

Series and parallel circuit patterns

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

Name: _____ Date: _____ Class: _____

How much does a bulb dim when you add more bulbs? In this lab you build series and parallel circuits with identical bulbs and measure the brightness of one bulb each time with a light meter. You will see which arrangement shares the supply and which one gives every bulb its own connection.

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

Aim

To find out how the brightness of a bulb changes when more identical bulbs are added in series and in parallel.

Equipment

- Two 1.5 V cells in a holder (3.0 V in total)
- Three identical 2.5 V torch bulbs in holders
- Switch and about eight connecting wires
- Light meter or a phone light-meter app that reads in lux
- Ruler, a cardboard tube to shield side light, and a dim room

Safety

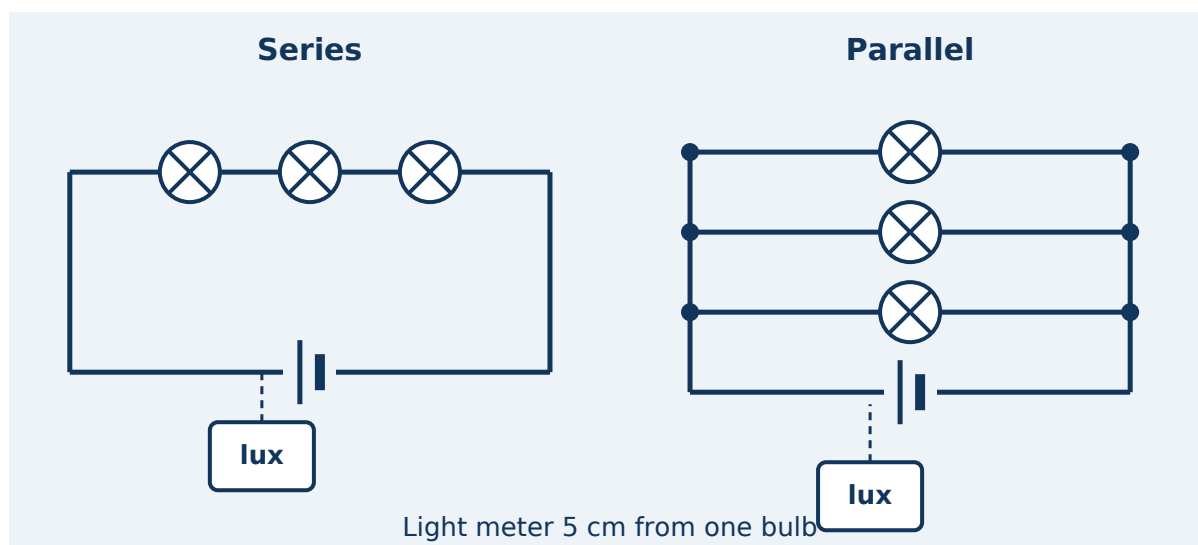
Safety

The voltage is low and safe, but bulbs and wires can become warm. Never connect a bare wire straight across the cells. Open the switch between changes and do not touch hot bulbs.

Method

1. Build a circuit with one bulb. Close the switch, hold the light meter 5 cm from the bulb and record the brightness in lux. Open the switch.
2. Add a second bulb in series. Measure the brightness of the first bulb at the same distance and record it.
3. Add a third bulb in series and measure again.
4. Rebuild the circuit with two bulbs in parallel and measure one bulb, then with three bulbs in parallel.

5. Repeat each reading once and record the mean.



Series and parallel set-ups with a light meter at the same distance from a bulb.

Results

Sample mean measurements from one group:

Arrangement	Number of bulbs	Brightness of one bulb (lux)
Single bulb	1	480
Series	2	45
Series	3	9
Parallel	2	472
Parallel	3	466

Analysis questions

Question 1 Describe the pattern

Describe how the brightness of one bulb changes as bulbs are added in series and in parallel.

Question 2 Series percentages

Calculate the brightness with two and with three bulbs in series as a percentage of the single bulb, to 1 decimal place.

Question 3 Parallel percentages

Calculate the brightness with two and with three bulbs in parallel as a percentage of the single bulb, to 1 decimal place.

Question 4 Explaining series

Explain why bulbs in series are dimmer using the idea that the supply is shared.

Question 5 A small drop in parallel

Suggest why the parallel bulbs were slightly dimmer than the single bulb.

Question 6 Cell life

Predict how long the cells would last in each arrangement compared with a single bulb.

Question 7 Reliability

Suggest two ways to make the brightness measurements more reliable.

Question 8 Unscrewing a bulb

Predict what happens to the other bulbs in each arrangement when one bulb is unscrewed.