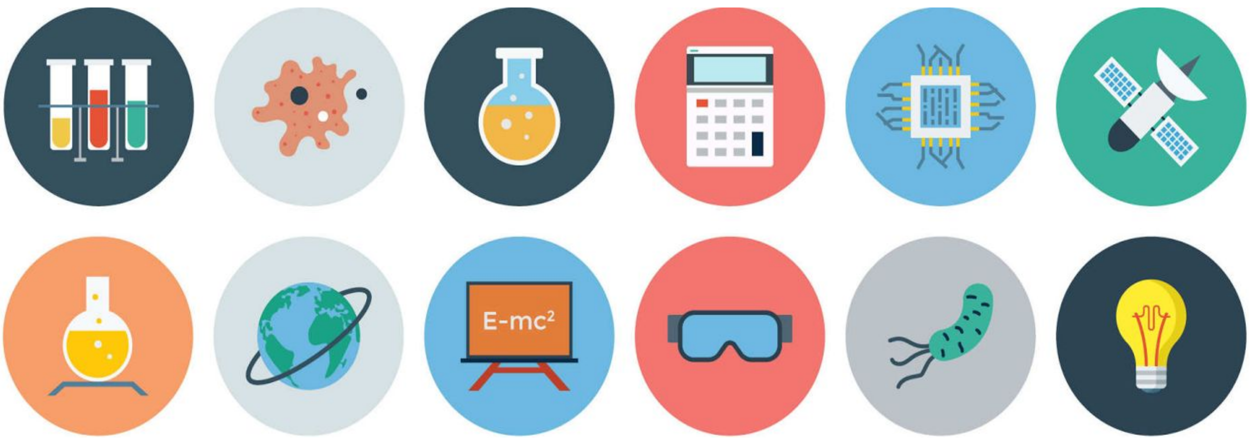
Brazoria County Science Fair



Science Projects
Helpful Hints

Science Projects

A science project is an investigation using the ‘scientific method’ to discover the answer to a problem or question. The ‘scientific method’ is a tool to help organize thoughts and possible solutions. It is a process or a plan to follow that allows the best solution to be found. Experimental science projects should include all steps of the scientific method. Students should write the information about each step of the project in a science journal or log book. Science projects do not always turn out as planned, but this also is an answer. Below are the steps of the scientific method:

Define the Problem
Research the Topic
Form the Hypothesis
Test the Hypothesis with an Experiment
Record the Results
Make a Conclusion

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A Science Project is NOT a:

Demonstration of a process
Model* of something
Research Paper

*Grades PreK-3 may submit Brazoria County Science Fair proposals for models.

Steps of Scientific Method

<u>Step 1: Define the Problem</u>

First, the student needs to select a topic. To help in finding a topic, the student can:

a. read science books, magazines, newspapers, or websites
b. talk to family members, teachers, or librarians
c. talk to scientists in the medical field, industry, or agriculture.

Second, the student needs to decide on a question to solve about the topic. It should be:

a. interesting to the student
b. one they could not already answer
c. one they can solve by an experiment
d. one they can measure results on
e. limited to one problem
f. age appropriate
g. creative and original.

Beware of science fair projects on the internet that are only demonstrations.

A GOOD Problem is...

1. **Does the type of bread, wheat or white, affect how fast it will mold?**
2. **Do plants grow taller in a taller pot?**
3. **Is a person's heart rate changed by the type of music being listened to?**
4. **Does drinking a coke affect the accuracy of playing a video game?**
5. **Which brand of detergent gets a grass stain out the best?**

A GOOD Problem is NOT...

1. **What is a wave?** *You can look this up in a dictionary.*
2. **Which star is closest?** *You can not design a test*
3. **What exercise makes me the hungriest?** *Not measurable*
4. **Does a plant grow better in sandy soil with a blue light at 90°?** *Too many problems to check - soil, light, temperature*
5. **How do volcanoes erupt?** *This is a demonstration, not an experiment.*

Step 2: Research your topic

The student needs to collect information about their topic and question. Find out what is already known about the topic. This background information will help the student become familiar with related vocabulary and help them understand how to set up their test or experiment on the topic.

