SCIENCE · PHYSICS AGES 12–15

Series vs Parallel Circuits

Two ways to connect the same components, with very different results for current, voltage and brightness.

Series circuit	Parallel circuit
PATHS FOR THE CURRENT	
One loop: every component is on the same path.	Two or more branches, each connected across the supply.
CURRENT	
The same at every point in the circuit.	Splits between the branches; branch currents add up to the total.
POTENTIAL DIFFERENCE	
Shared between the components; the parts add up to the supply voltage.	Each branch gets the full supply voltage.
TOTAL RESISTANCE	
Add them up: $R = R_1 + R_2 + \ldots$	Less than the smallest single resistance.
ADD ANOTHER LAMP	
Every lamp gets dimmer.	Each lamp stays as bright; the battery runs down faster.
ONE LAMP BREAKS	
The circuit is broken, so every lamp goes out.	Only that branch stops; the others stay on.
WHERE YOU FIND IT	
A switch, which must break the loop it controls.	Lights and sockets in a home, so each works on its own.

Same parts, different results

Two 6 Ω resistors on a 6 V battery. Series: 12 Ω, 0.5 A, 3 V each. Parallel: 6 V and 1 A each, 2 A in total. Check with V = IR.

Stay safe

Mains electricity can kill. Do circuit experiments only with low-voltage cells or a school power pack, and never short-circuit a cell.

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