# We use the **experimental cycle** to help us plan, carry out and write about scientific investigations.

*Use these sentence starters to guide the conclusion section of your lab report.*

**Data: Collect**, **transform** and **presen**t data

❏ This table shows my measurements.

❏ This graph shows my final results.

❏ I made these **observations** while carrying out my experiment...

❏ I think my data were / were not reliable because...

RECORDING RAW DATA:

❏ Large, clear table for your raw (un-processed) results.

❏ Title a descriptive of the data contained in the table.

❏ Table includes the key variables as well as any specific conditions of the experiment

❏ Units and labels identified

❏ Table numbered consecutively throughout the report with a specific identifying title.

Title: Table 1

|  |  |
| --- | --- |
| IndependentVariable(units) | DependentVariables(units) |
| Trial 1 | Trial 2 | Trial 3 | Trial 4 | Averages |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |

DRAWING YOUR GRAPH

Think about why you are drawing your graph …. It should be a visual representation of the data that allows you to answer the Aim. Therefore it should look like this

 Title: Figure 1

Dependent Variable

(units)

Independent Variable

(units)

❏ Large, clear graph of your averaged (processed) results.

❏ Identified data as continuous (line) and discontinuous (bar)

❏ Title a descriptive of the data contained in the table.

❏ Table includes the key variables as well as any specific conditions of the experiment

❏ Units and labels identified

❏ Included a key

❏ Graph numbered consecutively throughout the report with a specific identifying title

I have correctly organized the data I collected in my electromagnet experiment using tables that include units in the proper place. I have processed my data using proper methods and showed examples. My graph is correct, including titles, axis labels, and I have used lines of best fit.

**Patterns: Interpret** data and **explain** the results using *scientific reasoning*

❏ My data show that ....

❏ My data suggest that ...

❏ This might be because ...

❏ Another source that supports this reason is... which says... and transferred this to my references section at the end

❏ I conclude that this experiment has / has not helped me solve my original problem. This is because...

I have correctly used knowledge and understanding of science to recognize **patterns** and draw conclusions from the data. I have correctly given a detailed account of how and why the variables are related.

**Validity of Hypothesis: Discuss** the *validity* of the *hypothesis*

❏ I predicted that ...

❏ My data support / do not support /partially support my prediction.

❏ I think this because...

**Validity of Method: Evaluate** the *validity* of the *method*

❏ The method I followed did allow / did not allow / partially allowed me to answer the research question.

❏ I think this because…

❏ Some *strengths* in the method were...

❏ Some *weaknesses* in the method I was given were...

❏ Something I found *difficult* in carrying out the method was...

❏ If I wanted to test the same problem again, I would / would not use

the same method. This is because...

I have **evaluated my hypothesis** by weighing up the strengths and limitations of the data I collected, and have used the data to clearly state if I my hypothesis has been supported or not. I use scientific reasons and sources to help explain my reasons.

I have **evaluated my method** by weighing up the strengths and limitations of my procedures and lab work. I have specifically discussed the validity and reliability of my methods in the table and addressed its significance.

**Improvements: Explain** improvements or extensions to the method

❏ I could improve the method by ....

❏ I would make these improvements because...

❏ This investigation has made me think of a new question, which is...

❏ I could test this by...

❏ I would like to find out more about ... because...

I have given a detailed account of how I **suggest improvements** to specific limitations in my procedures. These suggestions are realistic and based on scientific reasoning and research.

Commonly-confused words. Make sure ***you*** use them correctly.

**Facts**

are *simple truths* that we use when we describe the universe. Often we can measure them.

**Hypothesis**

is a *testable prediction* that we make, with a logical *reason*.

**Good scientists**

are not trying to '*prove*' themselves '*right*'.

Good scientists want to **test their ideas** in case they are not supported. This gives them more interesting questions to ask next

**‘Banned words’**

• "Proves"

• "Correct"

• “Right"

• "Wrong"

*These are not*

*scientific.*

Instead we talk about how the evidence we collect (our data) do or do not support our hypothesis.

MYP 4/5 Science (Grade 9/10) **Lab Conclusion Sentence Starters** Name:

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**Criterion C: Processing & Evaluating**

1. present collected and transformed data
2. interpret data and explain results using scientific reasoning
3. evaluate the validity of a hypothesis based on the outcome of the scientific investigation
4. evaluate the validity of the method
5. explain improvements or extensions to the method

