

KS3 Electricity Lesson 6: Resistance Teaching Ideas

Learning Objective: To investigate resistance in circuits.

Success Criteria:

- To recall the definition of resistance.
- To carry out an investigation to determine how changing a variable can affect the resistance in a wire.
- To calculate the resistance of data from a given formula.

Context: This is lesson 6 in a series of lessons that covers the topic of KS3 electricity with a focus on resistance in a circuit. Students are asked to imagine that they are working for a local farming company as an electrical engineer fitting electric fences. The electric fence in the cow field has recently blown down during a storm. Students are asked to test the resistance of five different lengths of wire with the aim of finding the length of wire that has the lowest resistance. The farming company, as an additional task, would like students to calculate the resistance of each of the five lengths of wire. The results of the test will help the company to select the lengths of wire they will use for other animal pens on the farm. You can teach this lesson as a stand-alone lesson or use it to form the wider unit of work on the introduction of electricity. The choice is yours!

Resources

power pack
five different lengths of copper wire (20, 40, 60, 80, 100cm)
crocodile clips
three circuit wires
ammeter
graph paper

Starter

Circuit Symbol Bingo

Ask students to choose four words from the following list and write them in the spaces on the grid:

bulb, open switch, closed switch, ammeter, voltmeter, motor, battery and conductor.

Read out questions from the [Circuit Symbol Bingo Question Sheet](#). The first pupil to get all four words shouts bingo!

Main Activities

Resistance

You can choose this section to introduce students to the idea of resistance in a circuit. Ask students what they think resistance in a circuit is and how do temperature, the width of a wire, length of a wire and the material affect resistance? An increase in temperature causes an increase in resistance. This is because as the flow of charges moves through the metal, the charges collide with the metal ions. The temperature causes the metal ions to vibrate more and so makes it difficult for the charges to flow. This results in an increase in resistance. In a longer wire, the flow of charges has to travel a greater distance and so the flow of charges collide with metal ions more often. The smaller the diameter of the wire, the smaller the area that the flow of electrons can travel through. This results in an increase in resistance.



Models of Resistance

You can choose to model the activity with students or you may wish to gather ideas from the class about the image and create a mind map.

To model the activity with students, create two rows using chairs on either side to represent different widths of wire. Select 10 students for each width of the wire and ask them to walk through the line of chairs. The students represent a flow of charges going through the wire. You may wish to question students about which width of wire was the easiest for the charges to flow through.

Students should find that the wider the diameter, the easier it was for the flow of charges to move down the wire and hence why the amount of resistance is low. Strengths of the model are that it shows a flow of charges moving through a wire. However, it fails to show how charges collide with metal ions on their journey through the wire.

Resistance Investigation

Provide students with the context of the lesson and the investigation. Students should imagine that they currently work as an electrical engineer fitting electric fences for a local farming company. The electric fence in the cow field has recently blown down during a storm. You need to fence off the cow field but for safety reasons, you can only use 3V of electrical energy. Students need to select a wire that will carry the maximum amount of current. They have been asked to test the resistance of five different lengths of wire with the aim of finding the length of wire that has the lowest resistance. As an additional challenge, the company would like students to calculate the resistance of each of the five lengths of wire.

Before you begin the practical investigation, present students with a selection of the equipment and ask students to suggest how they could build a circuit to measure the resistance in a wire. There is a step-by-step method for those students who may need more support for this task.

Provide students with the following investigation sheet, [Resistance Investigation](#), for their ability level.

Ask students to make a prediction about what they think might happen. Will the length of the wire affect the resistance? At this point, you may choose to remind students how to write a method. Go through the two examples of how to make a cup of tea, on the board and ask students to suggest the good and bad points of each method and how they may apply this to their own work. After demonstrating the practical to the class, you may wish to ask students to write the method. Allow students time to self-assess their method. You may choose to do this as a peer-assessment activity instead.

Teacher note – please check that this lesson and its experiment are suitable for your learning environment. Twinkl accepts no responsibility for injury caused in the carrying out of this lesson.

The Conclusion and Evaluation

After students have been given time to complete the investigation, there is scope for a class discussion on the findings of the investigation. Question students on how they might improve the practical for next time and discuss some of the problems they encountered and how they overcame them. Depending on the ability of the class, you may choose to do this as a mind map or a discussion. Allow students time to self-assess the findings from the investigation and correct any mistakes. You may choose to do this as a peer-assessment activity instead.

Extension

Once students have a set of results, you may choose to ask them to draw a graph. The graph should be a line graph with a line of best fit drawn. If students' results do not lie close to the line of best fit, ask them to comment on why they may have anomalous results.

Plenary

Crazy 8: What's the Word?

There are eight questions for students to answer that all have a one-word answer. You may choose to allow pupils to play individually or as a pair. Allow students time to self-assess or peer-assess their answers, if you wish.

