THE UNIVERSITY of York

EPSE Project 1: Sample Diagnostic Questions - Set 2

Electric current

These questions all probe pupils' understanding of the idea of electric current – as a 'conserved' quantity, i.e. as something which goes round an electric circuit but is used up as it goes. The questions explore this idea in several contexts, with different components in the circuit. It is easy to make more questions of the same sort, by changing the components (e.g. from a bulb to a resistor or motor, or vice versa), or changing the way the current is 'measured' (e.g. from asking about the size of the current at a point to asking about the reading on an ammeter).

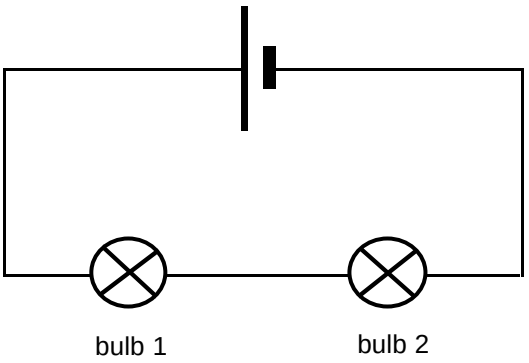
Qs1-8 ask about observable phenomena. These questions all have a two-tier format which we have found useful for probing pupils' ability to predict what will be observed but also to choose the best explanation for this. If a pupil gets both tiers right it is unlikely that their answer is a guess.

Qs9-10 then ask about pupils' 'mental models' of what is going on. It is interesting to see if these are consistent with their predictions and explanations in the earlier ones.

These questions are taken from a larger bank of diagnostic questions and tasks developed by the *Evidence-based Practice in Science Education (EPSE) Research Network*. We hope to publish the whole set of materials later in 2003. In the meantime, this sample may suggest ideas for developing more questions along similar lines.

1

The two bulbs in this circuit are identical.



(a) How bright will the bulbs be?

Tick ONE box (✓)

- ❑ Bulb 1 is lit. Bulb 2 is off.
- ❑ Bulb 2 is lit. Bulb 1 is off.
- ❑ Both bulbs are lit. Bulb 1 is brighter than bulb 2.
- ❑ Both bulbs are lit. Bulb 2 is brighter than bulb 1.
- ❑ Both bulbs are lit, with the same brightness.

(b) How would you explain this?

Tick ONE box (✓)

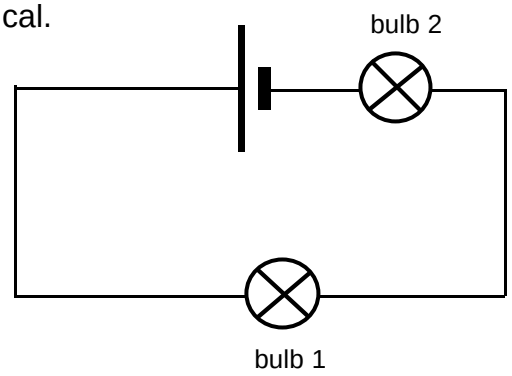
- ❑ The first bulb uses up **all** of the electric current, so there is none left for the other one.
- ❑ The first bulb uses up **some** of the electric current, so there is less left for the other one.
- ❑ The electric current is shared equally between the two bulbs.
- ❑ The electric current is the same all round the circuit.

How confident are you that your answers to this question are correct? Tick ONE box (✓)

Very confident ☐ Fairly confident ☐ Not confident ☐ Just guessing ☐

2

The two bulbs in this circuit are identical.



(a) How bright will the bulbs be?

Tick ONE box (✓)

- ☐ Both bulbs are lit. Bulb 1 is brighter than bulb 2.
- ☐ Both bulbs are lit. Bulb 2 is brighter than bulb 1.
- ☐ Both bulbs are lit, with the same brightness.
- ☐ Bulb 1 is lit. Bulb 2 is off.
- ☐ Bulb 2 is lit. Bulb 1 is off.

