I have given actual measurements here. Note that these globes are not "ohmic resistors". As they get hot with current flowing through them, the resistance increases and as such they don't quite give the exact expected values when combined in series and parallel.

1. Conductors & insulators

a) Draw up a table in your book and classify the materials as good or bad conductors of electricity.

- Good conductors: Iron nail, Carbon
- Bad conductors: plastic, wood

b) What types of materials make the best conductors of electricity?

Metals tend to make the best conductors.

2. Voltage & current - Ohms law.

a) Start with the power supply on 2V and ensure that the globe glows. Record the current and voltage from the meters. Increase the voltage on the power supply and record again. Record the voltage and current up to 12V.

Power supply setting	Measured voltage across globe	Measured current through globe
2V	2.1V	0.3A
4V	3.8V	0.05A
6V	5.6V	0.06A
8V	7.6V	0.07A
10V	9.6V	0.08A
12V	11.6V	0.09A

b) What relationship do you notice between increases in voltage and current?

As the voltage is increased, the current also increases.

c) What is the relationship between current and brightness of a globe?

As the current increases, the globe gets brighter.

d) What current do you think would flow if the voltage was increased to 24V?

If the voltage was doubled, you would expect that the current that would also be doubled.

3. Series circuits

a) Measure and record the current that runs through the circuit.

The current is 0.06A.

b) How does the current through two globes compare to the current through one globe with 12V? (This was measured in question 1.)

This is approximately (a bit more than!) half the current if one only one globe is connected.

c) What do you notice about the brightness of the two globes in series compared to just one?

The two globes in series are dimmer than when there was just one.

d) Measure and record the voltage across each globe.

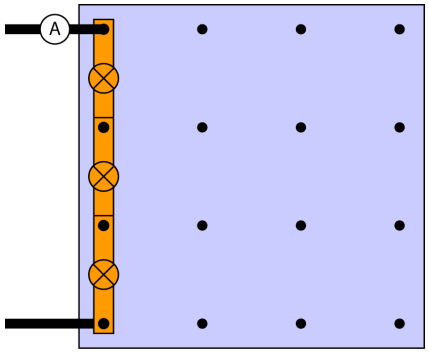
There was 5.8V across each globe.

e) What do you notice about the two voltages across the globes in series?

The voltages across the two globes (5.8V each) add to be the same as the voltage across just one globe connected (11.6V).

f) Predict and then measure what you think that the current would be if three globes were placed in series. Draw a diagram of this circuit.

The current through three series globes would be approximately one 1/3 of the current through just one.



g) Does it matter where the ammeter is placed in series in the circuit? Explain why.

No. As long as the ammeter is in series with the two globes, it read the same. The current through all points in the circuit is the same.

h) Explain what a negative reading on the ammeter means. Is this a problem?

A negative reading means that that the red & black leads have been connected in reverse (red should be connected to the positive on the power supply). This is not a problem as the measurement will still be the same.

4. Parallel circuits

a) Measure and record the total current that runs through the circuit.

The current is 0.18A.

b) How does the current through two globes in parallel compare to the current through one globe with 12V? (This was measured in question 1.)

This double the current if one only one globe is connected.

c) What do you notice about the brightness of the two globes in series compared to just one?

Both globes are the same brightness as one globe on it its own.

d) Measure and record the voltage across each globe individually.

There was 11.6V across each globe.

e) What do you notice about the two voltages across the globes in parallel?

The voltage across the two globes in parallel is the same as if there was just one.

Extend the circuit to allow the current through each globe to be measured. (Remember that the ammeter must be placed in series by breaking the circuit!)

f) Measure and record the current through each globe.

