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Science

How to Succeed in Junior Cycle

Science CBA 1

by Conor Eivers

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Introduction to E.E.I

Classroom-Based Assessment 1 (C.B.A.) for Junior Cycle Science is called the **Extended Experimental Investigation (E.E.I.).** Over a three-week period of time you will follow the scientific method to form a hypothesis on a question you have developed. You will then plan and conduct an experimental investigation to test your hypothesis. From this experiment you will then generate and analyse primary data and reflect on the process, with support from your teacher.

The E.E.I. has four sections:

1. **Q**uestioning and predicting
2. **P**lanning and conducting
3. **P**rocessing and analysing
4. **R**eflecting and reporting.

Your report can be completed in various ways. For example, you could complete a written report (by hand or typed), submit a PowerPoint, produce a poster (remembering that this will need to include significant detail) or you could make a podcast or video.

When completing your report, you will need to make sure you have covered all features of quality for the level of achievement you are aiming to receive for your E.I.I. There are four different levels of achievement; **Exceptional, Above expectations, In line with expectations, and Yet to meet expectations.** The report you submit will be judged to fit one of these four levels of achievement. Your teacher will use a document entitled **'Features of Quality'** to decide the level of achievement your report receives.

An explanation of the levels of achievement are as follows:

- **Exceptional** describes a piece of work that discusses all of the Features of Quality for the C.B.A. to a very high standard. Your C.B.A. does not need to be perfect, but the strengths of the work far outweigh its weaknesses, which are minor. You suggest improvements clearly.
- **Above expectations** describes a piece of work that discusses the Features of Quality for the C.B.A. very well. You would have shown a clear understanding of how to complete each area of the investigation, and your work would contain a lot of detail. Feedback from your teacher would include comments on small sections of your report that need further attention or polishing, but, on the whole your work is of a high standard.
- **In line with expectations** describes a piece of work that reflects most of the Features of Quality for the C.B.A. well. You would have shown a good understanding of the task and your report would have been free from significant error. Feedback from your teacher would include comments on sections of your report that need further attention or correction, but your work is generally competent and accurate.
- **Yet to meet expectations** describes a piece of work that falls short of the demands of the C.B.A. and its Features of Quality. You would have made a good attempt, but you might not have grasped the task clearly or have left out large sections of the report. Feedback from your teacher would include comments on the fundamental errors that need to be addressed.

Scientific Terminology

Investigation	A task for which a student may not immediately see an answer or provide a routine method for finding it.
Primary Data	Data you collect yourself.
Secondary Data	Data collected by others.
Quantitative Data	Data that consists of numbers.
Qualitative Data	Data that does not consist of numbers.
Fair Test	An investigation where only one variable is changed at a time. All other variables stay the same.
Variable	Something in an experiment that can be changed, measured, or controlled.
Independent Variable	What you change in an experiment.
Dependent Variable	What changes when you change the independent variable in an experiment.
Controlled Variable	Variables that are kept constant in an experiment

Examples:

Experiment 1

A group of students want to investigate if water is needed for the growth of cress seedlings. The students place cotton wool in the base of two petri dishes. 5 cm^3 of water is added to the cotton wool in dish A. No water is added to the cotton wool in dish B. Five cress seeds are added to both dish A and dish B. The students will then observe the growth of the cress seeds in both dishes for two weeks.

Independent variable: Amount of water

Dependent variable: Growth of seeds

Controlled variables: 5 cress seeds in both dishes / cotton wool used in both dishes / both left for two weeks

Experiment 2

A group of students want to investigate if the same amount of jelly will melt faster in one block or in smaller pieces. The students will place a 10-gram solid block of jelly in beaker A. They will break up another 10 grams of jelly to make smaller pieces of jelly. These will be placed in beaker B. Both beakers are the same make and size. The students place both beakers over a Bunsen burner and time how long it takes the jelly in each beaker to melt.

Independent variable: Size of jelly pieces

Dependent variable: Time taken for the jelly to melt

Controlled variables: Same amount of jelly / same size and type of beaker

Scientific Method

Step 1	Identify a question to investigate
Step 2	Carry out background research
Step 3	Form a hypothesis
Step 4	Test the hypothesis
Step 5	Analyse the results
Step 6	Form a conclusion

Example 1

Step 1: How much lunch do I need to bring to school?

Step 2: I investigate the amount of food in my house, how much time I have to eat lunch in school, what type of food I should bring to school, etc.

