

# Reading ammeters and voltmeters in circuits

Grade 7 science (Year 8 · Class 7) · Lab

Name: \_\_\_\_\_ Date: \_\_\_\_\_ Class: \_\_\_\_\_

Do the textbook rules for current and voltage really work? In this lab you measure both quantities in a series circuit and in a parallel circuit, using ammeters in the loop and voltmeters across the parts, and check whether the readings add up. The aim is to learn how to connect meters and to judge how close your results should be.

**Level:** Grade 7 science (Year 8 · Class 7) · **Curriculum:** MS-PS2-3

## Aim

To measure the current and voltage in a series circuit and a parallel circuit, and to test the rules that link them.

## Equipment

- Two 1.5 V cells in a holder (3.0 V in total)
- Two identical 2.5 V torch bulbs in holders
- Two digital multimeters used as ammeters (0 to 1 A range) and one used as a voltmeter
- Switch and connecting leads

## Safety

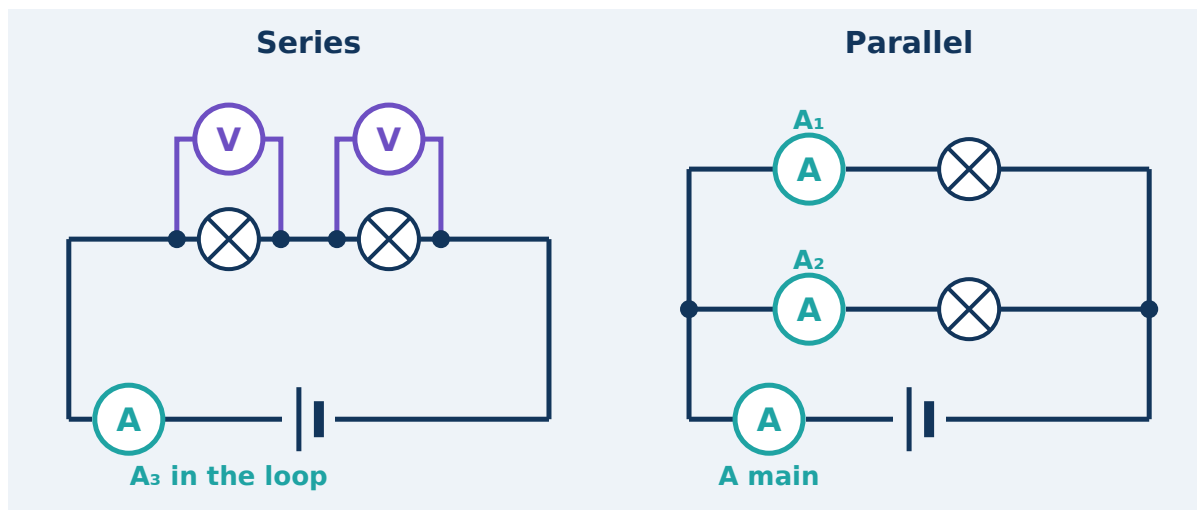
### Safety

Start every current reading on the highest range of the meter. Switch the circuit off before you move a meter. Never connect an ammeter straight across the cells or across a bulb. Leave bulbs to cool before touching them.

## Method

1. Build the series circuit with the switch open. Place an ammeter in the loop before bulb 1. Connect a voltmeter across bulb 1.
2. Close the switch and record the current and the voltage across bulb 1. Open the switch.
3. Move the voltmeter across bulb 2 and the ammeter to the loop between the bulbs, then after bulb 2. Record each reading. Measure the voltage across the cells with the voltmeter.
4. Build the parallel circuit. Place an ammeter in the main wire, one in the branch of bulb 1 and one in the branch of bulb 2. Record all three currents.

5. Measure the voltage across each bulb and across the cells.



Set-ups for the series and parallel circuits. In both, ammeters are in the circuit paths and voltmeters are across the parts.

## Results

Sample measurements from one group:

| Circuit  | Quantity                  | Reading |
|----------|---------------------------|---------|
| Series   | Current before bulb 1     | 0.19 A  |
| Series   | Current between the bulbs | 0.19 A  |
| Series   | Current after bulb 2      | 0.18 A  |
| Series   | Voltage across bulb 1     | 1.5 V   |
| Series   | Voltage across bulb 2     | 1.4 V   |
| Series   | Voltage across the cells  | 2.9 V   |
| Parallel | Current in the main wire  | 0.63 A  |
| Parallel | Current in branch 1       | 0.32 A  |
| Parallel | Current in branch 2       | 0.31 A  |
| Parallel | Voltage across bulb 1     | 2.9 V   |
| Parallel | Voltage across bulb 2     | 2.9 V   |
| Parallel | Voltage across the cells  | 2.9 V   |

## Analysis questions

### Question 1 Series current

Compare the three series current readings and decide whether they support the rule for current in a series circuit.

**Question 2 Series voltage**

Add the voltages across the two bulbs and compare with the voltage across the cells.

**Question 3 Parallel current**

Add the branch currents and compare the total with the main current.

**Question 4 Parallel voltage**

Compare the voltages across each bulb in the parallel circuit with the cell voltage and explain the result.

**Question 5 Converting units**

Convert the main current and the branch 1 current in the parallel circuit to milliamperes.

**Question 6 A third bulb**

Predict the main current if an identical third bulb were added in parallel.

**Question 7 Meter placement**

Explain why the ammeter must be in series and what would happen if it were placed across a bulb.

**Question 8 Evaluation**

Suggest two reasons why the series currents were not exactly equal, and one improvement.