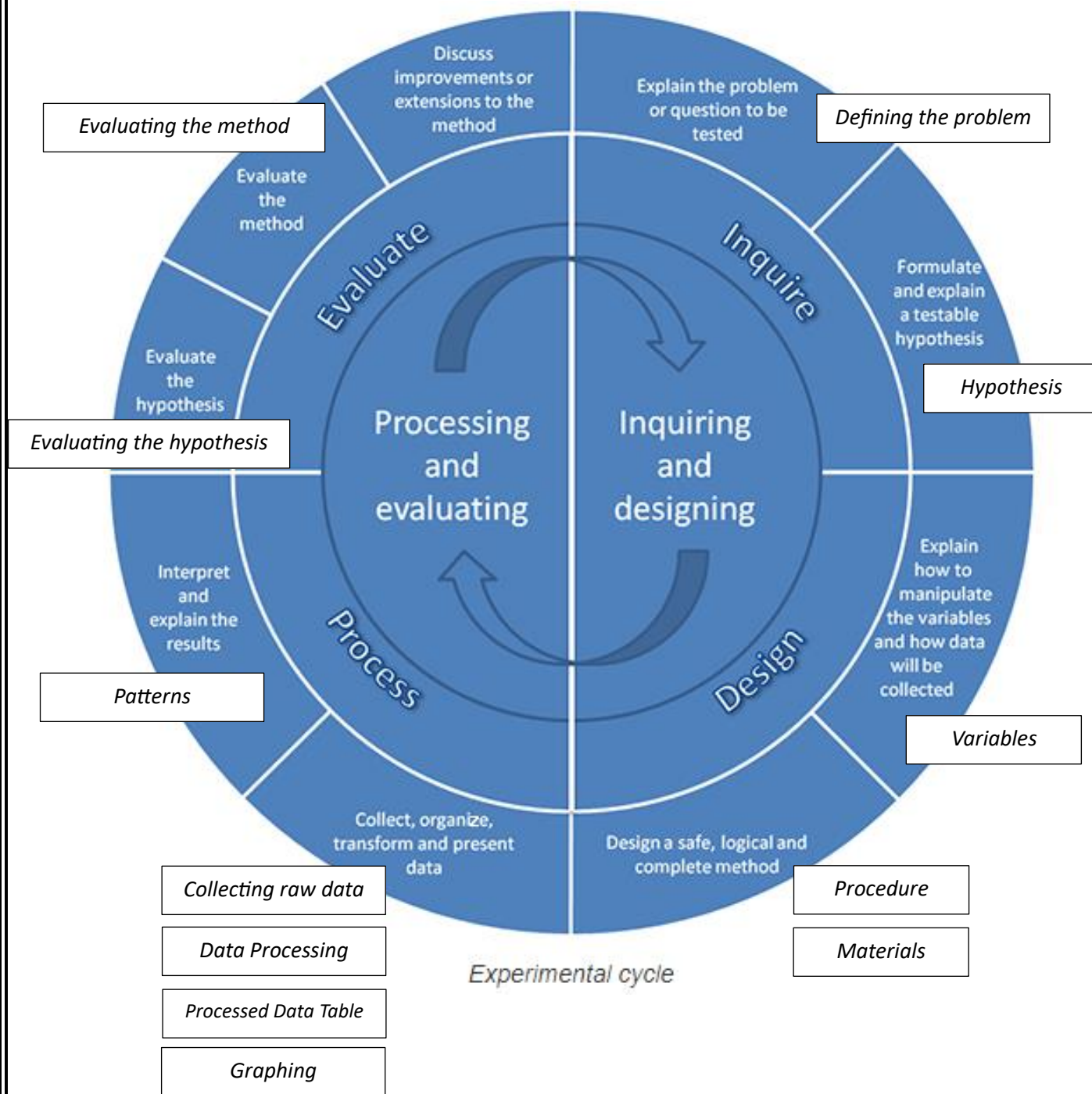


MYP SCIENCES (PHYSICS)

Preparing Investigation Skills for eAssessment



Criteria B – Inquiring and Designing

Variables:

- Variables are the part of your experiment that you will change and measure.
- Remember variables are always physical quantities and not objects.
- Choosing appropriate variables will also help you make it a *fair* test.

Independent Variable:

- the variable you decide to change
- always choose a range based on the question information
- make sure to include appropriate labels

Dependent Variable

- what you will measure after changing IV

Control Variable

- all the other factors you will keep the same
- describe what they should be, and how you will make sure they stay that way!

Defining the Problem

- When you put your independent and dependent variables together, you can form a question that you will try to answer through your experiment.
- Your research question is what you are trying to answer when you write your conclusion or form your hypothesis.
- Remember to include the independent and dependent variables. You can write your question in form:

How does the (*independent variable*) affect the (*dependent variable*)?

OR

To what extent does the (*independent variable*) affect the (*dependent variable*)?

