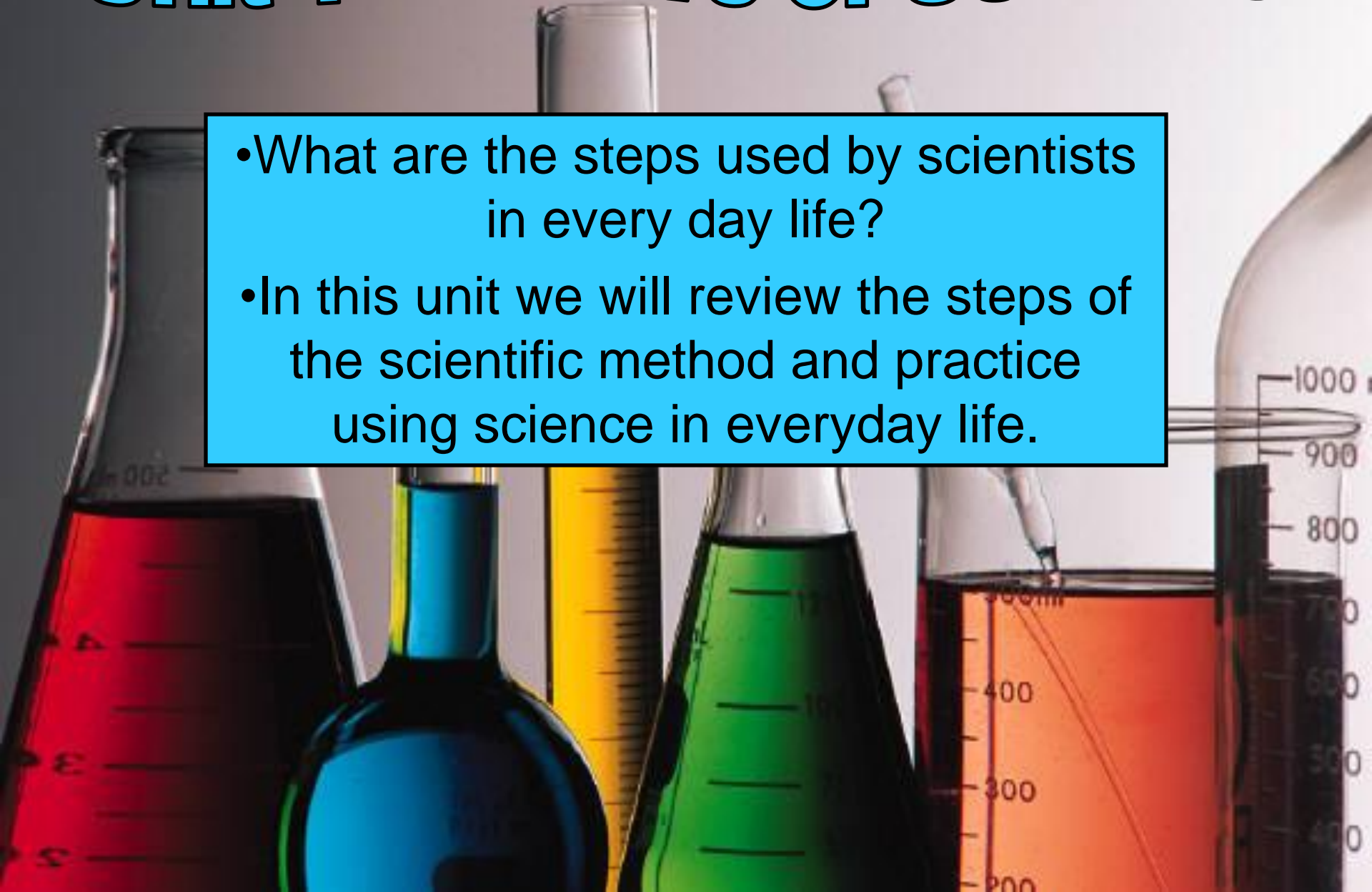# Unit 1 – Nature of Science

- What are the steps used by scientists in every day life?

- In this unit we will review the steps of the scientific method and practice using science in everyday life.

Unit 1 – Nature of Science

What is Science ?

- **Science** is the organized way of using evidence to learn about the natural world.

- The goal of science is not only to investigate, but to explain events in the natural world and predict future events.

