
# Science Fair Manual

## A step by step guide to doing a science fair project

**NAME** _____

**0**

# Table of Contents

# Scientific Method

## 1. Question

Make observations. Look at your environment. Look at the materials you have available. Think about each item and each area. What are these things made of, how do they work, what can you do with them, and how can you make something happen? What do you want to find out?

## 2. Hypothesis

Think about your chosen experiment. Based on your observations and your research, what do you predict the outcome of the experiment will be? Why do you think this is so?

## 3. Experiment

Create a list of materials needed. Carry out your experimental procedure carefully, being sure to work safely and accurately.

## 4. Results

What happened? Record your results. Use graphs and charts to clearly show your findings.

## 5. Conclusion

Analyze your results and compare actual results with your hypothesis. Decide whether or not your hypothesis was supported. Think about further research. Write up your findings to share with other scientists.

# Stage One: Topic Choice

## Brainstorm:

Pick a topic that interests you. Remember, you will spend a lot of time on this topic. It will only be fun if you want to learn about it.

Where do you get ideas for brainstorming?

-Your interests or hobbies -science class topics -the Internet
- parents -relatives -friends -the library

Check out the idea list in this manual.

Make a list of project ideas that interest you below. The next step is to go through your list and decide which topics can be tested. (For example, topics such as space or radiation might be interesting, but it would be difficult to set up an experiment to test your research.)

Is it testable?

1._____ Yes No

_____

Is it testable?

2._____ Yes No

_____

Is it testable?

3._____ Yes No

_____

Is it testable?

4._____ Yes No

_____

Is it testable?

5._____ Yes No

_____

# Make a final choice and stick with it.

You probably won't have time to change your mind once you begin. Highlight the topic you choose on your brainstorm list.

# **Narrow your topic**.

example: Topic: plants — plants and water; plants and fertilizer; plants and sunlight

What is your topic? _____

All of these topics are testable because one may affect the other. The next step is to ask a question about the relationship.

example: How does the amount of water a plant receives affect its growth?

What is the **question** you want to answer with your science fair experiment? (This should not be a yes/no question.) State this as the **purpose**.

The **purpose** of this experiment is to determine _____

_____

## Your question should show a cause and effect.

**The cause** is also called the **independent variable.**

What are you changing in the experiment?

**The effect** is called the **dependent variable**.

What happens because of your changes?

example: **independent variable**: the amount of water
**dependent variable**: the amount of growth

## **IMPORTANT:**

*You may only have ONE independent variable in your experiment!
*All other variables must be carefully controlled so they remain the same in every trial of your testing process.

example: **variables to control** — light; placement of plant; temperature

# Variables:

My one independent variable is _____

_____

My dependent variable is _____

_____

Other variables I need to be sure to control during the experiment are: _____

_____

_____

# Stage Two: Research

Find out as much about your topic as possible. Look everywhere to collect information.

| | | | |
|---|---|---|---|
| -libraries | -Internet | -zoos | -plant nurseries |
| -magazines | -science journals | -videos | -encyclopedias |

Keep track of where you get your information.
Write your bibliography as you collect the information. (See format for references list.)

When you feel that you have enough information to really know your topic, then it's time to make a **hypothesis**. Take the question you wrote earlier and turn it into an "If/then/ because" statement that tells what you predict will be the result of the experiment and why.

| | |
|---|---|
| example: | **If I give the plant more water, then it will grow taller because plants need water to grow.** |

My hypothesis is: _____

_____

**IMPORTANT:** If your experiment requires time to work, (plants need time to grow) think about starting the experiment process before your research is totally finished. Jump ahead to the next stage and get started, then come back and finish your research.

**ACTIVITY:** Start forming the rough draft of your research paper. Depending on the length of your paper, it can be attached to your display board or bound separately and included on your table. You can continue to work on this until the science fair.

