STEMkey
Teaching standard STEM topics with a key competence approach

STEMkey
Module IO8

Electricity

Activity 4 - Ohm’s law and Electric shocks

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IV. Ohm's law and Electric shocks

Activity 3. Ohm's law and Electric shocks

Work in pairs

120 min

Learning Outcomes

Knowledge: Understand Ohm's law, know how to use electric current in different daily life situations and understand the effects of electric current in the human body.

Skills: Plan an investigation to investigate a research question, observe and record the results, critique experimental design and draw conclusions.

Attitudes: Foster creativity during the planning, investigation and find solutions/explanations to the research question.

Pre-service and in-service teachers should apply previous knowledge on series and parallel circuits, as well as tension, current and know how to measure electrical quantities, I and U.

Session description

This activity starts with four questions, regarding the use of current and their effects in human body. To answer the questions, pre-service teachers and in-service teachers begin searching in the internet for three components that allow building an electrical circuit. Then, they plan an investigation, carry out their plan, collect and analyse data and draw conclusions. Finally, they describe Ohm's law based on an internet search. All pre-service and in-service teachers, should participate in the discussion of the results, suggesting ongoing paths, pointing research problems and how they can be organized. The final challenge involves questions 6 to 10. In this part of the activity, pre-service and in-service teachers search on the internet values of human body electrical resistance, with dry and damp skin. Then, they determine the current that passes through the human body when it is subjected to a potential of 12 V (car battery), with dry and wet hands, using Ohm's law. To understand the effect of current in these two conditions, i.e., with dry and wet hands, they cause the information shown in the table. At this point in the activity, pre-service and in-service teachers answer initial questions. Teachers' educators can also use a simulator of an electrical circuit (e.g., https://phet.colorado.edu/sims/html/circuit-construction-kit-dc/latest/circuit-construction-kit-dc_en.html) and explore with pre-service and in-service teachers.

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Interdisciplinary Approach

The activity shows the close relationship between physics, biology, math and technology and show how pre-service and in-service teachers can develop responsibility in their own learning, as well as develop emotional and scientific literacy.

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Activity 4: Ohm´s law and Electric Shocks

Worksheet

Many people are damaged each year by current from common 120-V electric circuits. To prevent, it is necessary to know how to use electric current and to know its effects on the human body. The answers to the following questions assess your knowledge of these issues.

Is an electric shock with a 12V car battery dangerous?

Why should you handle electrical equipment with dry hands?

Are the effects of electric shocks on the human body, when it is crossed by an electric current, all the same? What does this electric current depend on?

Is it safe to use the hairdryer barefoot in a wet bathroom?

Explore items 1 to 5 to answer the four questions above.

1. Search on the internet for three components that allow you to build an electrical circuit. Write the components selected and justify your options.

2. Using the components selected, plan an investigation to measure the value of the tension in an electrical circuit (U) divided by the current that flow through it (I). Write your plan.

3. Carry out the plan and collect the values of U and I in the electrical circuit. Repeat the procedure using three different voltage sources. Determine U/I.

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4. Draw a conclusion about the results.

5. Search in the internet information about the law, related with numerical equation explored in the previous question.

Let's answer the initial questions...

6. Search on the internet how much resistance the human body is worth, with dry skin and damp skin. Collect the values.

7. Consider the table below (Hewitt, 2015).

TABLE 1 EFFECTS OF ELECTRIC CURRENTS ON THE BODY

Current (A)	Effect
0.001	Can be felt
0.005	Is painful
0.010	Causes involuntary muscle contractions (spasms)
0.015	Causes loss of muscle control
0.070	If through the heart, causes serious disruption; probably fatal if current lasts longer than 1 s

8. Determine the electric current that passes through the human body when you touch one of the terminals of a 12-V battery with one hand and the other terminal of the battery with the other:

a) With the skin of the hand dry.

b) With the skin of the hand damp.

c) Look table 1 and write if an electric shock with a 12 V car battery is dangerous.

9. Why should electrical equipment be handled with dry hands? Explain your reasoning.

10. Are the effects of electric shocks on the human body when it is crossed by a current all the same? What does this electric current depend on?

11. It is safe to use a 120 V hair dryer barefoot in a wet bathroom? Explain your reasoning.

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