Radar/Satellite (Past 6 Hours)

LIGHT ▮▮▮▮▮▮▮▮▮▮ HEAVY

New Orleans

Currently

Forecast

5 Day Forecast

Almanac

New City

83

Humidity 44%
Wind NE 6
Heat Index 83

BIOLOGY
bio- = _____, -ology = _____

The study of living organisms and understand their relationships with one another.

SIR ISAAC NEWTON, ABOUT TO GET OFF TO A FALSE START ON HIS THEORY OF GRAVITY

http://home.alltel.net/nelpi/newton.jpg

Scientific Theory vs. Scientific Law

- When multiple hypotheses have been well tested and unify a broad range of observations, scientists consider this a **scientific theory**.

- A **scientific law** explains an observation in nature and tends to be universally accepted.

- With new information, laws and theories are constantly being revised and changed.

Observations

- You check out the window in the morning to determine your clothing for the day.

- Observing uses one or more of the five senses (sight, hearing, touch, smell, & taste) to gather information about events or processes.

- Observing allows you and scientists to gather information about the world.

corbisimages.com

http://www-g.eng.cam.ac.uk/mmg/environmental/images/smell.jpg
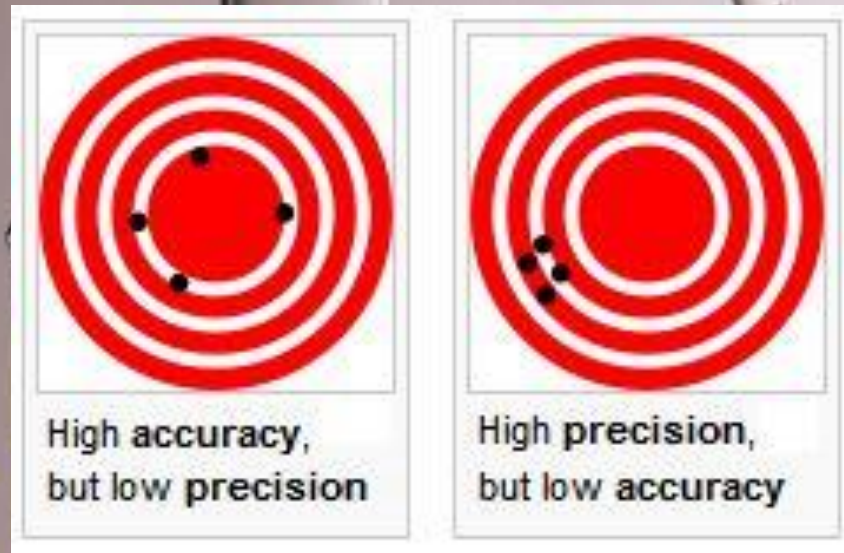
Unit 1 – Nature of Science

Inference & Prediction

- An **inference** is a logical interpretation based on experience or prior knowledge.

- A **prediction** is a statement or claim that a particular event will occur in the future.

Unit 1 – Nature of Science

Accuracy & Precision

High accuracy, but low precision

High precision, but low accuracy

- <u>Accuracy</u> describes the nearness of a measurement to its true value.
- <u>Precision</u> is the degree to which several measurements provide answers very close to each other.

Unit 1 – Nature of Science

The **scientific method** is a series of **SIX** steps that scientists use to answer a question.

Step #1 - Problem/Research
- Typically after making an observation a scientist will begin to question why?
- What do you want to learn or answer?
- You must research to find out what you already know about the problem and asks questions that still need to be answered.

Step #2 - Hypothesis

- A **hypothesis** is a possible explanation to a scientific question, often called an educated guess.

- A hypothesis must be testable, either by experimentation, collection of data, or other means.

- An easy way to write a hypothesis is using the

"If ..(mix)…then….(dry)… format".

•Ex. "If a beaker of water is placed in the sun, then it will evaporate faster than in the shade."
•Could you test this hypothesis?

Step #3 - Experimentation

- An **experiment** tests the hypothesis to see if it is correct.

- Scientists use instruments or equipment to test the experiment.

- Scientists also keep detailed notes on the experiment, also known as <u>procedures</u>, so the experiment can be duplicated (or copied) in the future.

