Student Experiment Planner - Physics

This is a planner to use as you go through the process of planning and completing your student experiment before then analysing your results to come to a justified conclusion.

The subheadings in this guide **do not** appear in the order in which they will appear in the final essay. The guide has been written in a way to allow you to logically develop your ideas.

1. Form a group of no more than 4.
   1. Create a shared document or method to share methodology and results. Not having access to your groups results will not be an excuse for extension.
2. Select **1** of the practicals from the Context section of the task sheet.

* Calculating Acceleration
* Calculating Force
* Calculating energy efficiency

Original experiment:

1. Summarise the original experiment in 2 sentences

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| Summary of procedure  (what did you do) |  |
| Summary of results  (what did you find) |  |

Modifications to methodology:

1. Identify modifications you will make to the methodology. You should be able to **justify** why you made all these modifications to your methodology.

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| Refine – Increase reliability, accuracy or precision of results.  *Makes your results better ie. using a temperature probe, rather than a thermometer because it gives a reading to two decimal places, which improves the accuracy of the results.* |  |
| Extend – Variations of the independent variable.  *Extends the independent variable ie. doing 5 hotter temperatures, rather than just the 3 in the initial, to extend the understanding of the relationship to increased temperatures.* |  |
| Redirect – Testing of other variables, development of an understanding of different relationships.  *Looks at a different relationship in the experiment ie. instead of changing the temperature, changing the surface area of the reactant, to show the relationship between surface area and rate of reaction.* |  |

1. Including your modifications, list all required materials and explain your methodology.

**Material:**

You will need to specify the exact equipment you require.

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**Method:**

Your methodology should enable you to collect sufficient and relevant data. Consider what you are measuring, how you are measuring it, units and how you plan to analyse your data.

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Management of risks

1. 1 person from each group must complete a risk assessment to order equipment and assess the safety risks.
2. Visit - <https://www.riskassess.com.au/> Username – GCCstud Password – GCCra
3. Click the green button “Start Blank Risk Assessment”.
4. Fill in each box of the online form.
5. Chemical training codes – Teacher: 2, Lab Tech: 1
6. Room- C9. Period 4- 20th of August.
7. Fill the box titled “Equipment / chemicals to be prepared by laboratory technician” listing EXACTLY what you need, specifying the amount and size of any equipment.
8. Below this box will be a section titled “Equipment, Chemicals and Biologicals for Risk Assessment”. **If in doubt of what to enter here, please ask for assistance.**
   1. In the box titled “Equipment” you must include all equipment you will be using. Where there are multiple options, a box will open to the right and you will have to select from one of the options. Often you will just need to specify what they are made of and the size of them

1. Click the button “Generate Risk Assessment”
2. A risk assessment will be generated. Review this information to identify the risks, ethical implications and any environmental issues associated with your practical. Use this page to assess the risks, ethics and environmental impact of your experiment.
3. Scroll down to the box titled Assessment by Student(s).
   1. You must consider the inherent level of risk of your experiment. Click the green text for some guidance. **Your experiment will be medium risk at minimum.**
   2. In the box titled “Controlled measures” you **must** describe how you will manage risks, ethics and environmental impacts.
   3. You must also identify which safety equipment you will require by checking the boxes.
   4. When finished, click save control measures.
   5. Scroll to bottom of page and click “Save/Print PDF”. Keep this PDF and ensure each member of the group has a copy. Not having a copy of this will not be an excuse for extension.
   6. Email a copy of the PDF to your teacher
4. If you need to make changes, go back into your risk assessment, and click “Author’s Update”. Do not generate a new risk assessment.

**DUE – End of Lesson on the 9th of March**

Research Question

(Will also become your title)

1. Formulate a research question.

Your research question should be specific and relevant to your experiment.

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| Independent variable – what you are changing? |  |
| Dependent variable – what you are measuring? |  |

Combine your independent and dependent variables to form a concise, specific and relevant research question.