Step 3: I make an educated guess based on the background research on how much lunch I should bring. I decide I should bring a sandwich, yoghurt and packet of crisps to school for lunch.

Step 4: I bring a sandwich, yoghurt and packet of crisps to school. I make note of my hunger levels throughout the day.

Step 5: Based on my hunger levels, I did not bring enough food to school.

Step 6: I conclude that I must bring an apple in addition to all of the other food to ensure that I am not hungry during the day in school.

Example 2

Step 1: What show should I watch on Netflix?

Step 2: I investigate the different shows on Netflix and make note of the types of shows that I enjoy watching.

Step 3: I make an educated guess based on the background research on the show I should watch on Netflix. I choose to watch 'Friends'.

Step 4: I watch 'Friends' and make note on whether I am enjoying watching the show.

Step 5: Based on my investigation, I did like watching 'Friends'.

Step 6: I conclude that I should continue watching 'Friends'.

Deciding on the Question to Investigate

You may find deciding on a question to investigate challenging. It might take some time as you must come up with a question that is **original** and **easily investigated**. The most interesting questions come from things that you like to do in your spare time. For example, think of your hobbies, sports or chores at home when trying to decide on a question to investigate with an experiment. You can use google or look at newspapers and magazine articles for inspiration too. The best thing to do is get a sheet of A4 paper and brainstorm ideas. Ask your partner(s), classmates, friends, teacher and parents to help you decide on the best question to investigate for your C.B.A.

Use the following questions to help you decide if the question you have chosen would be suitable for an experimental investigation:

- Would you be able to carry out the experiment in the laboratory?
- Would you have enough time to complete the investigation?
- Would you have access to all of the materials/equipment needed?
- Would you be able to collect data from your experiment?
- Would you be able to create a fair test?
- Would the investigation be safe to carry out in a laboratory?
- Is your experimental question original?
- If not, could you change it slightly to make it more original?

Sample Questions

1. Which indigestion remedy is best at neutralising excess stomach acid?
2. What type of drinking cup can best retain the heat of a hot liquid?
3. How do fruit juices compare with each other in vitamin C content?
4. Which fabric keeps you warm longer?
5. How do household substances compare with commercial flower food to prolong the life of cut flowers in a container of water?
6. How does the voltage produced between two different metals depend on the type of metals used when placed in a fruit or vegetable?
7. Will the stopping distance of a toy car after travelling down a ramp be affected by the height of the ramp?
8. How do light and temperature affect the uptake of water by a plant?
9. What pH changes take place during the neutralisation reaction between an acid and a base?
10. How does the angle between a solar cell and the light source affect its output?
11. What is the frequency of several named plants in a local habitat?
12. How does the weight of a block of wood affect the force needed to keep it moving at constant speed?
13. If some seeds were placed in a hot press and other seeds were placed in a fridge before sowing, what effect would this have on (i) the speed of germination (ii) the percentage of seeds that germinate?
14. Which brand of antacid is best at neutralising stomach acid?
15. Does changing the temperature of a tennis ball affect how high it bounces?
16. Does the shape of an ice cube affect how fast/slow it melts?
17. Does temperature affect your ability to squeeze a soft ball?
18. Does the incline of a ramp affect how fast a toy car will travel?
19. Does different sizes or masses of a ball affect how quickly it will roll?
20. Does the temperature of water affect how quickly salt dissolves?

Report Checklist

Have I ...	Tick when complete
Included a title?	
Carried out background research?	
Written a justified hypothesis? (supported by my background research)	
Given the independent variable?	
Given the dependent variable?	
Listed the controlled variables?	
Included detailed safety precautions?	
Included a detailed method with enough detail that anyone could repeat it exactly the way I did it?	
Displayed the results from my investigation in in a table?	
Fully labelled the table of results so anyone could understand the results without reading the method?	
Included averages of my results table (if possible)?	
Included a graph/chart of my results (if possible)?	
Analysed my results to explain their meaning to anyone reading my report?	
Explained how the variables were related in the experiment (how the dependent variable changed when the independent variable was changed in the experiment)?	
Made note of any anomalies in the results?	
Explained any anomalies in the results?	