The student can collect background information from:

a. personal experiences
b. interviewing experts
c. science textbooks or other nonfiction books
d. science websites
e. consumer magazines and reports
f. television news reports

Research Guidelines:

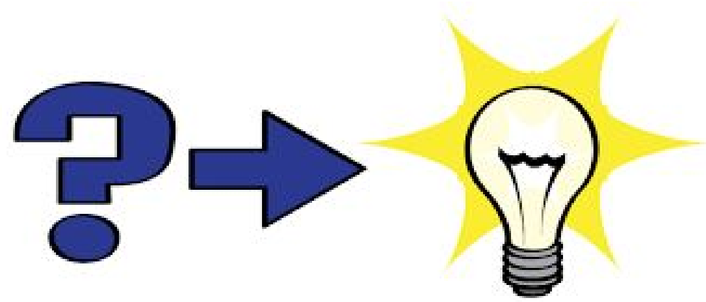
- Include at least three sources of information
- Use magazines, reports, and books published within the last 5 years
- Always list the sources at the end of the background information or in a bibliography

Step 3: Hypothesis

The student needs to make a *prediction* or *guess* about the answer to the problem or science question. The prediction or guess is called the **hypothesis**. The student's prediction is based on the information they gained in the background information.

Guidelines for the hypothesis

- Hypothesis must be written in the science journal before the experiment begins.
- Hypothesis is written as a prediction.
- Hypothesis can be tested and measured.
- Hypothesis is not changed if the results of the project are different than the prediction.



Put simply, say what you think will happen. Use the data or observations you have to predict what will happen. Write down the prediction. This is your hypothesis.

A **good** hypothesis is….

PROBLEM: Does the type of bread, white or white, affect how fast it will mold?
HYPOTHESIS: The wheat bread will grow mold sooner than the white bread.

A good hypothesis is **NOT…**

PROBLEM: Does the type of bread, white or wheat, affect how fast it will mold?
HYPOTHESIS: The mold will grow on the bread that remains the moistest.

<u>Step 4: Experiment</u>

The student will **design a test or experiment** that will help them find the answer to their science question.

There are many things that could have an effect on the results of the experiment. These things are called variables. There are three types of variables.

- The **manipulated variable** is what is being tested and the one thing that is changed.
- All other things in the experiment that will be kept the same and will not affect the results are called the **control** or **controlled variables**.
- The **responding variable** is what is observed as a result of the experiment. It is the measurable results.

As the student designs their experiment, they need to plan for each of the three types of variables.

EXAMPLE:

Problem: Does the type of bread, wheat or white, affect how fast it will mold?

Manipulated variable: type of bread - wheat or white

Controlled variables: same freshness of bread, same room temperature, same room humidity, stored in same type of container, same amount of light, conducted during the same period of time

Responding variable: the growth of mold

The experiment will include:

- Materials
- Safety
- Procedures

MATERIALS

The students will list all the materials used in the experiment. Include how much and what type of materials. The amounts should be written in metric units.

Example:
PROBLEM: Do plants grow taller in a taller pot?

A GOOD materials list is…

3 plants - 6 cm height
1 clay pot - 1 liter
1 clay pot - 5 liter
1 clay pot - 10 liter
1 100 kg bag potting soil
1 watering can
1 grow light
1 10 kg bag of pebbles
1 gardening spade

A good materials list is NOT…

Plants with various containers
Soil
Water

SAFETY

All projects must include a statement about the safety concerns of the project.

Safety Guidelines to consider:

- Parent/adult supervision required on all projects
- Safety goggles required on all projects that include sharp objects, liquids, any source of heat, or household chemicals
- Latex gloves required of all projects that involve bacteria/mold.
- Insulated gloves required of all projects with hot objects
- Veterinarian approval of all projects involving vertebrate animals require documentation that a vet has reviewed and approved the project
- Sterile Technique required of all projects involving bacteria or mold (see appendix)
- Science Specialist Supervision required of projects requiring a depth of science background beyond their classroom teacher's resources

PROCEDURES

The student will list step by step directions to the experiment. Anyone should be able to duplicate the experiment by procedures and get the same results.

