Name:

SACE Stage 1 Physics Practical Investigation Analysing Conductors

Materials differ in their ability to conduct electricity. Some are ohmic conductors and some of them are non-ohmic conductors.

**Resistors** are used to control current and voltage levels in electrical circuits.

Electromagnetic coils are used in many devices such as **speakers**, **solenoids**, **electromagnets**, **electric motors** and **transformers**.

Low voltage **incandescent**, **halogen** and **LED** lights are used for many lighting applications, particularly in motor vehicles.

You need to select one device from a selection provided by the teacher and investigate the current-voltage characteristics of the device to work out a way to determine whether it is an ohmic (constant resistance) or non-ohmic (varying resistance) conductor.

Devices may include:

* resistors –e.g. from electronics kit or extracted from un-needed electronic devices
* coils – e.g. old speakers from car, stereo or headphones; electric motors from toys or lego kits etc., electromagnetic coils from lab kits or Helmholtz coils from teltron tube
* lights – car or torch bulbs (incandescent, halogen or LED)

You will have available connecting leads, a 12 V power pack, ammeters, voltmeters and multimeters.

*Safety note for teachers:* Students should use 12 V maximum voltage source and be advised to use a voltage range that equipment designed for. This can be estimated from type and arrangement (usually series) of batteries used in original source.

**Part A – Introduction and Design**

Before commencing the practical component of this task you deconstruct the problem and need to submit a draft of the following (Part A only) and gain the approval of your teacher.

Consider the problem you are trying to solve. Make notes about:

* what you are trying to investigate
* what the differences between ohmic and non-ohmic conductors are
* **Hypothesis** for the investigation. It should take the form *‘If [the independent variable] is [changed how] then the [dependent variable] will [predict how you think it will change]’*
* factors that could affect the investigation, how and why any of these may need to be controlled
* the **independent** variable (that you will change) and a description of how you will change it.
* the **dependent** variable that you will measure and a description of how you will measure it.
* factors that must be kept **constant** to ensure a fair test. You should also briefly describe how they will be kept constant and any impacts there may be on the results if they are not kept constant.
* **materials** and equipment needed to complete your experiment. Annotate to explain why you have chosen these materials
* any likely **hazards** and describe precautions that should be followed to minimise the risk during the practical
* a set of numbered instructions to carry out the experiment. (Include a blank data table to show how you will record the data)
* Each statement should start with a verb. You should also include a circuit diagram and refer to it in your Procedure. Annotate to explain why you have chosen these steps.

Hand up Part A on: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Part B – Results, Analysis and Evaluation**

One you have permission from your teacher you may complete the practical investigation and write a report which includes the following components:

1. **Introduction**
	* A brief description of the purpose of the device you are testing
	* A brief description of how the device works
	* A description of Ohm’s Law
	* A brief description of the difference between an ohmic and non-ohmic conductor
	* The hypothesis and a summary of variables
2. **Materials and Method**

This includes what you actually used and what you actually did in your investigation.

1. **Results**
* A table of results.
* An appropriate graph of your results.
* A description in words of any trends in your results
1. **Evaluation**
* A description of possible random errors
* A description of possible systematic errors
* An assessment of the precision of the results
* An assessment of the accuracy of the results
1. **Conclusion**
* A sentence or two describing whether the results support or do not support your original hypothesis and a justification for your conclusion.

A draft of Part B may be submitted for feedback.

**Final Report**

A final report including Parts A and B (and any amendments made during the practical and feedback) should then submitted for assessment.

The word count for the introduction with relevant physics concepts, a hypothesis and variables, analysis of results, identifying trends, and linking results to concepts, evaluation of procedures and data, and identifying sources of uncertainty and the conclusion sections of your final report should be a maximum of 1000 words.

**Practical Investigation Task – Circuit Analysis Marking Rubric**

**Student: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

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| --- | --- | --- | --- | --- | --- | --- |
|  | IAE1 | IAE2 | IAE3 | IAE4 | KA1 | KA4 |
|  | * Deconstruction
* Design
* Hypothesis
* Variables
* Procedure
* Hazards
* Justifications
 | * Correct wiring
* Use of measuring equipment
* Working safely
* Results table
* Results graph
 | * Description of trends
* Conclusion
 | * Evaluation
 | * Introduction
 | * Spelling and grammar
* Sentence and paragraph structure
* Logical structure
* Use subheadings
* Use of Physics terminology
 |
| **A** | Critically deconstructs a problem and designs a logical and coherent physics investigation with detailed justification.  | Obtains, records, and represents data, using appropriate conventions and formats accurately and highly effectively. | Systematically analyses and interprets data and evidence to formulate logical conclusions with detailed justification. | Critically and logically evaluates procedures and their effects on data. | Demonstrates deep and broad knowledge and understanding of a range of physics concepts. | Communicates knowledge and understanding of physics coherently with highly effective use of appropriate terms, conventions, and representations. |
| **B** | Logically deconstructs a problem and designs a well-considered and clear physics investigation with reasonable justification. | Obtains, records, and represents data, using appropriate conventions and formats mostly accurately and effectively.  | Logically analyses and interprets data and evidence to formulate suitable conclusions with reasonable justification. | Logically evaluates procedures and their effects on data. | Demonstrates some depth and breadth of knowledge and understanding of a range of physics concepts. | Communicates knowledge and understanding of physics mostly coherently with effective use of appropriate terms, conventions, and representations. |
| **C** | Deconstructs a problem and designs a considered and generally clear physics investigation with some justification. | Obtains, records, and represents data, using generally appropriate conventions and formats with some errors but generally accurately and effectively.  | Undertakes some analysis and interpretation of data and evidence to formulate generally appropriate conclusions with some justification | Evaluates procedures and some of their effects on data. | Demonstrates knowledge and understanding of a general range of physics concepts.  | Communicates knowledge and understanding of physics generally effectively, using some appropriate terms, conventions, and representations. |
| **D** | Prepares a basic deconstruction of a problem and an outline of a physics investigation. | Obtains, records, and represents data, using conventions and formats inconsistently, with occasional accuracy and effectiveness. | Describes data and undertakes some basic interpretation to formulate a basic conclusion. | Attempts to evaluate procedures or suggest an effect on data. | Demonstrates some basic knowledge and partial understanding of physics concepts. | Communicates basic physics information, using some appropriate terms, conventions, and/or representations. |
| **E** | Attempts a simple deconstruction of a problem and a procedure for a physics investigation. | Attempts to record and represent some data, with limited accuracy or effectiveness. | Attempts to describe results and/or interpret data to formulate a basic conclusion. | Acknowledges that procedures affect data. | Demonstrates limited recognition and awareness of physics concepts.  | Attempts to communicate information about physics. |