



# SCIENCE PROJECTS

Pick an idea that interests you, do some research and narrow your topic down to a problem/ question that is testable.

## General Topics:

### Water in the Environment:

- erosion
- lakes
- ponds
- oceans
- rivers
- streams
- watersheds
- wetlands

### Climate & Weather:

- dew
- frost
- ice
- mist/ fog
- rain
- snow
- vapor

### Biosphere Cycles:

- carbon cycle
- nitrogen cycle
- oxygen cycle
- water cycle

### Special Properties of Water:

- capillary action
- hydrogen bonding
- ice expands
- surface tension
- tendency for things to dissolve
- viscosity

### Physics of Water

- general forces of fluids
- density hydraulics
- floating and sinking
- pressure
- rainbows
- rate of flow
- reflection from above water
- refraction-passage of light through water
- water and sound – which travels faster/farther

**Water Pollution:**

- acid rain
- oceans
- rivers

**Water Purity and Water Quality****Things that Dissolve in Water:**

- chlorine
- copper and iron
- nitrogen
- organic matter
- oxygen
- hardness
- pH

**Water Resources Industry/ Man-Made Water Systems:**

- aquariums
- aqueducts
- backyard ponds
- bottling plants for bottled water
- bottling plants for distilled water
- drinking water filtration
- Diamond Valley Lake
- fish tanks
- reservoirs
- swimming pools
- wastewater treatment
- water distribution system
- wells

**Water and Life**

- animals
- humans
- micro-organisms
- plants

**Water Conservation**

- brush teeth and turn off faucet
- buckets in shower
- full load of dishes and laundry
- low-flow faucets and toilets
- shorter showers
- sweep driveway with broom
- water-saving garden

# THE SCIENTIFIC METHOD

The scientific method is a systematic way of finding the answers to a question or problem. Scientists use the scientific method when they want to find a solution. All scientists use the same five steps that make up the scientific method.

The steps of the scientific method are:

- Problem
- Research
- Hypothesis
- Experiment
- Conclusion

Notice that the actual experiment is only a portion of the scientific method. Just because you do an experiment does not mean that you have completed the scientific method. The main objective of doing a science fair project is to learn and understand the steps of the scientific method and to determine why each step is crucial.

The first step of the scientific method is the **PROBLEM**. You need to define your PROBLEM, specify what you are trying to find out, and phrase the PROBLEM into a question. When you put your PROBLEM into a question, format it so that everyone who sees your project knows what you are trying to find out. State the PROBLEM clearly at the beginning of the project and from then on everybody will understand what you are trying to find.

The second step is **RESEARCH**. In the RESEARCH phase of the scientific method you will investigate what is already known about your topic. This is not normal studying like you do when you read a chapter in your history book. The research for a science fair project can include many sources. Of course this includes reading books, but not just school books. You can also read newspapers, journals, booklets, and brochures. In addition you can look up your topic on the Internet, (if you have access and your parents' permission.) Or you can do interviews with people who have studies about your topic. There are all sorts of ways to do your RESEARCH and it will be a lot more fun if you use different types of resources to complete your RESEARCH.

The third step is forming your **HYPOTHESIS**. A HYPOTHESIS is an educated guess about the outcome of your experiment. Based on your research you are to speculate about the answer to your problem. Forming a strong HYPOTHESIS is a key step in the scientific method because it helps you to set up and plan your EXPERIMENT.

The fourth step of the scientific method is the **EXPERIMENT**. Your EXPERIMENT should be set up to test whether or not your hypothesis is correct. You will not know for sure if your hypothesis is true until you complete your EXPERIMENT. You may find out that your hypothesis was not correct. That is alright, just be sure to carefully plan your experiment from the beginning. Careful planning makes it more likely that your

EXPERIMENT will really test for the answer to your problem, whether your hypothesis turns out to be correct or not.

Keeping a journal or log is a very important part of your project. Be sure to write down all of the results of your experiment. But just writing down the results is not enough. You need to write down EVERYTHING that you observe or notice about your project. For example, if you are using plants as part of your experiment and you notice that the leaves are turning brown around the edges, write your observations down. You want to record anything that develops within your project and what time and date it occurred, especially during the experiment phase. This documentation will make your conclusion credible.

The last step to the scientific method is your **CONCLUSION**. Did your hypothesis prove to be correct or not? If your hypothesis did turn out to be correct GREAT! Why did it turn out correct? Is there another variable that you think could have changed your results? If your hypothesis was incorrect, why do you think it did not turn out the way that you thought it would? (Remember if your hypothesis was not correct that does not disqualify the validity of your experiment. The main objective is to learn and understand the scientific method.) Were there any major surprises that occurred while conducting your experiment? How might you have reduced your probability of error? What did you learn from this experiment? Be sure to clearly explain your answer. If there are other answers that you want to include in your CONCLUSION that is fine also. Your CONCLUSION ties up all the loose ends and answers questions anybody might have regarding your project. Other questions might arise from your experiment in which you may want to further study your topic, and if so, this is good.



# TYPES OF SCIENCE FAIR PROJECTS

As you plan your project, you may find it useful to consider the TYPE of science fair project you are doing. Science Projects fall into different categories from the simplest to the most complex.