Hypothesis

- Your hypothesis is a statement you make BEFORE you do your experiment, that describes what you think will happen.
- After your experiment you will see if your data supports or contradicts your hypothesis.
- Format for hypothesis:

"If I (*increase/decrease*) my (*independent variable*), the (*dependent variable*) will (*increase/decrease*), because (*reasons with information and citation of sources*).

Procedure

- Make sure to write a procedure that not just you understand, but that is good enough that someone from another school could do your experiment exactly the way you did!
- Remember: should be clear and easy to follow:
 - use proper vocabulary.
 - use the independent, dependent and control variables in your procedure.
 - use a numbered or bulleted list if it is helpful.
- Control Variables: make sure you describe how you will make sure they stay the same as part of your procedure.
- Data: include how you will collect your data and how many trials will you do.

Criteria C – Processing and Evaluating

Raw and Processed Data

- Raw data is data that you collect in the experiment.
- Processed data is data that you get after applying some sort of mathematical operation.
- Add more columns as required, for the processed data.

Time (seconds)	Dependent variable!	
	Temp #1 (C)	Temp #2 (C)
0	23	23
30	20	19
60	17	16

Graphing

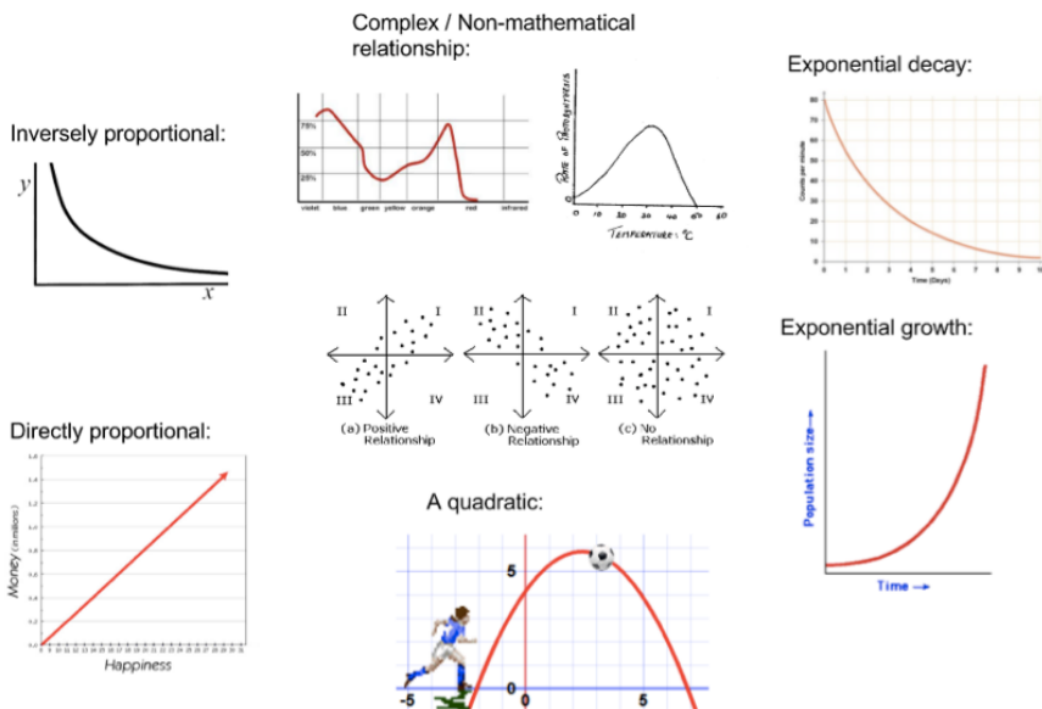
- The type of graph depends on the type of data your independent variable produces.
 - Continuous data: Line Graph or Scatter Plot
 - Discrete data: Bar or Pie Chart
- Make sure to include title; x and y axis; axis titles including units.
- Remember: should be clear and easy to follow:

Patterns

- Before evaluating your hypothesis, you need to first identify the patterns in the data.
Is the dependent variable increasing or decreasing? Is there a linear relationship, or exponential? How exactly are the variables related or not related?
- Relationship between variables can be:
 - Direct = both increase or both decrease by same amount every time; also known as *directly proportional*.
 - Indirect = one increases and the other decreases or vice versa by same amount every time; also known as *inversely proportional*.

(Refer to image on next page)

The Pattern And The Shape:



Evaluating the hypothesis

- When you evaluate your hypothesis, you will be discussing if it was supported or not. Remember you cannot prove your hypothesis correct; you can only support it.
- Refer to the table and graph to help support your thoughts.
- Reference your data, graph, and the patterns you found.
- Make sure to have a very clear statement of your final conclusion.

Evaluating the method

- There are two types of errors in the method, the first type is *reliability* and the other is *validity*.
- Reliability is the measure of how stable, dependable, trustworthy, and consistent a test is in measuring the same thing each time.
- A method is valid in the degree to which they accomplish the purpose for which they are being used, meaning, does your method actually measure what you are trying to measure.
- For reliability: talk about consistency of data.
- For validity: talk about correctness of data.

