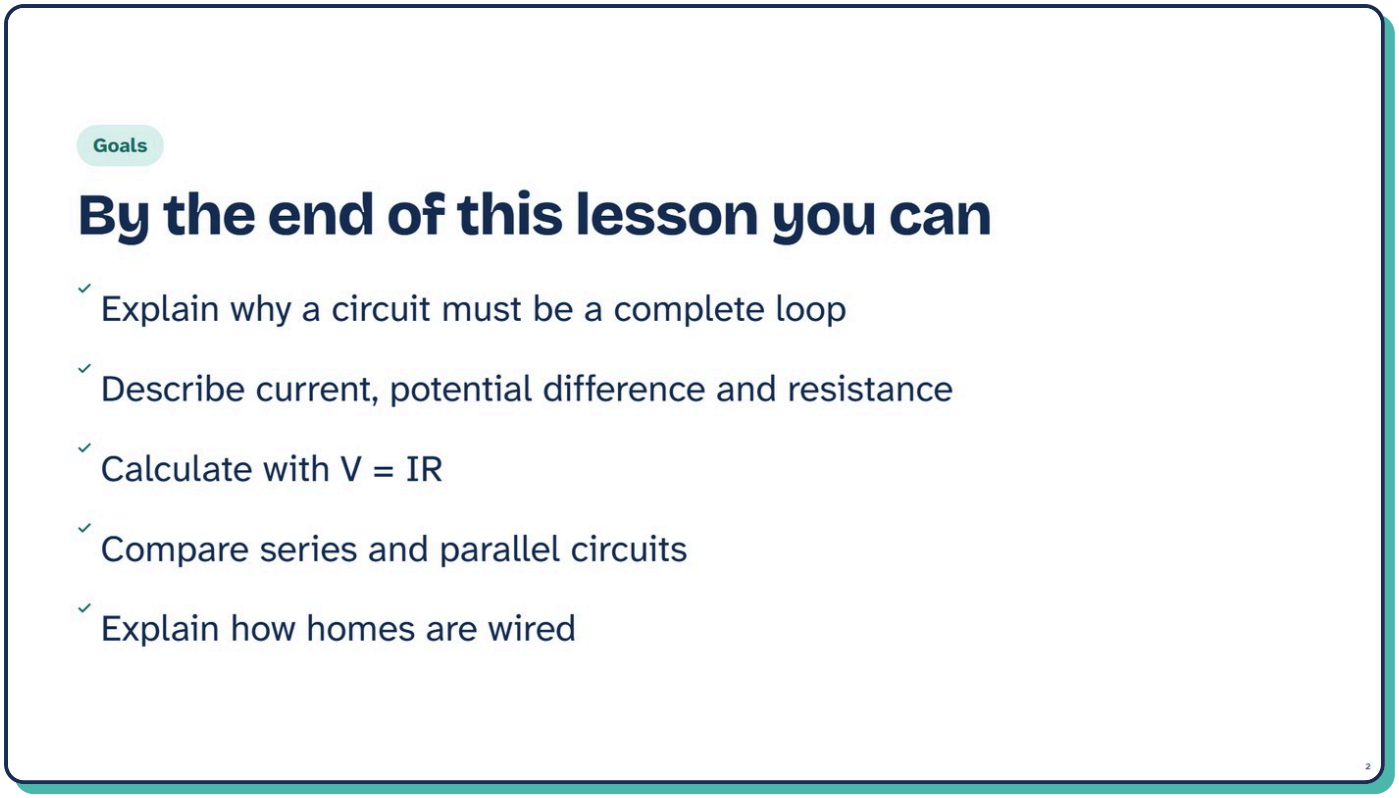

By the end of this lesson you can

Teacher notes

Point out that 'voltage' and 'potential difference' mean the same thing in this lesson; some courses prefer one term, some the other. Ask which objective students think will be hardest.