(b) How would you explain this?

Tick ONE box (✓)

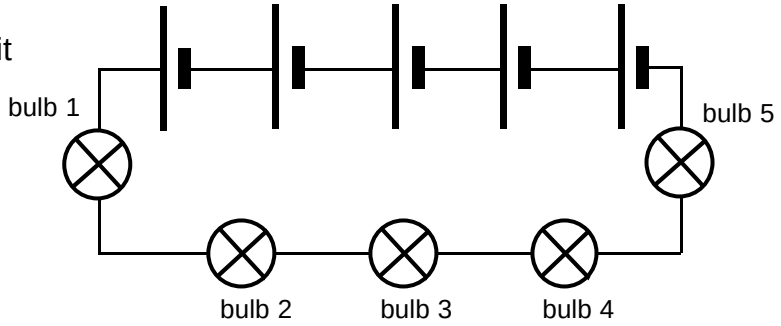
- ☐ The first bulb uses up **all** of the electric current, so there is none left for the other one.
- ☐ The first bulb uses up **some** of the electric current, so there is less left for the other one.
- ☐ Bulb 2 is closer to the battery, so it gets more electric current.
- ☐ The electric current is shared equally between the two bulbs.
- ☐ The electric current is the same everywhere in the circuit.

How confident are you that your answers to this question are correct? Tick ONE box (✓)

Very confident ☐ Fairly confident ☐ Not confident ☐ Just guessing ☐

3

The five bulbs in this circuit are identical.



(a) How bright will the bulbs be?

Tick ONE box (✓)

- ☐ Bulb 1 is lit. The others are off.
- ☐ Bulb 5 is lit. The others are off.
- ☐ Bulbs 1 and 5 are brightest, then bulbs 2 and 4, and bulb 3 is dimmest.
- ☐ Bulb 3 is brightest, then bulbs 2 and 4, and bulbs 1 and 5 are dimmest.
- ☐ Bulb 1 is brightest, then they get gradually dimmer as you go round the circuit.
- ☐ Bulb 5 is brightest, then they get gradually dimmer as you go round the circuit.
- ☐ All the bulbs are lit with the same brightness.

(b) How would you explain this?

Tick ONE box (✓)

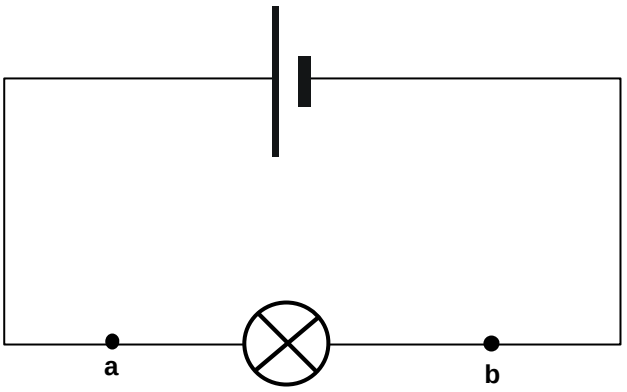
- ☐ The first bulb uses up **all** of the electric current, so there is none left for the others.
- ☐ Each bulb uses up **some** of the electric current, so there is less left for the next one along
- ☐ The electric current is shared between the five bulbs.
- ☐ The current gets weaker as it gets further from the battery.
- ☐ The electric current is the same all round the circuit.
- ☐ The currents from the two terminals of the battery meet at bulb 3.

How confident are you that your answers to this question are correct? Tick ONE box (✓)

Very confident ☐ Fairly confident ☐ Not confident ☐ Just guessing ☐

4

In this circuit, the bulb is lit.



(a) What can you say about the electric current at points **a** and **b**?

Tick ONE box (✓)

- ☐ The electric current at **a** is bigger than at **b**.
- ☐ The electric current at **b** is bigger than at **a**.
- ☐ The electric current is the same size at **a** and **b**.