- Lastly, several trials may be run to derive the most accurate data possible.
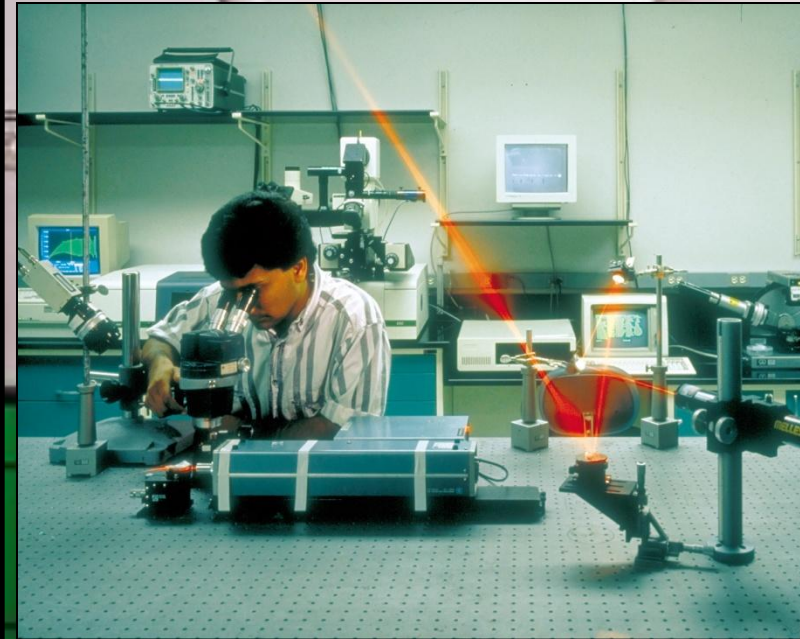
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Designing Controlled Experiments

- A **controlled experiment** is an experiment in which all factors except one remain constant (are the same).

- These factors are called **variables**, or any factor that changes in an experiment.

- "If I place a beaker of water in the sun, then it will evaporate faster than in the shade."

- On your notes draw and label your experimental setup?
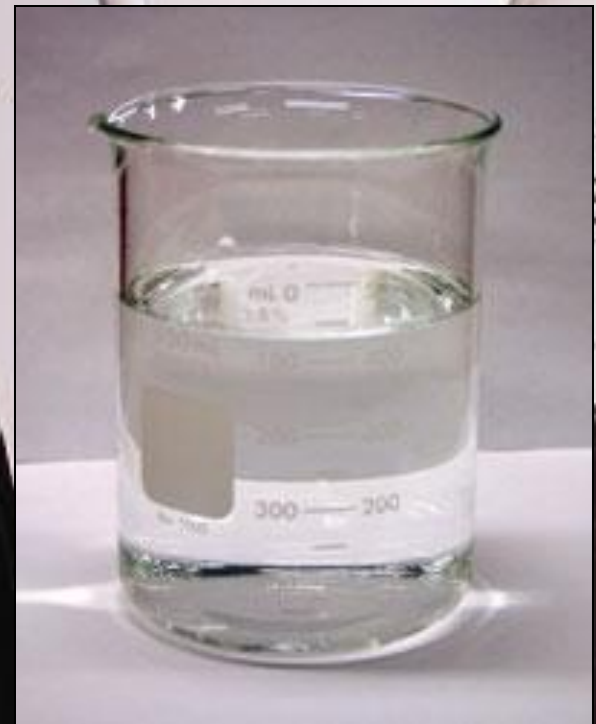
Constant vs. Control

- In order for an experiment to test only one variable, every other part of the experiment has to be the same, **constants**.

- If we measure evaporation, the beaker size must be the same, the amount of water must be the same, ambient air temperature must be the same, etc..

- A **control** is when one of the setups is not altered, not changed. The control is used to gauge whether or not the independent variable affect a change.

Unit 1 – Nature of Science

Independent or Manipulated Variable

- The variable the scientist changes is called the **independent / manipulated variable.**

- In our beaker/water example, what are we changing?

- The location of the beaker (sun & shade).

Dependent/Responding Variable

- The variable that is expected to change in response is the **dependent/responding variable**.

- Ex. What responds to the heat from the sun? The rate of evaporation!

http://www.all-science-fair-projects.com/science_fair_projects_coach/cap3a.jpg

Step #4 - Data Collection

- The information collected during an experiment is **data**.

- This data could be **qualitative/descriptive** (color, odor, sound) or it could be quantitative, numbers.

- Qualitative data can be recorded in a log

- **Quantitative data** must be recorded in a table from which derived calculations can be tabulated.

