Writing Up an Investigation

Unit 1 Lesson 8

Learning Objectives

- Appropriately process data obtained from an investigation.

- Interpret data and draw a valid conclusion.

- Evaluate an investigation describing its limitations, challenges faced, and improvements needed.

Key Vocabulary:

Averages, Conclusion, Data, Evaluation, Interpretation, Outlier

- Once you have collected your data from your experiment you then must report on your findings.

- This is called an investigation write up and has three parts.
    1. Processing your data.
    2. Interpreting your data.
    3. Evaluating your investigation.

Processing your data

- Conducting repeated tests for each value for the independent variable gives you a range of data that you can use to calculate averages and display as a graph.

- This helps you to identify trends and patterns.

Calculating the average or mean.

- This value can be calculated by adding all the measurements for a value of the independent variable together and then dividing by the number of repeats.

Example 1:

- Mean reaction speed 136 + 187 + 152s = 475 / 3 = 158.3 seconds.

Calculate the average reaction speeds in the table below. The first line has been done for you.

Temperature of Acid (°C)	Time for magnesium ribbon to disappear (s)			
	Test 1	Test 2	Test 3	Average
20	136	187	152	158
30	143	133	150	
40	105	158	127	
50	97	113	99	

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Answers:

Temperature of Acid (°C)	Time for magnesium ribbon to disappear (s)			
	Test 1	Test 2	Test 3	Average
20	136	187	152	158
30	143	133	150	142
40	105	158	127	130
50	97	113	99	103

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Graphing

- Numerical data is usually presented as a graph of averages. This enables a trend to be seen.

- If the data for the independent variable has been arranged in groups e.g., eye colors of students, then a bar graph can be used.

- If both the independent and dependent variables have numerical data, then a line graph is most appropriate.


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Guidelines for Line Graphs

- Use ruled axes and graph paper.
- Place the independent variable on the horizontal axis and the dependent variable on the vertical axis.
- Label each axis with the variable name and unit (if appropriate).
- Select a suitable scale for each axis and then mark it evenly along each axis.
  Note: the scale for each does not need to be identical.
- Plot the data in pencil using small dots or crosses.
- Draw a smooth line through the points if the data shows a curve, or a line of best fit if the trend is a straight line.
- Add an appropriate title.

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Example 2:

The data from example 1 above is shown in the graph below.

Temperature of Acid (°C)	Average time for magnesium ribbon to disappear (s)
20	158
30	142
40	130
50	103

Average Reaction Time for Magnesium Ribbon and Hydrochloric Acid at Different Temperatures.

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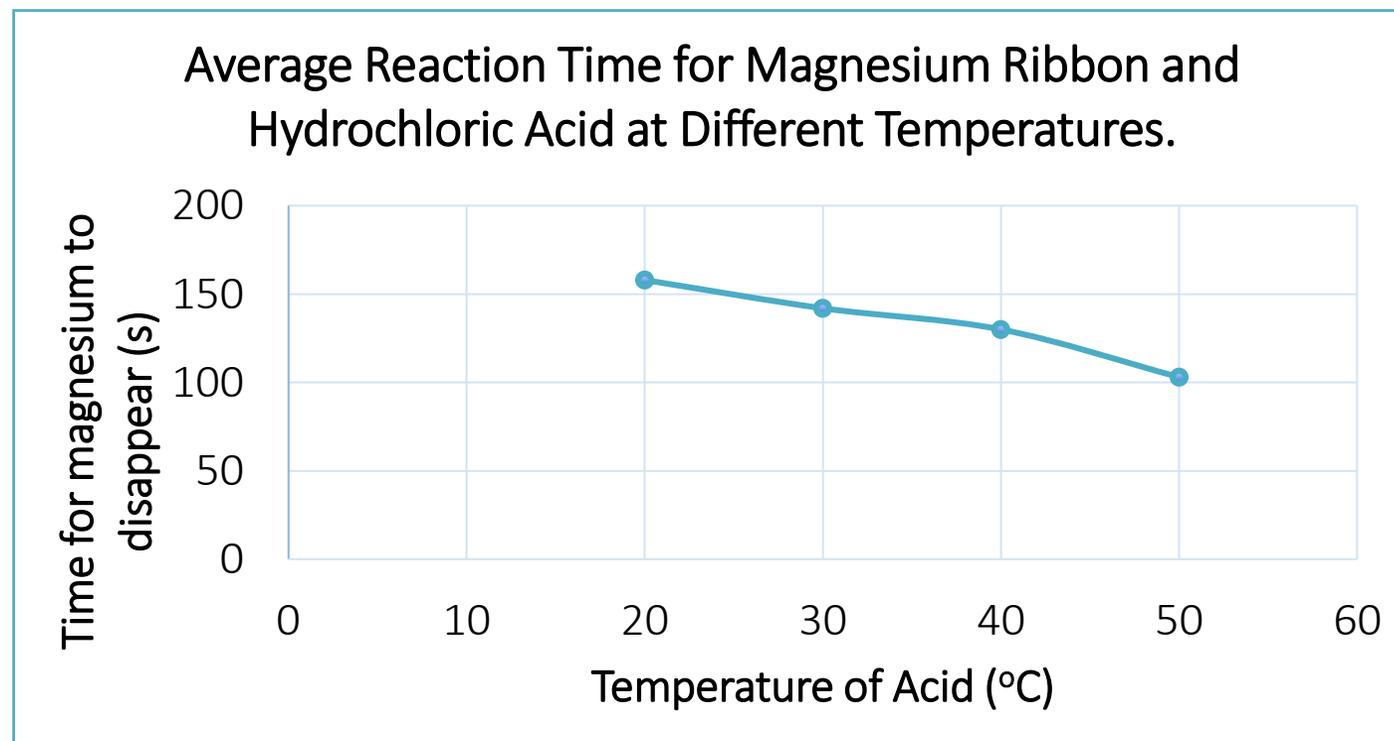
Interpreting your data

