

GCSE Physics required practical activity 4: V-I Characteristics

Student sheet

Required practical activity	Apparatus and techniques
Use circuit diagrams to construct appropriate circuits to investigate the V-I characteristics of variety of circuit elements including a filament lamp, a diode and a resistor at constant temperature.	AT 6, AT 7

What happens to the current through a component when the pd across it changes?

There are three activities. In each one you are going to measure electric current in a component as you change the potential difference (pd) across it. You will then plot a graph of current in A against potential difference in V. You will investigate the behaviour of a resistor, a lamp and a diode.

Learning outcomes
1
2
Teachers to add these with particular reference to working scientifically

Method

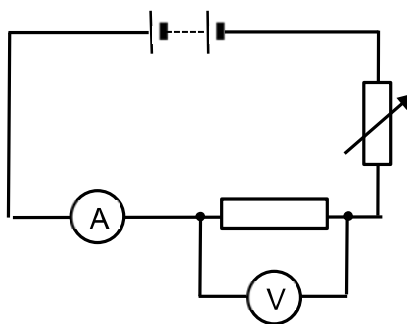
You have access to the following:

- ammeter and milliammeter, or multimeter
- voltmeter or multimeter
- component holders
- 12 V, 24 W lamp eg a ray box lamp
- resistor
- diode and protective resistor (eg 10 Ω)
- rheostat eg 10 Ω , 5A
- connecting leads.

You should read these instructions carefully before you start work.

Activity 1: The characteristic of a resistor.

1. Connect the circuit. It may be helpful to start at the positive side of the battery or power supply. This may be indicated by a red socket.
2. Connect a lead from the red socket to the positive side of the ammeter.

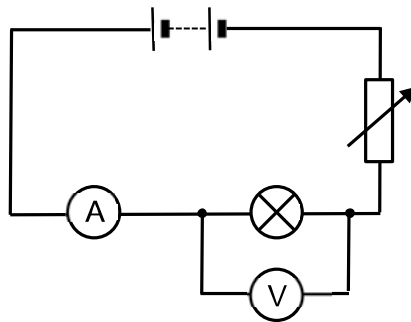


3. Connect a lead from the negative side of the ammeter (this may be black) to one side of the resistor.
4. Connect a lead from the other side of the resistor to the variable resistor.
5. Connect a lead from the other side of the variable resistor to the negative side of the battery. The main loop of the circuit is now complete. Use this lead as a switch to disconnect the battery between readings.
6. Connect a lead from the positive side of the voltmeter to the side of the resistor the ammeter is connected to.
7. Connect a lead from the negative side of the voltmeter to the other side of the resistor.
8. Record the readings on the ammeter and voltmeter in a suitable table.
9. Adjust the variable resistor and record the new ammeter and voltmeter readings. Repeat this to obtain several pairs of readings.
10. Swap the connections on the battery so that the ammeter is now connected to the negative terminal and variable resistor to the positive terminal. The readings on the ammeter and voltmeter should now be negative.
11. Continue to record pairs of readings of current and potential difference with the battery reversed.
12. Plot a graph of current in A against potential difference in V. As the readings include negative values the origin of your graph will be in the middle of the graph paper.
13. You should be able to draw a straight line of best fit through the origin. This is the characteristic of a resistor.

Activity 2: the characteristic of a lamp.

You should read these instructions carefully before you start work.

1. Swap the leads on the battery back to their original positions.
2. Replace the resistor with the lamp. If you are starting the circuit from the beginning, follow the instructions above, inserting the lamp for the resistor.

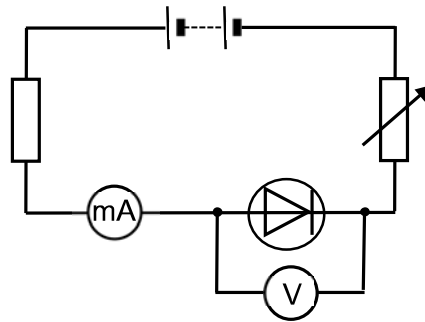


3. The lamp will get hot. Take care not to touch it.
4. Follow the procedure for the resistor, swapping the leads on the battery to obtain negative readings.
5. Plot a graph of current in A against potential difference in V. Again the origin will be in the middle of the paper. Draw a curved line of best fit for your points.

Activity 3: the characteristic of a diode.

You should read these instructions carefully before you start work.

1. Swap the leads on the battery back to their original positions.
2. If you can, reduce the battery potential difference to less than 5 V.
3. Remove the lead from the positive side of the battery and connect it to the extra resistor labelled P.
4. Connect the other end of P to the positive side of the battery.
5. Replace the ammeter with a milliammeter or change the setting on the multimeter.



6. Replace the lamp with the diode. Connect the positive side of the diode to the milliammeter.
7. Repeat steps 1 – 6 above to obtain pairs of readings of potential difference and current for the diode.
8. Plot the graph of current in A against potential difference in V. The origin will probably be in the middle of the bottom of your graph paper. There should not be any negative values of current.