

## S03 – Electricity Extension

### What's Happening?

Children will investigate series and parallel wiring circuits.

### Pupils will learn:

Circuits wired in series have the same voltage and current, so 2 bulbs that are the same will have equal brightness.

Circuits in parallel have the same voltage, but they share the current. 2 bulbs the same will have equal brightness, but half the brightness they would have if wired in series.

### Why Teach This?

There are positives and negatives to each circuit design. Knowing and understanding these will help pupils to design better circuits.

Knowing about series and parallel will allow pupils to be aware of safety implications when working with electricity.

(This information is actually covered in standard grade physics, so it should only be used to challenge the most able pupils.)

### Useful Questions

Q. In the series circuit, if one bulb breaks or is removed what happens?

A. Because there is only 1 way for the current to get around the circuit if a component is broken or removed then the circuit isn't a closed loop. Electricity won't be able to flow so it will switch off the whole circuit.

Q. In the parallel circuit, if one bulb breaks or is removed what happens?

A. In a parallel circuit there is more than one way to travel from the negative to the positive end of the cell. If one bulb breaks, then only that loop is broken. The current will simply use another loop to get to the end of the circuit.

Q. What is the voltage at different points in the series circuit?

A. The voltage measures how hard the battery is pushing. As the current is pushed through each component some voltage is lost. This means that the voltage is different across each component.

Q. What happens to the current in a series circuit?

A. Current is a measure of how many electrons pass a certain point. There is no way for the electrons to disappear or hide, and there is only one way around the circuit, so current is the same all over the circuit.

Q. What happens to voltage in a parallel circuit?

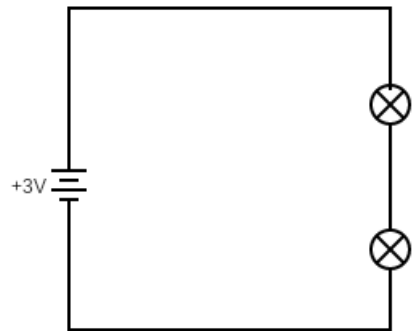
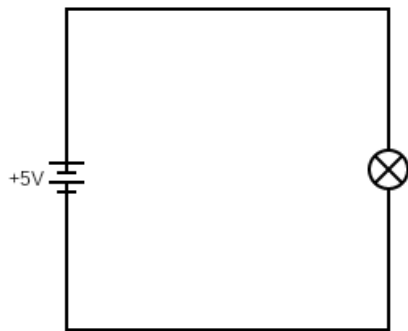
A. The voltage will be the same in each branch of the circuit, as each branch could be considered as its own circuit including the battery.

Q. What happens to the current in a parallel circuit?

A. As with the voltage, the current in a parallel circuit will be split between the branches. (This is why bulbs won't be as bright as series.) Measuring the current outside of the branches will be the same as the total current for the whole circuit. The sum of the current in the branches will equal the total current for the circuit.

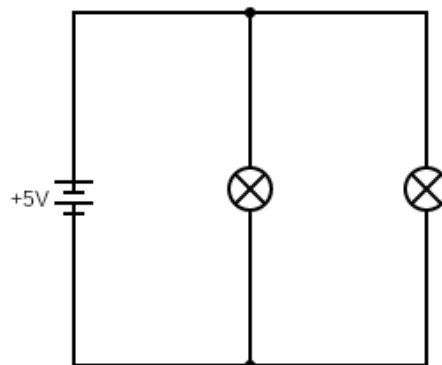
## S03 – Electricity Extension Pupil Sheet

1. Build the circuits shown below and answer the questions which follow.



- a) What do you notice about the brightness of the bulbs in the 2 circuits?
- b) Unscrew one of the bulbs in circuit 2. What happens to the other bulb?
- c) Why does this happen?

2. Now build the circuit shown below.

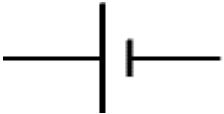
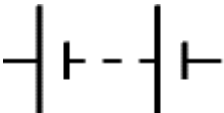








- a) What do you notice about the brightness of the bulbs?
- b) Unscrew one bulb. What happens to the other?
- c) Why does this happen?

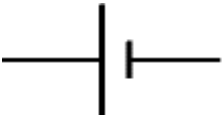
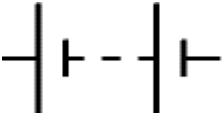





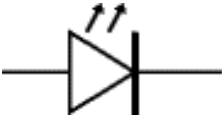
The circuit with 2 bulbs in question 1 is called a **series** circuit. Components are connected one after the other in the circuit. The diagram in question 2 shows a **parallel** circuit. The components are all connected to positive and negative independently.

3. Can you think of a situation when each circuit would be useful?

## S03 – Electrical Symbols (1)

Component Name	Symbol
Cell – a cell is the correct name given to a single “battery”. The long side is positive and the short side negative.	
Battery – 2 or more cells connected in series. The voltages will add together. 2 x 1.5v cells = 3v battery.	
Lamp – a bulb used to provide illumination.	
Bulb – used as an indicator, for example, a standby light.	
Switch – A simple on/off switch.	
Motor – a spinning shaft driven by electricity interacting with a magnetic field.	
Buzzer – when powered on produces a continuous buzzing tone.	
Light Emitting Diode – Shortened to LED. A diode only allows current to flow in one direction. (the left side in this picture is positive)	

## S03 – Electrical Symbols (2)

Component Name	Symbol	Energy In	Energy Out
Cell		Chemical	Electrical
Battery		Chemical	Electrical
Lamp		Electrical	Light
Bulb		Electrical	Light
Switch		Electrical	Electrical
Motor		Electrical	Kinetic
Buzzer		Electrical	Sound
Light Emitting Diode		Electrical	Light