**Exit ticket**

NAME:

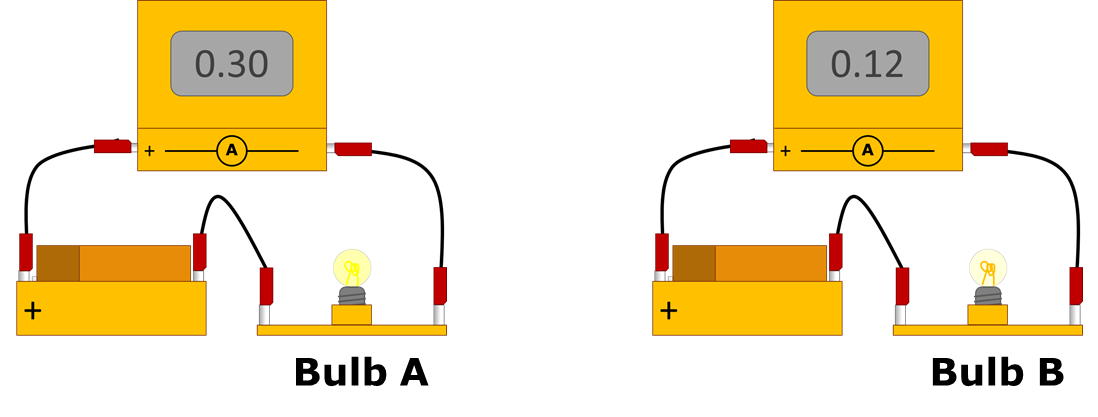
**—**

1. Sienna measures the current through different components.

She uses an ammeter.

She wants to find out which component has the biggest resistance.

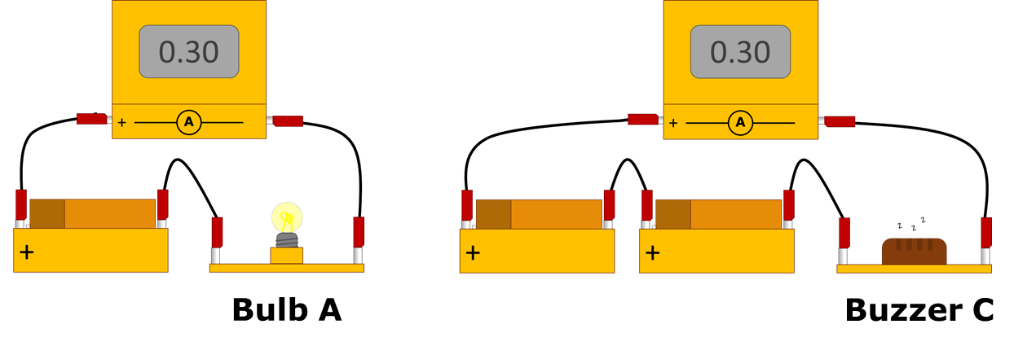
1. Which bulb has the biggest resistance?



*Put a tick (✓) in the box next to the best answer.*

|  |  |  |
| --- | --- | --- |
| **A** | **Bulb A** has a bigger resistance. |  |
|  |  |  |
| **B** | **Bulb B** has a bigger resistance. |  |

1. Which component has the biggest resistance?

****

*Put a tick (✓) in the box next to the best answer.*

|  |  |  |
| --- | --- | --- |
| **A** | **Bulb A** has a bigger resistance. |  |
|  |  |  |
| **B** | The bulb and the buzzer each have the same resistance. |  |
|  |  |  |
| **C** | **Buzzer C** has a bigger resistance. |  |

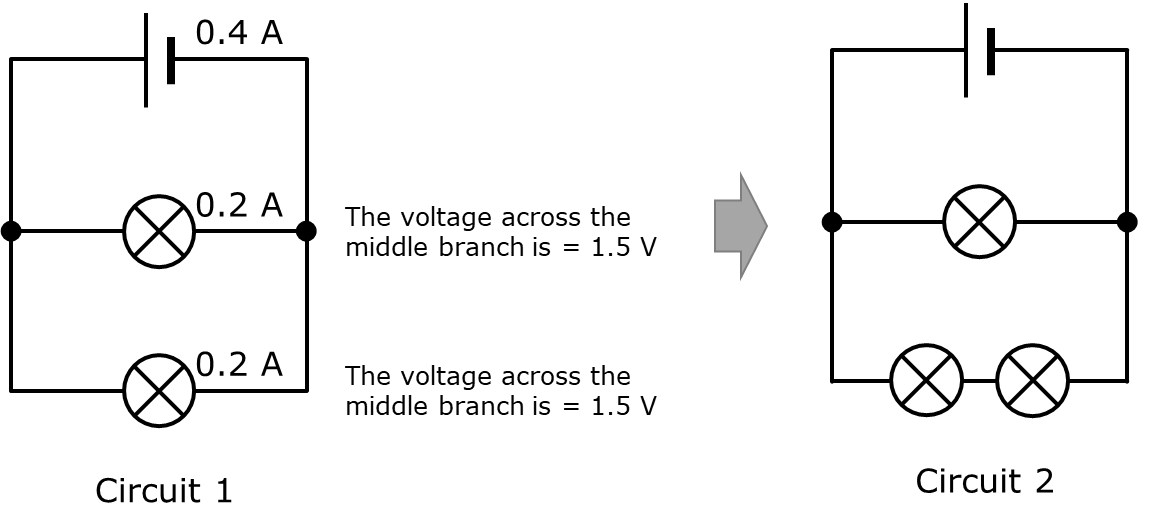
1. Matilda sets up circuit 1.