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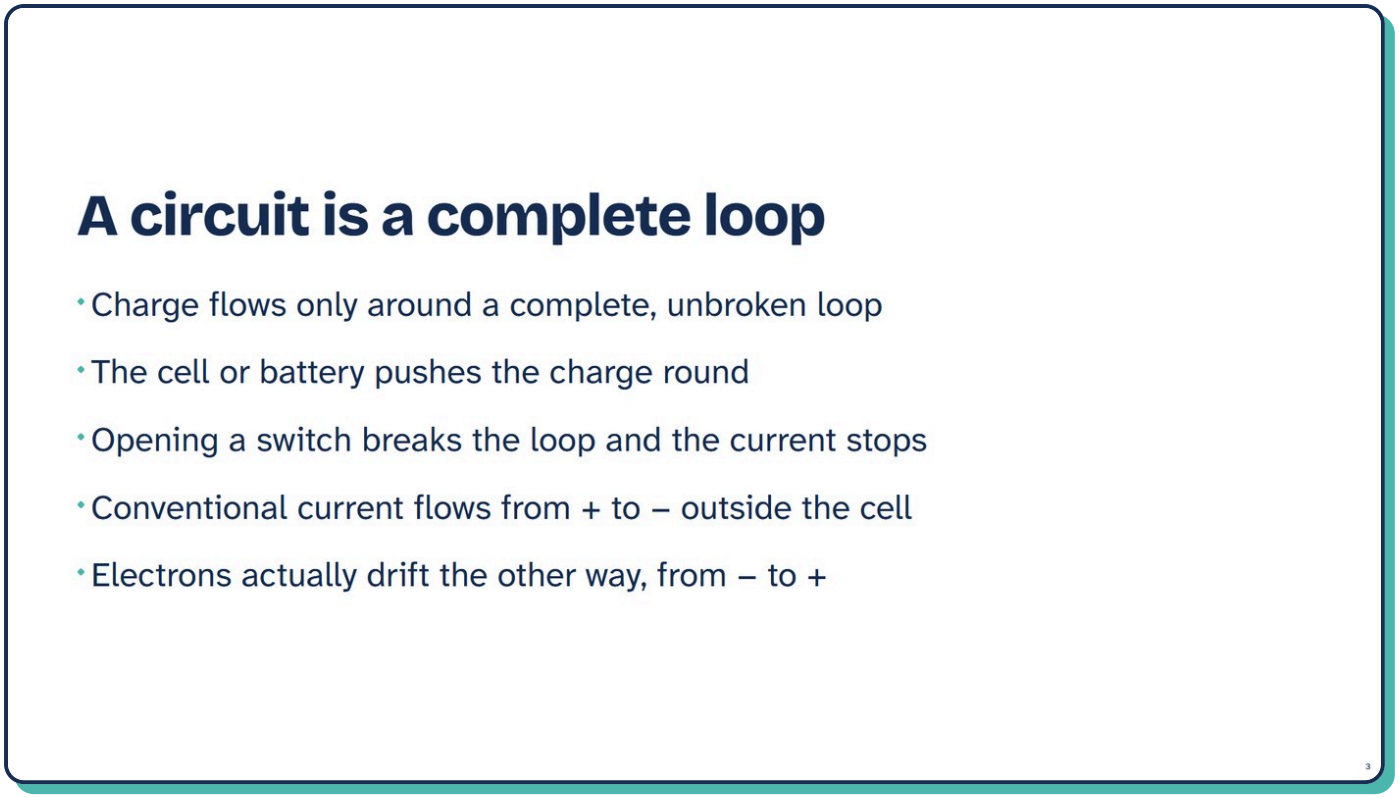

A circuit is a complete loop

Teacher notes

Draw a cell, a switch and a lamp in a loop using standard circuit symbols. Ask what happens if one wire is disconnected anywhere in the loop: everything stops. The direction convention was chosen before electrons were discovered, which is why the two directions differ.

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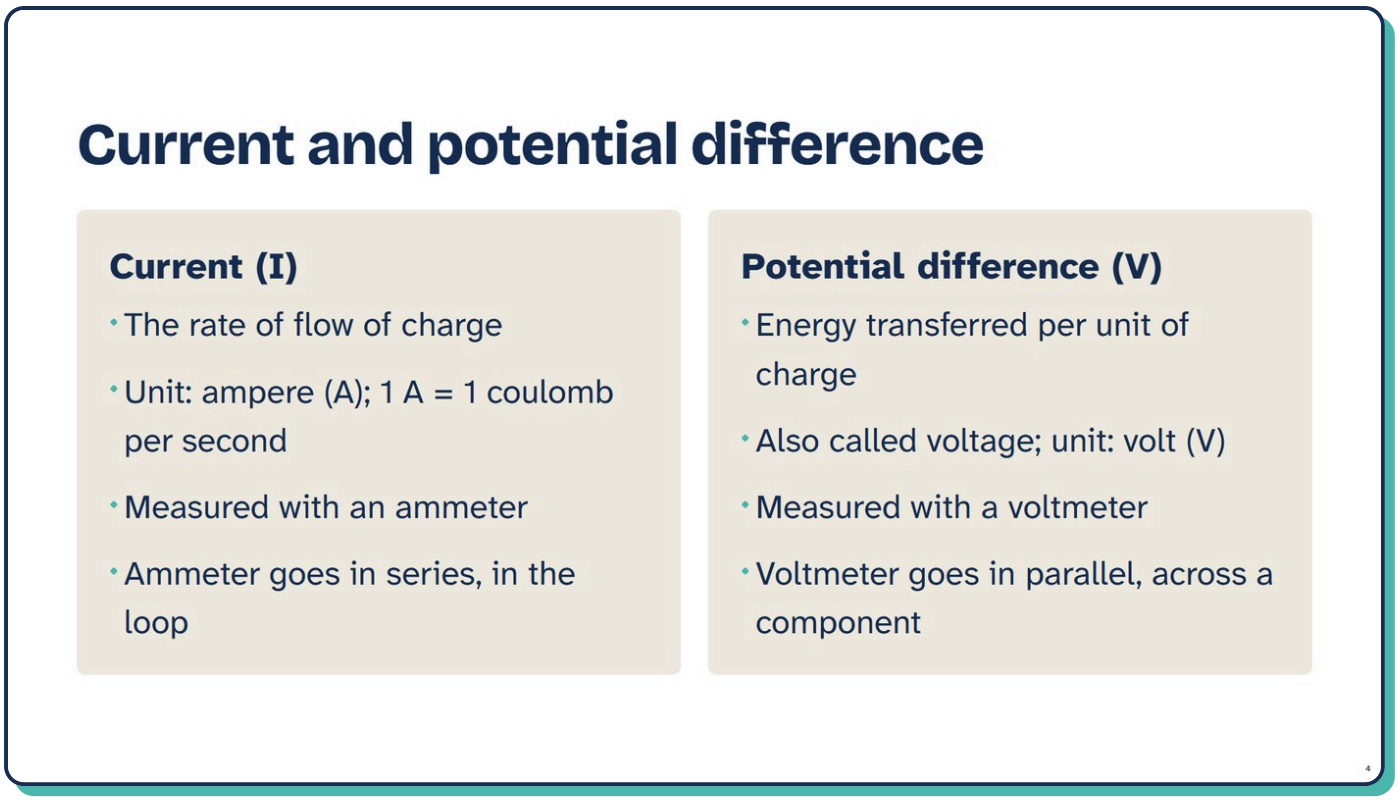

Current and potential difference

Teacher notes

A useful picture: current is how much charge passes a point each second; potential difference is how much energy each unit of charge gives up in a component. Ask students where the ammeter and voltmeter must go in a circuit and why: the ammeter must have all the current pass through it, the voltmeter compares two points.

