I–V characteristics and sensors

Name _____ Class _____ Date _____

Different components behave differently when the potential difference across them changes. An **I–V graph** shows how.

KEY IDEAS

- **Ohmic conductor** (resistor at constant temperature): straight line through the origin; current ∝ p.d.
- **Filament lamp**: curve that gets less steep, because resistance increases as the filament gets hotter.
- **Diode**: current flows in one direction only. **Thermistor**: R falls as temperature rises. **LDR**: R falls as light gets brighter.

CIRCUIT SYMBOLS



Section A · Recall

Grade 4–5

1 Which component has a resistance that decreases as the temperature increases? [1]

Thermistor

2 Give one use of a thermistor and one use of an LDR. [2]

Thermistor: thermostats / temperature sensors

LDR: automatic night lights / street lights

3 Describe how the current through a diode depends on the direction of the p.d. [2]

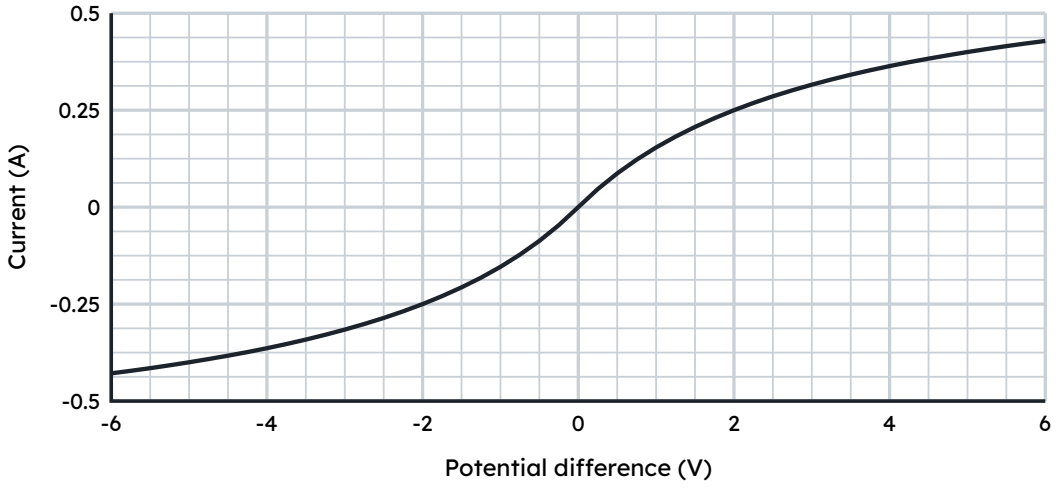
Current only flows in one direction (forward).

In the reverse direction it has a very high resistance, so almost no current flows.

Section B · Interpret the graph

Grade 5–6

4 The graph shows the I–V characteristic of a filament lamp.



a Use the graph to find the current when the p.d. is 4 V. [1]

About 0.36 A

b Calculate the resistance of the lamp at 4 V. [2]

R = V ÷ I = 4 ÷ 0.36

R ≈ 11 Ω

c Explain why the graph gets less steep as the p.d. increases. [3]

A bigger current makes the filament hotter.

The ions vibrate more, so electrons collide with them more often.

So the resistance increases and the current rises less for each extra volt.

Section C · Stretch

Grade 7+

5 Explain how a thermistor could be used to switch on a heater when a room gets cold. [3]

As the room cools, the thermistor's resistance increases.

For the same p.d. the current falls (V = IR).

This change is detected and used to switch the heater on.

Exam-style question

AQA style

6 A student wants to find the I–V characteristic of a resistor.

a Describe a method the student could use. [4]

Resistor in series with an ammeter and a variable resistor; voltmeter in parallel across the resistor.

Use the variable resistor to change the p.d.; record V and I for a range of values.

Reverse the connections to get negative values; repeat and find means.

Plot a graph of current against p.d.

b Describe and explain the shape of the graph the student should get. [2]

A straight line through the origin,

because current is directly proportional to p.d. at constant temperature (ohmic).

Total: _____ / 20

How confident am I?

	Not yet	Nearly	Got it
I can sketch I–V graphs for a resistor, lamp and diode	☐	☐	☐
I can explain how thermistors and LDRs behave	☐	☐	☐
I can describe the I–V practical	☐	☐	☐