Features of Quality

Exceptional	
Investigating	• You decide on a question to investigate. • You include a hypothesis or prediction for your investigation with justification. • You discuss the reliability and fairness of your investigation. • You discuss the independent, dependent and controlled variables. • You describe a detailed method, that could be easily repeated, to collect your data including detailed safety considerations. • You use an original approach that adds to your investigation. • You record a sufficient amount of good quality of data.
Communicating	• Your tables, charts or graphs and calculations, if any, are neat, accurate and fully correct. • Your data is presented in the most suitable way using the correct terminology. • You discuss the relationship between the variables in your investigation.
Knowledge and Understanding	• You discuss the investigation and provide a detailed conclusion referring to the data collected. • You use relevant science knowledge to assess and describe whether the hypothesis has/has not been supported. • You discuss all strengths and weaknesses of your investigation. • You discuss improvements to your investigation or explain how your investigation was of sufficient quality.

Above Expectations	
Investigating	• You decide on a question to investigate. • You include a hypothesis / prediction for your investigation and justify your thinking. • You discuss the independent, dependent and controlled variables for your investigation. • You describe a reliable method for collecting data including detailed safety considerations. • You record a sufficient amount of good quality of data.
Communicating	• Your tables, charts or graphs and calculations, if any, are neat, accurate and fully correct. • You discuss the relationship between the variables in your investigation.
Knowledge and Understanding	• You discuss the investigation and provide a conclusion referring to your hypothesis. • You discuss all strengths and weaknesses of your investigation. • You discuss improvements to your investigation or explain how your investigation was of sufficient quality.

In Line with Expectations	
Investigating	• You decide on a question to investigate with help from your teacher. • You describe a safe method to collect your data. Your steps are understandable but lack some detail. • You collect most of your data correctly.
Communicating	• Your tables, charts or graphs contain small errors but are drawn correctly. • You discuss the variables present in your investigation.
Knowledge and Understanding	• You discuss the investigation and provide a conclusion. • You identity some errors in your investigation. • You discuss future improvements to your investigation.

Yet to Meet Expectations	
Investigating	• You are given a question to investigate by your teacher. • You use a method given to you by your teacher to collect your data. • You collect your data incorrectly.
Communicating	• Your tables, charts or graphs are unfinished and drawn incorrectly.
Knowledge and Understanding	• You discuss the investigation but do not include a conclusion.

Report Template

Name: _____

Partner(s): _____

Topic:

Water	Earth/Moon/Sun	Food	Plants
Chemical Reactions	Plastics	Forces	Energy Conservation

Experimental Question:

_____

_____

_____

Hypothesis (an educated guess on what will happen in your experiment):

_____

_____

_____

Variables (parts of your experiment that can be changed, measured or controlled):

Independent Variable (what you change in your experiment):

_____

_____

Dependent Variable (what you measure in your experiment):

_____

_____

Controlled Variable(s) (what you keep constant in your experiment):

_____

_____

Background Research:

Explore what is already known about your investigation. Use various sources such as books, magazines, websites, podcasts, etc. If someone has completed the investigation already, find out their results so you can compare them later on in the write-up. Find out information on the materials you need to use.

_____

_____

_____

_____

_____

_____

Sources:

- _____
- _____
- _____
- _____
- _____
- _____
- _____
- _____

Equipment:

_____

_____

_____

_____

Risk Analysis:

_____

_____

_____

_____

Method:

A method is a step-by-step recipe for your science investigation and contains enough detail that anyone could repeat your investigation exactly the way you completed it.

Ensure that the method is ...

- Numbered
- Written in the past tense
- Clear and concise

You should repeat your investigation at least three times to verify your results are consistent. If your investigation involves growing plants, you should do the experiment on at least three plants in separate pots. If your investigation involves testing / surveying groups, you will need to test / survey a large enough number of people to ensure that your results are reliable.

Safety Precautions:

Diagram:

Ensure that this diagram is ...

- labelled
- drawn in pencil
- drawn with a ruler

Recording Results:

Step 1:

Write the results of your investigation in a data table in the space provided below.