Example

Problem: Do all brands of paper towels absorb the same amount of water?

A GOOD procedure is…

1. Cute three 15 x 15 cm squares from each brand of paper towels.
2. Label the brand name with each square.
3. Pour 50 ml of room temperature water into a 20 cm x 20 cm square cake pan.
4. Place one square of paper towel into the water in the pan.
5. Let the square soak for 30 seconds.
6. Remove the paper towel square.
7. Measure the water remaining in the pan and record the amount.
8. Dry the cake pan.
9. Repeat steps 4-8 for each brand of paper towel.
10. Repeat the entire process twice for each brand of paper towel.

A procedure is NOT…

1. Place a square of three brands of paper towels on the table.
2. Take a cup of water and pour some water in the center of the square.
3. Measure the distance the water spreads out from the original spot poured.

Step 5: Results

Recording Results

The student will record the observations and results from the experiment. The record keeping entry should be dated and can include:

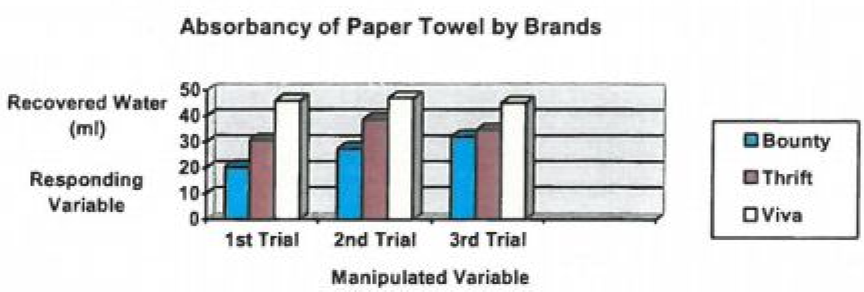
a. Written observations
b. Measurements recorded in charts
c. Photographs

Graphing Results

After the measurable results are recorded in the charts, decide how the information will be displayed.

Example:

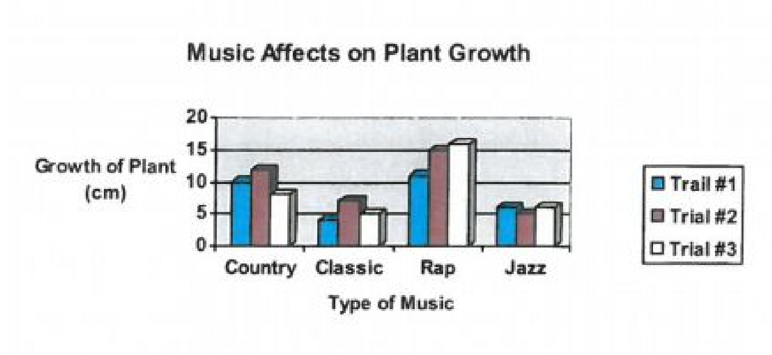
	1st Trial	2nd Trial	3rd Trial
Bounty	20.4 ml	27.4 ml	32.0 ml
Thrift	30.6 ml	38.6 ml	34.6 ml
Viva	45.9 ml	46.9 ml	45.0 ml



