**Will it work?**

Look at each circuit

Answer the question for each circuit

|  |  |
| --- | --- |
| 1 | Will the bulb light? |
| 2 | Will the bulb light? |
| 3 | Will the bulb light? |
| 4 | Will the bulb light? |
| 5 | Will the bulb light? |

|  |  |
| --- | --- |
| 6 | Will the bulb light? |
| 7 | Will the buzzer work? |
| 8 | Will the motor work? |
| 9  B  A | Which bulb / bulbs will light? |
| 10  B  A | Which bulb / bulbs will light? |

|  |  |
| --- | --- |
| 11 | Will the bulb light? |
| 12    A B | Which bulb / bulbs will light? |
| 13    A B | Which bulb / bulbs will light? |
| 14  Metal nail  (a conductor) A B | Which bulb / bulbs will light? |
| 15  Plastic spoon  (an insulator) A B | Which bulb / bulbs will light? |

*Physics > Big idea PEM: Electricity and magnetism > Topic PEM1: Simple electric circuits > Key concept PEM1.1: Making circuits*

|  |
| --- |
| **Diagnostic question** |
| **Will it work?** |

**Overview**

|  |  |
| --- | --- |
| Learning focus: | An electric circuit is a closed conducting loop containing a battery. |
| Observable learning outcome: | * Predict if a circuit will work, by tracing the circuit to find out if it is complete * Describe how a simple circuit can be used to identify conductors and insulators |
| Question type: | diagnostic, simple multiple choice |
| Key words: | electric circuit, complete circuit, conductor, insulator |

|  |  |
| --- | --- |
| **P** | **PRIOR UNDERSTANDING**  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?**

There has to be a closed loop of conducting material, from one end of the battery or power supply, through the device and back to the battery. This is a key idea about electricity that pupils have to learn, and it is important that they grasp it securely before progressing to other ideas (Shipstone, 1985).

It is good practice to trace the circuit around the circuit from different places (not always the battery) and in different directions. This method does not reinforce the misunderstanding that the current begins at the battery and moves sequentially around the circuit.

**Ways to use this question**

Students should complete the question 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.

The answers to the question will show you whether students understood the concept sufficiently well to apply it correctly.

If many of the students show misunderstanding you may wish to demonstrate the ideas with circuits on the bench.

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.

**Equipment**

For the optional demonstration:

* Electric circuit equipment if you wish to demonstrate any of the circuits

**Expected answers**

1 yes, 2 no, 3 no, 4 no, 5 no

6 no, 7 yes, 8 no, 9 A lit and B off, 10 A lit and B off

11 no, 12 A and B both off, 13 A and B both off, 14 A and B both on, 15 A and B both off

**How to respond - what next?**

Circuit 6 does not contain a battery. Circuits 1, 2, 5, 7, 9, 11, 12 and 13 are simple loop circuits, in which wires are connected correctly to components (to the correct terminals), and which are or are not complete.

Circuits 3, 4, 8 and 10 all contain a component with both wires connecting to the same terminal on a component. On some of these examples students will be seeing a loop, but not one that goes *through* the components.

Circuits 14 and 15 test the idea that ‘electricity’ can flow through a conductor, but not an insulator, and a complete conducting loop is necessary for a circuit to work. An investigation to identify insulators and conductors in a simple test circuit is usually completed below age 11.

If students have misunderstandings about tracing a circuit to find out if it is complete it is helpful to show them how to trace the circuit *through* different circuits whilst explicitly tracing the circuit through each component.

If students have misunderstandings about how conductors and insulators affect a complete circuit it would be useful to complete a practical investigation to find out which types of materials are electrical conductors and which are insulators.

**Acknowledgments**

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Images: EPSE

**References**

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