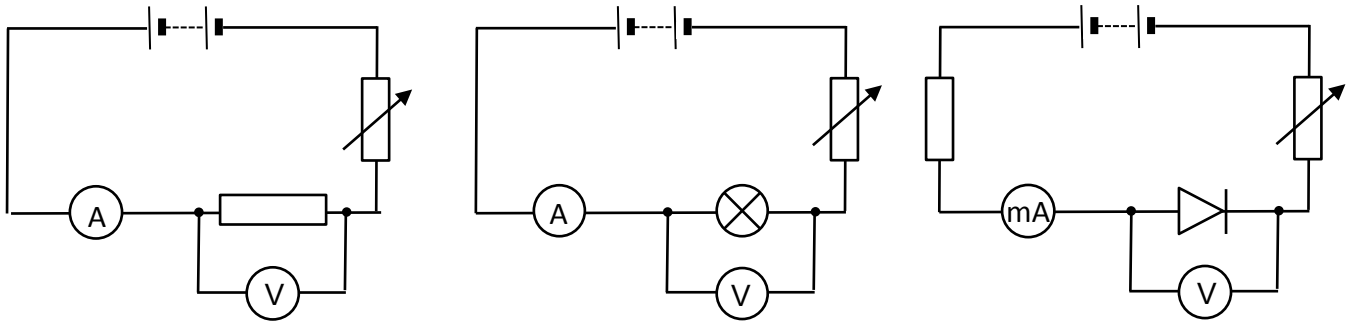
Required Practical Review

Physics Practical – Investigating I-V Characteristics

Free science lessons: https://www.youtube.com/watch?v=A1SyKvdHoqY
GCSEpod: https://members.gcsepod.com/shared/podcasts/title/10976

Know it

You completed three similar experiments. In each one you measured how the electric current through a component varied as the potential difference (voltage) across the component was changed. The three components you studied were an ohmic conductor, a filament lamp, and a diode.

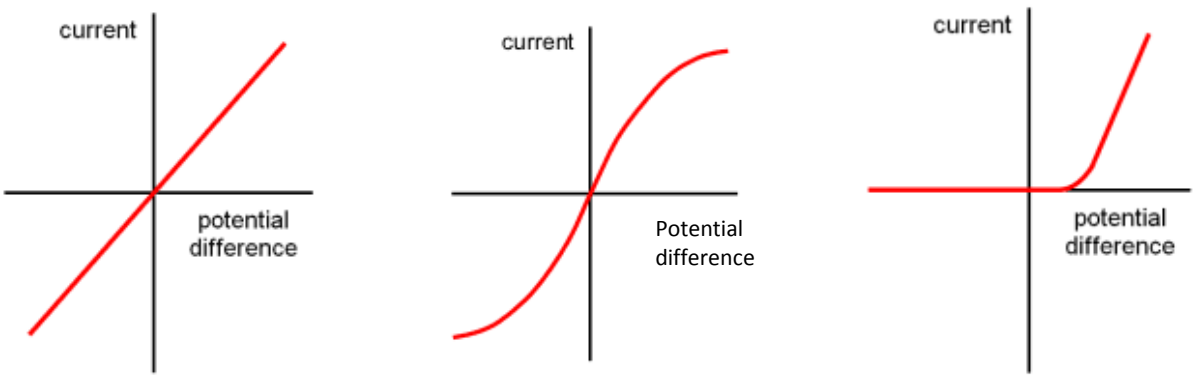


1) You connected each circuit shown above in turn.
2) You adjusted the variable resistor in order to change the potential difference across the component.
3) For each position of the variable resistor, you recorded readings from the voltmeter (to tell you the potential difference across the component) and the ammeter (to tell you the current flowing through the component).
4) You took at least six pairs of readings.
5) You swapped the connections round on the battery to make the potential difference apply in the opposite direction, and repeated steps 2-4.
6) You plotted a graph with "current in A" on the y-axis, and "potential difference in V" on the x-axis. This graph was called the "I-V Characteristic Graph" for the component. Your graph included negative readings, when the potential difference was applied in the reverse direction.

NOTE: The extra resistor used when you studied the diode was to ensure that this delicate component was not damaged by the currents through it being too high. The ammeter was changed to a milliammeter so that it was possible to measure the low currents involved.

Review it

Complete the tasks below in your book.



A **B** **C**

Up to grade 4

1) Which of the I-V characteristic graphs shown above is for an ohmic conductor, which is for a filament lamp, and which is for a diode?
2) For which I-V characteristic is potential difference directly proportional to current, and how is this shown by the graph?
3) How can you tell that a diode only lets current flow in one direction? How does its circuit symbol show this as well?