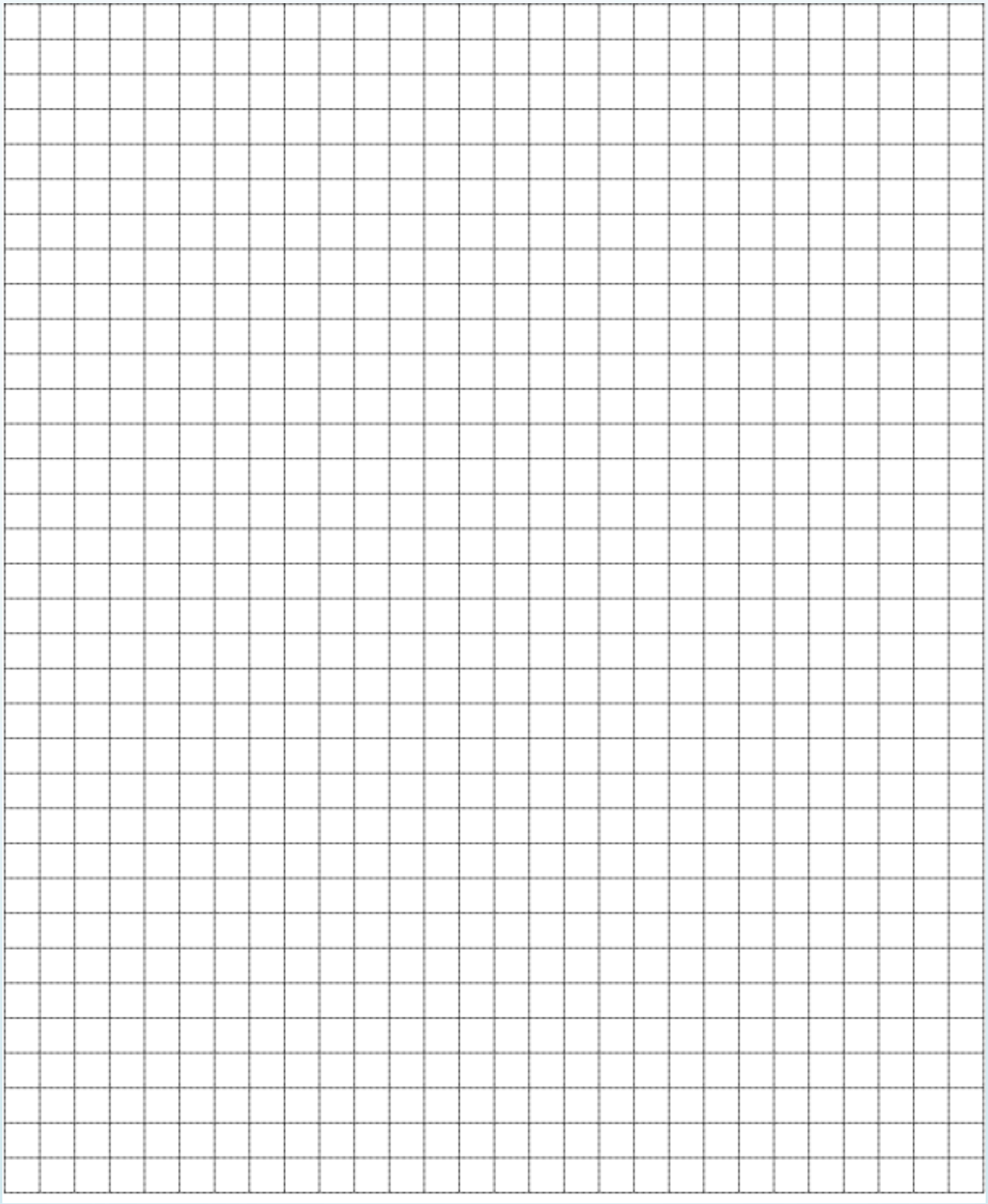
Step 2:

