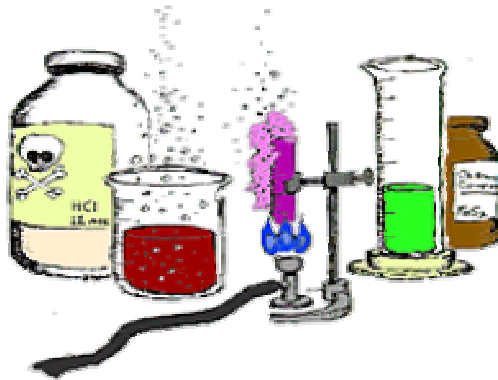


Scientific Method



Why are we studying science? What does science have to do with my world? Many students have probably pondered questions like these. Just because you may not care about water changing from a solid to a liquid or why it is important to keep from polluting underground sources of water, some aspect of science will eventually have an effect on your life. So remember that science is not just for laboratory workers in white coats. Science affects all of us each and every day of our life. One of the first and most important aspects of science we are going to explore is the Scientific Method. This method is extremely helpful in solving problems.



The Seven Steps to the Scientific Method are:

- 1. Stating the Problem**
- 2. Gathering information on the problem**
- 3. Forming a Hypothesis**
- 4. Performing Experiments to test the Hypothesis**
- 5. Recording and analyzing data**
- 6. Stating a conclusion**
- 7. Repeating your work**

Stating the Problem-

Have you ever questioned why the earth is round or what makes clouds form? If you have wondered about such things you have already taken the first small step toward recognizing a scientific problem.

Before investigating any problem, we must develop a clear statement defining the problem. An example of this could be: What factor causes the temperature of the water to be lower during the winter than during the summer?

Gathering Information on the Problem-

Our next step is to gather information. We could first find out how conditions during the winter, when the water is cooler, differ from conditions during the summer, when the water is warmer. The information might include the position of the sun during the winter and the summer.

Research is the process of collecting information from your own experiences, knowledgeable sources, and data from an exploratory experiment. The research you collect will help you understand the topic, propose a hypothesis, and design experiments to test your hypothesis. The references below are an excellent way to research your topic.

- references from printed sources—books, journals, magazines, and newspapers—as well as electronic sources—computer software and online services.
- professionals—instructors, librarians, and scientists, such as physicians and veterinarians.

Forming a Hypothesis-

After gathering information we are going to suggest a possible solution to the problem. A proposed solution to a scientific problem is called a hypothesis. It is an educated guess on a solution. An educated guess to the problem stated above could be: The water is cooler during the winter because the position of the sun is different during the two seasons. In the winter the sun is farther away from the Earth which makes the air temperature cooler.

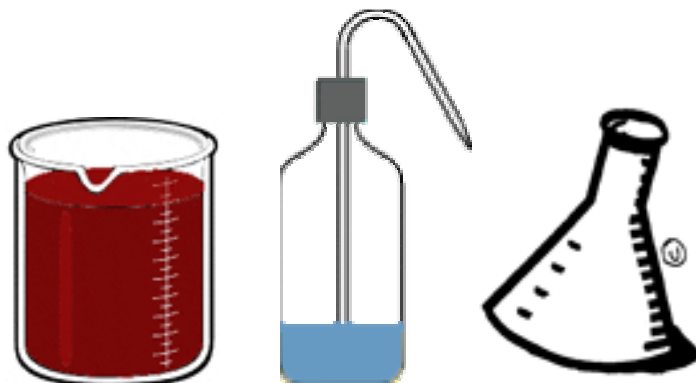
While the hypothesis is a single statement, it is the key to a successful project. It should make a claim about how two factors relate. When stating your hypothesis you should state facts from past experiences or observations on which you base your hypothesis. Do write down your hypothesis before performing your experiment. Do not change your hypothesis even if the experiment does not support it.



Experimenting-

Next we must find evidence that either supports our hypothesis or does not support it. That is, we must test our hypothesis to show whether or not it is correct. Such testing is usually done by performing one or more experiments. In order to test the hypothesis that the angle of the sun's rays affects the temperature of the water, we would have to design an appropriate experiment. Let's see how this can be done.

First we can place a measured amount of water into a container. Then we can place a thermometer into the water, just below the surface. Next we will place the heat source above the container. The heat source will take the place of the sun during our experiment. Since we are testing the effects of the angle of the sun during the winter, the heat source will be angled exactly as the sun is, in relation to the Earth during the winter. In our experiment the angle of the heat source is the variable. A variable in any experiment is the one factor that is being tested. After performing this experiment we will do it again, only this time we will change the angle of the heat source. This time it will represent the sun during the summer.



