Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Class \_\_\_\_\_\_\_\_ Date \_\_\_\_\_\_\_\_\_\_\_\_\_

**Lab 2:** **Applying the Scientific Method**

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 **Purpose**

How do scientists approach a problem and go about conducting an experiment?

**Introduction**

Scientific methodology is a general style of inquiry that is used to gather data and test ideas. Biologists use this type of inquiry to learn about living things. Doing experiments is a central part of scientific inquiry. For a controlled experiment, you need both an experimental setup and a control setup. The setups must be exactly the same except for the independent variable. With this approach, you will know that your results are due to that variable.

Using the materials provided by your teacher come up with a testable hypothesis and design an experiment to test this hypothesis making sure to follow the steps of the scientific method.

**Note:** *This is a two-part lab, first you are to complete this fill-in lab and then you will do a formal write up for the lab you design during this lab. The lab you write up will not have data or results so you can only setup the tables, charts or graphs you would use and you can include diagrams of the setup.*

**Materials**

**Safety**

**Pre-Lab Questions**

1. Give an example of an activity that takes place outside of the laboratory in which people use the scientific method to solve a problem \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Procedure**

**Part A: Scientific Method practice**

**Read the following description of an experiment, and then answer the questions.**

*All plants need water, minerals, carbon dioxide, sunlight and living space. If these needs are not met, plants can not grow properly. A biologist thought that plants would not grow well if too many were planted in a limited area. To test this idea the biologist set up an experiment. Three containers were filled with equal amounts of potting soil. One bean seed was planted in container 1, five seeds in container 2, and ten seeds in container 3. All three containers were placed in a well-lit room and received the same amount of water every day for two weeks. The biologist measured the heights of the growing plants everyday. Then the average height of the plants in each container each day was calculated and recorded in a table. The biologist then plotted the data on a graph*

1. What was the purpose of this experiment?

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2. What materials were needed for this experiment?

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3. What is the Independent Variable? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

4. What is the Dependent Variable? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

5. Write the hypothesis. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

6. Draw the experimental setup and include a description of what needs to be done

**Part B: Designing your own experiment**

*You will be provided a variety of items to use in your experiment, you must choose what items to use and design an experiment. Remember to only test ONE variable. The basis of your experiment is growing a plant; all else is up to you.*

1. The first step in any experiment is to clearly **identify the problem** or question being asked. Take a minute to decide what question you would like to ask. This must be written as a question and be specific, not general. State the problem you are investigating

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2. Once the problem is established the experimenter must determine what they think is going to happen. This is written as a **hypothesis**, which is a clear and concise statement that is based upon prior knowledge or research. Hypothesis’ are typically written in an “if \_\_\_\_\_\_\_\_\_\_, then \_\_\_\_\_\_\_\_\_\_ “ fashion.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

3. To clarify what is being tested and how it is being tested the independent variable and dependent variable can be identified. (If IV, then DV)

IV=\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

DV=\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

4. All of the necessary **materials** must be listed so that anyone looking to reproduce your experiment can prepare what they will need.

5. The **procedure** in which the lab is conducted must be written step by step in an ordered list fashion. Try to be as clear as possible and concise. (“KISS”)

|  |
| --- |
| **Example Data Table** |
| **IV** | **DV** |
|  |  |
|  |  |
|  |  |

6. The **data** collected during the investigation will have to be recorded and put into charts or data tables and it can then be graphed. Some investigations will also be better suited by adding pictures or sketches. *Here design a data table and experimental setup sketches.*

7. **Discussion** questions will be answered next.
*(Just use the question from below in” analyze and conclude” and create one question specific to your experiment)*

8. **Conclusion** will be written as a paragraph starting by restating the hypothesis and if it was supported or not. Evidence must be provided and explained to either support or dispute the hypothesis. And a concluding experiment will be written at the end to sum up the investigation. *(in this experiment you will not have data so just decide on what evidence would have been present if your hypothesis was supported)*

**Writing a Laboratory Report**

When scientists perform experiments, they make observations, collect and analyze data, and formulate generalizations about the data. When you work in the laboratory you should record all of your data in a laboratory report. An analysis of data is easier if all data is recorded in an organized, logical manner. Including tables, graphs or diagrams is often useful for this purpose.

A written laboratory report should include all of the following elements.

**Title**: the title should clearly describe the topic of the report

**Hypothesis**: write a statement to express your expectations of the results relating to the problem or question. (“If ….. ,then……” format)

**Materials:** list all laboratory equipment and other materials needed to preform the experiment

**Procedure:** describe each step of the procedure so that someone else could preform the experiment exactly as you have.

**Results:** include in your report all data tables, graphs, and sketches used to arrive at your conclusions

**Conclusions:** record your conclusions in a paragraph at the end of your report. Your conclusion should be an analysis of your collected data.

*Note: a successful experiment does not need to support your hypothesis*