## Organize your Research Report:

Your report must include:

1. Title Page
2. Table of Contents
3. Purpose
4. Your research (length will vary)
5. Your hypothesis
6. Materials list
7. Procedure
8. Results
9. Graphs, charts, tables to support your results (use metric measures)
10. Conclusions
11. Bibliography (use at least 3 different sources)

# Stage Three: Experiment

Design an experiment to test your hypothesis. Make a step by step list of what you will do to answer your questions. This is called an experimental procedure. Remember to select only one thing to change (independent variable) in your experiment. You must tell how you are going to change your variable, and how you are going to measure that. Also, in some experiments, you will need a control. A **control** is a comparison. It will help you to show that the results were directly related to your independent variable.

| example: The control is that one plant will receive no additional water. |
|---|

## Experimental Procedure:

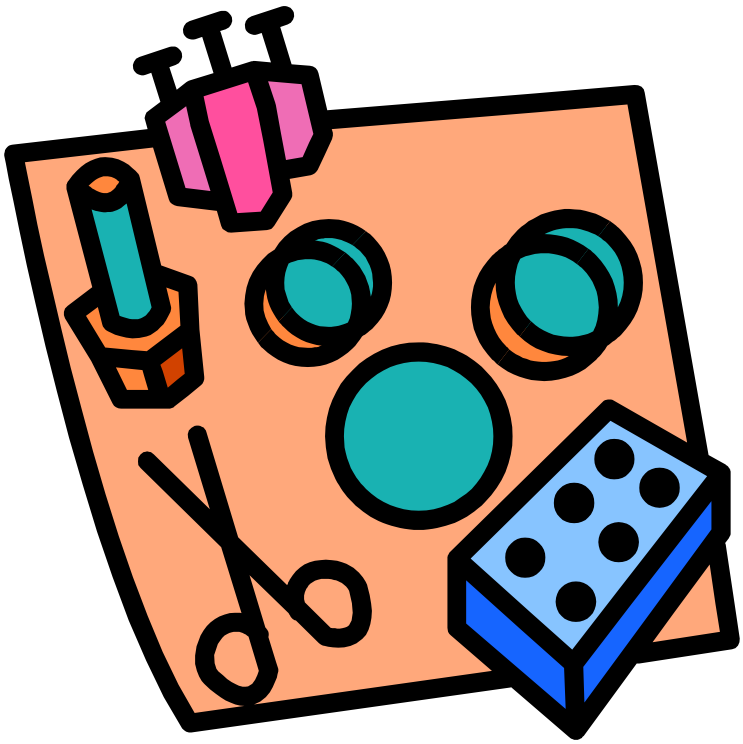
1. Make a list of the materials and equipment you will need to complete your experiment.
   -Try to use as many common household supplies as possible. For example, an ice cube tray with its many sections works well for many experiments.
   -If you need to purchase special supplies, try the local hardware store or surplus supply store. (Look in the Yellow Pages)

## Materials List: (Be sure to list every item you need!)

2. Now it's time to design the actual procedure of the experiment. Depending on what type of experiment you choose, carrying out this procedure may take a few hours, a few days, or a few weeks. Plan accordingly!

**REMEMBER:**

- **You may only have one independent variable.**
- **You must control any other variables to be sure they remain the same.**
- **You must repeat the experiment at least 3 times to be sure your results are correct.**
- **Be sure to accurately describe the set up of your experiment. Draw a picture to include in your report.**
- **Think carefully as you write to be sure to add in all of the details of every step you do to complete your experiment and collection of data.**
- **All data should be collected in metric measures.**



Example:

## Materials:

5 sets of 6 seedling pots numbered 1-5
90 brassica seeds
potting soil
measuring cup –marked in ml
water
centimeter ruler
data collection chart
small graduated cylinder
large bowl

## Procedure:

1. Measure 3000 ml of potting soil into a large bowl. Add water to dampen the soil and mix until all the water is evenly distributed throughout the soil.
2. Put 100 ml of dampened soil into each of the seedling pots.
3. Dig a small hole 2 cm. deep in the center of each seedling pot and drop in 3 Brassica seeds. Cover the seeds with soil.
4. Place the pots all together on the same counter or windowsill so all are exposed to the same light and temperature .
5. Every other day following the planting, the seeds/plants should be watered as follows: (watering will occur at 8:00 A.M. )

Tray 1: no water (control)
Tray 2: 5 ml water
Tray 3: 10 ml water
Tray 4: 15 ml water
Tray 5: 20 ml water

6. Start the data collection chart on the day you plant your seeds. Every second day after that, using the centimeter ruler, measure the growth of the plant by placing the ruler directly on the soil at the base of each plant and measuring the length to the tallest part.

