

INVESTIGATING

Writing Laboratory Reports

**Title**

A statement summarising what your investigation is about in less than 10 words. (Your dependent and independent variables may be mentioned – see below). ***HINT: Write this last.***

**Introduction:**

Clearly illustrates your knowledge and understanding of the topic. This may include explanations of keywords/concepts, information from your notes or text and research you have done on the topic (including answers to prelab questions).

Follow this structure:

* It begins with issues of a general nature i.e. where in your program does this experiment fit? What have you already learnt about this topic?
* Follow this with specifics about the particular lab activity. Now you are beginning to concentrate on exactly what you are doing in your experiment.
* By now the reader should understand how you have come to your hypothesis (if applicable).

The introduction should be at least 3-5 sentences long and can eventually be up to two pages in length.

**Aim**

One sentence which states the reason for doing the lab activity. Possible starters include *“To investigate ...”, “To observe ...”, “To determine ...”*, etc.

**Hypothesis**

This is a testable statement about what you are researching and explains what you think will happen. It should always include the dependent and independent variable (see below). It is often appropriate to construct it as an *“If ........, then ........”* sentence.

Depending on the nature of the experiment a hypothesis may not always be applicable.

**Variables**

Put this section under three sub-headings:

* Independent variable: often called the manipulated variable as it is the thing you purposely change in the experiment. There should be only one.
* Dependent variable: often called the responding variable as it responds to you purposely changing the independent variable and is what you will take measurements of.
* Controlled variables: the things that might have an impact on the experiment but you have kept them constant so that they do not impact on the results. There should be more than one (the more you can list the better).

**Materials and/or Apparatus**

List the total amounts of everything you will use in the experiment. Be as specific as possible e.g. 1 x 50 mL measuring cylinder, 3 x 200 mL beakers, etc. This should be written as a list in dot points in columns.

**Method**

Step-by-step numbered instructions of how to carry out the experiment. This section should provide enough detail for the reader to replicate *exactly* what you did. This section may include drawings of experimental set-up, flowcharts, maps or tables if they help.

Mention the hazards and risks associated with using the equipment or materials in the procedure.

**Results**

This section should be divided into three parts (although some experiments may not require all three).

* Text: this includes things you observe while carrying out the investigation (remember to use as many of the five senses as possible). Also include one sentence which states the main finding/trend of your experiment.
* Table: this should show raw data as well as any calculations or averages you have performed. You must include units for each quantity measured, a title written above the table and make sure it is presented neatly (i.e. use a ruler).
* Graph: your data should be presented in an appropriate graph, showing only averages (if appropriate). You must have a title written above the graph (this should mention both the independent and dependent variables), labels including units of measurement on both axes and appropriate scales. Make sure it is drawn in pencil (including the title and labels on the axis) on graph paper. Use a ruler when drawing your axes and use a key if needed.

**Discussion**

Follow this structure:

* The first section relates your results back to your hypothesis. The results are summarised and you state whether they supported or disproved your hypothesis. *You can NEVER say that your hypothesis was proved or is correct.* This is usually only one paragraph.
* The second section uses science knowledge to explain why you got the results you did. This might require you doing some research. This section should be at least one paragraph long and can eventually be up to more than one page.
* The third section describes what additional experiments may lead on from your results i.e. now that you have the results of your experiment what would you investigate next.

**Conclusion**

Nothing new should be written in the conclusion. Follow this framework when putting together your conclusion:

* Why did you do the experiment?
* What did your results tell you?
* Was your hypothesis supported?
* One additional sentence which summarises the main science idea related to your findings.

**Evaluation/Critical Review**

Recognise sources of error i.e what things couldn’t you control? If you were to do your experiment again, what would you do differently to try and reduce the effect of these errors? How much do you think the errors have impacted on your results? Taking your errors into account, how confident are you about your conclusions?

**References**

A numbered list of any books, websites, people, textbooks or worksheets that helped you with your experiment and lab report. Your work record comprehensively details how to do this.

**EXERCISES**

1. **Choosing Hypotheses**
2. A scientist has 12 plants. All the plants were the same kind and about the same size. He put three plants on a window sill inside a room. He put another three plants in a closet without a light. He put another three more plants outside on the ground. He put his last three plants outside too, but covered them with paper bags that had holes punched in them for air. All the plants were given good soil and enough water. The plants on the window sill and the plants outside in the open grew well. The plants outside in the bags turned yellow and grew badly. The plants in the closet died. Which of the following is the best hypothesis based on the facts?
	1. Green plants turn yellow due to disease.
	2. Green plants don’t live for very long.
	3. Green plants need light to grow.
	4. Green plants cannot grow inside
	5. Green plants grow well in closets.

Re-write this hypothesis below in your own words: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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1. Louis Pasteur, a famous scientist who lived over 100 years ago, made an important hypothesis about a certain germ called bacteria. He noticed that bacteria grew quickly in open jars of liquid, like chicken soup. Bacteria also grew in jars of soup that were sealed tightly so that no air could get in. However they didn’t grow in soup that was sealed tightly in a jaw, then boiled and kept sealed after it cooled. What was Pasteur’s correct hypothesis?
2. Bacteria cannot grow in jars.
3. Bacteria must have air to survive
4. Bacteria only grow in chicken soup
5. Bacteria can be killed by boiling.
6. Bacteria can live in boiling liquids.