Recording and Analyzing Data-

When performing any experiment we must observe the experiment and write down important information. Recorded observations and measurements are called **data**. Data in our experiment would include the time intervals at which the containers were observed and the temperature of the water in both containers at each interval. We would record these observations for both experiments. A very effective way to show data is to organize it into a table. This way we are able to visually compare the data.

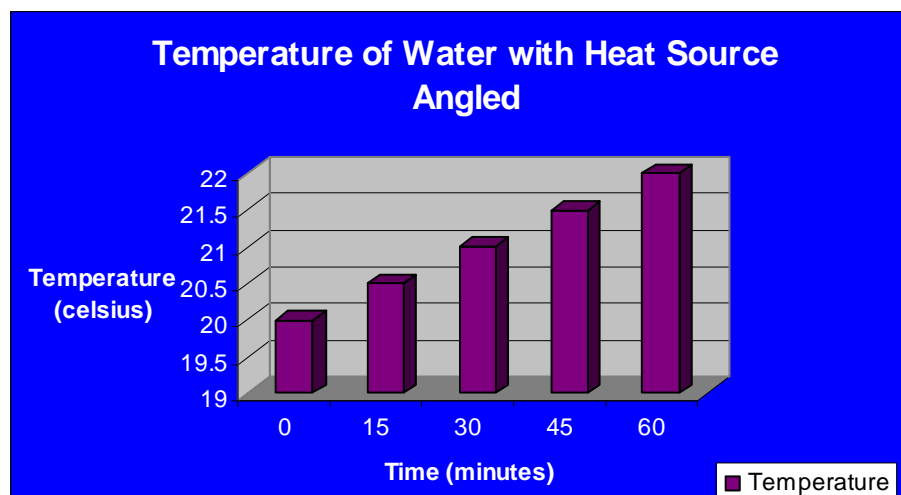
Time (minutes)	0	15	30	45	60
Temperature (Celsius)	20	20.5	21.0	21.5	22.0

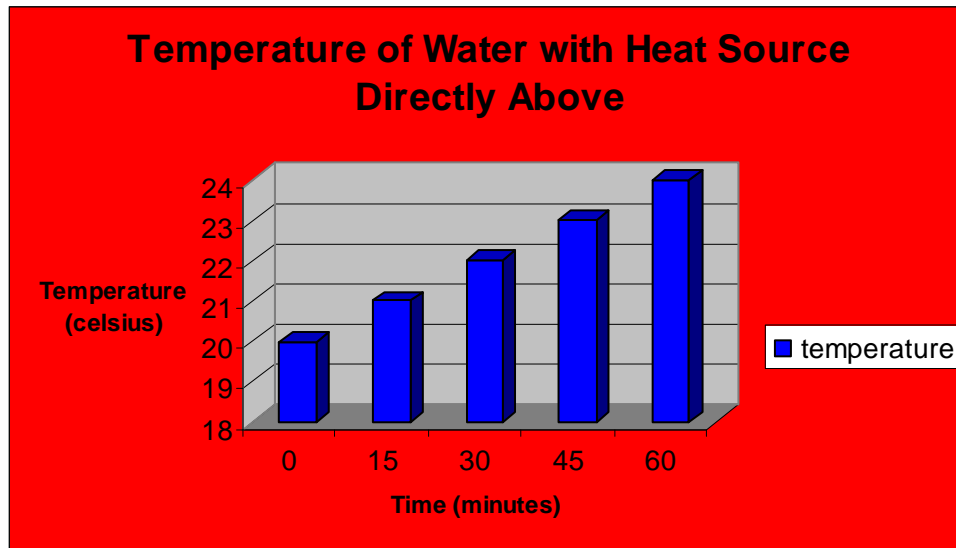
(Heat source angled, like it would be in the winter)

Time (minutes)	0	15	30	45	60
Temperature (Celsius)	20	21	22	24	26

(Heat source directly above water like it would be in the summer)

Another way you can visually compare data is by making a graph. Below are two graphs to represent the data. How else could you present this data?





Stating a Conclusion-

After running the experiment and recording and analyzing the data, our next step is to conclude that the angle of the heat source's rays does indeed affect the temperature of the water. We can further conclude that the temperature of the water rises higher when the sun's rays strike the water at a direct angle, than when they strike the water at an indirect angle.

In this step it is important to clearly state what you concluded from your observations and whether or not it matched your hypothesis. This can be done in a few sentences.

Repeat Your Work-

Although we may be completely satisfied with our conclusion we should repeat our experiment many more times to make sure our data is accurate.

If a scientist were to go through this process other scientists would have to repeat the experiment and check the results before the scientific community would accept it as true.

The process of the Scientific Method may seem long and confusing but once you get familiar with it, it makes solving a problem much easier. It is a great procedure!

