Series and parallel circuits

Name _____ Class _____ Date _____

Components can be connected **in series** (one path) or **in parallel** (separate branches). The rules for current, p.d. and resistance are different.

KEY RULES

Series
Same current through each component
Supply p.d. is shared
$R_{total} = R_1 + R_2$

Parallel
Same p.d. across each branch
Branch currents add up to the total
R_{total} is less than the smallest resistor

Section A · Recall

Grade 4–5

1 Two resistors of 4 Ω and 6 Ω are connected in series. Calculate the total resistance. [1]

4 + 6 = 10 Ω

2 Complete the sentences. [3]

In series, the current is the same everywhere.

In parallel, the p.d. across each branch is the same as the supply p.d.

Adding a resistor in parallel decreases the total resistance.

Section B · Calculate

Grade 5–6

3 A 12 V battery is connected to a 2 Ω and a 4 Ω resistor in series.

a Calculate the total resistance. [1]

2 + 4 = 6 Ω

b Calculate the current. [2]

I = V ÷ R = 12 ÷ 6

I = 2 A

c Calculate the p.d. across each resistor. [2]

2 Ω: V = 2 × 2 = 4 V

4 Ω: V = 2 × 4 = 8 V (they add up to 12 V)

4 A 6 V battery is connected to two lamps in parallel. The currents through the branches are 0.3 A and 0.5 A.

a Calculate the current from the battery. [1]

0.3 + 0.5 = 0.8 A

b State the p.d. across each lamp. [1]

6 V each

Section C · Stretch

Grade 7+

5 Explain why adding a second resistor in parallel reduces the total resistance of a circuit. [3]

The new branch gives charge an extra path to flow through.

The total current from the supply increases for the same p.d.

Since R = V ÷ I, a bigger total current means a smaller total resistance.

6 Explain why the lights in a house are wired in parallel. [2]

Each light gets the full mains p.d. and can be switched on and off independently;

if one bulb breaks, the others still work.

Exam-style question

AQA style

7 A 9 V battery is connected to a 3 Ω resistor and a 6 Ω resistor in parallel.

a Calculate the current through each resistor. [3]

Each resistor has 9 V across it.

3 Ω: I = 9 ÷ 3 = 3 A

6 Ω: I = 9 ÷ 6 = 1.5 A

b Calculate the total resistance of the circuit. [2]

Total current = 4.5 A

R = 9 ÷ 4.5 = 2 Ω (less than either resistor)

Total: _____ / 21

How confident am I?	Not yet	Nearly	Got it
I can state the rules for series and parallel circuits	☐	☐	☐
I can calculate currents and p.d.s in series circuits	☐	☐	☐
I can explain why parallel resistance is lower	☐	☐	☐