Step #5 - **Analysis**

- They analyze their data and study the results.
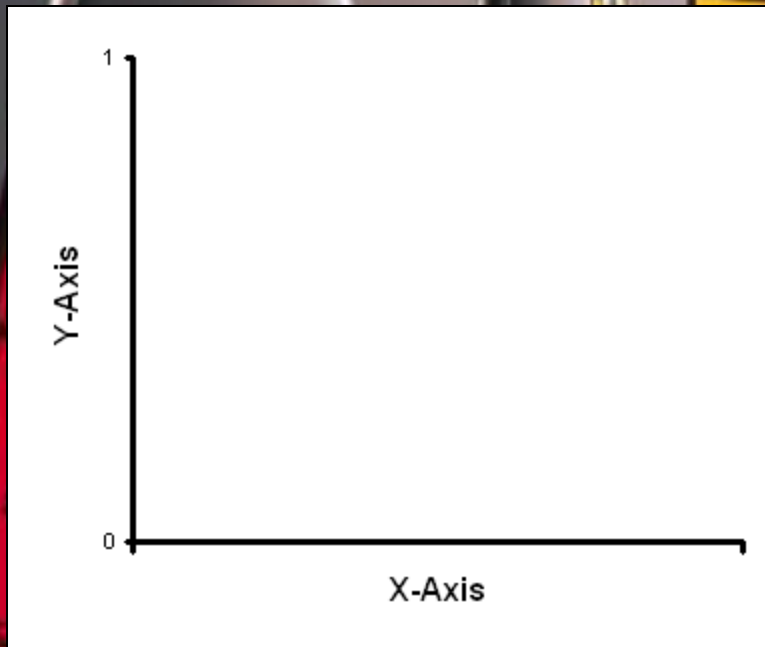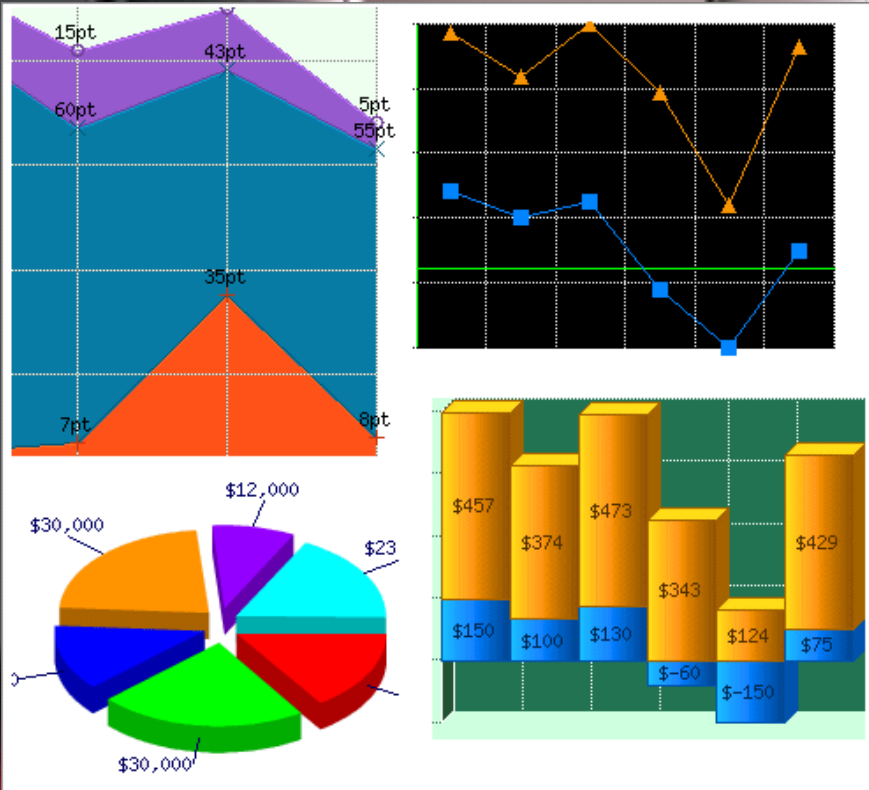
Graphs

