Exercise walk-through

2.3
Resistors and I–V characteristics (4.2.1.4, RP4)

AQA · GCSE · Physics

Circuit symbols, charge and current

- Circuit diagrams use standard **circuit symbols** .
- Learn the symbols for a cell, battery, open and closed switch, lamp, fuse, resistor, variable resistor, ammeter, voltmeter, **diode**, LED, **thermistor** and **LDR**.
- An ammeter is always connected **in series** with a component, and a voltmeter **in parallel** across it.
- For charge to flow, there must be a closed circuit with a source of potential difference, such as a cell. **Electric current** is the rate of flow of electrical **charge** :

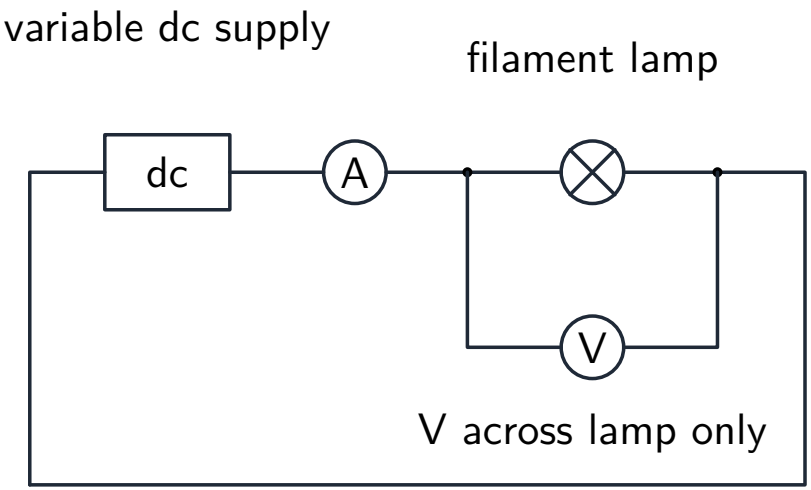
$$Q = It$$

Current, resistance and potential difference

- The current through a component depends on the potential difference across it and on its **resistance** :
- V is potential difference in volts (V), I is current in amperes and R is resistance in ohms (Ω).
- For the same potential difference, a bigger resistance gives a smaller current.
- **Worked example 4.** A potential difference of 0.45 V drives a current of 0.0075 A through a coin.

$$V = IR$$

Figure: Resistors and I–V characteristics



- Required practical 4: the ammeter is **in series** with the lamp, and the voltmeter is across it.
- Match each part of the diagram to the text.

Exercises 2.1·2.2

2.1 Describe the current–potential difference graph for a diode. [2]



2.2 Describe how the resistance of a light-dependent resistor (LDR) changes as it gets darker, and give **one** use. [2]



Exercises 2.1·2.2

2.1 Describe the current–potential difference graph for a diode. [2]



2.1

- in one direction, current flows once the potential difference is large enough; in the reverse direction there is no current, because the resistance is very high

2.2 Describe how the resistance of a light-dependent resistor (LDR) changes as it gets darker, and give **one** use. [2]



2.2

- the resistance increases as it gets darker; e.g. switching on street lights at night

Exercises 2.3·3.1

2.3 Give **one** use of a thermistor, and explain why a thermistor is suitable. [2]



3.1 Explain why the resistance of a filament lamp increases as the current through it increases. [3]



Exercises 2.3·3.1

2.3 Give **one** use of a thermistor, and explain why a thermistor is suitable. [2]



2.3

- e.g. a thermostat, or a fire alarm; its resistance changes with temperature, so the current changes