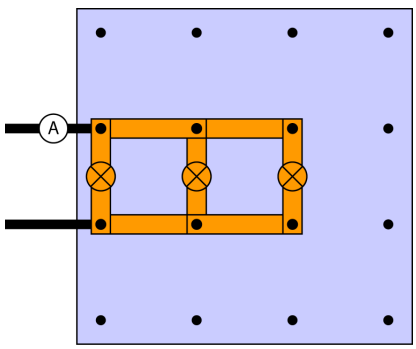
Each globe has 0.09A through it.

g) What do you notice about the current through each globe, in comparison to the original reference (12V, one globe)?

Each globe in parallel has the same current running through it that a single globe would have. (0.09A + 0.09A = 0.18A)

h) Predict and then measure what you think that the total current would be if three globes were placed in parallel. Draw a diagram of this circuit.

Three globes in parallel would have a total current of 0.27A flowing.



5. Measuring resistance – Series and parallel

Use the multimeter on the resistance scale to record the resistance of:

a) one globe - 13Ω

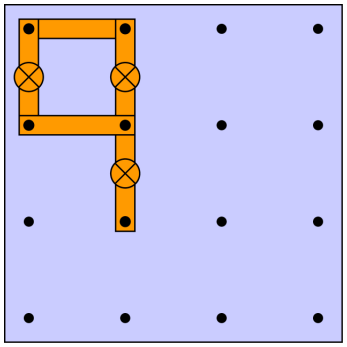
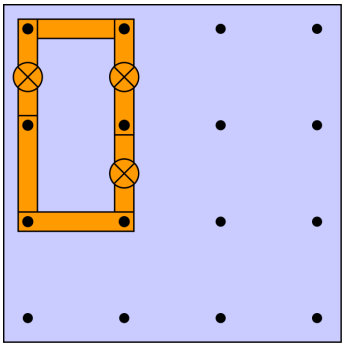
b) two globes in series - 25Ω

c) two globes in parallel - 7Ω

d) Predict and then measure the resistance of three globes in series and three globes in parallel.

Three globes in series - prediction 39Ω, actual measurement 39Ω
Three globes in parallel - prediction 4Ω, actual measurement 5Ω

e) There are two other ways in which the three globes can be arranged to give different overall resistances. Build and draw the circuits and record the measurements.

	
Total resistance is 19Ω	Total resistance is 9Ω

6. Extension circuits

a) Measure and record the current through the two connected globes.

The current is 0.06A. (This is the same as what was measured in question 3.)

b) Predict and then measure the current through the single globe.

The current is 0.09A. (This is the same as what was measured in question 2.)

c) Explain the result of part b. (Hint: What are the resistances of the single and two globes?)

The single globe has more current through it as it has less resistance than the two globes.

d) Which globe(s) is brightest? Why?

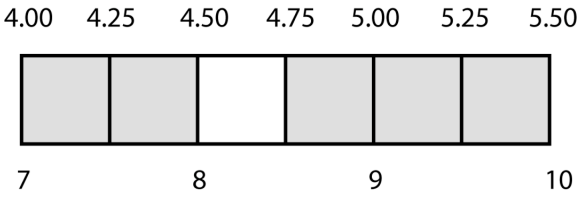
The single globe is brightest because it has the highest voltage across it and the highest current flowing through it.

7. Summary

Write down at least five things that you have learnt from doing this activity.

Any five reasonable (different) observations.

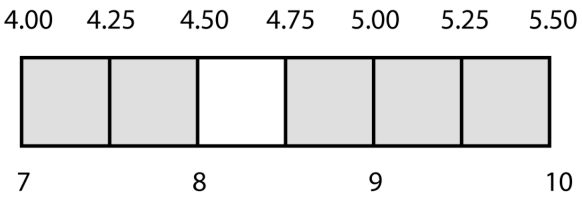
VELS – Science knowledge & understanding



To meet level 4.75:

- Most questions have been addressed correctly.
- A correct understanding of the difference between voltage & current is apparent.

VELS – Science at work



To meet level 4.75:

- Measurements were completed correctly & safely with instructions followed on the correct use of the equipment.