NOTE: When the plants reach 2 cm, thin each pot to have only one sprout growing. (Choose the stronger looking plant to continue growing.)

Continue to measure and record data (see example chart) every other day for 14 entries.

This experiment allows for 6 trials at each variable change (different amounts of water). This way if some plants do not grow, I will still have results. The 6 trials (6 plants in each tray) will be averaged to chart on the final graph.

## My Procedure:

## Procedure – continued

# Stage Four: Results and Conclusion

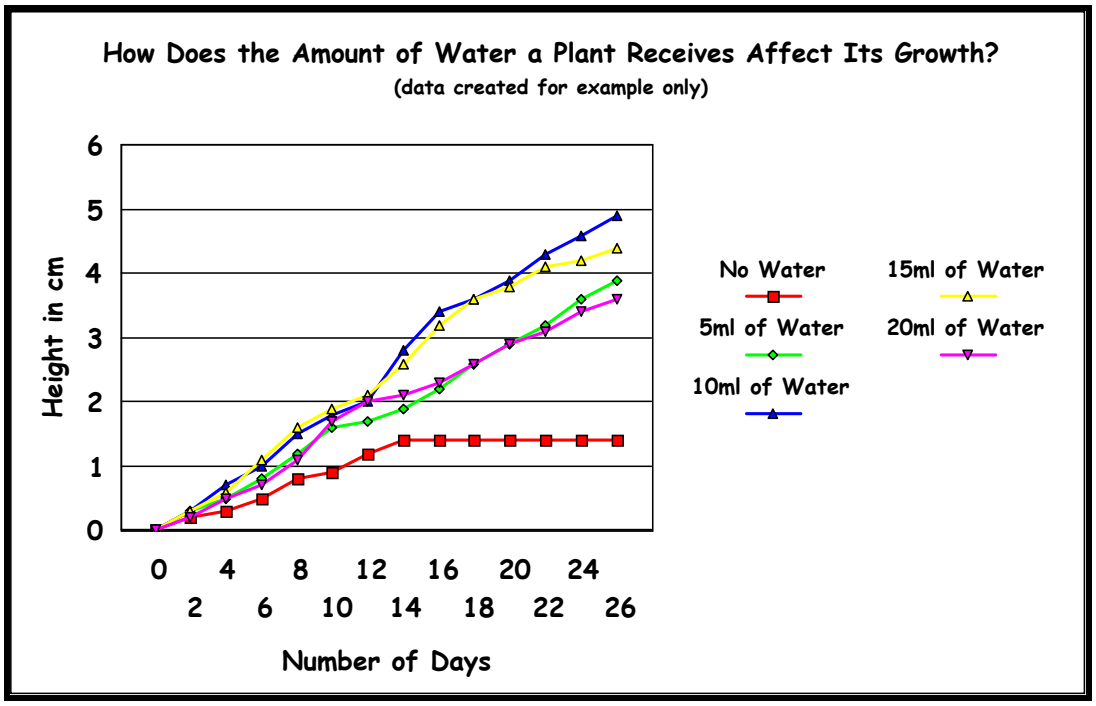
Your results are collected as you complete your experimental procedure. Be sure to measure accurately and record the data in the same manner every time . Make a chart to collect your data in an organized way. (see example)

Summarize your results in paragraph form for your report. Include your data collection chart and a graph of the results. Decide if your original hypothesis was supported or not.

## Your conclusion should:

-Refer to your original question and hypothesis.
-Include all data collected even if it does not support your hypothesis
-Include your theories about why your hypothesis was either supported or disproved.
-Include ideas as to how to further test this or other related theories.
-Include any difficulties or problems that may have affected the data.

Finish your final draft of the written report. Be sure to include all the parts listed on page 6.