Grade 5-7

4) How would the I-V characteristic graph for the ohmic conductor be changed as the resistance of the conductor was increased?
5) How can you tell from the I-V characteristic for a filament bulb that the resistance changes as current increases?
6) What happens to the resistance of a filament bulb as current increases? How does the I-V characteristic show this?

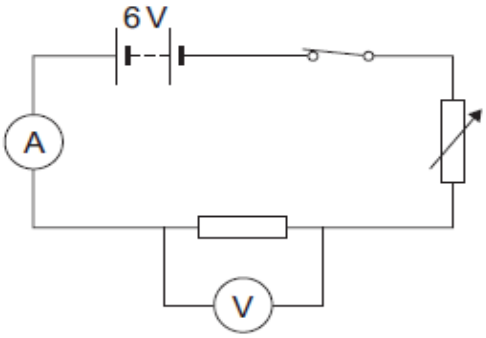
Grade 7+

7) Why does the resistance of a filament bulb change as current increases? Talk about what is happening to the electrons and to the metal ions in your answer.
8) Why does an ohmic conductor need to be kept at a constant temperature for its I-V characteristic to take the form that is shown above?
9) Describe how you would calculate the resistance of an ohmic conductor given its I-V characteristic graph.

Test it

Answer the exam questions below in your book.

The diagram shows the circuit set up by a student.



(a) The student uses the circuit to test the following hypothesis:

'The current through a resistor is directly proportional to the potential difference across the resistor.'

(i) If the hypothesis is correct, what should the student predict will happen to the current through the resistor when the potential difference across the resistor is doubled?

_____

_____

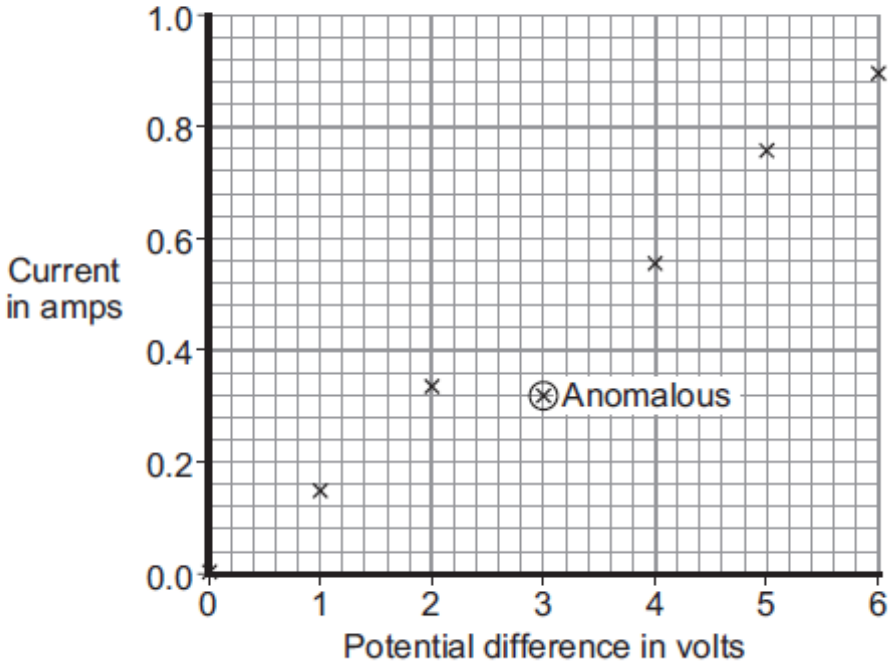
(1)

(ii) Name the component in the circuit used to change the potential difference across the resistor.

_____

(1)

(b) The student used the data obtained to plot the points for a graph of current against potential difference.



(i) Why has the student plotted the points for a line graph and not drawn a bar chart?

_____

_____

(1)

(ii) One of the points has been identified by the student as being anomalous.

What is the most likely cause for this anomalous point?

_____

_____

(1)

(iii) Draw a line of best fit for these points.

(1)

(iv) Does the data the student obtained support the hypothesis?

Give a reason for your answer.

_____

_____

(1)

(Total 6 marks)

Mark it

(a) (i) also double

increases is insufficient

1

(ii) variable resistor

accept rheostat / potentiometer

1

(b) (i) the data / results / variables are continuous

accept data / results / variables are not categoric / discrete

1

(ii) misreading the ammeter

*do **not** accept misreading the meter / results*

*do **not** accept misreading the ammeter and / or voltmeter*

reading / human error is insufficient

1

(iii) straight line from the origin drawn passing close / through points at 1 V, 5 V, 6 V and ignoring anomalous point

*do **not** accept line drawn 'dot-to-dot'*

1

(iv) yes

mark is for the reason

supports prediction
or
(straight) line passes through the origin

accept a mathematical argument, eg when p.d. went from 2 to 4 the current went from 0.3 to 0.6

it's directly proportional is insufficient

1

[6]