

Name \_\_\_\_\_

Date \_\_\_\_\_

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## Scientific Method Worksheet

Anyone who has ever read a mystery novel or seen a “whodunit” on TV, has seen the scientific method in action. Anyone who has ever tried to figure out what happens to the refrigerator light when you close the door, or where that other sock goes after you put it in the drier, has used the scientific method. The scientific method is not a mystical, incomprehensible rite that only “polyester plaid” science nerds use to solve problems. Instead, it is a logical, organized mechanism for identifying and researching a problem, and devising a strategy for solving it.

One way to look at the scientific method is to split it up into five major steps:

**1. Determining the problem or question. -**

In this step, you (the researcher) must decide what it is that you will be studying. This sounds like a simple procedure, but it is actually very important. It identifies exactly what you wish to learn and it allows you to focus only on that material.

**2. Development of a hypothesis. -**

The hypothesis is not just a random guess to your problem. Instead, the hypothesis is an Educated Guess. In other words, it involves researching the problem and finding out what other people have learned, and using that information to help devise an answer. An important aspect of the hypothesis is that it should answer the original question, and it should be testable!

**3. Design an experiment to test the hypothesis. -**

Design an experiment whose results will either support or disprove your hypothesis. If your hypothesis is supported(accepted), then the results of your experiment will indicate that your hypothesis is correct. However, this does not mean that your hypothesis is 100%, beyond a shadow of a doubt, correct. There may be other factors that will influence the results that you haven't tested. Therefore, it is important to say that the hypothesis is **supported or accepted**, you should never say that it is proven! However, the results of your experiment can prove your hypothesis wrong! - There should be at least two groups in your experiment. The first group is the experimental group. This group is the group(s) that has the factor that is being tested (Independent Variable). It is easy to identify the Independent variable, since it is stated in the hypothesis. You may have more than one experimental group- testing varying levels of the independent variable. The second group is the control group. The control group is identical to the experimental group in every way, except that they lack the independent variable. (If there were other differences, then they would invalidate the results of the experiment.) All other factors(variables) should be constant.

**4. Conduct the experiment and collect the data. -**

Run the experiment that you have so carefully constructed. In this step, you will be **measuring** the dependent variable. This variable (DO NOT confuse it with the independent variable) is the thing that is being observed or measured. Any pieces of information that you collect regarding the dependent variable are called DATA. Collect data in an organized data table. Then use the data to create a graph.

**5. Draw Conclusions from your data. -**

Here, it is stated directly whether the hypothesis was supported/accepted or rejected/disproven. - If your hypothesis is supported, it should be repeated, since one of the basic foundations of the scientific method is that it is repeatable. The more an experiment is repeated, the more valid the results are. However, if there is a hypothesis that is supported by many experiments and a lot of data, we call that hypothesis a **theory**. - The word theory is often misused in everyday language. Theory and hypothesis are *not* synonyms, a hypothesis is just an educated guess that perhaps has been supported once or twice by an experiment. A theory was once a hypothesis, but is now supported by a lot of data and is accepted as being correct, until new information is discovered to disprove it.

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## Scientific Method Review

1. The procedure scientists use to answer a question or solve a problem is known as the S\_\_\_\_\_ M\_\_\_\_\_.
2. The steps involved in carrying out the S\_\_\_\_\_ M\_\_\_\_\_ include:
  - a. Identify a P\_\_\_\_\_ or Ask a Q\_\_\_\_\_
  - b. Stating a H\_\_\_\_\_
  - c. Test the H\_\_\_\_\_ by designing a controlled E\_\_\_\_\_
  - d. C\_\_\_\_\_ and R\_\_\_\_\_ data
  - e. A\_\_\_\_\_ your results
  - f. Coming to a C\_\_\_\_\_ as to whether your H\_\_\_\_\_ is supported/accepted or R\_\_\_\_\_
3. A hypothesis is an E\_\_\_\_\_ G\_\_\_\_\_ that suggests a possible explanation to some phenomenon or event.
4. The D\_\_\_\_\_ V\_\_\_\_\_ is what the scientist/experimenter M\_\_\_\_\_ and R\_\_\_\_\_ during an experiment.
5. The I\_\_\_\_\_ V\_\_\_\_\_ is the ONE factor the scientist/experimenter V\_\_\_\_\_ or C\_\_\_\_\_ during an experiment.
6. All good experiments must have only O\_\_\_\_\_ I\_\_\_\_\_ V\_\_\_\_\_ and a T\_\_\_\_\_ Hypothesis.
7. A C\_\_\_\_\_ G\_\_\_\_\_ is a necessary component of many science experiments and serves as a C\_\_\_\_\_.
8. C\_\_\_\_\_ are variables/factors that stay the same in both groups.
9. An E\_\_\_\_\_ G\_\_\_\_\_ is identical to the C\_\_\_\_\_ G\_\_\_\_\_ in every way except for the I\_\_\_\_\_ V\_\_\_\_\_.
10. A good conclusion will include D\_\_\_\_\_ collected during the E\_\_\_\_\_ that validates the conclusion.