# Stage Five: Science Fair

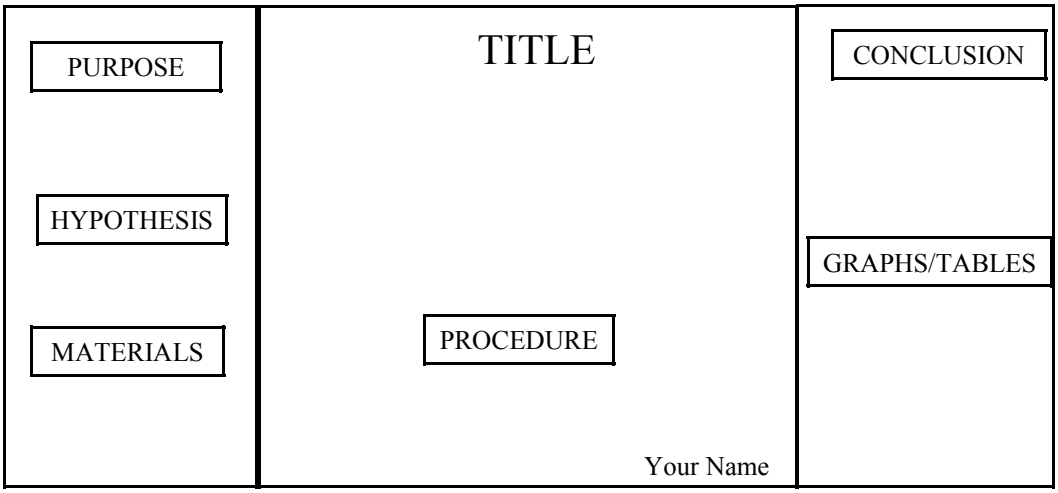
Now that you have finished all of your hard work, it is time to show it all off to the judges and your co-scientists. How you present your experiment and your findings is just as important as the experiment itself.

Science Fair display boards consist of three panels and are available at most office supply stores. The traditional way to set up the board is: (variations are acceptable)

**Left panel**: Purpose, Hypothesis (research if report is short)
**Center panel**: Project title, Procedure (use photos, drawings, outlines)
**Right panel**: Results (use tables, graphs, photos) Conclusions

Your written report should be on the table, in front of the center panel.

Use bold, clear headings for each section on your board.



# Preparing Your Display Board

Your **display board** should:

- -Look professional
  - Use a computer, typewriter or stencils to present your information
  - It should attract the attention of the viewer and make them want to come over and read about your project
- -Look neat. (Use a ruler)
- -Have everything spelled correctly (Have an adult double check.)
- -Use colors
  - Stick to two or three non-clashing colors, Any more than that, and your project will lose its professional look
- -Include your first and last name

The **title** is very important in a display board.

- -It should be eye-catching and easy to read
- -Be sure that the letters are large enough to be read from across the room
- -Use dark colors

The **procedure and results** sections should:

- -Have pictures or clear drawings
- -Use graphs to show data
- -Be specific

The **conclusion** section should:

- -Tell exactly what happened during the experiment
- -Tell whether your results supported your hypothesis
- -State any other information that you discovered

# Presenting your Project

Your speech should consist of three parts:

- -An introduction (your name, topic)
- -Some background information about your topic
- -An explanation of your experiment

When giving your speech:

- -Dress neatly
- -Do not chew gum
- -Have eye contact
- -Stand still
- -Speak clearly
- -Speak for 1-5 minutes
- -Make sure you have practiced!

# Science Fair Project Checklist

Use the following list to be sure you have a complete project. Check off each item as it is completed.

| | **Due Date** |
|---|---|
| _____ Choose Topic | _____ |
| _____ Create your Question/Purpose Statement | _____ |
| _____ Do Initial Research-rough draft | _____ |
| _____ Develop a Hypothesis | _____ |
| _____ Create Materials List | _____ |
| _____ Write Procedure | _____ |
| _____ Do the Experiment and Collect the Data | _____ |
| _____ Analyze Results | _____ |
| _____ Create Graphs and Charts as needed | _____ |
| _____ Write Research Paper-final draft | _____ |
| _____ Write up Bibliography | _____ |
| _____ Assemble Display Board | _____ |
| _____ Prepare Presentation | _____ |

## My Science Fair will be held at:

Place:_____

Date: _____

Time: _____

# Format for Reference List

# Appendix B

# Science Fair Ideas

# Appendix A

# Science Fair Ideas

How does the angle of a ramp affect how quickly a ball will roll down it?

