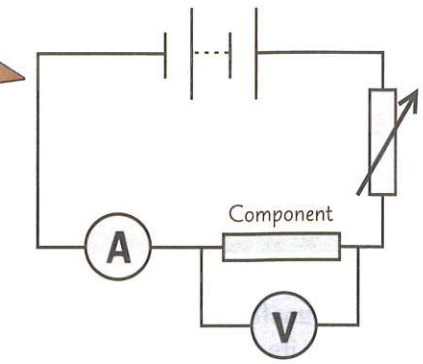
Investigating Components

Ooh experiments, you've gotta love 'em. Here's a simple experiment for investigating different components.

The Standard Test Circuit

You can use this circuit to investigate the relationship between current (I) p.d. (V) and resistance for a range of components, such as a filament bulb or a fixed resistor. This relationship can be easily shown with an I-V graph — just like the ones over on the next page.



The standard test circuit contains:

- An ammeter and a voltmeter to measure current and potential difference — there's lots about how to set them up on page 210.
- A variable resistor to change the current through the circuit. As $I = V \div R$, increasing the total resistance by increasing the variable resistor's resistance lowers the current through the circuit (for a fixed supply potential difference). This also changes the potential difference across the test component.

PRACTICAL

To use the circuit above to investigate a component, e.g. a fixed resistor or a filament lamp:

1) Connect the circuit as shown above. The component and the ammeter are in series, which means they can be put in any order in the main circuit. (The voltmeter must be in parallel around the component under test.)
2) Change the resistance of the variable resistor. Measure the current through and p.d. across the component.
3) Take several pairs of readings from the ammeter and voltmeter at a number of different resistances.
4) Plot the current against the potential difference to get I-V graphs like the ones on p.187.
5) You can use this data to work out the resistance for each measurement of I and V, using the formula on p.185, so you can see if the resistance of the component changes as I and V change.
6) Make sure the circuit doesn't get too hot over the course of your experiment, as this will mess up your results (p.185). If the circuit starts to warm up, disconnect it for a while between readings so it can cool down. And, like any experiment, you should do repeats and calculate means.

Have a look at page 6 for more about calculating averages and interpreting your results.

You Can Investigate Diodes, LDRs and Thermistors

You can also create I-V graphs for diodes, thermistors and LDRs using the method above (there's more about thermistors and LDRs on the next page). However, the resistance of these components (and so their potential difference) can depend on other factors besides current.

1) Diodes — after you've finished taking measurements for a range of currents, remove the diode and swap its direction. You should find that current cannot flow through the diode anymore (see p.187).
2) Thermistors — keeping the resistance of the variable resistor constant, gradually heat the thermistor. (You can do this by placing the thermistor against a beaker of hot water.) You should find that as the temperature increases, the current through the thermistor increases as the resistance decreases.
3) LDRs — conduct your experiment in a dim room. Again keep the resistance of the variable resistor constant and slowly adjust the light level near to the LDR (e.g. by using a lamp connected to a dimmer switch). You should find as the light level gets brighter, the current through the LDR increases as the resistance decreases.

Measure gymnastics — use a vaultmeter...

Make sure you can describe the experiment above — remember, ammeters in series, voltmeters in parallel.

Q1 Draw a circuit you could use to create an I-V graph for a filament lamp. [3 marks]

Investigating Components

1 Voltmeters and ammeters are used to investigate circuits. Grade 4-6

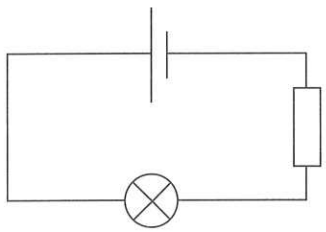
a) A voltmeter should always be connected

- ☐ **A** in series with the component.
- ☐ **B** in series with the source of potential difference.
- ☐ **C** in parallel with a resistor.
- ☐ **D** in parallel with the component.

[1]

b) **Figure 1** shows a circuit. Draw an ammeter in an appropriate place on the diagram to measure the current flowing through the bulb.

Figure 1



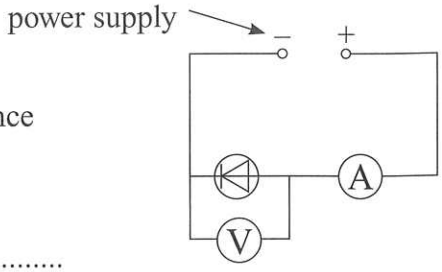
[1]

[Total 2 marks]

PRACTICAL

2* A student is investigating the resistance of a diode. He sets up the circuit shown in **Figure 2**. Grade 7-9

Figure 2



Describe how he could use this circuit to investigate the resistance of the diode. Include a discussion of the steps he should take to make sure his results are accurate and repeatable.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

[Total 6 marks]