A well-constructed research question should:

* Be appropriate to the topic
* Include measurable variables – the independent variable and the dependent variable.
* Use guiding words such as what, why, will, how.
* Have variables worded so measurement can be achieved.
* Be directly answered, verified or falsified

*Examples:*

*Does the time taken for the production of 25mL of hydrogen gas decrease as the temperature of the solution of 50ml 0.5mol L-1 hydrochloric acid and 5g zinc is increased?*

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Raw Data

1. You are required to collect sufficient and relevant data from your experiment. Ensure that you have considered how you will analyse your information, so you have enough information for analysis of the data in sufficient depth to answer your research question. Record all units.

Sufficient and relevant means you are collecting enough data to substantiate whether or not a relationship exists between the variables. This includes an appropriate number of replicated and an appropriate number of individual samples. (5 variations of the independent variable – 3 repeats of each)

Utilise the space below to create a table to organize the raw data you will collect during your experiment. You should also record the accuracy/uncertainty of the equipment you are using.

**DUE – End of lesson on the 11th of March**

Processing of data

1. Processing of data. Using the raw data you collected, process your data to determine values for the comparison of independent variables and identification of any trends, patterns and relationships. It may be useful for you to organise your information in tables or graphs. You can utilise excel to determine many values based on set equations (if you need help on this, please ask. If you are doing the same calculation 47 times, I guarantee there is an easier way than doing them all individually).

All graphs and tables should be accurately labelled with figure titles. They should be numbered in numerical order.

Not all calculations need to be shown in your final report, a table with example calculations of each type of equation is however required.

**Remember, in science we record information to two decimal places.**

1. You should also be processing your data to identify uncertainty and limitations of your evidence. You should only apply analyse that are RELEVENT to your data. You may like to consider some of the following:

* Average
* Standard Deviation
* Coefficient of Variation ((Standard Deviation / Mean) x 100)
* Assessment of the precision and accuracy of results
* Trend lines
  + R2 values

Trends, patterns and relationships

1. Based on your processed data, you will need to identify any relevant trends, patterns or relationships.

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| Describe the trend |
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| Provide evidence to justify the trend – use your data |
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| Explain why this trend was observed – the science behind it. You will need to complete research for this and the information will need to be referenced. |
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Evaluation of Methodology

1. Identify the limitations in your experiment.

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| What were some of the limitations of your experiment? |
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| How did these limitations effect the results of your experiment? |
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1. Based on the limitations you just identified, decide whether your experiment was reliable and valid. Explain why/why not.

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| Was the experiment reliable and valid? |
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1. Describe improvements and extensions that could be made to your methodology to make it more accurate and to give you a more thorough answer to your research question.

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| How could the experiment be improved? |
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| How would these changes improve the experiment? |
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Conclusion

1. Use the trends, patterns and relationships you have identified to answer your research question. You should explicitly identify whether the data you collected answers your question. A justified conclusion will be formed by basing your conclusion on the data you obtained. **You will not be penalised if your data does not fully support the question, so long as you justify why it does not.**

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Rationale

1. Complete research to introduce your experiment and analysis. Your rationale should consider all key aspects of your experiment, explaining the key theories behind the process and the chemistry behind the experiment. Information **MUST** be referened

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| What is energy?   * Focus on the types of energy in your experiment |
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| Explain the transfer and transformation of energy.   * Give examples that are relevant to your experiment |
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| What is the law of conservation of energy?   * Explain the law of conservation of energy in terms of the transformation of energy that is relevant to your experiment. * If you are completing an experiment using the cart and the ramp, you will need to explain newton’s 2nd law in this section. |
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Reference List

1. All information should be referenced according to APA guidelines.

(This isn’t a subtitle)

1. Proofread your work:
   1. Content and cohesion
      1. Are there gaps in information?
      2. Do the ideas flow in a logical order?
      3. Can you make the writing more concise?
   2. Punctuation and grammar
      1. Are any paragraphs too large or small?
      2. Do all figures, graphs and tables have a title?
         1. Are they numbered accurately?
   3. Spelling
2. Upload your assignment to scribe and read through the feedback.
3. Print out your assignment. Read it out loud.
4. Under the review tab on word, click read aloud. Listen for any errors.

**Draft Due – 18th of March**

**Final Due - 25th of March**