Demonstrate whether or not quarters and feathers fall at the same rate.

Which chewing gum's flavor lasts the longest?

Which cleaning product is best for removing carpet stains?

Which brand of diaper is the most absorbent?

Which brand of paper towel is the strongest?

Which brand of popcorn leaves the fewest unpopped kernels?

Which fast-food burger contains the least grease?

Which cereal will stay crispy the longest when placed in milk?

Do suction cups stick equally well to all surfaces?

What effect does the weight of a bat have on how far a ball can be hit?

Which paper airplane will fly the farthest?

Is an egg stronger one way or another?

Compare the bonding strength of various types of glue.

What effect does moisture have on various types of glue?

Does the color of an object determine how much heat it absorbs from sunlight?

Does temperature affect the strength of rubber bands?

Which materials are the best insulators? What factors affect insulation?

Which would melt first, ice wrapped with plastic wrap or with aluminum foil?

Which freezes faster? Hot water or cold?

Which will boil faster? Hot water or cold?

What factors determine how long a candle will burn?

Does the color of a liquid contribute to its ability to absorb heat?

Does temperature affect how much salt or sugar can be dissolved in water?

How does surface area affect the evaporation rate of liquids?

What effect does temperature have on water evaporation?

What factors affect the period of a pendulum?

Do sunscreens really reduce the amount of ultraviolet radiation?

Does temperature affect how well seeds sprout?

Will soaking in water before planting help seeds sprout?

What effect would freezing have on how well seeds sprout?

Does soil acidity affect how well seeds sprout?

Does the depth a seed is planted affect its ability to sprout?

Does the type of water source used affect seed germination?

Is plant growth affected by how closely together the seeds were planted?

Do plants grow better with tap water or distilled water?

What is the effect of different colors of light on plant growth?

Is plant growth affected by exposure to ultraviolet light?

Does sound have any effect on plant growth? Does music?

What effect does different types of music have on plant growth?

Which additive is the best for preserving cut flowers? (salt, asprin, 7-up, etc.)

Does the angle that the stalk is cut have any effect on the life of cut flowers?

What effect does salt water have on  plant growth?

Would soapy water harm or help seed sprouting and/or plant growth?

What would be the effect on plants of using liquids such as milk, Coke, or juice instead of water?

# Resource List

# Appendix C

# Resources

## Books

100 Amazing Make-It-Yourself Science Fair Projects
by Glen Vecchione

50 Nifty Science Fair Projects
by Carol Amato,et al.

Kidsource: Science Fair Handbook
by Danna Voth

More Blue Ribbon Science Fair Projects
by Maxine Haren Iritz

Environmental Science: 49 Science Fair Projects
by Robert L. Bonnet

Experiment With Plants
by Monica Byles

The First Timer's Guide to Science Fair Projects
by Q.L. Pearce

Botany: 49 Science Fair Projects
by Robert L. Bonnet

The Complete Handbook of Science Fair Projects
by Julianne B. Bochinski

Magic Mud and Other Great Experiments
by Gordon Penrose

Janice VanCleave's Spectacular Science Series
by Janice VanCleave

175 More Science Experiments to Amuse and Amaze Your Friends
by Terry Cash

200 Illustrated Science Experiments for Children
by Robert J. Brown

Adventures With Atoms and Molecules: Chemistry Experiments for Young People
by Robert C. Mebane

50 Terrific Science Experiments
by Lisa Taylor Melton

Science for You
by Bob Brown

Mr. Wizard's 400 Experiments in Science
by Don Herbert

Dr. Zed's Zany Brilliant Book of Science
by Gordon Penrose

## Web Sites

www.school.discovery.com/sciencefaircentral/

www.halcyon.com/sciclub/cgi-put/scifair/guestbook.html

www.scifair.org/

www.parkmailand.org/sciencefair/