INTRODUCTION TO THE SCIENTIFIC METHOD
How to take notes:

• For the first semester, you will have a FIB (fill in the blank) page or similar type of page.
• On this page, record important information. You can tell if it is important — it is RED!
Why use the Scientific Method?

The goal of science is to investigate and understand the natural world, to explain these events, and to use those explanations to make useful predictions.

Scientists use this method to:

Collect and organize information in a careful, orderly way, looking for patterns and connections between events.
Scientific Method

The scientific method is:
A series of steps used by scientists to solve a problem or answer a question.

The Steps to the Scientific Method:
1. Question or Problem
2. Form a Hypothesis
3. Experiment
4. Record and Analyze Results
5. Draw Conclusions and communicate them
Science begins with an observation.

This is the act of using one or more senses to gather information and to make note of what occurs.

Data is the information gathered from making observations.
Question or Problem

A problem or a question must first be identified, before an experiment can begin.

The purpose of the question is to narrow the focus of the inquiry, to identify the problem in specific terms.

How do you ask an “in-depth” or testable question?
Let’s think!

What are the similarities and differences between these questions?

1. How cold does it have to be to snow?
2. What causes a tsunami?
Thoughts?

Thoughts on question 1 –
How cold does it have to be to snow?

This is a SKINNY question!
Now, let’s talk!

#2? What causes a tsunami?

What’s the take away?

**Skinny questions** don’t take much thought or research and can usually be answered in just a few words. **Fat questions** are inquiry questions that make us think, often have to be researched in detail, and need a lot of explanation to answer in full.

Fat questions are the kind of questions you want to ask in class!
Hypothesis

Definition: A possible explanation for an observation that can be tested by scientific investigation. It refers back to the question or problem.

Generally, a hypothesis is stated as an "if … then" statement. In making such a statement, scientists engage in deductive reasoning.

In our case we will sometimes add the “because” as well.
Hypothesis (cont’d)

Deduction requires movement in logic from the general to the specific.

Here's an example: If the amount of sun on a tomato plant is increased (general statement), then the plant will grow to 4 feet tall (specific statement). What might be a “because”?

• Once you have a TESTABLE Hypothesis, you do an experiment.
During the Experiment…

- You collect data!
- Data all looks different, but it is found as 2 main types

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Trial 1</th>
<th>Trial 2</th>
<th>Trial 3</th>
<th>Average</th>
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<tbody>
<tr>
<td>(This is the one thing I changed in my experiment)</td>
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Experiments and Data:

Two types of data:
1. **Quantitative** - information about quantities; that is, information that can be measured and written down with numbers.

2. **Qualitative** – It is information about qualities; information that can't actually be measured.
Examples of data:

• Your age. (Quantitative.)

• The number of hairs on your knuckle. (Quantitative.)

• The softness of a cat. (Qualitative.)

• The color of the sky. (Qualitative.)

• The number of pennies in your pocket. (Quantitative.)
There are three variables in an experiment:

1) The independent variable is the variable that is deliberately changed by the scientist.

2) The dependent variable is the one observed during the experiment. The dependent variable is the changing data we collect during the experiment. This data is collected as a result of changing the independent variable.
There are three variables in an experiment:

Example experiment:
A scientist studies the impact of withholding affection on cats.
What is the IV?
What is the DV?

The **independent variable** is the amount of affection.
The **dependent variable** is the reaction of the cats.
Third variable:

A third variable is the constant or controlled variable. This is everything you want it kept the same so that you can see the changes caused by the other variables!
Results

The data that has been collected must be organized and analyzed to determine whether the data are reliable. Data is analyzed and compared, often in charts, to determine if it supports the hypothesis or not.
Drawing Conclusions

The evidence from the experiment is used to determine if the hypothesis is proven or disproven.

Experiments must be repeated over and over (called “trials”). When repeated, the results become more reliable.
Drawing Conclusions

The conclusion includes results, analysis of data and lesson learned.

1. What did you learn
2. Was the hypothesis correct?
3. What are mistakes made
4. Questions you have now or ideas for improvements
Communicating Results

- Scientists write articles
- Make presentations to other scientists
- Multi-media communication around the world is common now
Scientific Method in Action

- It is not a straight line of steps!
- Depending on the experiment, some steps may be repeated over and over, while other steps are not needed.
- Sometimes, testing the hypothesis leads right to a conclusion!
Notes are complete!