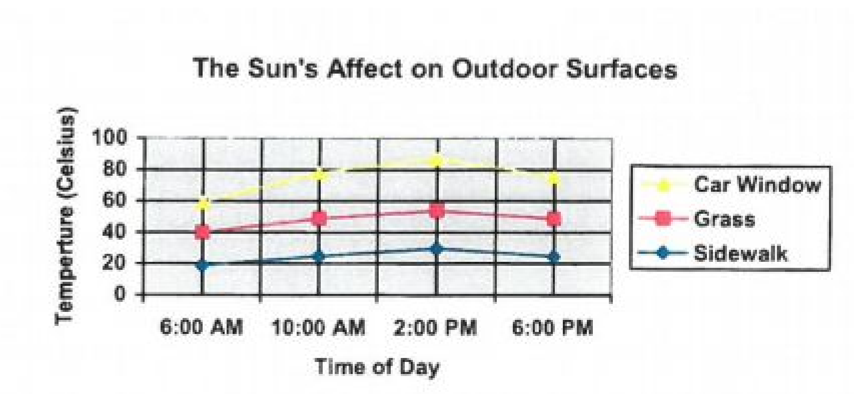
The graph should have a **title** which is a short description of the information. The horizontal axis should have the **manipulated variable** displayed on it. The vertical axis should have the **responding variable** displayed on it. There should be a **label** on both axes and units of measure should be included. A brief sentence should explain the graph.

There are two main types of graphs: bar graphs and line graphs.

BAR GRAPHS are used to display the same kind of data for different things.



LINE GRAPHS are used to display data that changes as time passed. It is continuous information, and the shape of the line tells whether something increases, decreases, or stays the same.



<u>Step 6: Conclusion</u>

The conclusion is a **summary** of the information collected in the experiment. What do the results prove? Does it agree or disagree with the project's hypothesis? The project should state if the data **agrees or disagrees** with the hypothesis. If the results are not clear, then state not enough data to agree or disagree with the original hypothesis and more testing is needed. In this section the student can include problems. The **problems** are things that occurred during experimentation that could cause the outcome to be different. For example, one of the three plants died or the cat knocked half of the soil out.

The project's conclusion ends with ideas of how the student could revise the experiment to improve the results or expand on other areas of the project that could be studied. This is referred to as "**Further Study.**" The student does not have to actually do the revisions of further study but should think of ways to improve or expand the design.

Presentation:

If the student plans to enter their science project in a science fair, all five parts of the project need to be displayed on a board (see appendix). The science journal is also required to be displayed.

APPENDIX

<u>Sterile Technique</u>

<u>to be used with BACTERIA and Mold Cultures</u>

1. Wash hands, wear goggles and gloves. (You may borrow goggles from your science teacher or contact the Science Fair Committee if necessary.)

2. Turn off AC/vent system and close door to avoid circulating dust in the air. Mold spores are sometimes attached to dust particles.

3. Wipe working surface down with alcohol or 10% ammonia/water.

4. Sterilize (dip in alcohol) any utensils that may touch the object you're testing.

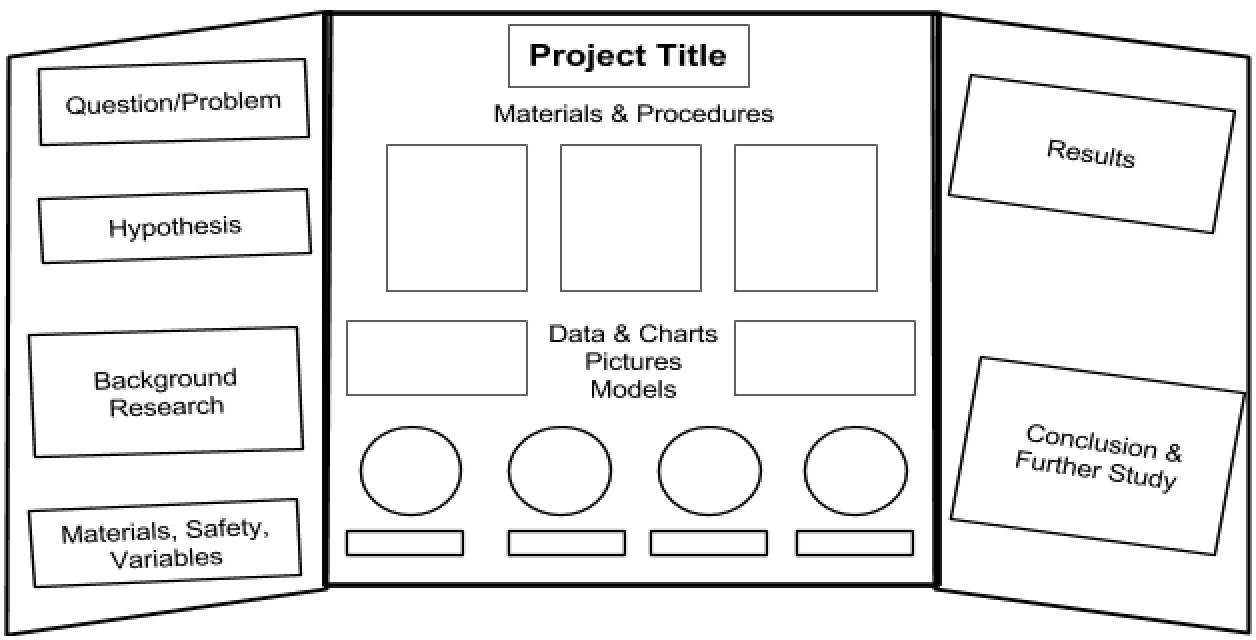
5. If you are testing a certain food object with mold, it must be in a container: petri dish or ziplock bag. Once the object is placed in the container, it should be sealed (tape Petri dish/ snap ziplock shut). You should not open the container throughout the experiment. When viewing the object, do not hold it close to your face or smell it. Observation must be made in the container.

