**Fixing Circuits**

When we set up an electric circuit it sometimes doesn’t work. We then need to test it to find out what is wrong.

**Apparatus and materials**

* 1.5 V battery
* 1.25 V bulb in holder
* X2 connecting leads

**Procedure**

Test each circuit to find out which part(s) needs to be replaced

* For each circuit say what needs replacing.
* Draw a circuit diagram to show the faulty part(s).

**Observations**

|  |  |
| --- | --- |
| Circuit 1 | Circuit 2 |
| Circuit 3 | Circuit 4 |

|  |  |
| --- | --- |
|  |  |
| Circuit 5 | Circuit 6 |
| Circuit 7 | Circuit 8 |

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

|  |
| --- |
| **Response activity** |
| **Fixing circuits** |

**Overview**

|  |  |
| --- | --- |
| Learning focus: | An electric circuit is a closed conducting loop containing a battery. |
| Observable learning outcome: | * Explain how to fault find, and fix, a more complicated series circuit without taking it apart |
| Activity type: | Response, application and practice, practical experiment |
| Key words: | Complete circuit, electric circuit, component |

This activity can help develop students’ understanding by addressing the sticking-points revealed by the following diagnostic question:

* Diagnostic question: Circuit repair

**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).

Students generally set up circuits, and fault find, correctly if they approach the circuit in a systematic way. E.g. starting at one point in the circuit and moving from component to component in order, going clockwise or anti-clockwise from that point.

Confidence in building circuits and quickly fixing faults, will allow students to more easily construct and interpret the circuits they will use to develop their thinking on the more challenging aspects of electricity later on.

**Ways to use this activity**

This practical activity gives students the opportunity to practise applying their understanding and to clarify their thinking through discussion. To support this, students should complete the practical in pairs or small groups.

Eight circuits are set up round the room, each with a faulty component or two. Ask students to identify the faulty component(s) in each circuit without taking the circuit apart. They should experiment with the equipment given to them to find quick ways to test each component in situ.

Students should record a list of replacements necessary for each circuit. They need to practise using precise descriptions or diagrams to identify the specific component each time.

You may wish to ask students to draw up a flow chart to describe the steps they need to take to fault-find in a circuit.

Listening to individual groups as they work often highlights any difficulties they might have. These can often be overcome, through a whole class clarification or redirection part way through the activity.

Asking students to report their findings at end of the practical work is a useful check. After a group has fed back, it might be helpful to model an even better answer. You could do this, for example, by asking another group to add to, or clarify, the first observation. Then ask another group to sum up the important part of the observation, and so on.

*Differentiation*

You may choose to set up simpler circuits for some students.

For an extra challenge, some of the circuits could have more than one faulty component or wire.

**Equipment**

For each student/pair/group

* 1.5 V battery
* 1.25 V bulb in holder
* X2 connecting leads

For the class

* **A circus of x8 series circuits** set up with multiple components. In each circuit, one of the components or wires is broken.

**Technician notes**

Eight series circuits are needed made up from a range of components. One component in each circuit should be faulty.

If possible use one colour of wire for the circuits and another colour for students to use for their test circuits. This will make it less likely that the circuits are altered during the course of the practical work, although slight alterations are not critical.

**Health and safety**

**Mains electricity:** students should be reminded that wires should never be pushed into electrical sockets. It should be made clear to them that mains supply can kill.

If there are students in your class who are at risk of ignoring this advice, then it is advisable to turn off the power to the electrical sockets in your room.

Practical work should be carried out in accordance with local health and safety requirements, guidance from manufacturers and suppliers, and guidance available from CLEAPSS.

**Expected answers**

Students show that they can find a faulty wire or component using a variety of techniques:

|  |  |
| --- | --- |
| Component being checked | Strategy |
| Battery | Connect a working bulb directly to the battery. |
| Bulb | Connect a working battery to either side of the bulb. |
| Wire | Connect a working wire to the same connections as the wire being tested. If the circuit starts working, the wire is faulty. |
| More than one wire or component? | If more than one wire or component is broken then the previous methods will not work.  Connect a battery and bulb to make a complete circuit that works. Use this circuit to test each component in the original circuit in turn, in a methodical order. |

**Acknowledgments**

Developed by Peter Fairhurst (UYSEG).

**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.