3.1 Explain why the resistance of a filament lamp increases as the current through it increases. [3]



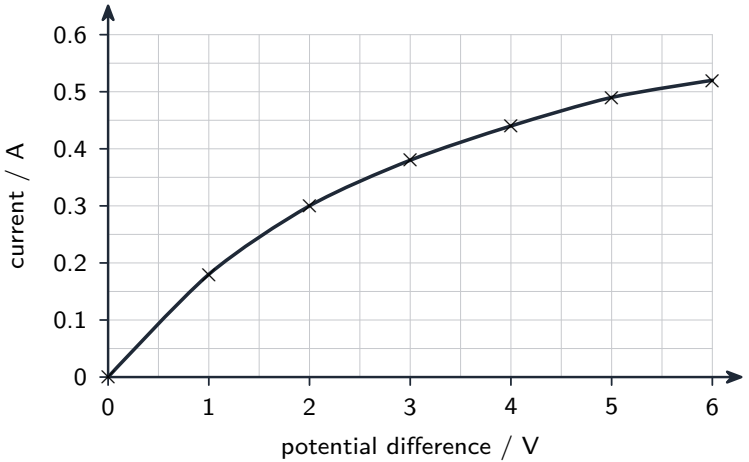
3.1

- a larger current makes the filament hotter
- the ions in the metal vibrate more
- the electrons collide with the ions more often, so the resistance increases

Exercise 3.2 (a)

3.2 A student measures the current through a filament lamp at different potential differences. The graph shows the results.

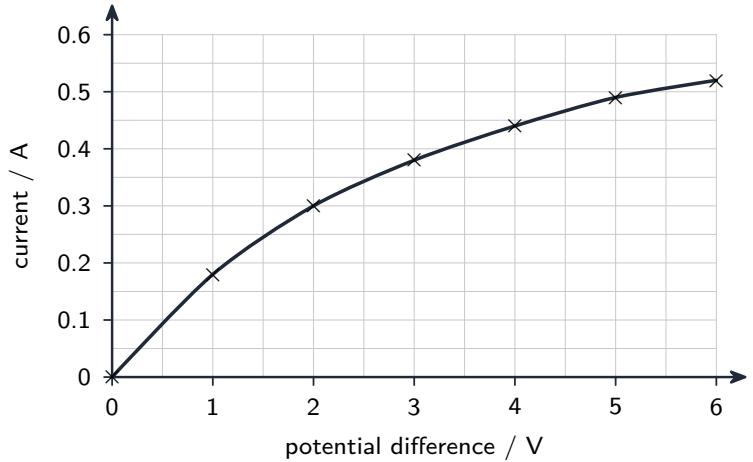
(a) Use the graph to find the current at 2.0 V and at 6.0 V. [2]



Exercise 3.2 (a)

3.2 A student measures the current through a filament lamp at different potential differences. The graph shows the results.

(a) Use the graph to find the current at 2.0 V and at 6.0 V. [2]



(a) 0.30 A; 0.52 A

Exercise 3.2 (b)

3.2 A student measures the current through a filament lamp at different potential differences. The graph shows the results.

(b) Calculate the resistance of the lamp at 2.0 V and at 6.0 V. What do the answers show? [3]

Exercise 3.2 (b)

3.2 A student measures the current through a filament lamp at different potential differences. The graph shows the results.

(b) Calculate the resistance of the lamp at 2.0 V and at 6.0 V. What do the answers show? [3]

(b) $2.0 \div 0.30 = \mathbf{6.7}\ \Omega$; $6.0 \div 0.52 = \mathbf{11.5}\ \Omega$; the resistance increases as the potential difference increases

Exercise 3.2 (c)

3.2 A student measures the current through a filament lamp at different potential differences. The graph shows the results.

(c) The student reverses the connections to the lamp. Describe how the graph continues for negative potential differences. [2]

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3.2 A student measures the current through a filament lamp at different potential differences. The graph shows the results.

(c) The student reverses the connections to the lamp. Describe how the graph continues for negative potential differences. [2]

(c) the same shape; the current is negative, so the graph is the same curve turned through the origin

Exercise 3.2 (d)

3.2 A student measures the current through a filament lamp at different potential differences. The graph shows the results.

(d) Describe how the student could get these results. [6]

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(d) Describe how the student could get these results. [6]

(d) points to include:

- connect the lamp in series with an ammeter, a variable resistor and a power supply
- connect a voltmeter in parallel across the lamp
- change the variable resistor to set the potential difference in steps, e.g. 1.0 V
- record the current at each potential difference
- reverse the connections to the lamp and repeat for negative values
- plot current against potential difference; repeat readings and find means

Levels: **5–6** a full, logical answer with correct physics and correct terms; **3–4** several correct points, partly linked; **1–2** one or two relevant points.