6. When experiment is over, throw the container away without opening it.

7. Wash hands; wipe down work area with 10% ammonia/water mixture or alcohol.

Science Fair Display

A science project competing in a science fair must be displayed on a free standing board, for example, a tri-fold cardboard or a foam board. The exhibit size is limited to 76 cm front to back, 122 cm side to side, and 274 cm from floor to the top of the display. Project will be placed on a 76 cm high table. All parts of the project should be displayed on the board*. A lab journal or logbook containing the project's notes is required to be displayed also. Models, specimens, or equipment used in the experiment and which help explain the project may be displayed. For safety of the public, no chemicals, sharp objects, glass containers, or expensive equipment will be allowed to be displayed with the projects.



*** Student faces and/or names are NOT allowed on the board or in the lab journals.**

Brazoria County Science Fair
Experimental Project Judging Criteria
PreK - 6th Grade

Criteria
Project Objective
Clear statement of problem or question
Creative and original
Background Knowledge
Research of key scientific concepts
Use of relevant resources in background
Experimental Design
Hypothesis: stated as a prediction and testable
Variables: Identification and description of all relevant
Control or controls: are present and used as a standard of comparison
Repeated trials: experiment was repeated or large number of experimental subjects were tested
Materials and Equipment: suitable for experiment and described clearly
Procedure: clear and detailed
Laboratory Notebook: accurate, dated, record of project
Safety: procedures for safety are discussed and followed
Results
Graphs and Tables: correct type used, labeled, clear, quantitative measurements, label units
Summary: explains the data on the graphs/tables
Conclusion
Discussion of major findings
Statement of how data supports hypothesis
Suggestions for further study
Display
Attractive, clear, creative
Displays all steps of project and follows fair rules

Brazoria County Science Fair
Experimental Project Judging Criteria
7th - 8th Grade

Criteria
Project Objective
Clear statement of problem or question
Creative and original
Background Knowledge
Research of key scientific concepts
Use of relevant resources in background
Experimental Design
Hypothesis: stated as a prediction and testable
Variables: Identification and description of all relevant
Control or controls: are present and used as a standard of comparison
Repeated trials: experiment was repeated or large number of experimental subjects were tested
Materials and Equipment: suitable for experiment and described clearly
Procedure: clear and detailed
Laboratory Notebook: accurate, dated, record of project
Safety: procedures for safety are discussed and followed
Results
Graphs and Tables: correct type used, labeled, clear, quantitative measurements, label units
Summary: explains the data on the graphs/tables
Conclusion
Discussion of major findings
Statement of how data supports hypothesis
Suggestions for further study
Display
Attractive, clear, creative
Displays all steps of project and follows fair rules
Presentation of Project
Student was articulate in the presentation: showed knowledge and thoroughness of research and experimentation