- Next, you will need to describe any patterns or trends that can be seen in your data.
  - This can be done by deciding if the dependent variable increase or decrease as the independent variable is changed?
  - If you have your independent variable grouped, then you may look at which is the most popular group e.g., which eye-color is the most common in your class?
- From here you can interpret what your trend means and form a conclusion.

Conclusions:

- A conclusion is a summary of the inferences that have been made based on what you have observed in your data.

- It must:
  - ✓ Relate back to the hypothesis for your investigation.
  - ✓ Include the independent and dependent variable.

So what?

Example 3:

For the data table and graph used in examples 1 and 2, the conclusion would be:

These results support the hypothesis that increasing the temperature of the acid decreases the reaction time between magnesium and hydrochloric acid.

Reaction Time for Magnesium Ribbon and Hydrochloric Acid at Different Temperatures.

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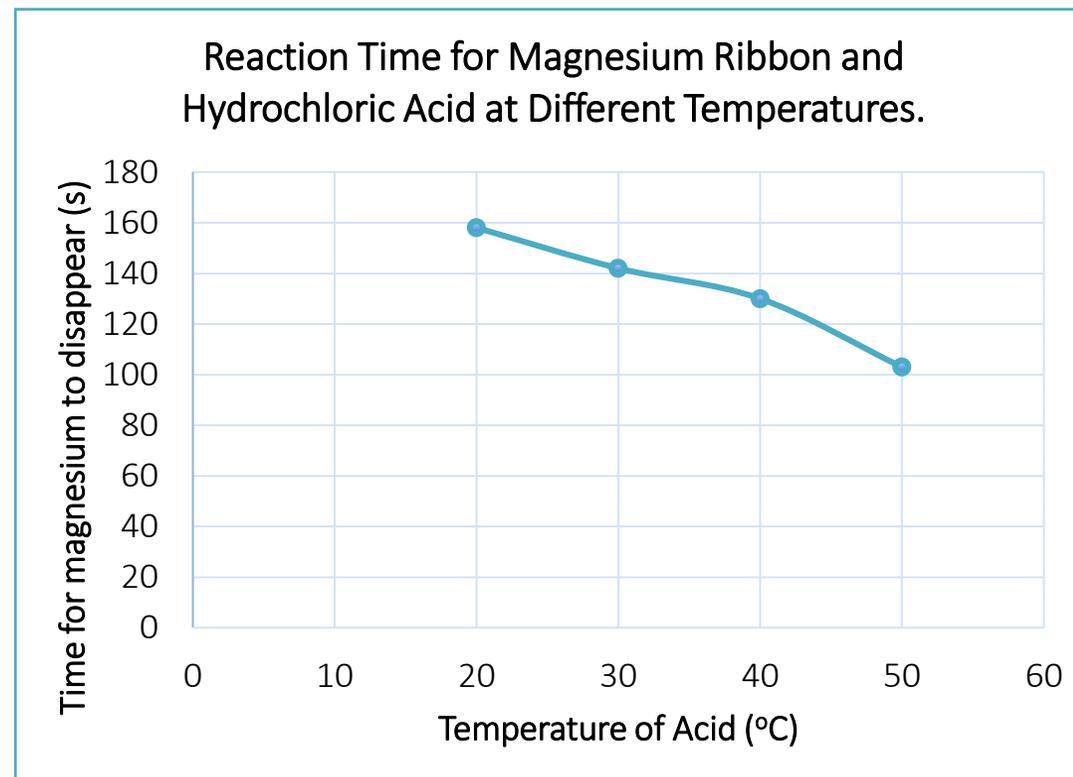
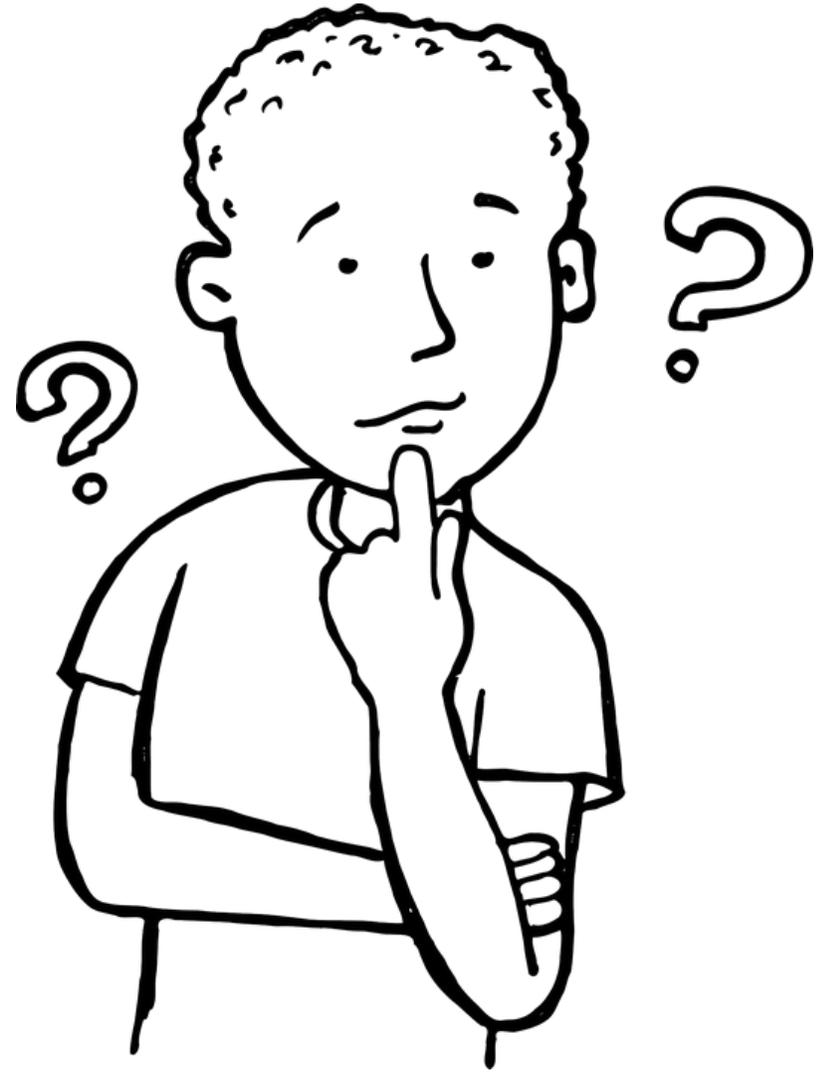**Evaluating your investigation 1**

- The final step to your investigation is to discuss the limitations and reliability of your experiment.

- This may include results that did not fit in with all the others (outliers) or prove your hypothesis.

- E.g.

  Test two for 20ºC did not fit with the data and the time taken to dissolve was much longer. This may have been because this piece of magnesium was much longer than the other pieces used.

Temperature of Acid (º C)	Time for magnesium ribbon to disappear (s)			
	Test 1	Test 2	Test 3	Average
20	136	187	152	158
30	143	133	150	142
40	105	158	127	130
50	97	113	99	103

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Evaluating your investigation 2

- Any problems or difficulties that you encountered when collecting data or sources of error that you found difficult to control and how you attempted to control them.

- E.g.

  Adjusting the temperature of the acid to the exact degree each time while keeping the volume the same was difficult. So, we ended up adjusting the temperature and then removing excess volume with a pipette, so it was more precise.

Evaluating your investigation 3

- Changes that you made to your method.

- E.g.

  Originally, we had decided to conduct all three tests for each temperature at once, but discovered it was too hard to judge when each strip had finished dissolved as they all finished close to each other. Instead, we needed to do one strip at a time to ensure we could accurately identify when each dissolved.

Evaluating your investigation 4

- Improvements that you could make to your investigation if you were to do it again.

  - E.g.

    Next time we could measure the dimensions of the magnesium strips to make sure they are similar in size as we found larger strips took longer to dissolve than smaller ones.

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