SCIENTIFIC METHOD

What are Scientific Methods?

When Scientists observe the natural world around them, they use the inquiry process of asking a question.
Scientific Methods are a series of steps scientists follow to solve problems.

Make Observations

Any information gathered through your senses is an observation.

> Observations can take many forms.
> They may be measurements.
> They may describe shape or behavior.

Observations are only useful if they are accurate!

Ask a Question / Identify the Problem

When scientists observe something out of the ordinary or difficult to explain, they ask a question!

Making Predictions

- Before scientists can test a hypothesis, they must first make predictions.
- A prediction is a statement of cause and effect that can be used to set up a test for the hypothesis.

Form a Hypothesis

A hypothesis is a possible explanation or answer to a question.

- A good hypothesis is based on observation and must be able to be tested.
- Predict a possible answer to the problem or question.

Example: If soil temperatures rise, then plant growth will increase because…

Create an Experiment

Once scientists make a prediction and create a hypothesis, they create an experiment to test the hypothesis and see if they are correct.

Perform The Experiment

Collect Data

Scientists keep accurate records of their experiments so they can be repeated by themselves or replicated by other scientists to verify the results.

Analyze Results

After scientists finish their tests, they must organize their data and analyze the results,

Draw Conclusions

- After scientists have analyzed the data from several experiments they can draw conclusions.
- They decide if the results of the experiment support their hypothesis.

Modify the Experiment

- If the data is inaccurate or the experiment is flawed, modify and repeat the experiment

COMMUNICATE RESULTS

Scientists form a global community. After they communicate their investigations, they communicate their results to other scientists.

Let's put our knowledge of the Scientific Method to a realistic example that includes some of the terms you'll be needing to use and understand.

Problem/Question

John watches his grandmother bake bread. He ask his grandmother what makes the bread rise.

She explains that yeast releases a gas as it feeds on sugar.

John wonders if the amount of sugar used in the recipe will affect the size of the bread loaf?

Observation/Research

John researches the areas of baking and fermentation and tries to come up with a way to test his question.

He keeps all of his information on this topic in a journal.

Formulate a Hypothesis

After talking with his teacher and conducting further research, he comes up with a hypothesis.

"If more sugar is added, then the bread will rise higher."

VARIABLES

The ***Independent Variable*** or manipulated variable is a factor that's intentionally changed by the scientist.

 John is going to use 25g., 50g., 100g., 250g., and 500g. of sugar in his experiment.

The ***dependent variable*** is the factor that may change as a result of changes made in the independent variable.

In this case, it would be the size of the loaf of bread

Control Variables are the variables that stay the same. There are most always more than 1.

 John's teacher reminds him to keep all other factors the same so that any observed changes in the bread can be attributed to the variation in the amount of sugar. Same recipe, oven, bowl ingredients brands etc.

The ***Control Group*** is exposed to the same conditions as the experimental group, except for the variable being tested.

 In this case the control group is 50 g of sugar. The amount used in Grandmas recipe.

Size of Baked Bread (LxWxH) cm^3

Amt. of Sugar (g.)	1	2	3	Average Size (cm³)
25	768	744	761	758
50	1296	1188	1296	1260
100	1188	1080	1080	1116
250	672	576	588	612
500	432	504	360	432

Trials refer to replicate groups that are exposed to the same conditions in an experiment.

 John is going to test each sugar variable 3 times.

Collect and Analyze Results

Use the data table

Conclusion

John rejects his hypothesis, but decides to re-test using sugar amounts between 50g. and 100g.

He explains the reason his Hypothesis was incorrect using the data he analyzed, possible flaws and what he will do next.