**Circuit from a diagram**

Can you set up electric circuits to make things work?

Look at this circuit.

|  |  |
| --- | --- |
| **C:\Users\pf650\AppData\Local\Temp\Temp1_circuitpictures.zip\IMG_1324.JPGA** | **C:\Users\pf650\AppData\Local\Temp\Temp1_circuitpictures.zip\IMG_1323.JPGB** |
| **C:\Users\pf650\AppData\Local\Temp\Temp1_circuitpictures.zip\IMG_1322.JPGC** | **C:\Users\pf650\AppData\Local\Temp\Temp1_circuitpictures.zip\IMG_1321.JPGD** |

Which picture shows this circuit set up in the right way?

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

|  |
| --- |
| **Diagnostic question** |
| **Circuit from a diagram** |

**Overview**

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| --- | --- |
| Learning focus: | Electric circuits are represented using circuit symbols and specific circuit diagram conventions |
| Observable learning outcome: | • Interpret circuit diagrams to build series circuits |
| Question type: | Diagnostic, simple multiple choice |
| Key words: | electric circuit, motor, ammeter, bulb |

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| --- | --- |
| **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?**

Building complete circuits is an idea that many students have seen earlier in their learning, but if this is their first experience of electric circuit work in a new school then unfamiliar equipment and surroundings will impair their ability to recall what they know (Solomon, 2000).

Students generally set up circuits correctly if they approach circuit building in a systematic way. E.g. starting at one point in the circuit and connecting each component or wire in order, going clockwise or anti-clockwise from that point. However if students always start at the battery then this may reinforce the misunderstanding that electric charge originates at the battery and moves sequentially through each component in turn. Starting with different components each time mitigates this concern.

Most students are competent in recognising circuit symbols and using circuit diagrams to answer questions, but difficulties arise whenever students translate a circuit diagram into a real circuit (Gott, 1984).

Being able to interpret circuit diagrams, and to build a circuit successfully, is essential if students are to use electric circuits to develop their understanding of electricity.

**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 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.

You may wish to set up the circuit on the bench to demonstrate the process of setting up the circuit systematically after students have given their answers.

*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:

* x3 1.5V battery
* Motor
* Ammeter
* Bulb in holder
* x6 connecting wires

**Expected answers**

Circuit D

**How to respond - what next?**

Circuit A has a voltmeter instead of an ammeter. Some students do not discriminate between voltmeters and ammeters.

In circuit B, the bulb and the ammeter are swapped, and in circuit C the ammeter and motor are switched. These choices show the student has identified the components, but not in the systematic way, and is copying the layout of the components rather than their order around the circuit.

Circuit D is correct because the components are in the right order around the circuit, even though they do not map the layout in the circuit diagram.

If students have misunderstandings about whether a circuit is set up correctly from a diagram, it will help to show them how to set up circuits systematically and give them practise in doing so. That is to start at one point in the circuit and follow the connections round one after the other in a loop until the loop is complete. The following BEST ‘response activity’ could be used in follow-up to this diagnostic question:

* Response activity: Building circuits (2)

**Acknowledgments**

Developed by Peter Fairhurst (UYSEG)

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.

Solomon, J. (2000). Electricity and magnetism. In Sang, D. (Ed.), Teaching secondary physics (pp.139-186). London: John Murray (Publishers) Ltd.