Name: _____

Period: _____

The Scientific Method

The Scientific Method is a process to gather verifiable FACTS, not opinions.

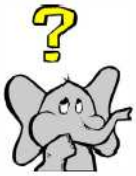
The Basic 4 Steps

[ ]

Pay attention and notice what's happening. Good scientists are curious and question "why".

[ ]

Make an educated guess based on your observations. It doesn't have to be complicated. Just try to explain why the phenomenon works the way it does.



Trial and Error

What if your hypothesis was wrong? (This happens often in science.) Then your experimental data becomes part of your observation. Rethink your hypothesis and try, try again.

Repeat as necessary

[ ]

Design an experiment that will test your hypothesis.

[ ]

Collect and record data to prove or disprove it.

[ ]

State whether your hypothesis was correct, basing your decision on your experimental data.

Hypothesis Wrong

Hypothesis Right

[ ]

Hypothesis → Can become a → **Theory** → and *could* become a → **LAW**

Before you can claim your hypothesis as fact, it must be verified by other scientists. They must repeat your experiment several times to prove it! If so, it may be come a theory.

A Scientific Theory must have a lot of evidence, facts to support it. This is not like a "theory" you have about something, which usually means a "guess". A Scientific Theory is a fact supported by experimental data!

Few Theories become Scientific Laws. Laws have to be tested SO MANY times so we are absolutely certain they are true for all cases. Some theories (like in biology) can't become laws because we can't repeat them, due to the time necessary.

An Everyday Example: Printer Problems

We all use the scientific method when solving everyday problems, we just don't know it. The following example shows an easy application of the above method.

[ ] My computer will not print.

[ ] Maybe it's not turned on?

[ ] Check the power switch.

[ ] The switch is on.

[ ] The printer is on.
My hypothesis was wrong.

So you need a new hypothesis!

Try again!

[ ] My computer will not print.
The printer is on.

[ ] Maybe it is out of paper.

[ ] Check the paper supply.

[ ] It is out of paper

[ ] The printer just needed paper.
My hypothesis was correct.

You put paper in and print.

Even though this is an easy example, much of science works the same way: Trial and Error!

1. Hypothesize	A. Facts in science that have been shown to be absolutely true in all cases.
2. Observe	B. A statement about whether your hypothesis was right; is based on data.
3. Law	C. Scientific facts supported by much evidence, but can't be retested for all cases.
4. Theory	D. A controlled test to gain evidence.
5. Conclusion	E. Careful study of a problem or situation.
6. Experiment	F. How you think it works based on your observations.
7. Data	G. Facts measured and collected in the lab.

Theory, Hypothesis, or Guess?

Remember: an hypothesis comes from observations that can be tested in an experiment. A Theory is scientific fact.

____ You think that a person is going to come late to the bus because they were late yesterday.

____ You think that some plastic water bottles may not be healthy because you can taste the plastic in the water.

____ The earth revolves around the sun. The sun does not revolve around the earth.

____ You think that adding salt to water allows it to have a higher boiling point (it boils at a higher temperature).

____ You think that your favorite basketball team will lose because they are playing on Thanksgiving, again.

____ All matter consists of electrons, protons, and neutrons.

The dandelions in a lawn are grow very short.
The dandelions in the tall grass by a lawn will grow tall.

Give a reasonable hypothesis for the above observation:

Which of the following statements could be supported by the scientific method? Why?

"Come to Willarby Auto Store—the best car dealership in town."

"Try Dry-Toes Powder. A recent independent research company proved Dry-Toes Powder kept feet dry up to 30% longer than any other foot powder."

"Acorn Powder helps you live longer and stronger. 89 year old Ethyl Krumke swears by Acorn Powder. 'I take my Acorn Powder every day, just like my mother!' "

Scientists present a scientific theory to news reporters. Your friend listens to the scientists and says she doesn't believe it because "it's just a theory". Respond to your friend.

How is a Scientific Law different than a Scientific Theory?

Why is the "Theory of Evolution" not a Law?

Which part of the Scientific Method?

_____ A scientist measures the amount of acid necessary to dissolve a certain amount of magnesium.

_____ You believe your car won't start because you are out of gas.

_____ You notice that a ball rolls farther up a hill depending on how fast it was going.

_____ You decide that adding salt to ice water allows the ice water to get colder than water alone.

Liquid	Color	Burns?	Volume	Density
A	Clear	No	35 mL	1 g/mL
B	Pale Yellow	Yes	12 mL	.94 g/mL
C	Clear	No	46 mL	1 g/mL
D	Blue	Yes	88 mL	.99 g/mL

The above data was collected about 4 unknown liquids.

What can you conclude from this experiment and why?

You walk into a room and notice that the lights will not come on. Use the scientific method to figure out why.

Observation:

Hypothesis:

Experiment:

Data:

Conclusion:

(Repeat as necessary)