(b) How would you explain this?

Tick ONE box (✓)

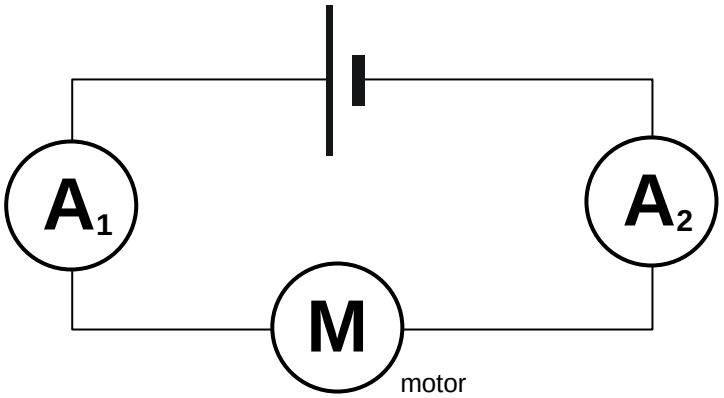
- ☐ The current is the same all round the circuit.
- ☐ **Some** of the current is used up by the bulb.
- ☐ **All** of the current is used up by the bulb.

How confident are you that your answers to this question are correct? Tick ONE box (✓)

Very confident ☐ Fairly confident ☐ Not confident ☐ Just guessing ☐

5

In this circuit, a battery is connected to a motor.
There is a reading on both ammeters.



(a) What can you say about the readings on the two ammeters?

Tick ONE box (✓)

- ☐ The reading on ammeter A_1 is bigger.
- ☐ The reading on ammeter A_2 is bigger.
- ☐ The readings on the two ammeters are the same.

(b) How would you explain this?

Tick ONE box (✓)

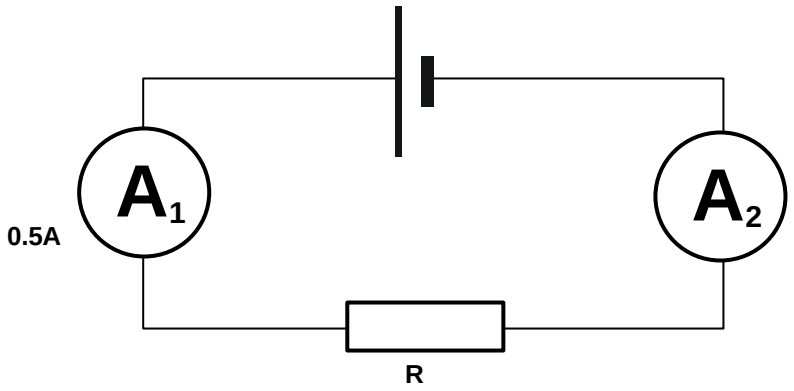
- ☐ The current is the same all round the circuit.
- ☐ **Some** of the current is used up by the motor.
- ☐ **All** of the current is used up by the motor.

How confident are you that your answers to this question are correct? Tick ONE box (✓)

Very confident ☐ Fairly confident ☐ Not confident ☐ Just guessing ☐

6

In this circuit a battery is connected to a resistor, R.
The reading on ammeter A_1 is 0.5 amps.



(a) What will the reading on ammeter A_2 be?

Tick ONE box (✓)

- ☐ More than 0.5 amps
- ☐ Exactly 0.5 amps
- ☐ Less than 0.5 amps, but not zero
- ☐ Zero

(b) How would you explain this?

Tick ONE box (✓)

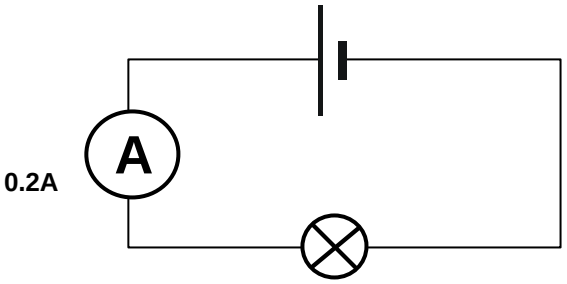
- ☐ **Some** of the current is used up by the resistor.
- ☐ **All** of the current is used up by the resistor.
- ☐ The current is the same all round the circuit.