She measures the current through the battery and through each branch.

She measures the potential difference across each branch.

Matilda adds a bulb to the bottom branch.

The bulb is identical to the other two.



Potential difference across bottom branch = 1.5V

Potential difference across middle branch = 1.5V

What do you think about circuit 2?

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | | I am **sure** this is right | I think this is right | I think this is wrong | I am **sure** this is wrong |
| **A** | Potential difference across the bottom branch is 1.5 V. |  |  |  |  |
| **B** | Current through the battery is 0.4 A. |  |  |  |  |
| **C** | Current through the middle branch is 0.2 A. |  |  |  |  |
| **D** | Resistance of the bottom branch is bigger than the resistance of the middle branch. |  |  |  |  |
| **E** | Current in the bottom branch is 0.2 A. |  |  |  |  |

**FEEDBACK**

**Question 1**

**Expected answers**

1 bulb B

2 buzzer C

**How to respond - what next?**

In question 1 the bulb with the bigger resistance has the smaller current. Because the same voltage is used in each circuit, this question requires a straight forward application of the idea that resistance is as a measure of how hard it is for charge to flow.

Question 2 requires students to recognise that a battery with a bigger potential difference ‘pushes’ harder. If more potential difference is needed to ‘push’ electric charges through the buzzer, to get the same sized current as that which flows through the bulb, this must be because the buzzer has a bigger resistance than the bulb.

If students have misunderstandings about resistance as a measure of how hard it is for electric charge to flow, it can help to use the rope-loop model to elicit students’ explanations of what happens to current when a component with a bigger resistance is swapped into a circuit; and why a different voltage is needed to push charge through the new component so that current is the same size as it was through the first component.

The following BEST ‘response activity’ could be used in follow-up to this diagnostic question:

* Response activity: Ordered resistance (find this here [https://www.stem.org.uk/best/physics/big-idea-electricity-and-magnetism](https://www.stem.org.uk/best/physics/big-idea-electricity-and-magnetism%20under%20Topic%202) under Topic 2 More electric circuits, Key concept 1, Resistance)

**Question 2**

**Expected answers**

A, C and D are correct; B and E are wrong.

**How to respond - what next?**

The idea that the potential difference across each branch is the same as the potential difference across the battery is central to understanding parallel circuits, and in circuit 2 the potential difference across the bottom branch is 1.5V (statement A).

Adding a bulb to the bottom branch increases the resistance of that branch (statement D) and therefore reduces the current through it, so it is now less than 0.2A (~~statement E~~). Because the voltage across the middle branch and its resistance are unchanged, then the current through the middle branch is still 0.2A (statement C).

The current through each branch adds up to the current through the battery, and as the current through the bottom branch is now smaller, the current through the battery is also smaller (~~statement B~~).

It is common for students to consider that the current from a battery is the same, no matter what circuit it is connected to, so it is likely that several students think that statement B is correct. If these students apply the rule for current in a parallel circuit they could incorrectly identify statement E as correct. This contradicts the logic of having increased the resistance in this branch, but when in doubt it is tempting to apply rules blindly!

If students have misunderstandings about what determines current in a parallel circuit, it is likely that they have not understood some of the earlier steps in the progression toolkits for parallel circuits. This is especially true if understanding of potential difference in parallel circuits is not secure. It may be appropriate to use some of the other resources in this key concept to consolidate each step of the thinking about the circuits in this question.

The following BEST ‘response activity’ could be used engage students in small group discussions about these same ideas, in follow-up to this diagnostic question:

* Response activity: Adding a bulb (find this here [https://www.stem.org.uk/best/physics/big-idea-electricity-and-magnetism](https://www.stem.org.uk/best/physics/big-idea-electricity-and-magnetism%20under%20Topic%202) under Topic 2 More electric circuits, Key concept 2, Parallel circuits)