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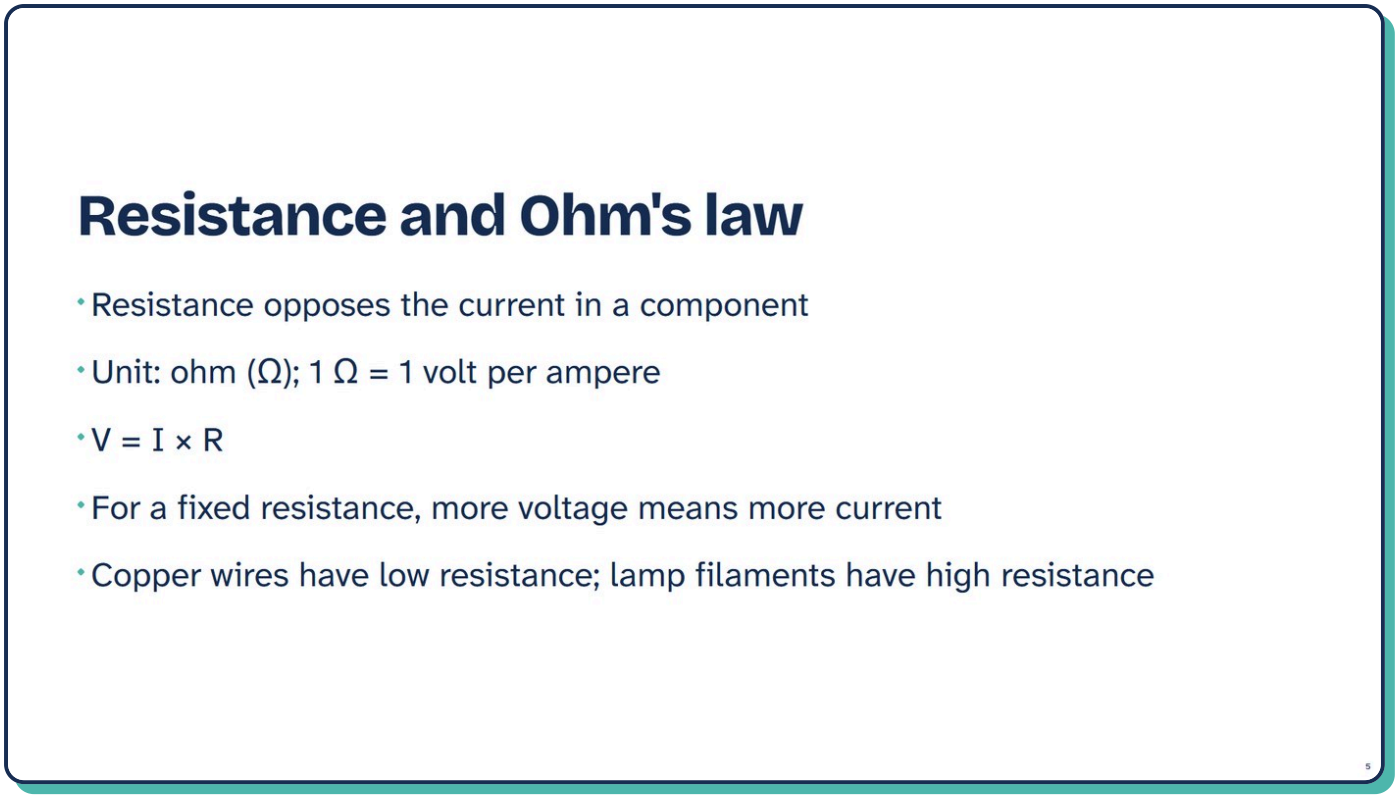

Resistance and Ohm's law

Teacher notes

Show the rearrangements I = V ÷ R and R = V ÷ I. Components that keep the same resistance as the current changes are called ohmic; a filament lamp is not, because its resistance rises as it heats up. Older students can sketch a current-voltage graph for each.

