

- Ask a question.
- Form a hypothesis.
- Test the hypothesis.
- Analyze the results.
- Draw conclusions.
- Communicate results.

The Scientific Method Lecture Notes (EC printing: 5pts)

What is the scientific method?

Let's cut to the chase, what in the name of Newton, is the scientific method? It is a series of steps that scientists use to _____ and _____

_____ There are about 6-7 steps.

Imagine this... One day you are walking down the street. It is a lovely day; blue sky, white puffy clouds, warm temp, faint breeze, and you smell barbeque off in the distance. Suddenly, you notice something weird. *You see 5-year-old Buddy next door pouring a bottle of Gatorade on a rose bush.*

Steps of the Scientific Method	Example
<p>Step 1: _____ While on your walk, you made an observation. Or, in other words, you _____ using one of your senses. Observations can include seeing, smelling, tasting, touching, or hearing something. You can make a detailed observation by measuring something (volume, temp, mass, etc.)</p>	
<p>Step 2: _____ After making an original observation, you will next ask a question.</p>	<p><i>After observing Buddy, you started to wonder... "Does a sports drink make a plant grow faster?"</i></p>
<p>Step 3: _____ Once you've asked your question, your next step is forming a hypothesis. A hypothesis is a possible explanation or answer to a question. It's an _____. Before developing a hypothesis, scientists usually research the original question. After all, what if there is already an answer out there?? A good hypothesis is _____ - I can create an experiment to test my idea. A good hypothesis is also typically written in an _____ format.</p>	<p><i>For my experiment, I need to learn as much about Gatorade as I can.</i></p> <p><i>"If a plant receives 20 ml of Gatorade daily, THEN it will grow 10% more quickly than if it received just water. "</i></p>
<p>Step 4: _____ Now that I've developed my fine hypothesis, it's time to test it. Before testing the hypothesis, you need to: <ul style="list-style-type: none"> ✓ Create a _____ ✓ Identify your _____ and _____ <p>The Experiment: The _____ are the step by step directions for conducting the experiment. It's like following a recipe. If the procedures are good enough, any one can copy my experiment.</p> <p>Variables: A variable is something that I am changing in my experiment. The _____ is what I am changing in the experiment. The _____ is what I am measuring in the experiment.</p> <p>Controls: A _____ is a standard for comparison. It is what I leave alone in my experiment and use to show that the experimental change is not due to some other condition.</p> <p>Once you've planned the experiment, you can then go ahead and conduct it. Some experiments take months and years to complete. The point of each experiment: to _____! What is data? _____ and _____ recorded during an experiment.</p> </p>	<p><i>Example:</i></p> <ol style="list-style-type: none"> 1. Obtain and plant 10 rose bushes. 2. Give rose bushes #1-2 10 ml of water at 8:00 AM and 8:00 PM daily. 3. Give rose bushes #3-4 20 ml of water at 8:00 AM and 8:00 PM daily. 4. Give rose bushes #5-6 10 ml of Gatorade at 8:00 AM and 8:00 PM daily. 5. Each day, measure & record plant growth. Etc. <p>Experimental Variable: <i>I am changing the amount of Gatorade versus water.</i></p> <p>Measured Variable: <i>I am measuring the how quickly the plant grows.</i></p> <p>Controls: <i>The control in my experiment is that some plants are receiving water. Also, all plants get the same amount of sunlight, dirt, etc.</i></p>

Step 5: _____

Now comes the math! When the experiment is done and the data has been collected, it's time to look at what you got! Experimental results usually involve data tables, graphs and pictures.

Step 6: _____

Based on your experiment, what is the answer to your original question? Time to form your conclusion. You may conclude:

- The results supported my hypothesis → Ask more questions
- The results did not support my hypothesis → Check for errors or conduct a new experiment
- I need more information → Start all over, seek help

You Try It: Observation or Conclusion?

1. The pencil is yellow _____
2. Water is a liquid _____
3. My grade shows that I did not study hard enough before the quiz _____
4. Copper Sulfate is blue _____
5. Science is an easy subject for me _____

What is a theory?

A _____ is a logical explanation for events that occur in nature. It is an explanation based on _____ and _____. Some conclusions lead to scientific theories. Theories are not set in stone; they can be changed with new information

Step 7: _____

After days, months, years of research and experimentation, you are finally ready to share your results with the world! You make recommendations by talking with peers or writing it down in a scientific paper. In this last step, you are not only _____ what you discovered, but also making recommendations for _____ or improvements.

Review of the Scientific Method:

Step 1: Observation

Step 2: Ask a Question

Research question

Step 3: Make a Hypothesis

Step 4: Test Hypothesis

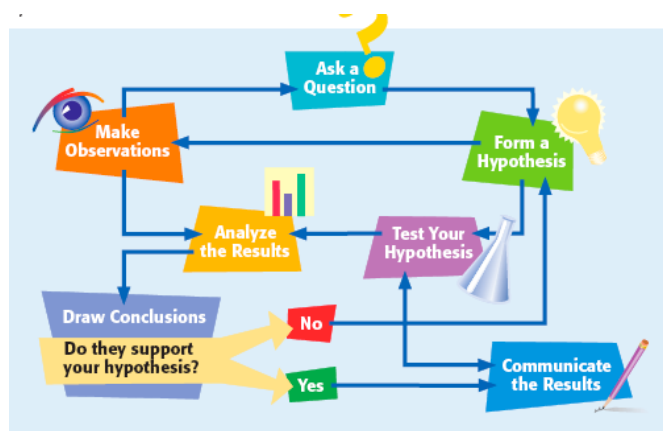
Develop experiment, record results in data tables

Step 5: Analyze Results

Make graphs

Step 6: Form Conclusions

Step 7: Make Recommendations (Communication)



You Try It: Mini Demo

I have two beakers with a small amount of clear liquid. Can you tell what the two liquids are? *My Hypothesis:* Although the two liquids look the same, you believe they are very different. Think of a way to test this hypothesis and write it down:

What conclusions can you draw from this demonstration?