

Planning & conducting investigations

Experiment Printout - Series & parallel circuits

Investigating series and parallel circuits

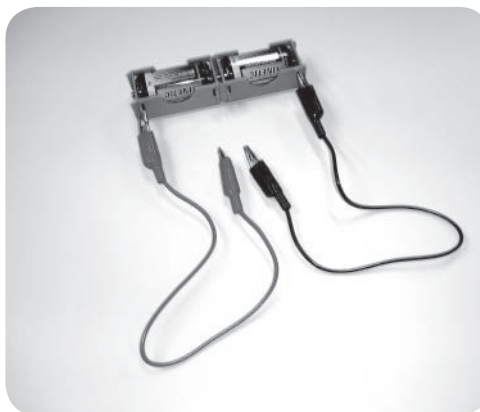
Observing and exploring

(ask questions, pose problems, find out what is currently known)

- Discuss with students the terms series and parallel

Batteries in series

1. Have students construct a closed circuit that includes 1 battery, 2 wires and a light bulb.
 2. Place a dark coloured card behind the light bulb and observe its brightness.
 3. Have students repeat step 1 using 2 batteries connected in series.
 4. Place a dark coloured card behind the light bulb and compare the brightness of the light bulbs in each circuit.
- Discuss with students what they observed and have students suggest explanations for their observations.



Batteries in parallel

1. Have students construct a closed circuit that includes 2 batteries set in parallel, 2 wires and a light bulb.
 2. Place a dark coloured card behind the light bulb and compare the brightness of the light bulb with the previous circuit.
 3. Ask students to place a third battery in parallel and compare the brightness of the light bulb.
- Discuss with the class:
 - did the additional battery make the bulb glow brighter?
 - what do you think is happening to the flow of electrons in a series and parallel circuit?



Teachers Notes

The word series mean “following on from the previous one”, like a TV series.

It’s important to connect the batteries with their terminals in the correct order. Batteries in series need to be connected with the positive end of one battery to the negative end of the next battery.

If they are incorrectly connected, the batteries will cancel out each others energy and quickly flatten each other. This can be dangerous.

Batteries correctly placed in series, positive to negative, will add their output voltages, producing a greater voltage.

The word parallel means “alongside each other”. When batteries are placed in parallel all the positive terminals are joined together with a single wire to one part of the circuit, and all the negative terminals are joined with a single wire to the rest of the circuit.

Remember the voltage increases when batteries are in series, but with batteries in parallel this is not the case. When two or more batteries are placed in parallel, the voltage in the circuit is the same as each individual battery. That is two, three, four or more 1.5 volt batteries in parallel will produce a voltage of 1.5 Volts!

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Hypothesising and predicting

(define a problem that can be investigated scientifically)

The greater the number of batteries connected in series the greater the voltage.

Equipment/Materials

- role badges for manager, safety officer and speaker
- each team member's SciTech journal
- 2 x 1.5 volt batteries
- multimeter
- Discuss with students ways of accurately testing the hypothesis.
- Teacher introduces, explains and demonstrates the use of the multimeter to the students.
- Have students reconstruct their series and parallel circuits from the previous activity replacing the light bulb with multimeter to complete the circuit.
- Have students construct a table to record their observations in their SciTech Journals (sample below).

Type of circuit	Number of batteries	Multimeter reading (DCV)/(DCA)
	1 battery	
Series	2 batteries	
	3 batteries	
Parallel	2 batteries	
	3 batteries	

- Using the multimeter have students measure record and compare the voltage and amps of each circuit.

Analysing and drawing conclusions

(reach a conclusion which is communicated to others)

- Have students construct a graph using the collected data.
- Discuss with students what type of graph would best represent the data in a way that best addresses their hypothesis.
- What labels must they include on the X and Y axis?
- Once students have constructed their charts discuss the results and construct a statement summarising what they have learnt about batteries set in series and parallel circuits. Add the statements to the KWL chart and any new words should be added to the word wall.

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Observing and exploring

(ask questions, pose problems, find out what is currently known)

- Revise the previous activity of placing batteries in series or parallel.
- Ask students to predict what may happen to the brightness of 2 light bulbs if they were placed in series.
- Ask students to predict what may happen to the brightness of 2 light bulbs if they were placed in parallel.

Equipment/Materials

- role badges for manager, safety officer and speaker
- each team member's SciTech journal
- 1.5 volt battery
- 2 x light bulbs and lampholders
- connecting wires

Devising and Testing

(describe a procedure for collecting data, identify appropriate equipment to carry out the procedure)

- Have students construct a closed circuit that includes 1 battery, wires and 2 light bulbs connected in series.
- Place a dark coloured card behind the light bulbs and observe their brightness.
- Ask students to predict what would happen if 1 light bulb was removed from its holder.
Discuss the student's answers.
- Remove one light bulb from its holder, observe what happens.
- Have students construct a closed circuit that includes 1 battery, wires and 2 light bulbs connected in parallel.
- Place a dark coloured card behind the light bulbs and observe their brightness. Compare the brightness of the light bulbs from both the parallel and series circuits.
- Ask students to predict what would happen if 1 light bulb was removed from its holder.
Discuss the students' answers.
- Remove one light bulb from its holder, observe what happens.