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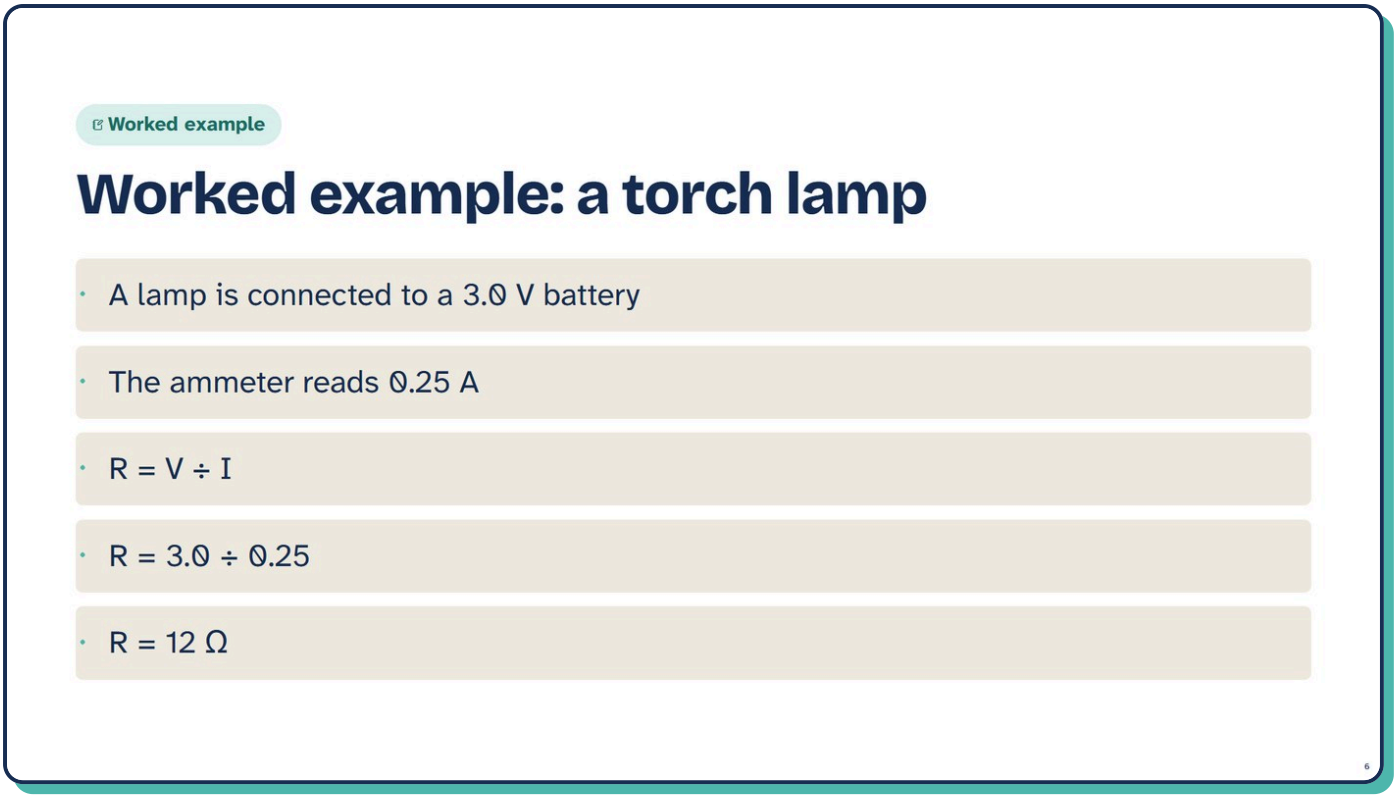
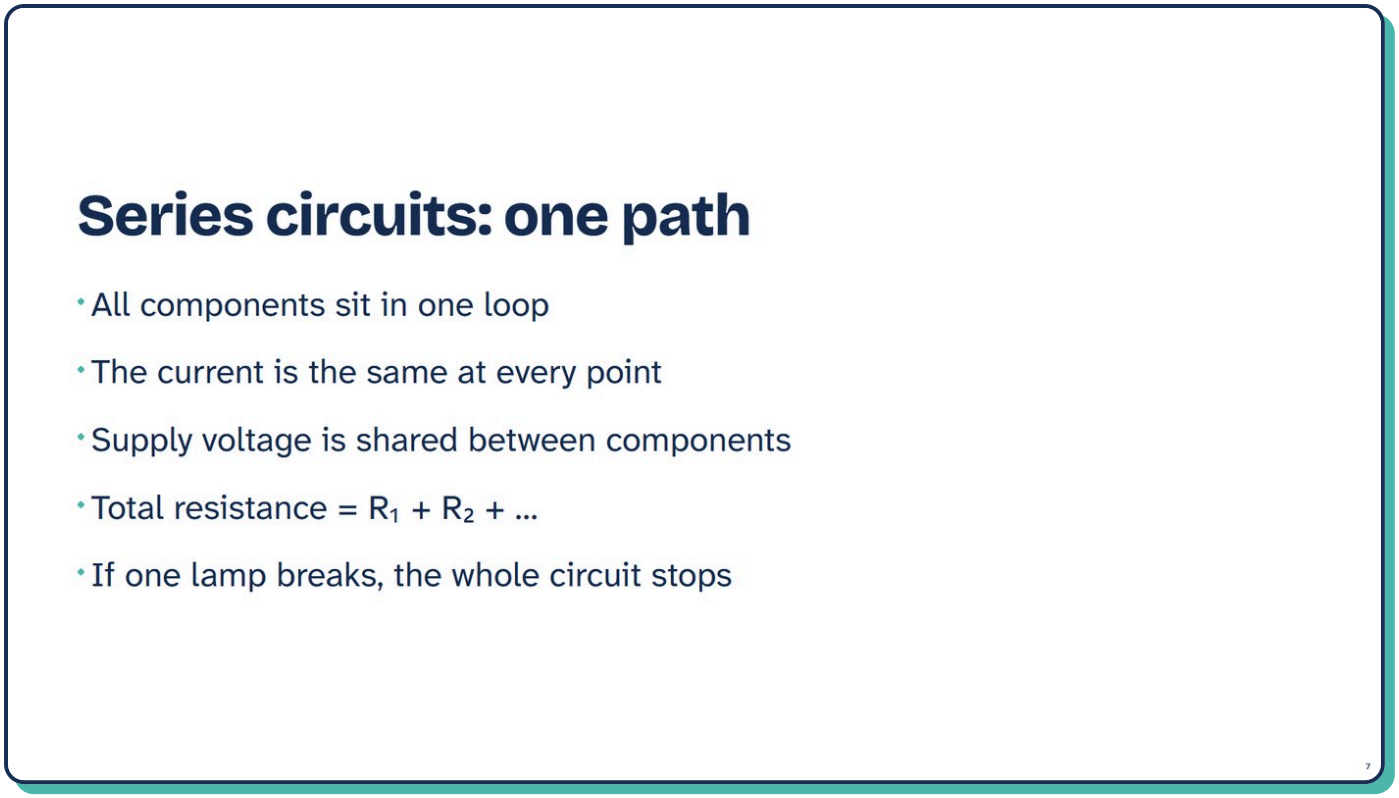


Worked example: a torch lamp

Teacher notes

Write each line on the board and ask students to check the units: volts divided by amperes gives ohms. Follow-up: if the same 12 Ω lamp were connected to a 6.0 V battery and its resistance did not change, the current would be 0.5 A. In reality the filament gets hotter, so the current would be a little less.



