Learning Targets

I will be able to…

- define the steps of the Scientific Method in order, in my own words.

- apply the scientific method in a naturally occurring scenario.

- contrast between hypotheses and speculations.

- contrast between theories and laws.

The Scientific Method

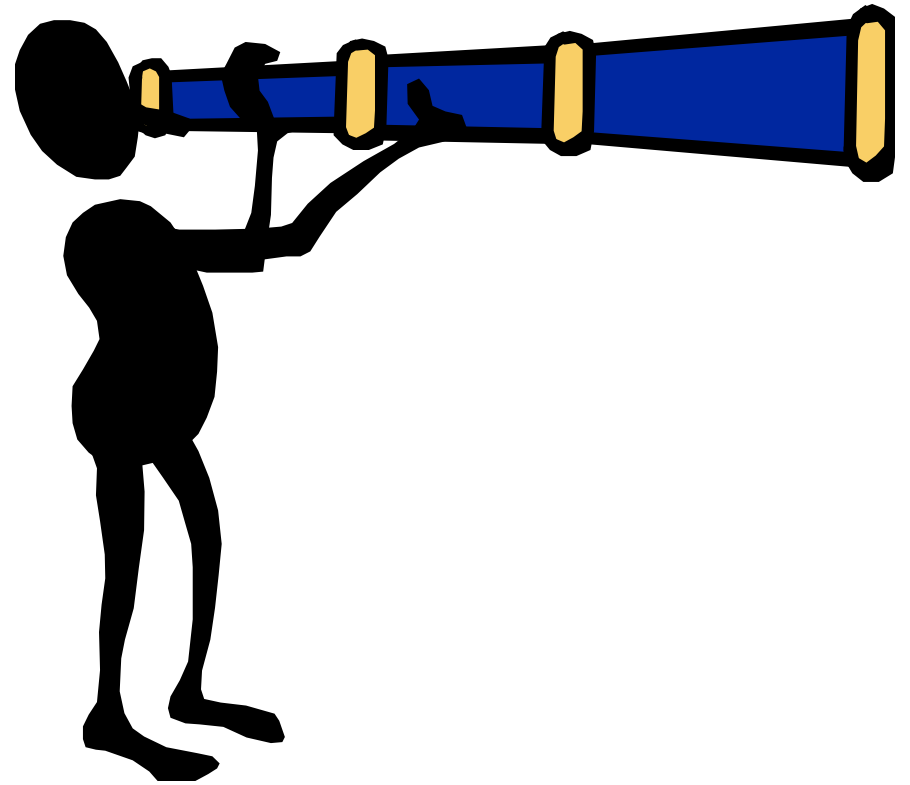A series of steps used to investigate a natural occurance

What are the Steps in the Scientific Method

1. Observation/Question
2. Hypothesis
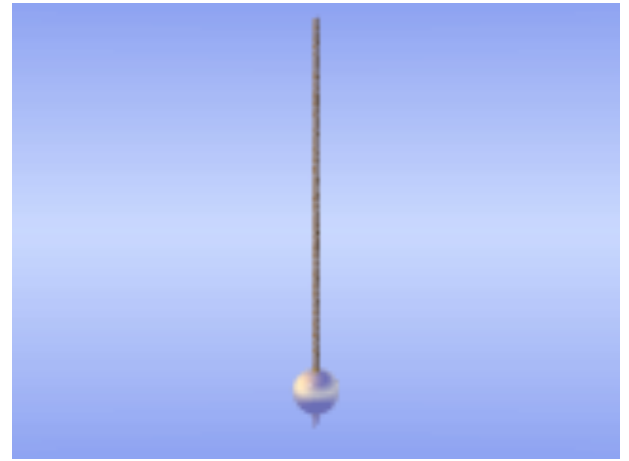3. Experiment
4. Conclusion
5. Retest

1. Question/Observation

- **Information obtained through your senses or research**

- **Develop a question that can be solved through an experiment.**

Observations

- An **example of an observation** might be noticing that a clock's pendulum swings back and forth every two seconds.