How confident are you that your answers to this question are correct? Tick ONE box (✓)

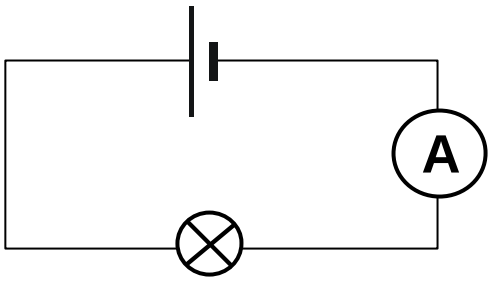
Very confident ☐ Fairly confident ☐ Not confident ☐ Just guessing ☐

7

In this circuit the bulb is lit and the reading on the ammeter is 0.2 amps.



The ammeter is then moved to the other side of the circuit.



(a) What is the reading on the ammeter now?

Tick ONE box (✓)

- ☐ More than 0.2 amps
- ☐ Exactly 0.2 amps
- ☐ Less than 0.2 amps, but not zero
- ☐ Zero

(b) How would you explain this?

Tick ONE box (✓)

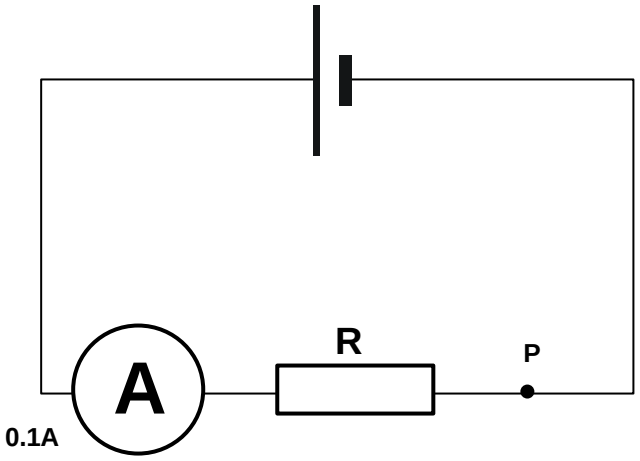
- ☐ The current is the same all round the circuit.
- ☐ **Some** of the current is used up by the bulb.
- ☐ **All** of the current is used up by the bulb.

How confident are you that your answers to this question are correct? Tick ONE box (✓)

Very confident ☐ Fairly confident ☐ Not confident ☐ Just guessing ☐

8

In this circuit, a battery is connected to a resistor, R.
The reading on the ammeter is 0.1 amps.



A second ammeter is then connected into the circuit at point P.

(a) What will the reading on this second ammeter be?

Tick ONE box (✓)

- ☐ More than 0.1 amps
- ☐ Exactly 0.1 amps
- ☐ Less than 0.1 amps, but not zero
- ☐ Zero

(b) How would you explain this?

Tick ONE box (✓)

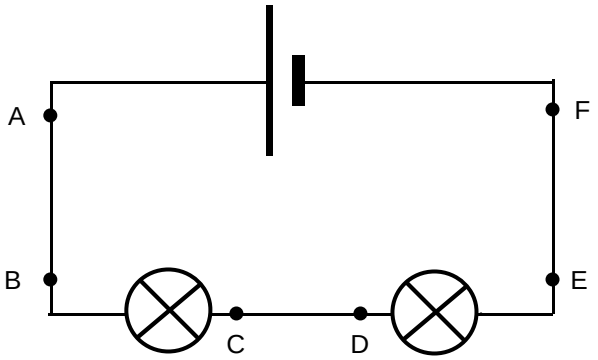
- ☐ **All** of the current is used up by the resistor.
- ☐ **Some** of the current is used up by the resistor.
- ☐ The current is the same all round the circuit.

