SCIENTIFIC METHOD

Steps to solve problems

Observation

Use your "senses" to collect information.

- Something that you see, hear, taste, smell or touch.

Inference

- An attempt to explain your observations.
- The “likely” reason.

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 after researching.

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

Test the Hypothesis

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

Collecting Data & Analyzing Results

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

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

Qualitative

- Deals with descriptions.
- Data can be observed but not measured.
- Colors, textures, smells, tastes, appearance, beauty, etc.

Quantitative

- Deals with numbers.
- Data which can be measured.
- Length, height, area, volume, weight, speed, time, temperature, humidity

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 asks his grandmother what makes the bread rise.

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

Problem/Question

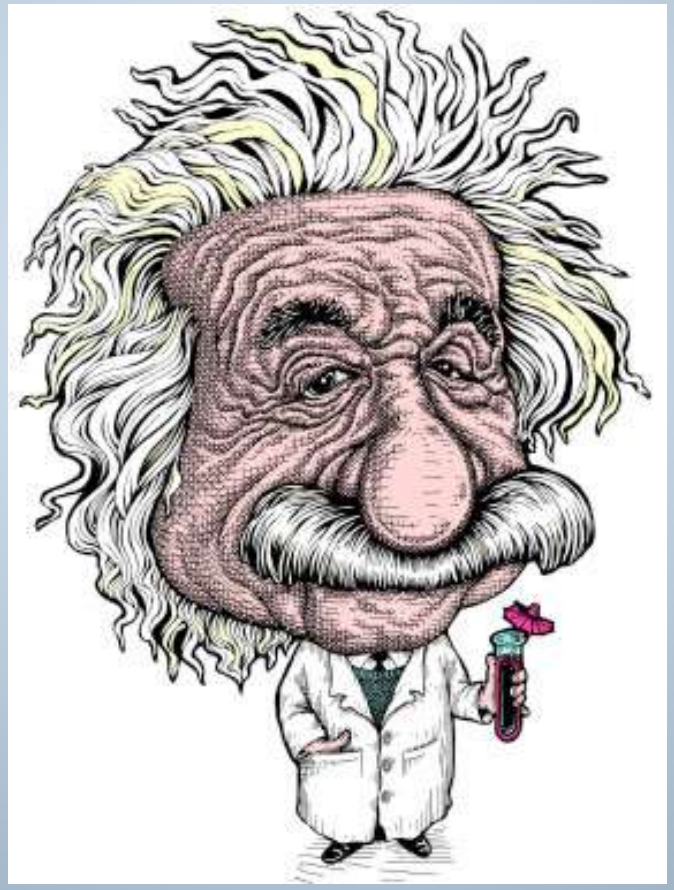
- John wonders if the amount of sugar used in the recipe will affect the size of the bread loaf?

Formulate a Hypothesis

After conducting further research, he comes up with a hypothesis.

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

Do you know the difference between a dependent and an independent variable?????



Independent Variable

The independent, 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.

Dependent Variable

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 Variable

The variables that stay the same
There are most always more than 1

Control Group

In a scientific experiment, the control group is the group that serves as the standard of comparison.

The control group may be a “no treatment" or an “experimenter selected” group.