- You may ask: What happens to the amount of time it takes to swing when I make the pendulum longer?

2. Hypothesis

- An untested but **TESTABLE** statement that answers the question.
- Not a guess
- Based on prior knowledge or experience.
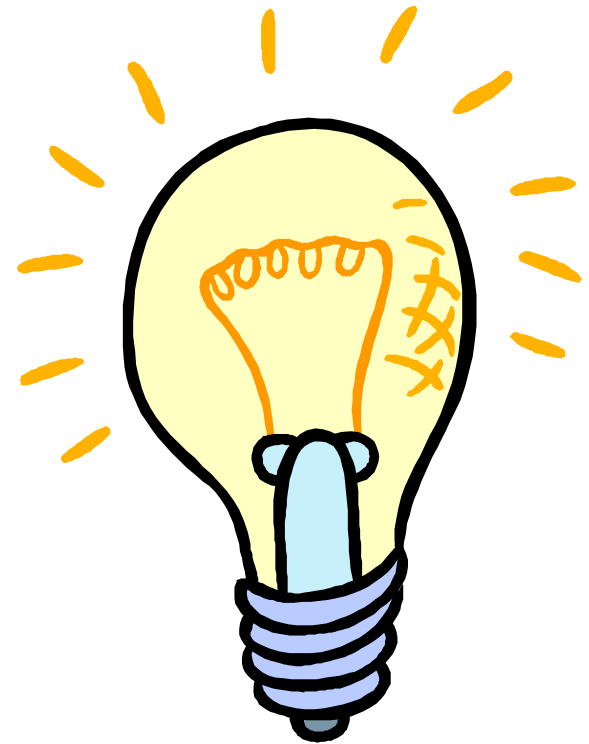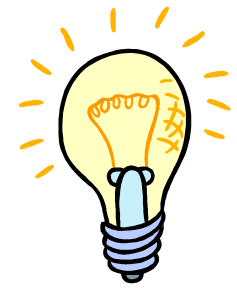
Hypothesis

- Must be **testable**
- **Predicts** a possible **answer** to the question.
- Sometimes written as **If...Then...** statements.
- An **example of a hypothesis** might be that if you make the pendulum longer, then it will take longer to swing.

3. Experiment

- **Includes a procedure to test the hypothesis by collecting data**

-Includes a materials list

-Must be measurable

Making Pancakes Procedure

1. Gather Ingredients and supplies: Flour, sugar, 2 eggs, milk, vanilla, baking soda, bowl, beater, measuring tools, pan, spatula, butter
2. Crack both eggs into bowl and beat lightly with beater
3. Measure 2 cups of flour and dump into bowl.
4. Measure ¼ cup of sugar and dump into bowl
5. Measure 2 cups of milk and dump into bowl.
6. Measure 1 TB of vanilla and dump into bowl.
7. Mix all ingredients on low speed until all ingredients are incorporated and there are no lumps.
8. Heat pan on medium low heat for about 5 minutes
9. Test pan by adding a teaspoon of water. If water sizzles then the pan is ready. Be careful not to burn yourself
10. Add 1 teaspoon of butter to pan and let it melt completely
11. Pour ½ cup of batter into pan
12. When the edges drying out and all there are no bubbles forming in the pancake, use the spatula to quickly flip the pancake over to cook.
13. Press down firmly on the pancake to flatten it out and encourage it to cook faster.
14. Cook the remaining side for up to 1 minute.
15. Check to see if the pancake is fully cooked if both sides are light brown in color.
16. Remove the pancake place on a plate. Garnish with favorite topping such as syrup.
17. Turn off hot pan and let cool.

Experiment

Variable – any part of an experiment that has the ability to change

A good or "valid" experiment will only have **ONE variable changed** by the experimenter!