|  |  |  |
| --- | --- | --- |
| **Achievement Level** | **Level Descriptor** | **Clarifications** |
| **0** | The student does not reach a standard described by any of the descriptors below. | The student does not reach a standard described by any of the descriptors below. |
| **1–2** | The student is able to;1. **collect and present** data in numerical and/or visual forms
2. **interpret** data
3. **state** the validity of a hypothesis based on the outcome of a scientific investigation
4. **state** the validity of the method based on the outcome of a scientific investigation
5. **state** improvements or extensions to the method
 | * I attempted to **collect** and **present** DV’s and IDV’s in a table or graph
* I attempted to observe trends in the data
* I **stated** how the data supports or rejects the hypothesis validity of a hypothesis based on what happened in the experiment
* I **stated** improvements or extensions to the method
 |
| **3–4** | 1. **correctly collect and present** data in numerical and/or visual forms
2. **accurately interpret** data and **explain** results
3. **outline** the validity of a hypothesis based on the outcome of a scientific investigation
4. **outline** the validity of the method based on the outcome of a scientific investigation
5. **outline** improvements or extensions to the method that would benefit the scientific investigation.
 | * I correctly **collected** and **presented** the DV/s and IDV/s in a table or graph
* I **stated** a trend based on the data
* I **outlined** how the data supports or rejects the hypothesis validity of a hypothesis based on what happened in the experiment.
* I **outlined** if the method allowed for sufficient collection of data based on the outcome
* I outlined improvements to the method that would benefit the scientific investigation
 |
| **5–6** | 1. **correctly collect, organize and present** data in numerical and/or visual forms
2. **accurately interpret** data and **explain** results **using scientific reasoning**
3. **discuss** the validity of a hypothesis based on the outcome of a scientific investigation
4. **discuss** the validity of the method based on the outcome of a scientific investigation
5. **describe** improvements or extensions to the method that would benefit the scientific investigation.
 | * I **collected** the DVs, show how the IDV’s were manipulated and **organized** and **presented** the data in a suitable table or graph
* I drew a line / curve of best fit (if appropriate)
* I **described** most relevant trends in the data and made links to correct scientific reasoning
* I **discussed** how the data supports or rejects the hypothesis validity of a hypothesis based on what happened in the experiment
* I considered multiple problems of my results with regard to the hypothesis and method
* I **discussed** if the method allowed for sufficient collection of data based on the outcome
* I **described** clear improvements to the method that would benefit the scientific investigation.
 |
| **7-8** | 1. **correctly collect, organize, transform and present** data in numerical and/or visual forms
2. **accurately interpret** data and **explain** results **using correct scientific reasoning**
3. **evaluate** the validity of a hypothesis based on the outcome of a scientific investigation
4. **evaluate** the validity of the method based on the outcome of a scientific investigation
5. **explain** improvements or extensions to the method that would benefit the scientific investigation
 | * I **correctly collected** the DV’s, showed how the IDV’s were manipulated and **organized, transformed** data by including calculations and **presented** the data in a table or graph with clear headings, labels and units.
* I drew a line / curve of best fit (if appropriate)
* I **described** all relevant trends in the data and **explained** them scientifically
* I clearly considered the **strengths and limitations** of my data and if the data supported or rejected the hypothesis based on what happened in the experiment
* I considered multiple problems of my results with regard to the hypothesis and method
* I clearly considered the **strengths and limitations** of the method to determine if the method allowed for sufficient collection of data based on the outcome.
* I made clear and realistic improvements and e**xplained** why they would benefit the scientific investigation
 |

**Self Reflection Rubric**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| ***C*** | ***i.*** *present collected and transformed data* | ***ii.*** *interpret data and explain results using scientific reasoning* | ***iii.*** *evaluate the validity of a hypothesis based on the**outcome of an investigation* | ***iv.*** *evaluate the validity of the method* | ***v.*** *explain improvements or extensions to the**method* |
| **1-2** | I have presented the data I collected in my experiment using **tables** or **graphs**. | I have used knowledge and understanding of science to recognize **patterns** and draw conclusions from the data. | I have **evaluated my hypothesis** by stating if it has been supported or not, based on my data. | I have **evaluated my method** by listing errors in my procedures and lab work. | I have stated how I **suggest improvement** to limitations in my procedures. |
| **3-4** | I have presented the data I collected in my experiment by using the correct type of **graph**, including titles, axis labels. | I have used knowledge and understanding of science to recognize **patterns** and draw conclusions from the data. I have given an account of how and why the variables are related. | I have **evaluated my hypothesis** by briefly mentioning the data to state if I my hypothesis has been supported or not, based on my data. | I have **evaluated my method** by briefly considering my procedures and lab work. | I have given brief details of how I **suggest improvement** to limitations in my procedures. |
| **5-6** | I have organized the data I collected in my experiment using **tables** that include units in the proper place. My **graph** is the correct type, including titles, axis labels, and I have used lines of best fit. | I have correctly used knowledge and understanding of science to recognize **patterns** and draw conclusions from the data. I have given a detailed account of how and why the variables are related. | I have **evaluated my hypothesis** by considering many possibilities. I have used the data to clearly state if I my hypothesis has been supported or not. I use scientific reasons and sources to help explain my reasons. | I have **evaluated my method** by considering the strengths and limitations of my procedures and lab work. I have discussed the validity and reliability of my methods, and addressed its significance. | I have provided details of how I **suggest improvement** to limitations in my procedures. These suggestions are realistic and based on scientific reasoning and research. |
| **7-8** | I have correctly organized the data I collected in my experiment using **tables** that include units in the proper place. I have **processed** my **data** using proper methods and showed examples. My **graph** is correct, including titles, axis labels, and I have used lines of best fit. | I have correctly used knowledge and understanding of science to recognize **patterns** and draw conclusions from the data. I have correctly given a detailed account of how and why the variables are related. | I have **evaluated my hypothesis** by weighing up the strengths and limitations of the data I collected, and have used the data to clearly state if I my hypothesis has been supported or not. I use scientific reasons and sources to help explain my reasons. | I have **evaluated my method** by weighing up the strengths and limitations of my procedures and lab work. I have specifically discussed the validity and reliability of my methods in the table and addressed its significance. | I have given a detailed account of how I **suggest improvements** to specific limitations in my procedures. These suggestions are realistic and based on scientific reasoning and research. |