Re-write this hypothesis below in your own words: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**2. Errors in experiments**

Tell what is wrong with each of these experiments. Choose from this list:

* Not enough subjects
* Subjects were not similar.
* Conditions were not kept the same
* The experiment was not reproduced.
1. A gardener wanted to know if XYZ fertilizer would be good for this vegetable. He fertilized all his bean plants with XYZ but didn’t put any fertilizer on his pepper plants. His beans didn’t do well at all, but he got a good crop of peppers. He concluded that XYZ fertilizer was no good.

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1. Alice Larsen wanted to see if a new premium gasoline would give her more kilometers to the litre. She filled her car with the new gas and went on a long trip. When she figured her mileage, she discovered that she had gone 40 Km farther on this tank of gas then she went on a tank of regular gas when she was driving around town as usual. She decided to buy the premium gas for then on to get better mileage.

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1. A molding machine in a factory was not working very well. About a third of the time, the plastic squirt guns that it was making come out with a flaw in the handle. The repair mechanic adjusted the stamping pressure. Then she ran one gun through. It came out just fine, so she figured she had solved the problem.

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1. **Comprehension**
2. **The Strange Case of BeriBeri**

*In 1887 a strange nerve disease attacked the people in the Dutch East Indies. The disease was beriberi. Symptoms of the disease included weakness and loss of appetite, victims often died of heart failure. Scientists thought the disease might be caused by bacteria. They injected chickens with bacteria from the blood of patients with beriberi. The injected chickens became sick. However, so did a group of chickens that were not injected with bacteria.*

*One of the scientists, Dr. Eijkman, noticed something. Before the experiment, all the chickens had eaten whole-grain rice, but during the experiment, the chickens were fed polished rice. Dr. Eijkman researched this interesting case. He found that polished rice lacked thiamine, a vitamin necessary for good health.*

1. State the Problem
2. What was the hypothesis?
3. How was the hypothesis tested?
4. Should the hypothesis be supported or rejected based on the experiment?

e) How could this experiment be improved?

1. **How Penicillin Was Discovered**

*In 1928, Sir Alexander Fleming was studying Staphylococcus bacteria growing in culture dishes. He noticed that a mould called Penicillium was also growing in some of the dishes. A clear area existed around the mould because all the bacteria that had grown in this area had died. In the culture dishes without the mould, no clear areas were present.*

*Fleming hypothesized that the mould must be producing a chemical that killed the bacteria. He decided to isolate this substance and test it to see if it would kill bacteria. Fleming transferred the mould to a nutrient broth solution. This solution contained all the materials the mould needed to grow. After the mould grew, he removed it from the nutrient broth. Fleming then added the nutrient broth in which the mould had grown to a culture of bacteria. He observed that the bacteria died.*

1. Identify the problem.
2. What was Fleming's hypothesis?
3. How was the hypothesis tested?
4. Should the hypothesis be supported or rejected based on the experiment?

j) This experiment led to the development of what major medical advancement?

1. **Identify the Controls and Variables**

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| SmithersSmithers thinks that a special juice will increase the productivity of workers. He creates two groups of 50 workers each and assigns each group the same task (in this case, they're supposed to staple a set of papers). Group A is given the special juice to drink while they work. Group B is not given the special juice. After an hour, Smithers counts how many stacks of papers each group has made. Group A made 1,587 stacks, Group B made 2,113 stacks.   | Identify the:1. Control Group2. Independent Variable 3. Dependent Variable 4. What should Smithers' conclusion be? 5. How could this experiment be improved? |
| HomerHomer notices that his shower is covered in a strange green slime. His friend Barney tells him that coconut juice will get rid of the green slime. Homer decides to check this this out by spraying half of the shower with coconut juice. He sprays the other half of the shower with water. After 3 days of "treatment" there is no change in the appearance of the green slime on either side of the shower.  | 6. What was the initial observation?Identify the-7. Hypothesis8. Independent Variable 9. Dependent Variable 10. What should Homer's conclusion be?  |
| Bart believes that mice exposed to radiowaves will become extra strong (maybe Barthe's been reading too much Radioactive Man). He decides to perform this experiment by placing 10 mice near a radio for 5 hours. He compared these 10 mice to another 10 mice that had not been exposed. His test consisted of a heavy block of wood that blocked the mouse food. He found that 8 out of 10 of the radio-waved mice were able to push the block away. 7 out of 10 of the other mice were able to do the same.  | Identify the-11. Control Group12. Independent Variable 13. Dependent Variable 14. What should Bart's conclusion be?15. How could Bart's experiment be improved? |
| KrustyKrusty was told that a certain itching powder was the newest best thing on the market; it even claims to cause 50% longer lasting itches. Interested in this product, he buys the itching powder and compares it to his usual product. One test subject (A) is sprinkled with the original itching powder, and another test subject (B) was sprinkled with the Experimental itching powder. Subject A reported having itches for 30 minutes. Subject B reported to have itches for 45 minutes.  | Identify the-16. Hypothesis 17. Independent Variable 18. Dependent Variable 19. Explain whether the data supports the advertisements claims about its product. - It does  |

1. **Graphing**
	1. Draw a graph using the information below

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| --- | --- |
| Amount of drop height (cm) | Height of Bounce (cm) |
| Trial 1 | Trial 2 | Trial 3 | Average |
| 10 | 8 | 18 | 16 |  |
| 20 | 24 | 26 | 25 |  |
| 30 | 38 | 34 | 36 |  |

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* 1. What would the rebound height of the ball be if it was dropped from a height of
		1. 25cm? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
		2. 40cm? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_