The simplest type of project involves observing the environment. If you are doing this type of project you will be studying your surroundings in order to classify and organize what is there. You will not be CHANGING your environment in any way, you will simply be observing it.

For example: What types of plants can you find in a wetland?

A more complicated science project involves not just observing what is there but also collecting and analyzing data.

For example: How many of each type of plant live in a particular wetlands?

The most complex and interesting type of science project involves controlled experimentation. In addition to observing the environment and collecting data about what you observe, you will be CHANGING ONE ASPECT OF THE ENVIRONMENT in order to see what happens. The one thing that you change is called the *manipulated variable*.

Your manipulated variable could be temperature, amount of light, size or shape of a container, the number of plants per pot, the amount of water, etc. It is important to have just one manipulated variable. If you are changing the amount of light your plants get, be careful to use a light source that does not also change the temperature of the water. In controlled experimentation you KEEP EVERYTHING THE SAME EXCEPT FOR THE MANIPULATED VARIABLE. All other variables are kept the same and are called the *controlled variables*.

To continue our example: Let's say you have observed more Duckweed than Water Lilies growing in a particular wetlands. You want to know why this is so. You state your problem as a question: "Why is there more Duckweed than Water Lilies in the XYZ Wetlands?" After doing your research, you come up with a hypothesis: "I think there is more Duckweed because the amount of nitrogen in the water is just right for growing Duckweed but not as good for growing Water Lilies." Now you have to set up your experiment to test this hypothesis. Your manipulated variable will be the amount of nitrogen in the water. Your controlled variables will be everything else: amount of water, water temperature, size and shape of the containers, the number of each type of plants you start with in each container, the amount of light the plants get, and so on. You will have to have several containers each with a different amount of nitrogen in the water. And you have to measure the growth of the Duckweed and Water Lilies (these are the *responding variables*) over time. The data you collect will tell you the best amount of nitrogen in the water for growing each type of plant. You can then compare that to the amount of nitrogen in the XYZ wetlands and see if your hypothesis was correct.

You will learn the most if you plan your science fair project as a controlled experiment.

In planning your project, you need to consider the following things:

- What am I trying to find out? This is the **PROBLEM**.
- What do I think the answer to my problem will be? This is the **HYPOTHESIS**.
- What is the one variable that I plan to change during the experiment? – (**MANIPULATED VARIABLE**).
- What are the other variables that I need to keep the same during the experiment? – (**CONTROLLED VARIABLES**).
- What is the variable that I think will, or will not, change in response to the manipulated variable? – (**RESPONDING VARIABLE**).

Science Fair Project Planning Grid			
Project	Problem:	Hypothesis:	Procedure:
Observation of the Environment			
Collecting and Analyzing Data			
Controlled Experimentation			manipulated variable:
			controlled variables:
			responding variables:

# SCIENCE FAIR PROJECT PRE-PLANNING SHEET

So, you need to come up with a topic for a science fair project. Is there anything in your house or in your yard that you are curious about? Have you ever wondered why something works the way it does or how it originated?

Choose a topic that YOU like, and are curious about.

List some things that you think you could do a project on. Remember to keep it simple.

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Once you have decided on a topic for your project look in your Science Book to see what information it has on your topic. Other sources you can go to for information include: your teachers, the library, or the Internet (if you have access.) You may also be able to use the Internet at your local library. Be sure to write down everything you find and where you found it. (The author, the title of the book, the year it was written, and the publisher.)

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Have you thought about how you are going to conduct your experiment? Remember to keep in mind how long it is going to take you to set-up your experiment, how long the process of your experiment will take in order for you to get accurate results, and how long it will take for clean-up. For example, if you are going to be growing plants you need to think about the time it is going to take to plant seeds. Be sure to keep in mind that plants don't grow over night, therefore you need to allow several days or even weeks for your experiment process to be completed. Other experiments might need time to set or to dry. How long do you expect your experiment to take?

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Writing down the procedure that you plan to use is VERY important. This will help you save time and energy by carefully planning your experiment. It may also help you to come up with simpler steps and help you think about ways to make your experiment safer for yourself, your parents, and your teacher. Keep your procedure in mind now, you'll write it down in a little while. When planning your experiment try to think of whose help you're going to need ahead of time. Do you need your parents' help? \_\_\_\_\_ Do you need your teacher's help or supplies? \_\_\_\_\_ Do you need help from other people? \_\_\_\_\_

BE SURE TO TELL YOUR PARENTS ALL OF YOUR PLANS AND MAKE SURE THAT THEY SAY OKAY. ALSO KEEP IN MIND YOUR BUDGET, YOU DO NOT WANT YOUR EXPERIMENT TO COST BIG BUCKS.

Decide on the title of your project. Remember to keep it simple

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Don't forget to keep a journal of everything that you do concerning your science fair project, from start to finish. You'll be thankful later.

# SCIENCE FAIR PROJECT PLAN

1. I am trying to find out\_\_\_\_\_

2. In question form (also the title)\_\_\_\_\_

3. My hypothesis is\_\_\_\_\_

4. I plan to prove this by (procedure\_)\_\_\_\_\_

5. Materials I will need\_\_\_\_\_

6. Resources I will use to research this topic and help me to understand my results