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**Experiment Scenario 3:** A biologist set up an experiment to study nine mice. On day 1 of the study, the mice were measured for a variety of characteristics. Then the mice were put into individual cages and kept under the following conditions:

<u>Mice 1, 2, 3</u>	<u>Mice 4, 5, 6, 7</u>	<u>Mice 8, 9</u>
14 hours of light per day	14 hours of light per day	14 hours of light per day
Food one time/day – 5 oz.	Food one time/day – 5 oz	Food one time/day – 5 oz
Temp. 70 ° F	Temp. 85 ° F	Temp. 50 ° F
Wheel for exercise	Wheel for exercise	Wheel for exercise
Cage size: 3 feet by 1 foot	Cage size: 3 feet by 1 foot	Cage size: 3 feet by 1 foot

After the study, which lasted for 28 days, the same data about the mice was collected. Some of the data is given below:

Mouse Number	Weight (grams)		Length (cm)	
	Before	After	Before	After
1	352	392	24.7	25.4
2	346	395	25.1	25.8
3	355	410	24.9	25.4
4	353	385	24.9	25.3
5	359	382	25.0	25.7
6	357	386	24.8	25.3
7	349	378	25.0	25.3
8	345	365	22.9	22.9
9	352	361	24.3	24.5

What are the constants (variables that stay the same- also called controlled variables)?

\_\_\_\_\_

What is the independent variable? \_\_\_\_\_

What is the dependent variable? \_\_\_\_\_

What data do you need to collect during this experiment? \_\_\_\_\_

\_\_\_\_\_

What flaw in the design of the experiment can you find? Explain.

\_\_\_\_\_

\_\_\_\_\_

What conclusion(s) can be drawn from the data? Explain, using data to support your conclusion(s).

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## Scientific Method Practice Scenarios

**Experiment Scenario 1:** A Biology student wants to conduct a study of how the amount of sunlight affects the length of sleep for mice. She sets up four cages with a mouse in each cage.

	Mouse 1	Mouse 2	Mouse 3	Mouse 4
<b>Size of cage</b>	30cm x 30cm	30cm x 30cm	30cm x 30cm	30cm x 30cm
Amount of Water per Day	50 mL	50 mL	50 mL	50 mL
Amount of food per day	1 serving per day, 25 grams	1 serving per day, 25 grams	1 serving per day, 25 grams	1 serving per day, 25 grams
Temperature in cage	20 °C	20 °C	20 °C	20 °C
Amount of Sunlight per Day	12 hours	8 hours	15 hours	18 hours
Exercise wheel?	Yes	yes	Yes	yes

What are the constants (variables that stay the same- also called controlled variables)?

\_\_\_\_\_

What is the independent variable? \_\_\_\_\_

What is the dependent variable? \_\_\_\_\_

What data do you need to collect during this experiment? \_\_\_\_\_

\_\_\_\_\_

**Experiment Scenario 2:** A Biology student wants to conduct a study of how the amount of food affects the weight gain for mice. He sets up four cages with a mouse in each cage. Fill in the boxes that would allow the biology student to complete the study correctly.

	Mouse 1	Mouse 2	Mouse 3	Mouse 4
<b>Size of cage</b>	30cm x 30cm			
Amount of Water per Day	50 mL			
Amount of food per day	4 servings per day, 25 grams each			
Temperature in cage	20 °C			
Amount of Sunlight per Day	12 hours			
Exercise wheel?	yes			

What are the constants (variables that stay the same- also called controlled variables)?

\_\_\_\_\_

What is the independent variable? \_\_\_\_\_

What is the dependent variable? \_\_\_\_\_

What data do you need to collect during this experiment? \_\_\_\_\_

\_\_\_\_\_