Series circuits: one path

Teacher notes

Add a second lamp in series and the lamps get dimmer, because the total resistance goes up and the current goes down. Show ammeter readings before and after each lamp: they are the same. Current is not used up; energy is transferred to the lamps.

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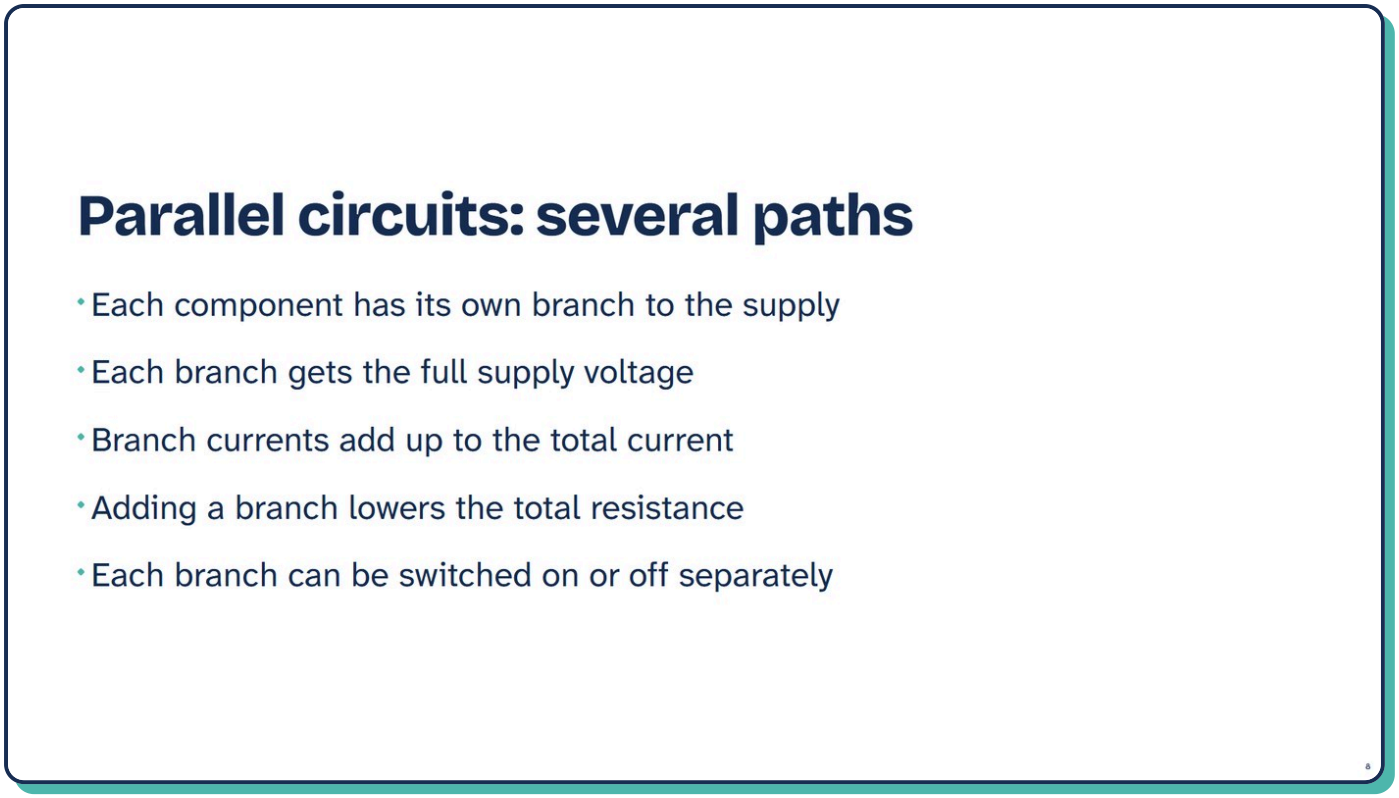
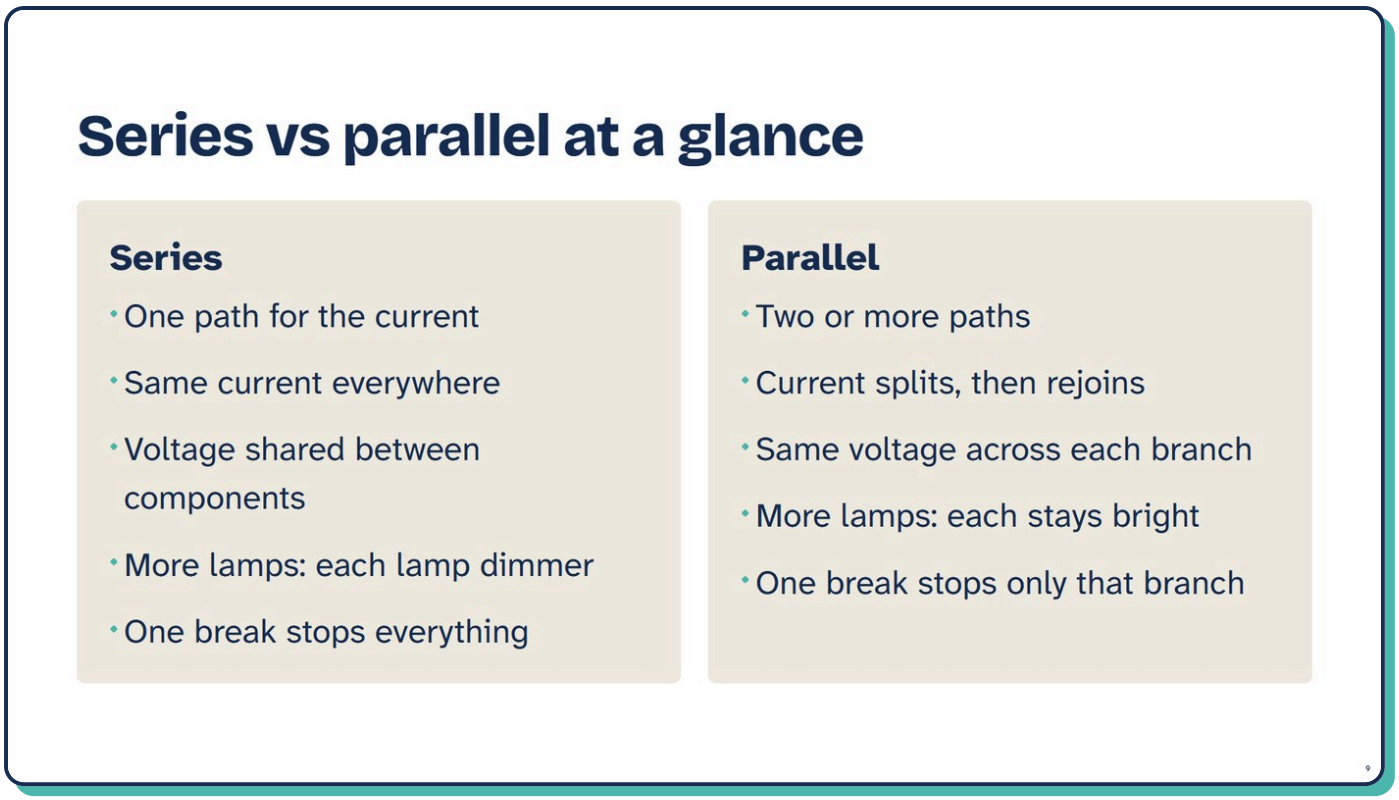


