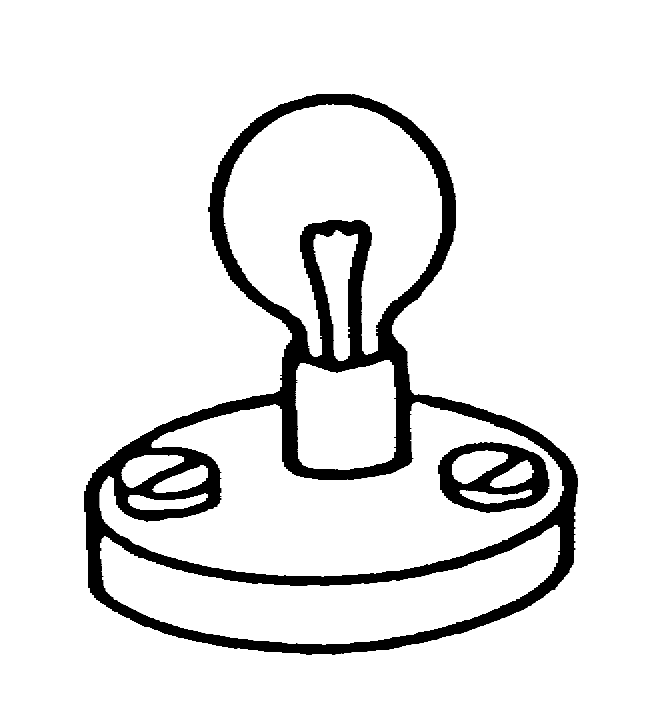
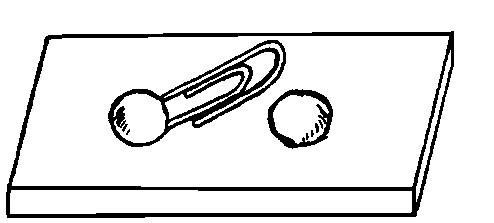
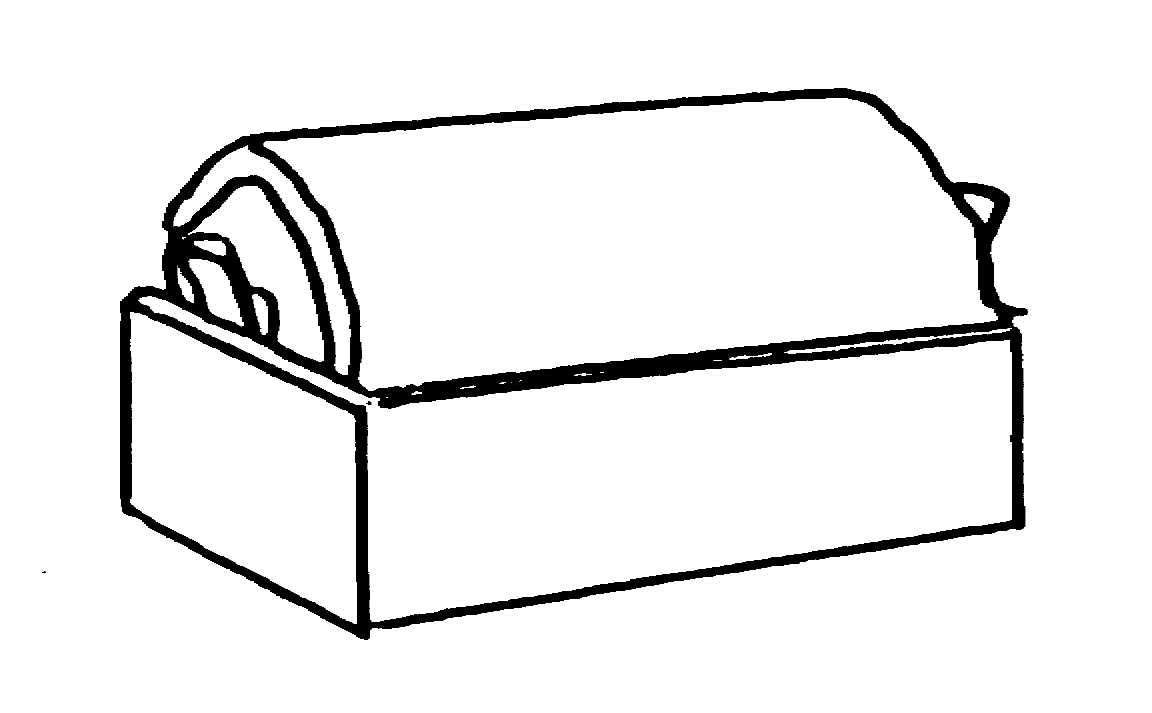
**Circuit diagrams (1)**

Look at this circuit



Circuit diagrams show us how to connect a circuit:

|  |  |  |
| --- | --- | --- |
| **1** | **2** | **3** |
| **4** | **5** | **6** |

Which of the circuit diagrams show how to connect the circuit?

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

|  |  |  |
| --- | --- | --- |
| **A** | Just circuit diagram 1 |  |
|  |  |  |
| **B** | Just circuit diagram 5 |  |
|  |  |  |
| **C** | Circuit diagrams 1 and 3 |  |
|  |  |  |
| **D** | Circuit diagrams 1, 2 and 3 |  |
|  |  |  |
| **E** | Circuit diagrams 1, 3, 4 and 5 |  |

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

|  |
| --- |
| **Diagnostic question** |
| **Circuit diagrams (1)** |

**Overview**

|  |  |
| --- | --- |
| Learning focus: | Electric circuits are represented using circuit symbols and specific circuit diagram conventions |
| Observable learning outcome: | • Identify circuit diagrams that represent a series circuit by tracing round the circuit |
| Question type: | Diagnostic, simple multiple choice |
| Key words: | electric circuit, circuit symbol, bulb, switch |

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

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.

Gott (1984) notes that 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 and vice-versa. He goes further to suggest that students often think of a circuit diagrams as a map of a circuit, when in fact it is a stylised representation, drawn in a particular way to increase its clarity.

**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 class (optional demonstration):

* 1.25V bulb in holder
* 1.5V battery in holder
* Switch
* x3 connecting wires

**Expected answers**

Answer D

**How to respond - what next?**

Answer A is one of three possible correct answers. This answer shows students are viewing the circuit diagram as a direct copy of the circuit, but using symbols and circuit diagram conventions to make it neat. Answer B is the same thing except that they have got the battery back to front which shows they do not know which the positive end is on the circuit symbol. (They may not know this for choice A either).

Answer E shows that the student is tracing round the circuit and identifying each component in turn. They do may not realise that the battery symbol shows which way round the battery should be, or they may think that it just does not matter.

Answer C shows that the student is tracing round the circuit and identifying each component in turn, and they have recognised the direction of the battery shown on the circuit symbol. They have failed to recognise that they can trace around the circuit in both directions and that circuit 2 is simply circuit 1 set out the opposite way round. This leads onto the correct answer D.

If students have misunderstandings about identifying circuit diagrams that represent a series circuit, it will help to set up the circuit, with long connecting wires, and show them how it can/cannot be arranged into the different representations. Alternatively you can set up circuits 1, 2 and 3 together, so they look exactly like the circuits in the diagrams, and then, without disconnecting wires, rearrange them to show they are the same.

**Acknowledgments**

Developed by Peter Fairhurst (UYSEG) from EPSE E09-001

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.