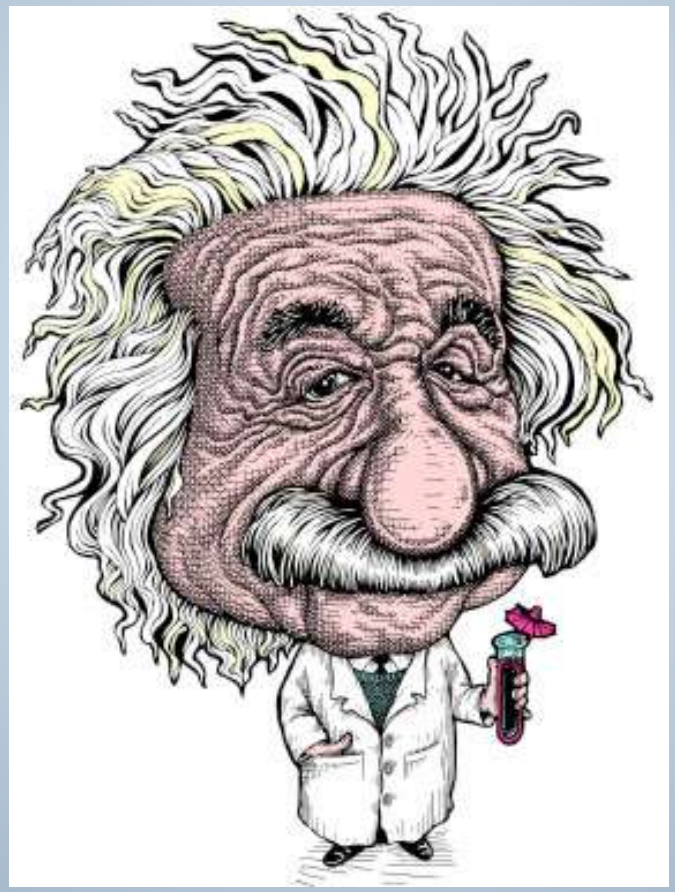
Control Group

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

Control Group

Because his grandmother always used 50g. of sugar in her recipe, John is going to use that amount in his control group.

Can you think of some constants for this experiment?



Trials

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

John is going to test each sugar variable 3 times.

Size of Baked Bread (LxWxH) cm^3

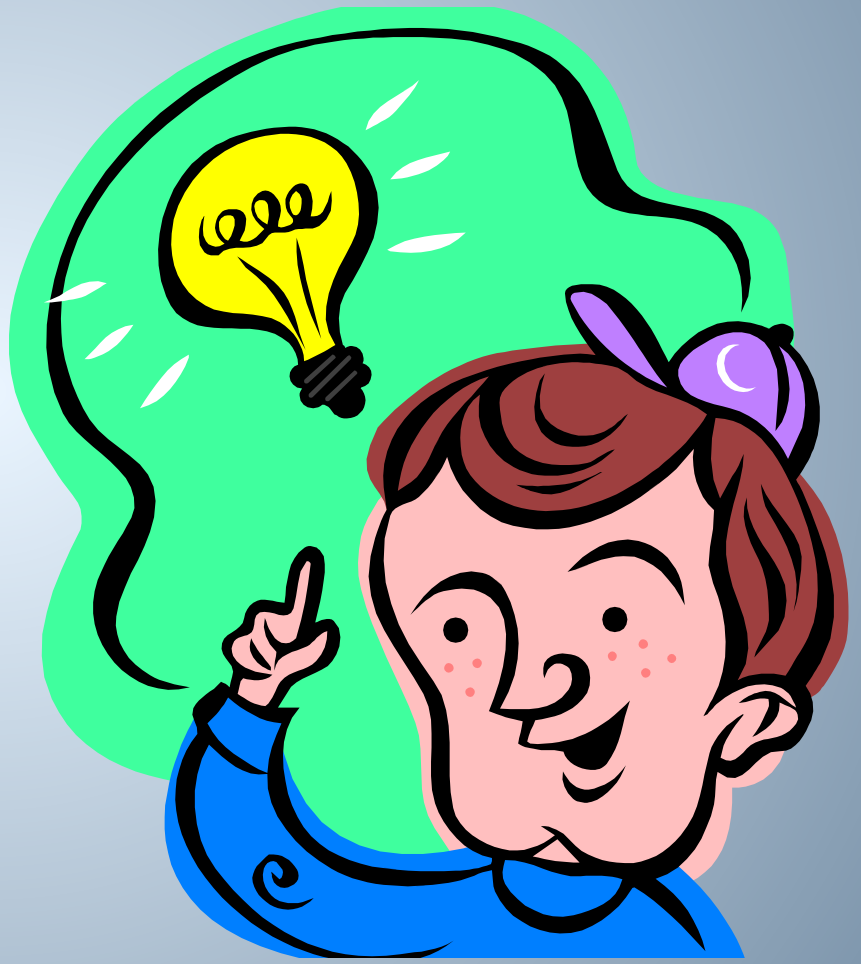
	TRIALS			
Amt. of Sugar (g.)	1	2	3	Average Size (cm^3)
25	768	744	761	758
50	1296	1188	1296	1260
100	1188	1080	1080	1116
250	672	576	588	612
500	432	504	360	432

Collect and Analyze Results

John examines his data and notices that his control worked the best in this experiment, but not significantly better than 100g. of sugar.

