**Go-Lab**

Global Online Science Labs for Inquiry Learning at School

*Collaborative Project in European Union’s Seventh Framework Programme Grant Agreement no. 317601*



**Inquiry Learning Space (ILS): Electricity - An Alternative approach of Ohm's Law**

 

**About Go-Lab**

The Go-Lab project aims to encourage young people to engage in science topics, acquire scientific inquiry skills, and experience the culture of doing science by undertaking active guided experimentation. Targeting students from 10 to 18 years old, Go-Lab offers the opportunity to perform personalized scientific experiments with online labs in pedagogically structured and scaffold learning spaces that are extended with collaboration facilities.

The Go-Lab thus offers students:

* access and use of scientific instruments (remote and virtual laboratories) for investigations
* access to research data and archives
* use of advanced tools for data acquisition, analysis, and visualization
* structured learning spaces based on a well-defined inquiry cycle
* cognitive scaffolds for the inquiry process
* facilities and support for communication and collaboration on scientific topics and data

One of the main components of the Go-Lab Portal is the Inquiry Learning Space (ILS). Inquiry Learning Spaces are online labs embedded in resources and scaffolds to offer students a complete inquiry learning experience. The Go-Lab portal offers school teachers the possibility to create learning spaces customized for their classes and students or to adapt existing inquiry spaces. Another benefit of Go-Lab is the possibility to share Inquiry Learning Spaces with other teachers and adapt it to fit their purpose.

Below you will find the content of the “Electricity - An Alternative approach of Ohm's Law” ILS which can be accessed also online under:

<http://graasp.eu/ils/54ad280351830bd46a66658a?lang=en>

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# Orientation

Dear Student,

The term electricity is used in everyday life to describe a wide range of phenomena involving the flow of electric current. However, electricity is a general term and the variety of the phenomena of electricity is described with more specific terms. In order to begin your lesson, brainstorm with your teacher and peers looking for keywords that come to mind when you hear the term 'electricity'. In the Orientation phase you will familiarize yourself with electric circuits, the current that flows through them and the two kinds of setups, parallel and in series. Learn more about electricity and the concepts related to electric circuits.

## Related resources

* + YouTube video 1: [https://www.youtube.com/watch?v=k7aPL5cnYsM&feature](https://www.youtube.com/watch?v=k7aPL5cnYsM&amp;feature)
    - Electrical Circuits: The Basics: Arc Mapping, or Arc Fault Circuit Analysis, uses the electrical system to help reconstruct a scene, providing investigators with a means of determining the area of a fire's origin. This module shows how electrical circuits can be damaged by fire, discusses how electrical arcs occur, defines and describes the arc mapping technique, and provides tips for how to present arc mapping technique and findings in legal proceedings.
  + YouTube video 2: <https://youtu.be/VnnpLaKsqGU>
    - Explaining an Electrical Circuit: A simple explanation on how an electrical circuit operates.
  + YouTube video 3: <https://youtu.be/RQ3djos_LY8>
    - Types of Electrical Circuits: Explaining different types of circuits including series and parallel circuits.

# Hypothesis

In the Hypothesis phase you will use the concepts you noted in the Orientation phase in order to create a concept map about electric circuits, and form groups to create specific hypotheses you will investigate in the next phase.

## Related resources

* + Concept map tool: <http://graasp.eu/ils/54ad280351830bd46a66658a?lang=en>
    - Use the Concept map tool and try to relate concepts you noted in the previous phase. You can access your notes in the "Tools" bar at the bottom of the phase. Discuss with your teacher about the concept map you created considering the questions below:
      * How many ways an element can be connected to a battery in order to create a circuit?
      * What happens if more than one element is connected to a circuit?
      * Does the electric current change each time we add an element on a circuit?
      * What happens to a circuit if we increase the voltage?

In order to answer some of the previous questions you discussed before, you are about to conduct investigations. But first you have to form group with the help of your teacher. Discuss with your teacher about the elements (bulb or battery) your group is going to investigate and how it affects the current of the electric circuit. This means that you will add bulbs or batteries in a circuit in order to investigate what changes are happening to the electric current.

