The Scientific Method
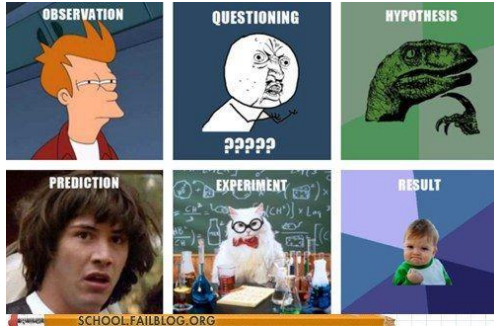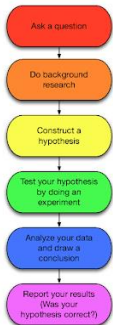

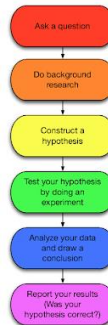SCHOOL.FAILBLOG.ORG

Scientific Method

- Science follows a series of specific steps in order gain information about the natural world.

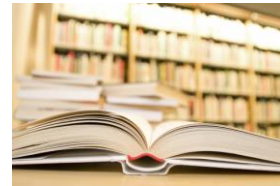- This process is referred to as the scientific method.

1. Ask a Question

- Something that needs to be solved

- Also known as the purpose.

- Example: How does fertilizer affect plant growth?
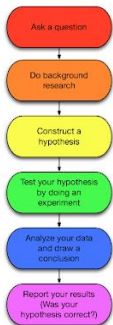
2. Research

- Gather information related to your problem.

3. Create a Hypothesis


- An educated guess based upon your research

- Written as an "IF…THEN…" statement

- Example: If plants receive fertilizer, then they will grow taller.

Practice: Writing a Hypothesis Statement

- Directions: Write a hypothesis for each of the following problems.

1. How does temperature affect the amount a person sweats?

2. How do Band-Aids affect the time it takes for a cut to heal?

4. Conduct an Experiment
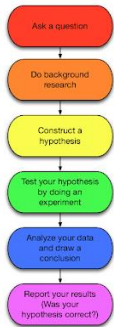
- <u>Procedure</u> used to test the hypothesis

- In science, anything that can change is called a <u>variable</u>.

- Only **ONE** variable can be tested per experiment; everything else must remain constant.

Independent Variable

- The variable that is being tested is called the <u>independent variable</u>.

- Example: The independent variable is the amount of fertilizer.
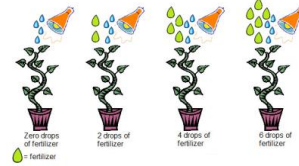
Dependent Variable

- The variable that changes in response to the independent variable is called the <u>dependent variable</u>.

- Example: The dependent variable is the plant height.

Constants

- All other variables in an experiment must remain the same and are called <u>constants</u>.

- Example: The constants include the amount of water and sunshine.

Experimental vs Control Group

In each experiment, there is:
1. The <u>experiment group</u>, which includes all parts of the experiment.

2. The <u>control group</u>, which undergoes all parts of the experiment but does <u>not</u> receive the independent variable.
   ➢ Used for <u>comparison</u> for results from the experimental group

Experimental vs Control Group

- Example: The experimental group includes all plants that receive fertilizer. The control group is the plant without fertilizer.

Practice:

1. Rob wants to know how temperature affects the amount a person sweats. He places Group A in a room that is 100° F and Group B in a room that is 70° F. Rob measures the amount of sweat produced by each group.

   Independent: Dependent:
   Experimental Group: Control Group:

2. Colin wants to know how band aids affect the amount of time it takes for a cut to heal. Group A does not apply a band aid to their cut. Group B places band aids on their cuts. Colin checks the cuts daily and records how long it takes for the cuts to heal.

   Independent: Dependent:
   Experimental Group: Control Group:

Observations

- An important part of an experiment is making <u>observations</u> (information collected using the five <u>senses</u> and/or scientific <u>tools</u> like thermometers, microscopes, rulers).
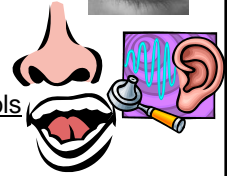
Observations are:

QUALITATIVE

- measureable or countable
  - ✓ 3 meters long
  - ✓ 4 marbles
  - ✓ 50 kilograms
  - ✓ 25 degrees Celsius

QUANTITATIVE

- describable, not measureable
  - ✓ red flowers
  - ✓ smells like fresh baked cookies
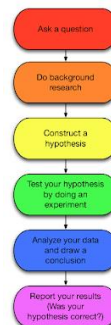 - ✓ Tastes bitter

---

Inferences

- Inferences are <u>conclusions</u> or deductions based on observations.

- In science, it is important that we make <u>observations</u> rather than inferences during an experiment.

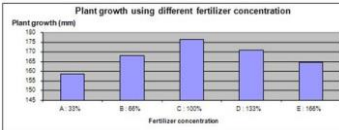- Inferences come later, when data is analyzed.

Statement	Observation	Inference
Object A is round and orange.	X	
Object A is a basketball.		X
Object B is round and white.	X	
Object B is smaller than Object A.	X	
Object B is smooth.	X	
Object B is a table-tennis ball.		X

---

5. Analyze Data and Conclude

- Organize data in charts and <u>graphs</u> to easily see trends.
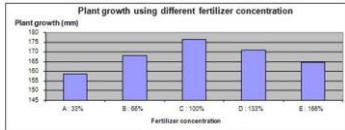
- Explain your results.

Ask a question
Do background research
Construct a hypothesis
Test your hypothesis by doing an experiment
Analyze your data and draw a conclusion
Report your results (Was your hypothesis correct?)

Example:

Plant growth using different fertilizer concentration

- The plants grown with fertilizer grow taller than plants grown without fertilizer.

Example:

Plant growth using different fertilizer concentration

- Moreover, there is an optimal amount of fertilizer that can be applied. Too much or too little negatively affects plant height.

6. Report

- State if hypothesis was <u>supported</u> or <u>rejected</u>.

- If hypothesis was rejected, or found to be only partially true, <u>repeat</u> the process!

Example:

Plant growth using different fertilizer concentration
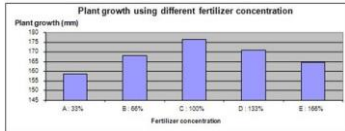
- The hypothesis is supported – plants grown with fertilizer grow taller than plants grown without fertilizer.