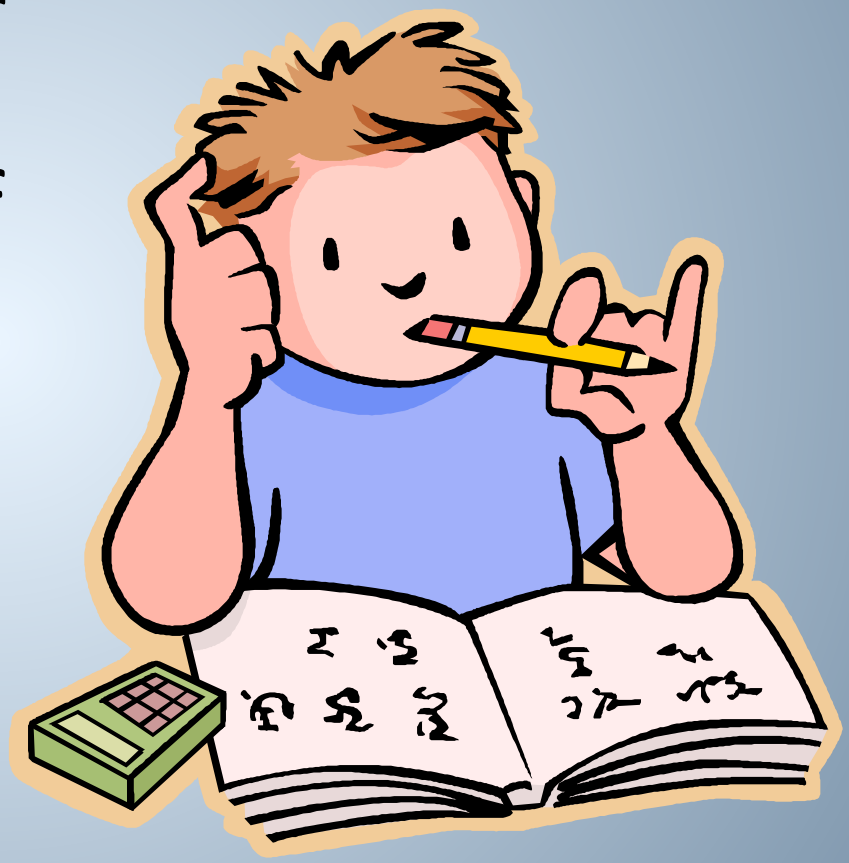
Conclusion

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

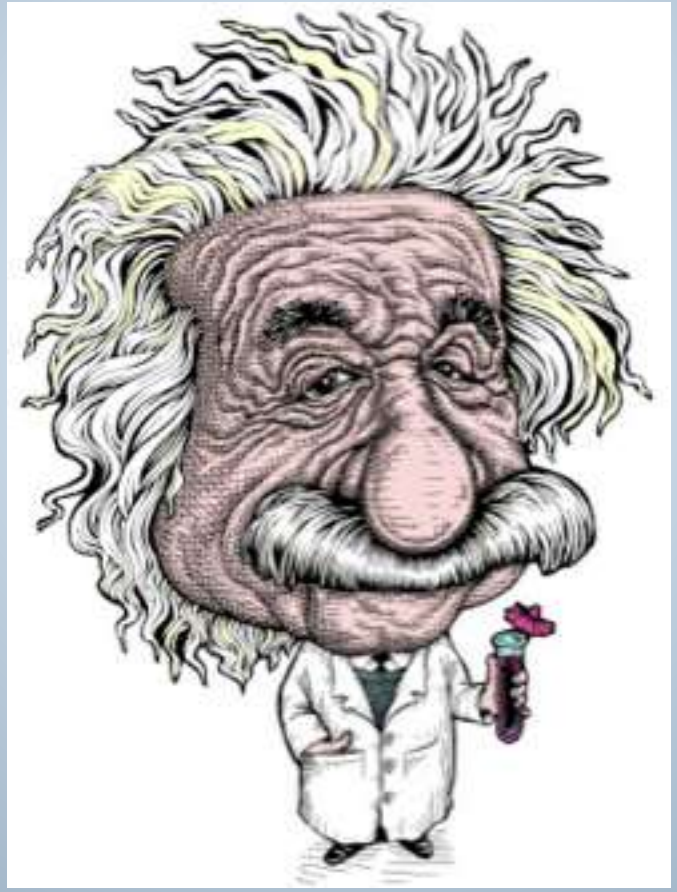


New hypothesis

If I add 70 g of sugar to the bread it will make a bigger loaf because there wasn't much difference in size between 50g and 100 g.



Can you tell which group did the best?



Size of Baked Bread (LxWxH) cm^3