* + Hypothesis Scratchpad tool: <http://graasp.eu/ils/54ad280351830bd46a66658a?lang=en>
    - Formulate your hypotheses according to your expert specialization. In order to do this, use the Hypothesis Scratchpad tool.

A good hypothesis can be formulated in the form of an "If ... then..." statement, which will include one dependent variable and at least one independent variable. This is an example of how variables are linked in a hypothesis: "If the independent variable increases, then the dependent variable decreases." We should incorporate only one independent variable in each hypothesis. This will ensure that we will investigate the impact that this variable has on the dependent variable.

# Experimentation

In the Experimentation phase you will form expert groups in order to design and carry out your experiment. First you will familiarize yourself with the Electrical Circuit Lab in order to identify the variables and design your experiment. Then you will proceed by carrying out your experiment and collecting your data.

## Related resources

* + YouTube video : <https://youtu.be/w9p_j6qng3o>
    - Electrical Circuit Lab: In this video you will see how you can create an electric circuit, take measurements with the meters and draw graphs.

Discuss with your teacher and peers how you will carry out your experiment in order to confirm or reject your hypothesis. Now form expert groups. Each expert group is going to specialize on a different circuit setup. For example, if your group is consisted

of 4 members, two of you will specialize on the parallel setup and the other two on the in series setup. This means that the "in series setup" experts will manipulate the number of the element (bulb or battery) added on a series circuit. Respectively, the "in parallel setup" experts will manipulate the element (bulb or battery) added on a parallel circuit. Your teacher will provide more instructions on how to form your expert groups.

* + Experiment Design tool: <http://graasp.eu/ils/54ad280351830bd46a66658a?lang=en>
    - Use the Experiment Design tool to plan and design your experiments. Follow the step by step instructions in order to complete your experiments.
  + Electrical Circuit lab: <http://graasp.eu/ils/54ad280351830bd46a66658a?lang=en>
    - Conduct your experiments in the Electrical Circuit lab. You have to vary only one variable at a time.

# Data Interpretation

In the Data Interpretation phase, you will use the Data Viewer to graph your data and examine the relation among the different variables.

## Related resources

* + Data Viewer tool : <http://graasp.eu/ils/54ad280351830bd46a66658a?lang=en>
    - The Data Viewer tool will help you to create data graphs and/or tables for all the measurements you recorded for the independent and dependent variables of each of your hypotheses.
    - Interpret your data trying to find relations among variables. If you don't have enough data, return to the Experimentation phase and collect more data.

# Conclusion

In this phase, you will use the Conclusion tool to retrieve your previous work (hypothesis, data, graphs, etc.) and form your conclusions. Your conclusions should be justified based on the evidence collected during the investigation and provide an answer to whether the hypothesis was supported or rejected.

1. Conclusion tool: <http://graasp.eu/ils/54ad280351830bd46a66658a?lang=en>
2. Presentation:

o Now, in your expert group you have to prepare a 5 minute presentation (Power point) about your expert conclusions. Try to give enough evidence from your experimentation in order to reject or confirm your hypotheses. Don't forget to save your presentation and give it a label with the names of your expert group members. Then, a member of each group has to upload the presentation in the File Drop: <http://graasp.eu/ils/54ad280351830bd46a66658a?lang=en>

# Communication

Now you have completed your work as experts. In the Communication phase you will return to your initial group and share your conclusions. Share your results with your group-mates. You can find your expert conclusion in the File Drop. Each expert must inform the other members of his/her team about his/her conclusions. As a group you will come to a final conclusion.

Write your general conclusion in the text box: <http://graasp.eu/ils/54ad280351830bd46a66658a?lang=en>

Your teacher will introduce Ohms' law and you will determine, based on your conclusions, whether the law is plausible (I vs. V and I vs. R). Try to provide enough evidence in order to verify Ohm's law.

# Reflection

In this Reflection phase you will engage in reflection activities which will help to think critically and improve your learning process.

## Related resources

* + Reflection tool: <http://graasp.eu/ils/54ad280351830bd46a66658a?lang=en>
    - Did you spend relatively more time than could be expected in one or more of the phases? If so, please consider why this was the case (e.g., a phase particularly difficult or a phase engaged your attention). Explain why you think your time in the inquiry phases differed from the suggested norm time. If your time was the same then explain if you think all inquiry projects follow this general distribution.