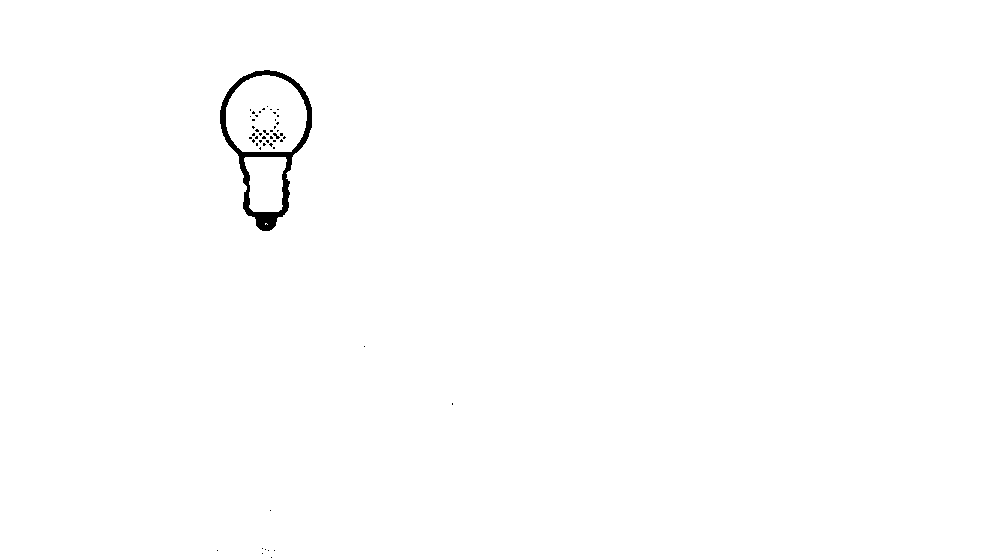
**Bulb Markings**



3.5V 0.3A

This torch bulb has a rating of

3.5V 0.3A

**What does ‘3.5V 0.3A’ mean?**

Look at these statements.

For each statement, tick (✓) **one** column to show what you think about it.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Statement** | | I am **sure** this is correct | I think this is correct | I think this is wrong | I am **sure** this is wrong |
| **A** | To light the bulb must be connected to a 3.5V battery |  |  |  |  |
| **B** | The bulb will ‘blow’ if you connect it to a 4.5V battery |  |  |  |  |
| **C** | The voltage across the bulb is always 3.5V |  |  |  |  |
| **D** | To make it work properly, the voltage across the bulb needs to be 3.5V |  |  |  |  |
| **E** | The current through this bulb is always 0.3A |  |  |  |  |

*Physics > Big idea PEM: Electricity and magnetism > Topic PEM1: Simple electric circuits > Key concept PEM1.3: Voltage*

|  |
| --- |
| **Diagnostic question** |
| **Bulb markings** |

**Overview**

|  |  |
| --- | --- |
| Learning focus: | Voltage is needed to push current through a component; and a particular voltage pushes just the right amount of current through a component for it to work well. |
| Observable learning outcome: | * Describe the effect of too little, or too much, voltage across a component. * Describe the voltage across a component as the strength of ‘push’ being used to get current through the component. * Use the idea of an ‘electrical push’ to explain why different components (usually) work best at a particular voltage. |
| Question type: | Diagnostic, confidence grid |
| Key words: | voltage, current |

|  |  |
| --- | --- |
| **P** | **PRIOR UNDERSTANDING – for the first of the three observable outcomes**  This diagnostic question probes understanding of ideas that are usually taught at age 5-11, to aid transition from earlier stages of learning. |

**What does the research say?**

The majority of students confuse ideas of voltage and current, typically they think of voltage as part of the current (Shipstone, 1985). Many students also have difficulty in applying their concepts of current [and voltage] to novel situations (Gott, 1984)

This activity gives students the opportunity to reflect on voltage as an ‘electric push’ and current as a flow of electric charge by considering how current is pushed through a bulb, and the effects that the current has on the bulb.

**Ways to use this question**

Students should complete the confidence grid individually. This could be a pencil and paper exercise, or you could use an electronic ‘voting system’ or mini white boards and the PowerPoint presentation.

If there is a range of answers, you may choose to respond through structured class discussion. Ask one student to explain why they gave the answer they did; ask another student to explain why they agree with them; ask another to explain why they disagree, and so on. This sort of discussion gives students the opportunity to explore their thinking and for you to really understand their learning needs.

*Differentiation*

You may choose to read the questions to the class, so that everyone can focus on the science. In some situations it may be more appropriate for a teaching assistant to read for one or two students.

**Expected answers**

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

**How to respond - what next?**

**D** is the best answer.

**Answer B** may be correct, but there is no hard evidence that it is. An increased voltage pushes more current through the bulb. If the moving charge shifts energy to the bulb quickly enough then the filament (thin wire in bulb) will melt and the bulb ‘blows’.

**Answer A** suggest that students’ recognise the bulb works best at a specified voltage, but their answer is based on experience rather than understanding of how the bulb is lit - by energy shifting from the moving charge. E.g., experience shows that phones only work with a charger that provides a particular voltage.

**Answers C and E** suggest the bulb controls the voltage and the current through it no matter what the circuit. House lights are always connected to 230V and can *appear* to work in this way.

If students have misunderstandings about how components often work best at a specified voltage, it may be helpful for them to observe and discuss the effects of changing the voltage supplied to a component with a known voltage rating. The following BEST ‘response activity’ could be used in follow-up to this diagnostic question:

* Response activity: Bigger voltage

**Acknowledgments**

Developed by Peter Fairhurst (UYSEG), from EPSE E05-604.

Images: EPSE

**References**

Gott R. (1984). *Electricity at age 15: a report on the performance of pupils at age 15 on questions in electricity*. London: Dept. of Education and Science, Welsh Office, Dept. of Education for Northern Ireland.

Shipstone, D.M. (1985). Electricity in simple circuits. In Driver, R. (Ed.), Children’s ideas in science (pp. 33-51). Milton Keynes: Open University Press.