Parallel circuits: several paths

Teacher notes

Add a second lamp in parallel and both stay as bright as a single lamp, because each gets the full supply voltage. The battery now supplies more current in total, so it runs down faster. For ages 14–15, introduce $1/R = 1/R_1 + 1/R_2$ as an extension.



Series vs parallel at a glance

Teacher notes

Ask students to copy this table and add a sketch of each circuit. Then ask a hinge question: a string of decorative lights goes out completely when one bulb fails. Is it wired in series or parallel? Series.

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Worked example

Worked example: two 6 Ω resistors, 6 V battery

- Series: total R = 6 + 6 = 12 Ω
- Series: I = 6 ÷ 12 = 0.5 A; each resistor gets 3 V
- Parallel: each resistor gets the full 6 V
- Parallel: each branch I = 6 ÷ 6 = 1 A
- Parallel: total current = 1 + 1 = 2 A

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Worked example: two 6 Ω resistors, 6 V battery

Teacher notes

Same parts, very different results. In parallel the total resistance is 6 V ÷ 2 A = 3 Ω, less than either resistor on its own. Check with older students: 1/R = 1/6 + 1/6 = 1/3, so R = 3 Ω. Ask why the battery would run down four times faster in the parallel circuit (four times the current).

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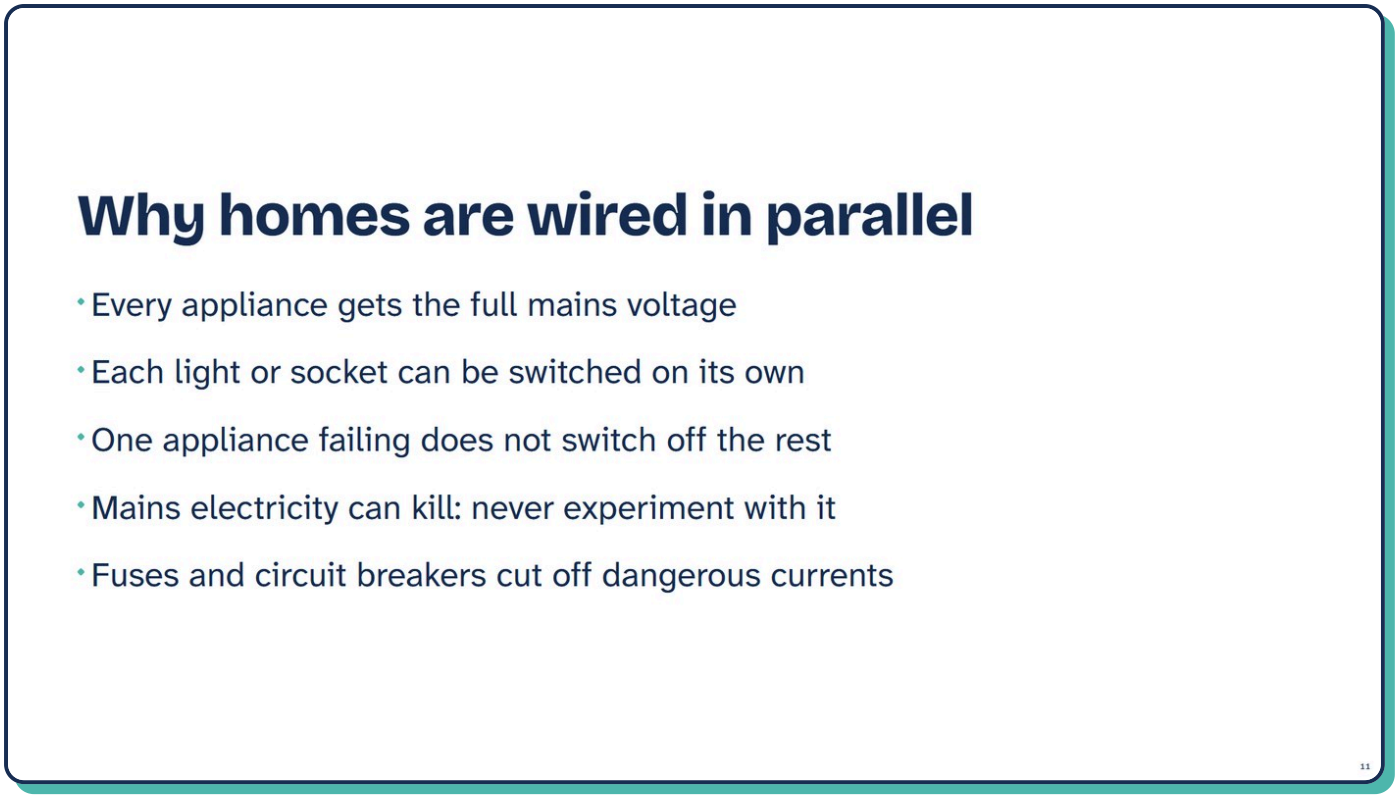