- Remember scientists <u>record</u> data in tables and <u>show</u> their data in graphs.
- Remember the acronym **<u>DRY MIX</u>** when graphing for science.
- **D**ependent/**R**esponding variable will go on the **Y** axis.
- **M**anipulated/**I**ndependent will go on the **X** axis.
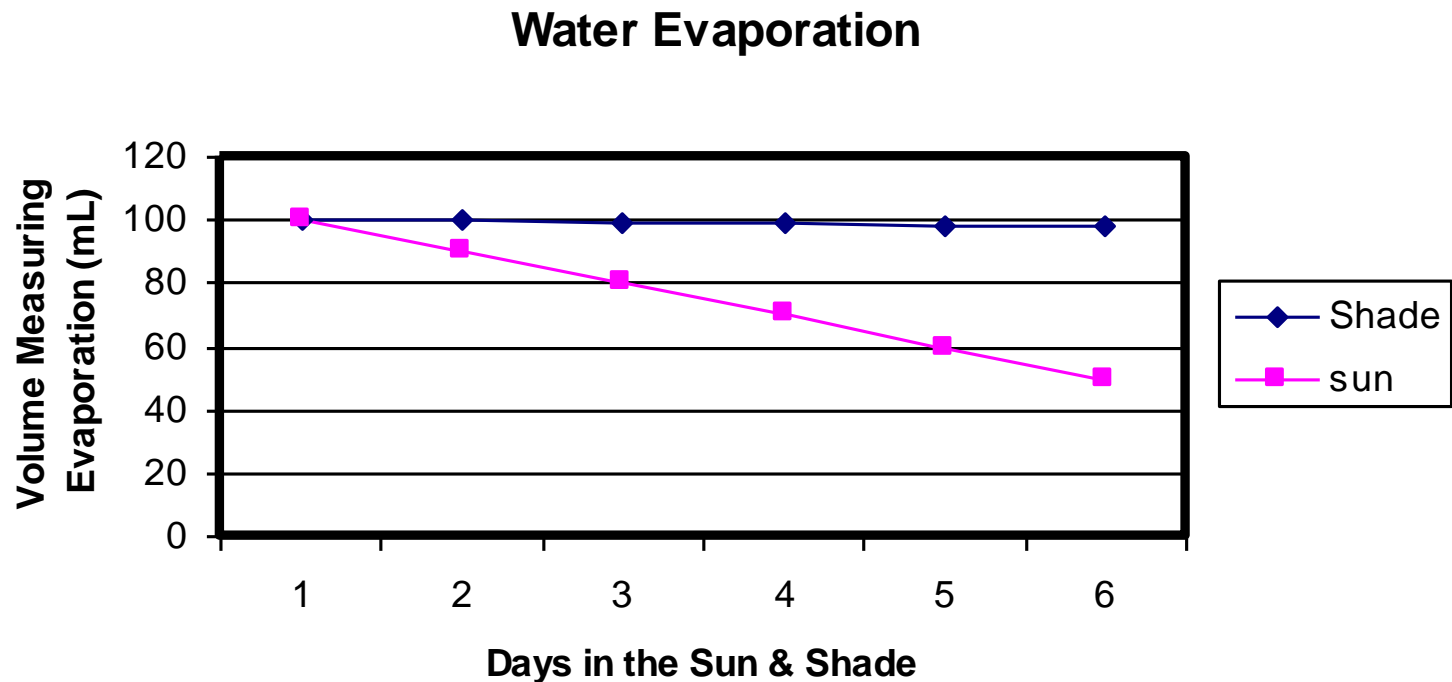
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What type of graph should you use?

- Line – use for infinite data (i.e. time)
- Bar – static or finite data (i.e. number of days in a week)
- Pie – good visual

Unit 1 – Nature of Science

- If we were to graph our example "If I place a beaker of water in the sun, then it will evaporate faster than in the shade." What axis would represent the independent variable?

