



Steps of

the

Scientific Method

The **Scientific Method** involves a series of steps that are used to investigate a natural occurrence.



# **Scientific Method**

Problem/Question

Observation/Research

Formulate a Hypothesis

Experiment

Collect and Analyze Results

Conclusion

Communicate the Results

# Steps of the Scientific Method

- 1. **Problem/Question:**
  - Develop or question or problem that can be solved through experimentation
- 2. **Observation/Research:**
  - Make observations and research your topic
- 3. **Formulate a Hypothesis:**
  - Predict a possible answer to the problem or question
  - Ex: If soil temperatures rise, then plant growth will increase

# Steps of the Scientific Method

- 4. **Experiment:**
  - Develop and follow a Procedure
    - Detailed Materials List
    - Outcome must be measurable (quantifiable)
  - Measures:
    - Control:
      - Does not change (Normal conditions)
      - Serves as standard of comparison
    - Variables:
      - Independent: Variable controlled or changed by you
      - Dependent: Variable that responds to the independent variable (what you measure)

# Steps of the Scientific Method

- 5. **Collect and Analyze Results:**
  - Modify the procedure if needed
  - Confirm the results by retesting
  - Include tables, graphs, and photographs
- 6. **Conclusion:**
  - Accept or reject the hypothesis
- 7. **Communicate the Results:**
  - Be prepared to present the project to an audience
  - Expect questions

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.





# Problem/Question

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



# Caution!

Be careful how you use **effect** and **affect**.

**Effect** is usually a noun and **affect**, a verb.

“The **effect** of sugar amounts on the rising of bread.”

“How does sugar **affect** the rising of bread?”

# Observation/Research

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



# Formulate a Hypothesis

- After conducting further research, he comes up with a hypothesis.
- “If more sugar is added, then the bread will rise higher.”
- The hypothesis is a prediction about the relationship between the independent and dependent variables



# Variables

## Independent

- Manipulated variable/  
What you will change
- John is going to use 25g., 50g., 100g., 250g., 500g. of sugar in his experiment.

## Dependent

- Responding Variable/  
What you will measure
- John will evaluate the size of the loaf of bread

# Experiment

John needs to come up with:

- Procedure
- List of materials
- Determine the control group and constants

John will then conduct the experiment running at least 3 trials

# Experiment

## Control

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

## Constants

- What is kept the same
- Other ingredients to the bread recipe, oven used, rise time, brand of ingredients, cooking time, type of pan used, air temperature and humidity where the bread was rising, oven temperature, age of the yeast...

# Collect and Analyze Results

John comes up with a table he can use to record his data.

John gets all his materials together and carries out his experiment.





# Size of Baked Bread (LxWxH) cm<sup>3</sup>

## Size of Bread Loaf (cm<sup>3</sup>)

### Trials

Amt. of Sugar (g.)	1	2	3	Average Size (cm <sup>3</sup> )
25	768	744	761	758
50 Control group	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.



# Experiment

Once again, John gathers his materials and carries out his experiment.

Here are the results.



# Size of Baked Bread (LxWxH) cm<sup>3</sup>

## Size of Bread Loaf (cm<sup>3</sup>)

### Trials

Amt. of Sugar (g.)	1	2	3	Average Size (cm <sup>3</sup> )
50 Control group	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.



# Communicate the Results

John tells his grandmother about his findings and prepares to present his project in Science class.

