

THE SCIENTIFIC METHOD

THE BIG QUESTION:

What do you want to know?

RESEARCH:

Gather more information about your Big Question

HYPOTHESIS:

What do you *predict* is the answer to your question?

EXPERIMENT:

Design & carry out a step-by-step test for your hypothesis

COLLECT YOUR DATA:

Keep track of what's happening during your experiment

OBSERVATIONS AND RESULTS:

What did you notice happened during your experiment?

CONCLUSION:

Was your hypothesis correct or incorrect?

Now roll up your sleeves, it's time to DO SOME SCIENCE! Read on for a review of the scientific method...

You can use these pages as a resource to help you get organized. Have no fear... *The scientific method is not scary!* It's really just a plan for investigating the world around you. You use the scientific method to create an experiment to test your ideas. If you follow the steps as best you can, you will be asking questions, doing science, and communicating about what you did. You can also read this and adapt some ideas for demonstration projects. So get your scientific thinking caps on and jump into step one!

FIRST: Be curious and observant

See, hear, touch, taste, smell things in the world around you. Scientist Rachel Carson once said, "*If I had influence with the good fairy who is supposed to preside over the christening of all children, I should ask that her gift to each child in the world be a sense of wonder so indestructible that it would last throughout life.*" What do you wonder about?

Write some ideas down here:

See, you are already thinking like a Scientist!

Step ONE: THE BIG QUESTION

What do you want to know?

Are you curious about life on other planets? Great. Is that a question that you, yourself can answer? Mmm, maybe not so much. A great Big Question is one that you can actually find an answer to. Let me repeat that, **A great Big Question is one that you can actually find an answer to.** This is also known in some scientific circles as a *testable question*. Right now, ask yourself if your idea can be turned into a question that *you*, yourself can answer, by conducting an experiment. Once you have a question that you think you can answer by conducting an experiment, you have just completed the most difficult step of the scientific method. The rest is cake - a large cake yes, but still tasty!

Write your Big Question here:

Step TWO: REseaRCH

Gather more information about your Big Question



Read up a little bit on your big question. Go to the library. Have your family help you with an internet search. (You can also check out the resources in this guide). This information will help you predict the answer to your big question.

Step THREE: Formulate Your Hypothesis

What do you *predict* is the answer to your question?

Formulate your hypothesis is science speak for predicting the answer to your Big Question. What do you guess will happen when you test your idea? Super fancy scientists often make their hypothesis into an "If I do _____, then _____ will happen." But you don't need to be a super fancy scientist, unless you want to

Write your Hypothesis here:

Excellent work! From here on in, your job is to find out whether your guess is right or wrong. *You can do it!*

Step FOUR: EXPERIMENT

Design & carry out a step-by-step test for your hypothesis

Now the going gets good (and sometimes a little messy!) - This is where you test your idea to figure out if your guess was right or wrong. Make a plan. Your plan for testing your guess is your *experiment*.



Design your experiment step-by-step

Collect all the materials you need



Follow the steps of your plan at least a three times (over and over) - good scientists like to repeat an experiment in order to confirm their results.

Step FIVE: COLLECT YOUR DATA

Keep track of what's happening during your experiment

Take careful notes on everything you do (these can also include drawings & sketches - like the notebooks of Leonardo da Vinci's, only you might not want to write everything in mirror writing like he did - why complicate things???)

Record the steps and outcomes of your experiment (also known as *collecting your data*) in your project notebook. You can also make pictures or take photographs of each step of the experiment to use for your project display board.

STEP SIX: OBSERVATIONS AND RESULTS

What did you notice happened during your experiment?

Look at your data and think about what happened in your experiment. Make a chart, table, or graph to show the results of the data you collected (Be creative!)

Step Seven: Conclusion

Was your hypothesis correct or incorrect?

Look at the results of your experiment and think about what happened. Was it what you expected? Explain your thinking. Remember, the conclusion is *not* the same as the results - your hypothesis could have been wrong.

Actually, making an incorrect hypothesis can be the best possible mistake - many important discoveries are made this way (Penicillin for instance!). In science, it's okay to be wrong (unless you're working with weird chemicals or nuclear reactors, then being wrong can really be a bummer).



Still



not quite sure what to do? *Have no fear!*
Read on...

To get a better idea of how to use the Scientific Method to investigate, it might be easier to see a short version of the scientific method in action... (The following section is adapted from the website: www.nceas.ucsb.edu/nceasweb/kids/experiments/scimethod/hypothesis.html)

Start with your Big Question: "Which falls faster, a feather or a bowling ball?"



Make your Hypothesis: Suppose a person is holding a bowling ball and a feather, and wants to find out which one will hit the ground first if both are dropped from the same height at the same time. First, the person would develop a hypothesis... *"I believe that the bowling ball will hit the ground before the feather if I drop them both from the same height at the same time."*

Experiment and Data Collection: Next, the person would drop the bowling ball and the feather at least 3 times, collecting data by keeping track of which item hit the ground first each time. After dropping the ball and the feather 5 times, the person would then calculate the number of times each item hit the ground first, something like:

Bowling Ball	Feather
1	0
1	0
1	0
1	0
<u>1</u>	<u>0</u>
5	0

Data Analysis and Conclusions: Finally, after demonstrating that the ball hit first each of the five times, the person could conclude that their hypothesis appears correct, the bowling ball DOES hit the ground first!!

So, often data is collected to test a hypothesis, and the analysis of the data is used to prove or disprove the hypothesis.