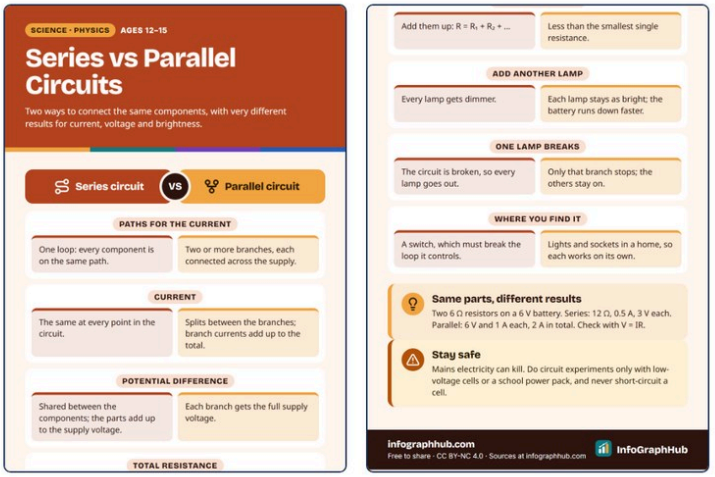
Why homes are wired in parallel

Teacher notes

Mains voltage differs between countries, for example about 230 V in many countries and about 120 V in others, so avoid quoting one figure as universal. Make the safety message explicit: classroom experiments use low-voltage cells or power packs only.

Series and parallel on one page

Series: one path, current the same everywhere, voltage shared. Parallel: several paths, voltage the same across each branch, currents add up.



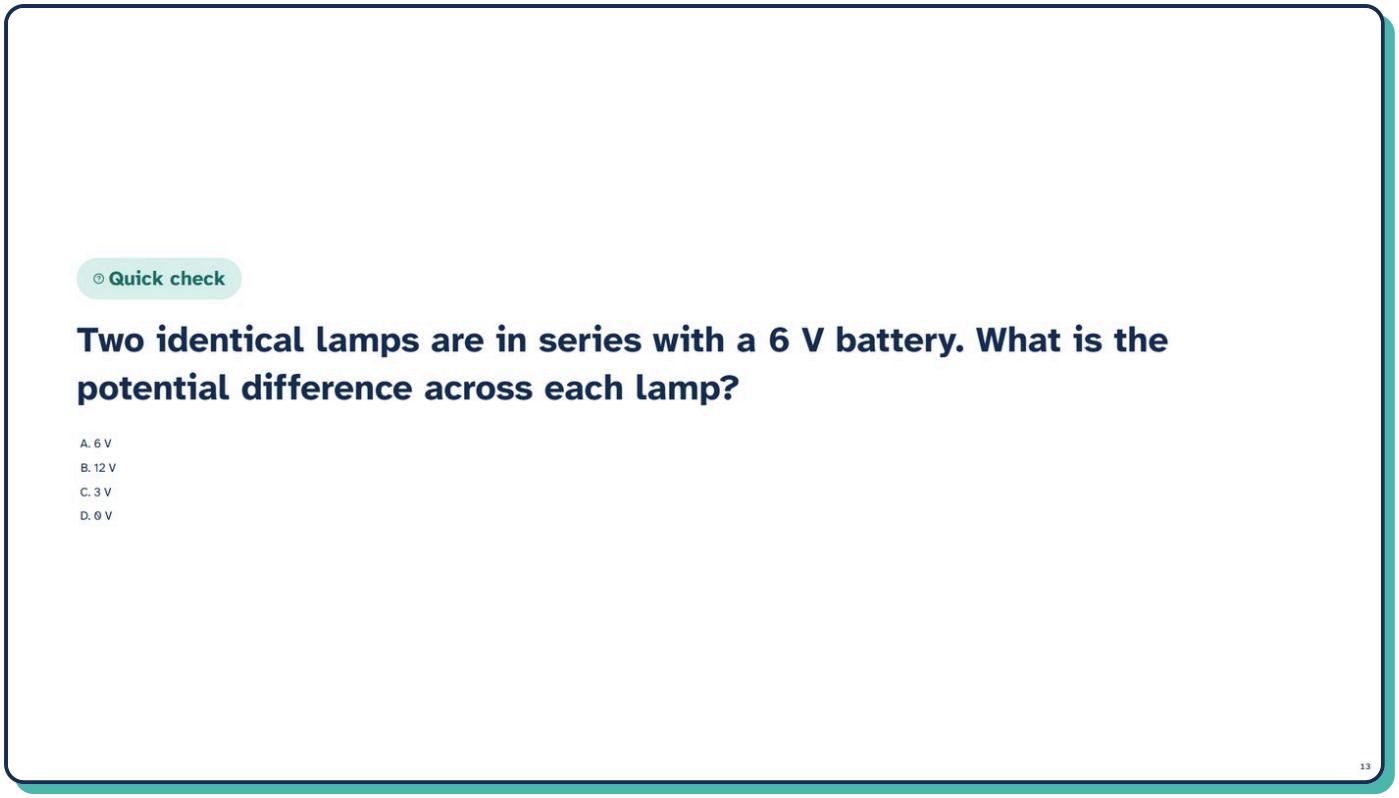
Poster: Series vs Parallel Circuits: Key Differences