Collect and analyze data(results)

GET TO KNOW YOUR
Variables

Which colors get hot in sunlight the fastest?

Independent

This is the variable that is changed in your experiment.

Different colored pieces of paper.

Dependent

This variable depends on the changes you made to the experiment.

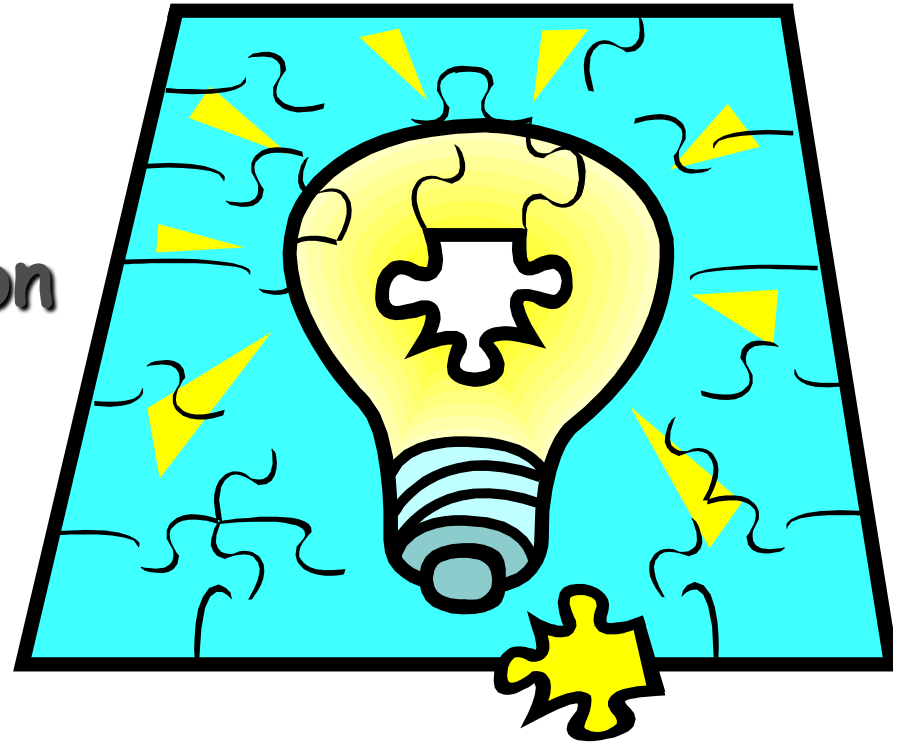*The temperatures of each colored piece of paper.*

Control

This is the part of the experiment that remains constant.

Equal amounts of sunlight for each piece of paper.

4. Conclusion

- **The answer to the hypothesis based on the data obtained from the experiment**

- **It accepts or rejects the hypothesis**

5. Retest

Repeat the experiment in order to **verify the results.**

What is the difference between a hypothesis, speculation, theory and law?

Hypothesis

- An untested but **TESTABLE** statement that answers the question.
- Not a guess
- Based on prior knowledge or experience.

Speculation

- Forming a theory without evidence

Theory

- A theory is a **well tested** <u>explanation</u> of a natural phenomenon based on many experiments (WHY things work the way they do)
  - THEORIES CHANGE WITH NEW EVIDENCE

Theories Cont'd

- Examples of theories:
    - Theory of Evolution
    - Theory of Relativity
    - Atomic Theory
- All of these theories are well documented and proved beyond reasonable doubt. Yet scientists continue to tinker with each theory in an attempt to make them better and more accurate.
- A theory is developed only through the scientific method.
- Theories do not become laws.

Scientific Law

- A Scientific Law is a generalized **description** of the natural world based on many experiments (HOW it works)
  - they tend to be more mathematical in nature
  - Example: Consider Newton's Law of Gravity. Newton could use this law to predict the behavior of a dropped object, but he couldn't explain why it happened.
  - LAWS CHANGE WITH NEW EVIDENCE