Suggesting Improvements

- Your suggestions should be very specific, not “try harder” or “do more”.
- Make sure that your suggestions are realistic.

Looking at eAssessment Questions

Question Type 1:

The question asks you to design an investigation for a particular scenario. Pay close attention to the points mentioned in the question.

This question assesses you only on Criterion B. In your answer discuss all strands for Criterion B.

The structure for your response should be similar to the following:

Independent Variable:

- State the independent variable.
- Include the range of values you will be using.
- Specify the increments (should be uniform).
- Mention you will be using at least 5 data sets.
- Outline how you will be changing the variable and what apparatus will you be using, including any safety precaution.

Dependent Variable:

- State the dependent variable.
- Outline how you will be measuring the variable and what apparatus will you be using, including any safety precaution.
- Mention that you will be repeating each measurement at least thrice and averaging the result.

Control Variable(s):

- State Control Variable 1.
- Justify clearly why you think this variable should be a control variable.
- Repeat for as many control variables as asked in the question.

Research Question:

- State the research question in the correct format.
- Ensure it is in the form of a question.
- Ensure both the independent and dependent variable is included.

Hypothesis:

- Formulate the required hypothesis.
- Ensure the correct format is used.
- Ensure both the independent and dependent variable is included.
- It is necessary to give a justification/scientific reasoning for the chosen relationship between variables.

Complete Method:

- Write down the complete method in correct order.
- Your language should be simple and easy to follow.
- You can use bullet points or steps or paragraph as per your ease.

- Ensure what you write is easy to understand and follow by someone who does not know Physics also.

Safety Precautions:

- Mention at least two safety precautions and justify.

Environmental Precautions:

- You only need to include these if the investigation will cause an adverse impact on the environment, otherwise this can be skipped.

Once you have completed your response, re-read the question and ensure every point they asked is included in your answer.

Sometimes the question may contain additional parts before or after the design question. These would ask you to identify variables, research question or hypothesis, may assess you on Criteria A or may ask you for further possible extensions to the one given above.

Question Type 2:

The question will begin by setting up a context (either via text, video, image or simulation).

The question will assess you on both Criteria B and C.

We will discuss ways on writing down answers to possible questions:

1. *Identify independent, dependent and control variables:*

- This would be mentioned in the question. Just read very carefully.
- Could be a select or state question.
- Sometimes a justification for control variable may be asked.

2. *State the research question:*

- This would be 1 mark only.
- Pay close attention to what is mentioned in the context. Usually, you can directly copy the statement and convert to question.

3. *Formulate a hypothesis:*

- This would be anywhere between 2 – 4 marks.
- Ensure proper format is followed. Ensure to justify your hypothesis with a linked scientific principle.

4. *Identifying the required apparatus.*

- This question may or may not require a complete list.
- Only need to include apparatus relevant to the variables.

5. *Data presentation:*

- You may be provided with raw data and asked to make a table.
- Rules for the table:
 - Column 1: Experiment Number (You should have at least 5 data sets)
 - Column 2: Independent Variable (Write it in full form or symbol along with the unit of data)
 - Column 3: Dependent Variable (Write it in full form or symbol along with the unit of data)
 - There should be NO units in the table other than in the heading.
 - Order your independent variable in ascending or descending order and change dependent variable accordingly.
 - All values of dependent variable should be written correct to the same number of decimal places. Add a zero or round of values if needed.
- Read the question carefully, many times they ask you to include a previous value also. Ensure to add it to the table.

6. *Graph related questions:*

- You will be provided with a graph for the collected data and asked any of the following:
 - Read a certain value from the x axis or y axis.
 - Calculate the gradient of the graph: $\frac{(y_2 - y_1)}{x_2 - x_1}$
 - Predict the relationship between the variables: Note two variables will only be directly or indirectly proportional if they increase or decrease with the same amount. Other wise we can only call them proportional. Remember calculation is required to prove.
- Any question that says “use the graph” will require you to show calculations using values from the graph in the form of gradient or area under graph.
- You may be asked to plot a graph also using provided data table or a table you have made. When plotting be careful:
 - Label both the axis.
 - Place the points carefully.
 - Line of best fit will need to be such that the spread of points is uniform around it.

7. *Evaluating the method:* Consider the following points when evaluating the method:
- Data sufficiency: An investigation is considered to have sufficient data if there are at least 5 different data sets (of independent variable)
 - Data fairness:
 - The increments between data sets should be uniform.
 - The entire available range of independent variable is included.
 - *Date reliability:* Each experiment with each data set is repeated at least three times. And then average for the value of dependent variable is calculated. This average is then used in graphs and calculations.
 - Any other sources of error due to experimenter or apparatus.
8. *Further extension:*
- You **cannot** suggest any extension that will require additional apparatus.
 - The easiest answer would be to use one of the mentioned control variables as the new independent variable and keep the dependent variable same.