- The dependent variable?
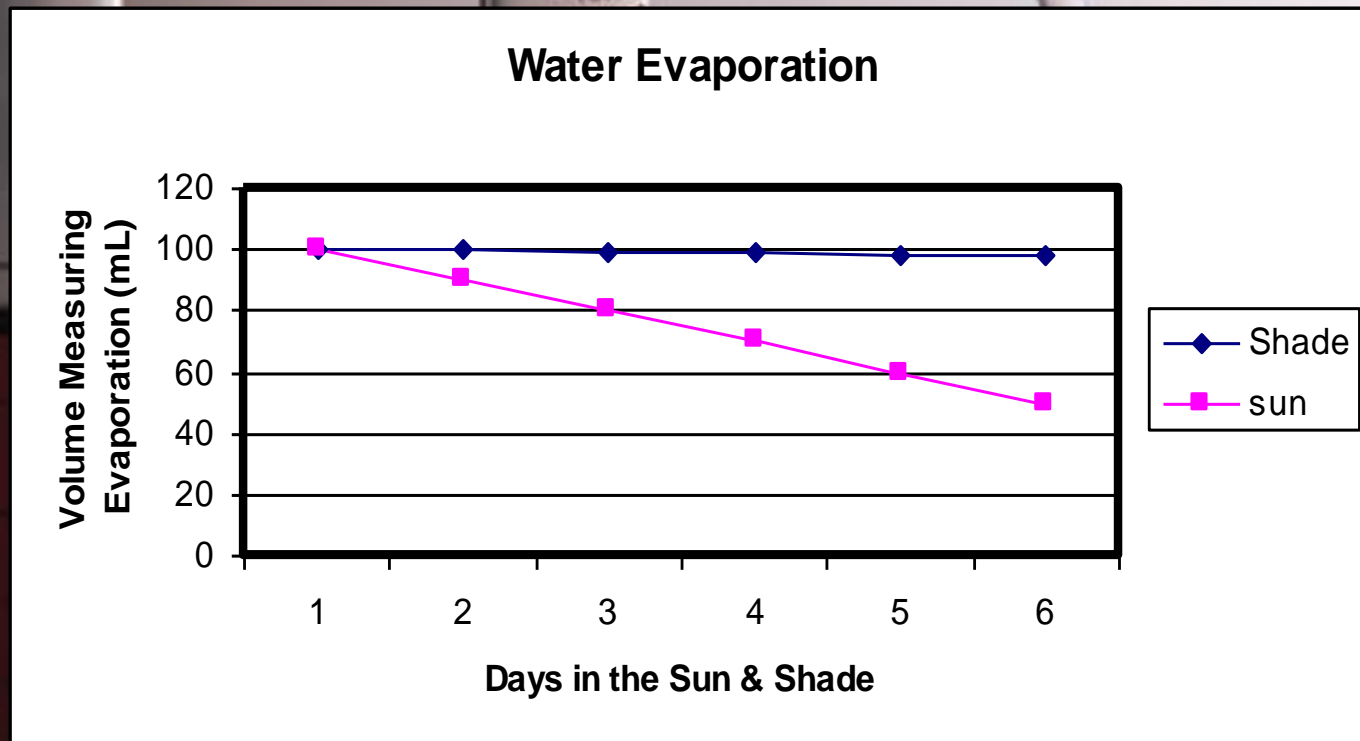
Water Evaporation

Step #6 - Conclusion

- At the **conclusion** of the experiment, the scientist asks, "What did I find out?"

- A conclusion states whether or not the hypothesis was correct.

- Often the data does not support the hypothesis which means the whole process starts over again with new questions to be answered!
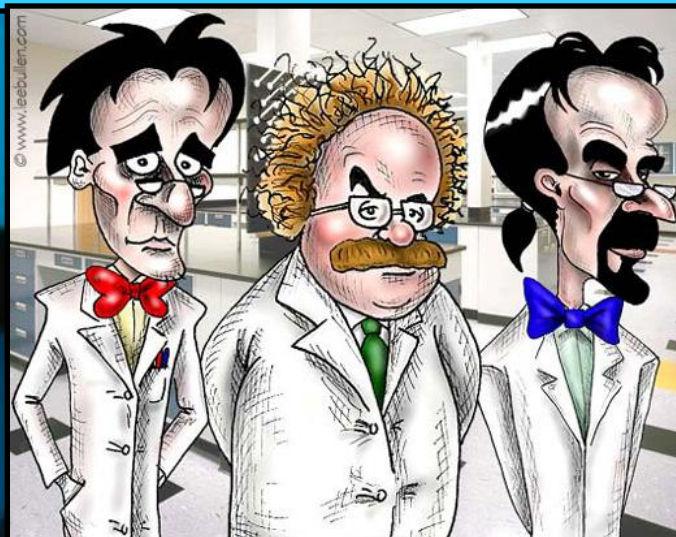
http://www.leebullen.com/Finished%20Pics/Scientist s.jpg

Unit 1 – Nature of Science

The steps of the scientific method will be used throughout the year during our class experiments and are used continually in the study of science throughout the world.

Scientists study the world through experiments.

As scientists in this classroom, safety is the number one priority!

To infinite and beyond!