Name: _____ Class: _____

The Scientific Method

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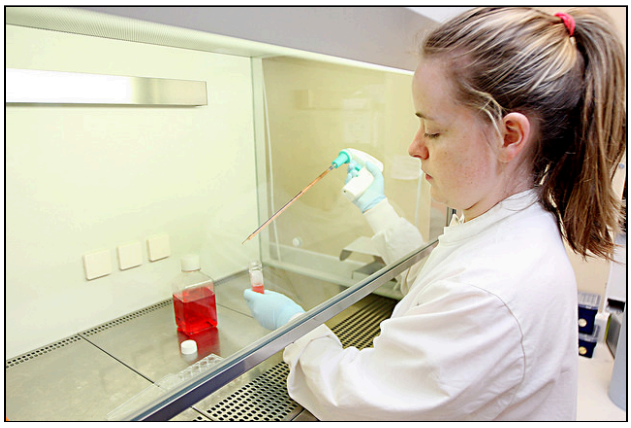
In this informational text, Barrett Smith explains the steps of the Scientific Method, a process that scientists use while conducting experiments. As you read, take notes on each step of the Scientific Method.

[1] The Scientific Method is the name for the steps that scientists follow when conducting an experiment. The Scientific Method was developed by the ancient Greeks and has been refined[1] by scientists ever since. Sometimes scientists modify[2] these steps depending on the type of experiment, and sometimes they have to back up and repeat steps. But it's important to follow these steps because they allow us to test things in the most accurate and valid[3] way possible.

These are the typical steps that scientists would go through in order to complete the Scientific Method:



Ask a question

Usually experiments start when people ask questions about things they see around them. The scientific method will help you answer those questions. When picking a question to study, it is best to start with a question that has an answer that can be measured. For example, how does caffeine, a substance found in coffee, affect plant growth? It will be easy to measure how much a plant grows over time using a ruler.

Construct a hypothesis

A hypothesis is a scientific term for an educated guess. When forming your hypothesis, you can often fill in an if ____ , then ____ statement. For example, if plants are watered with coffee, then they will grow faster. You should do background research on the topic while constructing your hypothesis so that your guess can be well-informed.

1. **Refine** ***(verb):*** to improve something by making small changes
2. **Modify** ***(verb):*** to make partial or minor changes to something
3. **Valid** ***(adjective):*** based on truth or fact

Test your hypothesis with an experiment

[5] It is important that your experiment is a fair and valid test of your hypothesis. You should make sure that you only change one condition in your experiment at a time and keep all other conditions the same. In our example, you would want to make sure that the only thing you change is what you water the plants with. You would use the same type of seeds in each plant, the same type of soil, and keep them in the same place where they will get the same amount of sunlight. If one plant gets more sunlight than another one, you won't know for sure if it was the sunlight or the coffee that made it grow faster. You also need to repeat the experiment several times to make sure the results were not random. This is called having multiple trials.

Analyze Data

Collect your measurements and analyze[4] them to see if they support your hypothesis. You can put your measurements in a chart or a graph to help you. It is important to think about what type of graph works best for your data.[5] A line graph would work well to present the data from our experiment, as it can show how the plant heights changed over time. Bar graphs and pie charts are also very useful graphs.

Communicate results

You might present your results on a display board or write about them in a final report. You will want to share the question you asked and your hypothesis and then explain your experiment. You will often be asked to present a list of materials and the steps of your experiment — this is called the procedure. Finally, you will present your data through charts and graphs and write a conclusion. The conclusion will state whether your hypothesis was true or not. Even if your results do not support your hypothesis, your experiment is still valid if you followed the scientific method!

Here are some important terms that scientists use when conducting experiments:

Variable — In experiments, the things that change are called variables. There are three kinds of variables: independent, dependent, and controlled.

Independent Variable — The independent variable is the one variable that the scientist changes during the experiment. In our experiment, the independent variable was what you used to water the plants. Again, it is important that this is the only thing you change in the experiment so your results are valid.

[10] *Dependent Variable* — The dependent variable is the thing scientists are looking to see change as a result of the independent variable. In our example, how much the plant grows is the dependent variable.

4. **Analyze** ***(verb):*** to study or determine the nature and relationship of the parts of something
5. **Data** ***(noun):*** facts and statistics collected together for analysis

Control — The control is an experiment where nothing is changed and offers a baseline to compare to the experiments in which something has been changed. In our experiment, the control would be a plant that you water with water. This way you can compare the other parts of the experiment to the control to see how much your independent variable affects it.

When you decide to conduct an experiment, whether it be for school, a science fair, or just to test out questions you have about the world, make sure to follow the scientific method and only change the independent variable so that your results will be valid. When you finish your experiment, don't forget to do multiple trials. If you find your results don't prove your hypothesis, you can do some more research and create a new hypothesis and experiment. If your results do prove your hypothesis, keep asking questions and you can conduct further experiments to more deeply understand the subject and the world around you.

Text-Dependent Questions

Directions: For the following questions, choose the best answer or respond in complete sentences.

1. PART A: Which statement expresses the text's central idea?
    A. The Scientific Method gives scientists a process to help them make sense of the world and determine what is true.
    B. The Scientific Method's simple process children use to make sense of the world around them.
    C. The Scientific Method is not perfect, but it is currently the only way humans can make sense of the world around them.
    D. The Scientific Method is difficult for many people to grasp due to its strict steps and discouragement of creativity.

2. PART B: Which quote from the text best supports the answer to Part A?
    A. "The Scientific Method was developed by the ancient Greeks and has been refined by scientists ever since." (Paragraph 1)
    B. "Usually experiments start when people ask questions about things they see around them. The scientific method will help you answer those questions." (Paragraph 3)
    C. "You will often be asked to present a list of materials and the steps of your experiment — this is called the procedure." (Paragraph 7)
    D. "make sure to follow the scientific method and only change the independent variable so that your results will be valid." (Paragraph 12)

3. What is the author's purpose for including the experiment regarding the effects of coffee on plant growth?
    A. to show students the benefits of drinking coffee
    B. to emphasize how easy it is to use the Scientific Method
    C. to prove that a scientist's hypothesis can be anything, even something silly
    D. to give students a real-world example of the Scientific Method

4. How does the conclusion contribute to the development of ideas in the text (Paragraph 12)?

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Discussion Questions

Directions: Brainstorm your answers to the following questions in the space provided. Be prepared to share your original ideas in a class discussion.

1. If you could conduct any experiment you wanted to using the Scientific Method, what would you test and why?

2. How does the Scientific Method help scientists better understand the world? How does the Scientific Method compare to other ways in which scientists study the world? Cite examples from the text, your own experience, and other literature, art, or history in your answer.

3. In your opinion, what are the benefits and disadvantages to using the Scientific Method? Cite examples from the text, your own experience, and other literature, art, or history in your answer.