Size of Bread Loaf (cm^3)

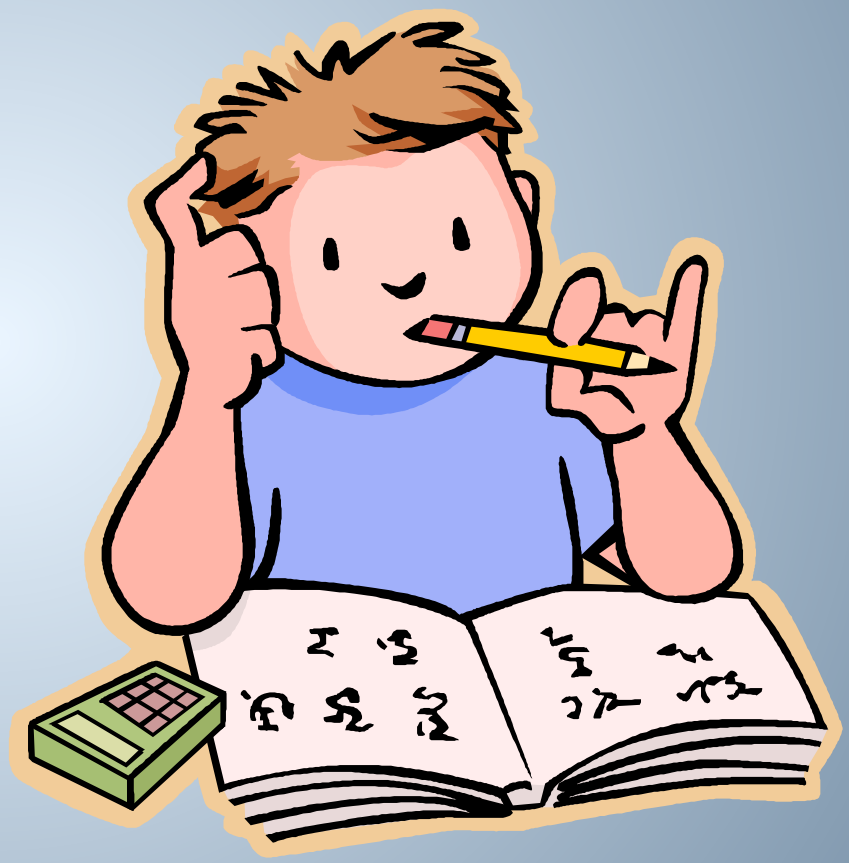
Trials

Amt. of Sugar (g.)	1	2	3	Average Size (cm^3)
50	1296	1440	1296	1344
60	1404	1296	1440	1380
70	1638	1638	1560	1612
80	1404	1296	1296	1332
90	1080	1200	972	1084

Conclusion

John finds that 70g. of sugar produces the largest loaf.

His hypothesis is accepted.



THE END