12

Series and parallel on one page

Teacher notes

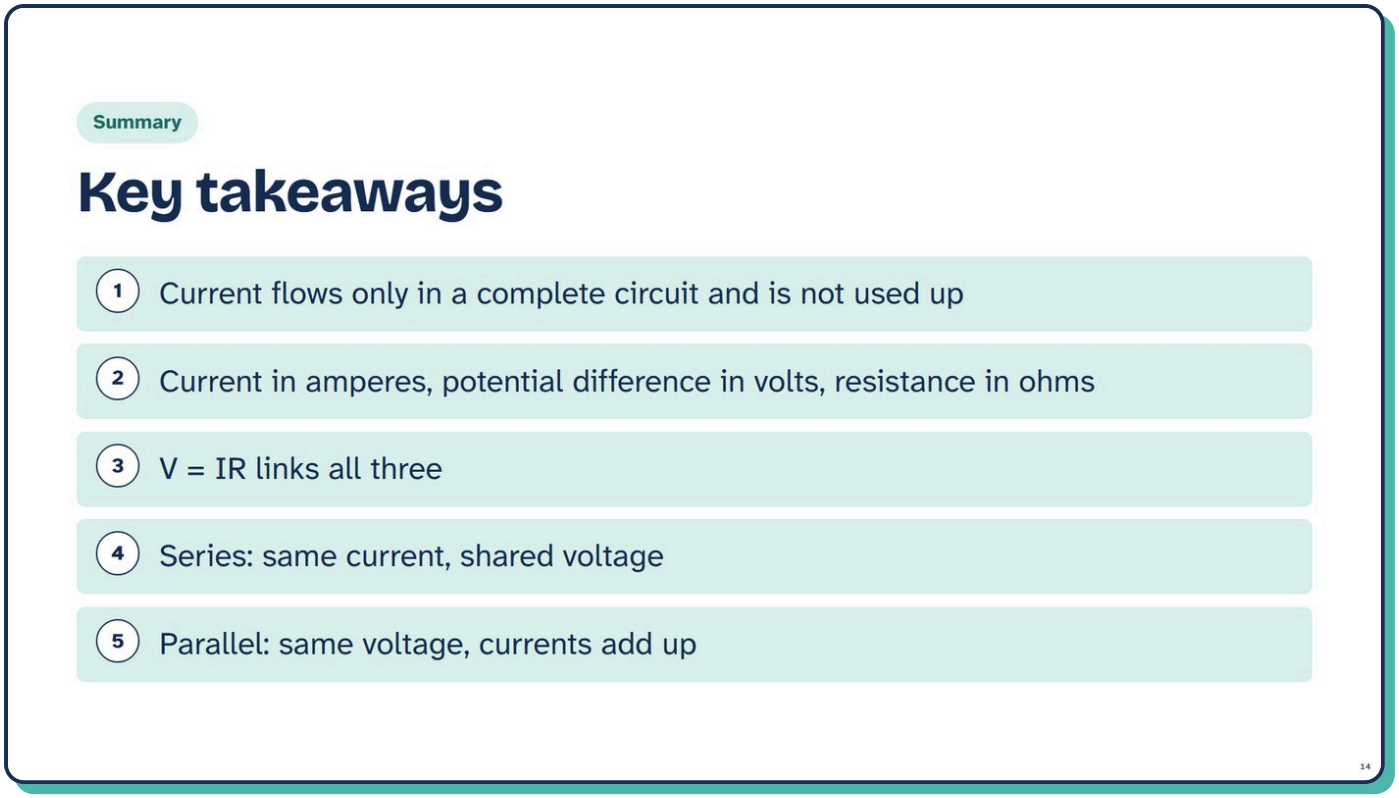
Use the poster as a recap or print it for the classroom wall. Ask students to cover one column and recall it from memory, then swap with a partner.



Quick check

Teacher notes

Answer: C, 3 V. In series the supply voltage is shared, and identical lamps share it equally. Students who chose A are thinking of a parallel circuit; ask them to explain what would change if the lamps were in parallel.



Key takeaways

Teacher notes

Return to the opening question about the torch and ask students to answer it again with the words current, potential difference and energy. Then move to the five-question quiz. Homework idea: find three things at home that are switched independently and explain how that shows parallel wiring.

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