

Kirchhoff's Laws for Circuits (Student)

Group Materials

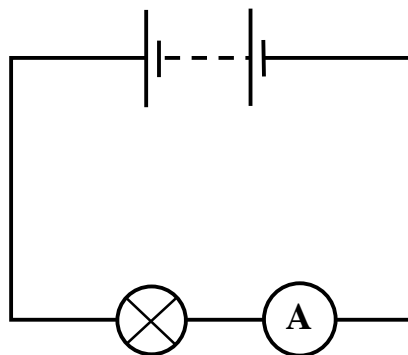
- 3 lamps
- Power supply or battery pack
- Ammeter (or multi-meter)
- Voltmeter (or multi-meter)
- 4 mm connecting leads (about 8)

Part 1: Kirchhoff's 1st Law

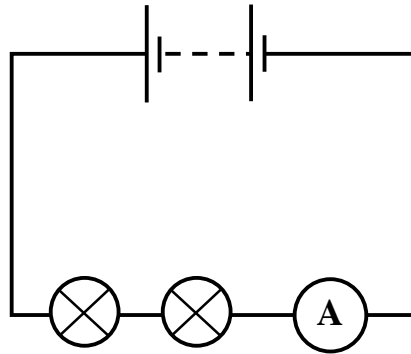
Use an ammeter to measure a current. Ammeters must be connected in series (the current to be measured has to flow through them). Current is measured in amps (A).

Lamps in series

(a) Measure the current through one lamp when it is lit.

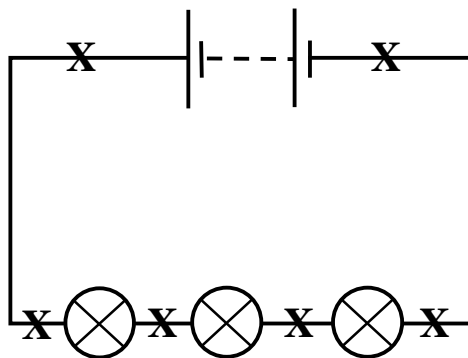


(b) Add a second lamp in series with the first (as shown) without increasing the supply voltage. Measure and record the current and compare it with 1(d). Why is it less?



(c) Now add a third lamp in series and again measure and record the current. Why does the current reduce as more lamps are added in series?

(d) Use the circuit below (3 lamps in series) and move the ammeter to measure and record currents at each of the points marked X. Record your results below:

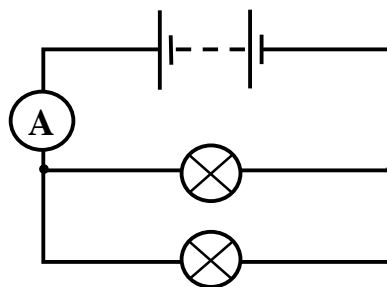


What conclusion can you draw about the current around a series circuit?

Can you explain this in terms of the flow of charge?

Lamps connected in parallel

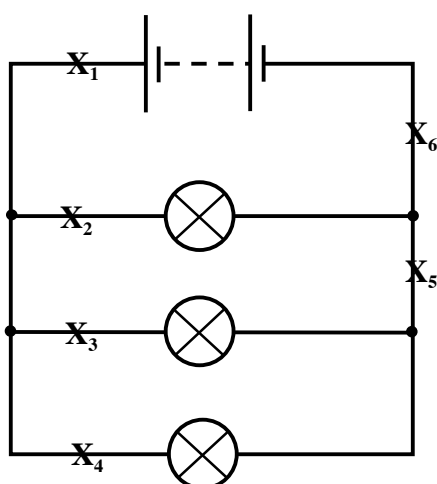
Connect up the circuit shown below.



(a) Measure and record the current. How does the current drawn from the cells and the brightness of the lamps compare to that of two lamps in series? Can you explain this?

Increase the number of lamps in parallel to three.

(a) Measure the currents X_1 to X_6 taking care to put the ammeter in the correct position each time.



X₁ =

X₂ =

X₃ =

X₄ =

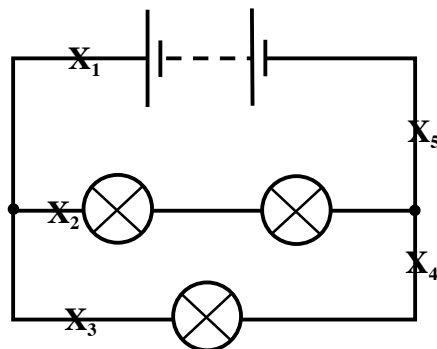
X₅ =

X₆ =

(c) You should be able to find some connections between these values. What are they and why are they connected like this? Your explanation should involve the way charge flows in the circuit.

(d) What happens to current when it reaches a junction in the circuit?

Now connect up the circuit below and measure currents at points X1 to X5.



X₁ =

X₂ =

X₃ =

X₄ =

X₅ =

Now explain what is happening in this circuit and why the currents have these values.

Part 2: Kirchhoff's second law

Measuring potential differences

There are several circuits drawn below. For each one:

- Construct the circuit.
- Use a voltmeter set to a suitable D.C. range to measure the potential difference across:
 - the supply.
 - each lamp individually.

Write the measured voltages above the lamps and cells in the diagram. Can you link the voltages across the individual lamps to the supply voltage in each case? What is the general rule?