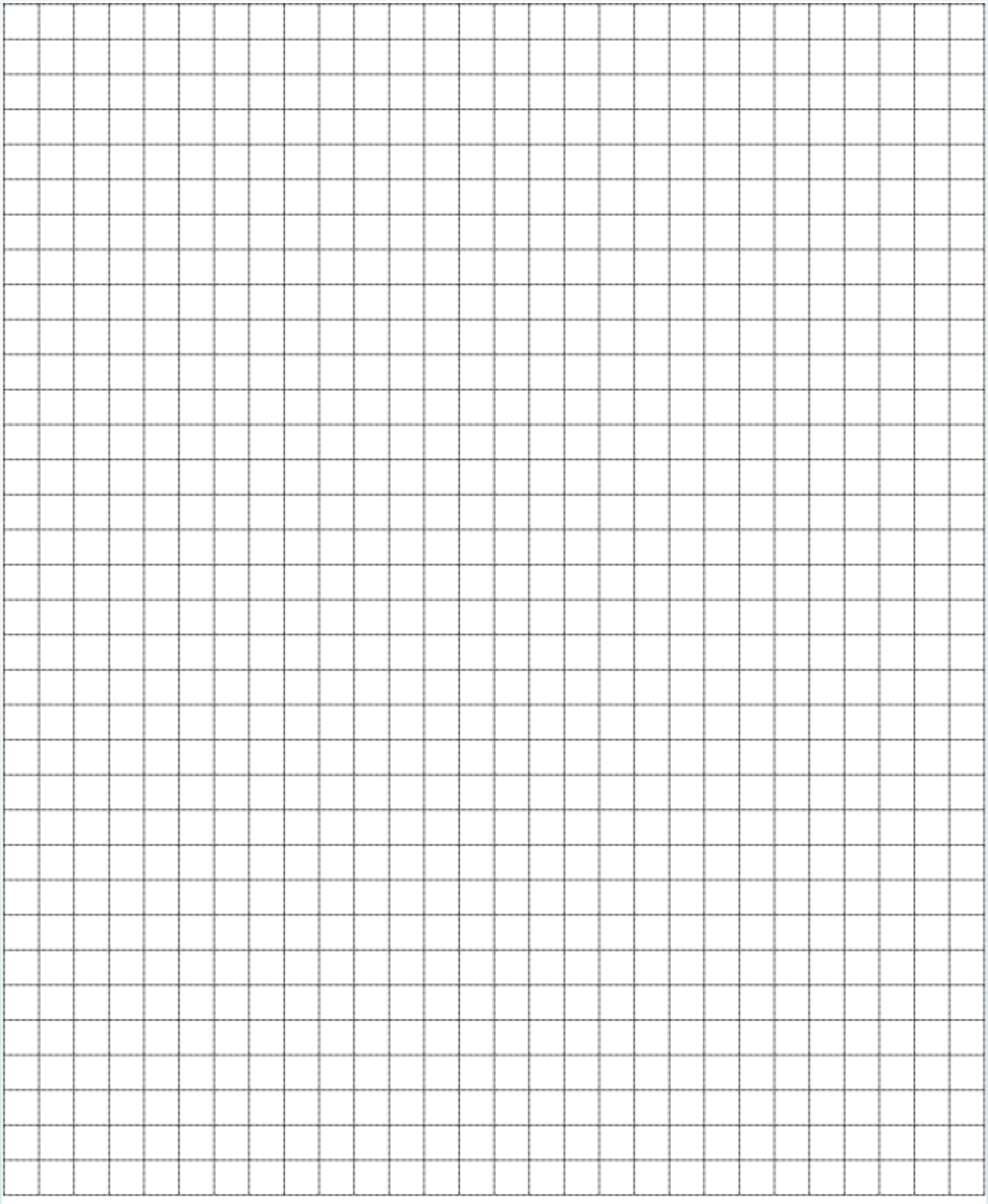
Calculate an average for the different trials of your experiment, if appropriate.

Step 3:

Use the following pages to display the data from your investigation on charts / graphs. When drawing the line graph, make sure to follow the steps below. Remember that the independent variable goes on the x-axis and the dependent variable goes on the y-axis.

Step 1	Write the title.
↓	
Step 2	Draw the x- and y-axis.
↓	
Step 3	Label the x- and y-axis (UNITS).
↓	
Step 4	Input the scale on the x- and y-axis.
↓	
Step 5	Plot the data.
↓	
Step 6	Join the points.





Discussing Results:

You must talk about what happened in your experiment. Answer the following questions:

- What did you observe while completing your investigation?
- What trend(s) can be seen from your analysing your results?
- Are there any outliers in your results?

Conclusion:

You must explain your results and compare them to your hypothesis. Answer the following questions:

- What is the relationship between the independent and dependent variable in this investigation? Answer this question referring to the results you found.
- Do your results support your hypothesis? Explain your answer.

Reflection:

You must consider how you completed the investigation. Answer the following questions:

- What were the strengths of your investigation?
- What were the weaknesses of your investigation?
- What would you change about your investigation if completing it again?
- Is your investigation useful for everyday life?
- What did you learn from completing your investigation?

Method:

Having completed your investigation, rewrite your method making any changes needed.

Safety Precautions:

Having completed your investigation, rewrite your safety precautions making any changes needed.

_____

_____

_____

_____

_____

_____

Diagram:

Having completed your investigation, redraw your diagram making any changes needed.

Extra Space if Needed:

Grading:

Using the Features of Quality to help, decide the grading category that you think your C.B.A. falls into and circle the grade below.

Exceptional	**Above Expectations**
In Line with Expectations	**Yet to Meet Expectations**

Submission:

Signed: _____

Date: _____