How confident are you that your answers to this question are correct? Tick ONE box (✓)

Very confident ☐ Fairly confident ☐ Not confident ☐ Just guessing ☐

9

The bulbs in this circuit are both lit.



(a) Which of the following statements is correct about **the wire on the left**?

Tick ONE box (✓)

- ☐ There is an electric current from A to B.
- ☐ There is an electric current from B to A.
- ☐ There is no electric current in this wire.

(b) Which of the following statements is correct about **the wire between the bulbs**?

Tick ONE box (✓)

- ☐ There is an electric current from C to D.
- ☐ There is an electric current from D to C.
- ☐ There is no electric current in this wire.

(c) Which of the following statements is correct about **the wire on the right**?

Tick ONE box (✓)

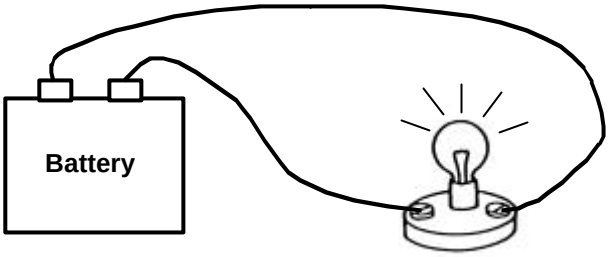
- ☐ There is an electric current from E to F.
- ☐ There is an electric current from F to E.
- ☐ There is no electric current in this wire.

How confident are you that your answers to this question are correct? Tick ONE box (✓)

Very confident ☐ Fairly confident ☐ Not confident ☐ Just guessing ☐

10

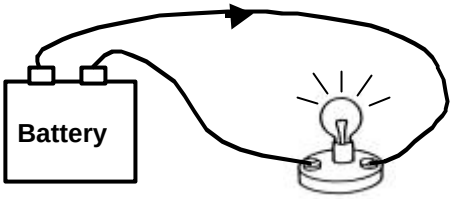
A bulb is connected to a battery.
The bulb is lit.



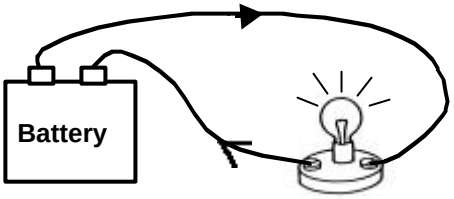
Which of the following best describes the **electric current** in this circuit?

Tick ONE box (✓)

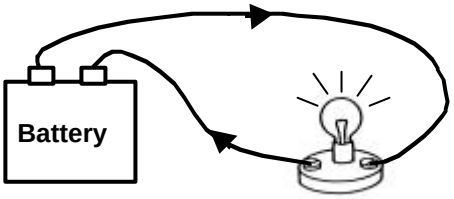
☐ There is an electric current through one wire to the bulb. It is **all** used up in the bulb. So there is **no current** in the other wire.



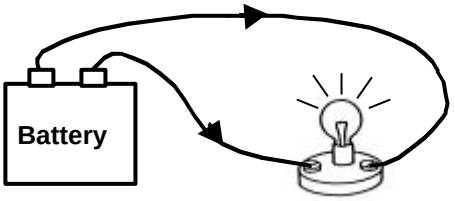
☐ There is an electric current through one wire to the bulb. **Some** of it is used up in the bulb. So there is a **smaller current** in the other wire.



☐ There is an electric current through one wire to the bulb. It passes through the bulb and back to the battery. The current in the other wire is **the same size**.



☐ There are **two** electric currents from the battery to the bulb. They **meet** at the bulb and this is what makes it light.



How confident are you that your answers to this question are correct? Tick ONE box (✓)

Very confident ☐ Fairly confident ☐ Not confident ☐ Just guessing ☐