Science Fairs

AND THE SCIENTIFIC METHOD

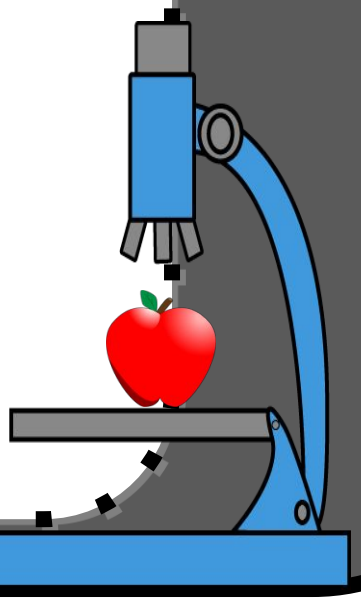
A Simple Step-by-Step Explanation of the Process

By
Suzanne Buras

Table of Contents

Scientific Method

Make an Observation
Ask a Question
Hypothesis
Materials
Experiment
Analysis of Data
Conclusion
*Application



Question

The first step in the Scientific Method and to designing a Science Fair Project is the **Problem**. The Problem should be stated as a question for which you are seeking to find the answer through experimentation.

IMPORTANT

The Problem you choose must be **testable**, **measurable**, and **observable**. In other words, when you are doing your experiment, you should be able to actually conduct a test, measure it in some way, and observe what is happening. Can you measure the results in grams, milliliters, feet, centimeters, etc., or by counting?

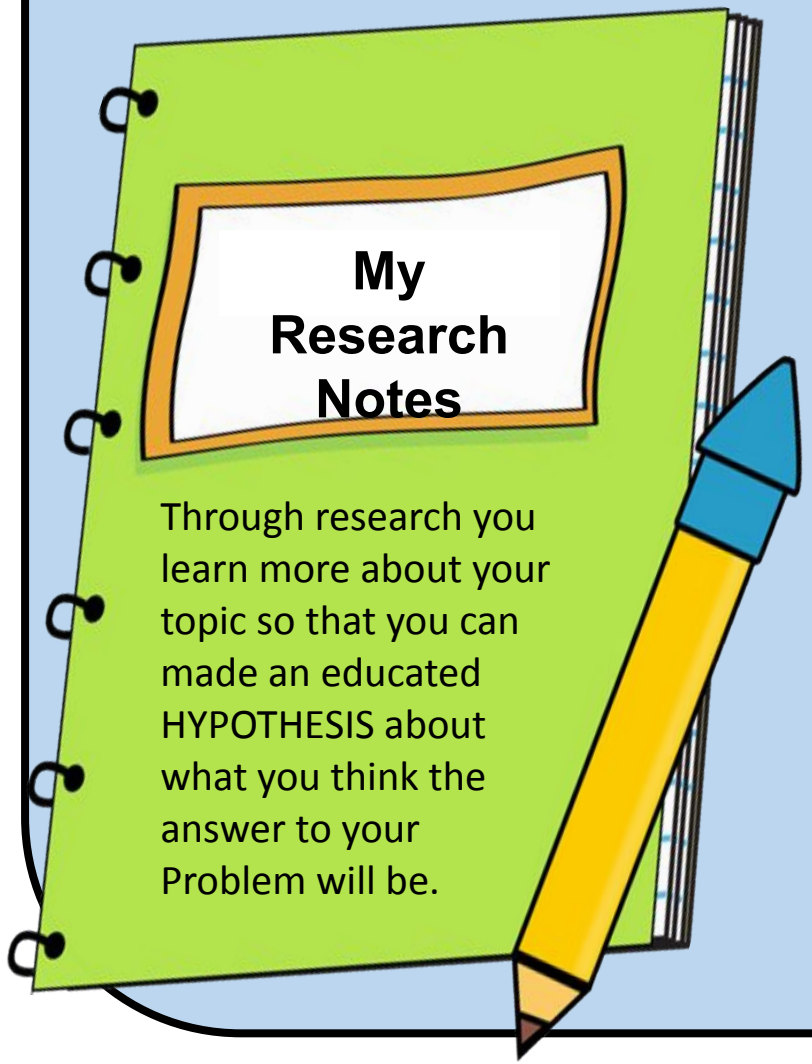
BE CAREFUL

Make sure you do **not** to choose something that is only a demonstration or display, such as building volcano and making it erupt!

Some Simple Examples

What is the effect of detergent on seeds?
Does humidity affect the growth of mold?
Which paper towel is most absorbent, _____, _____, or _____?
Are all brands of calcium equally solvable?

Review of Literature



Once you have your problem and **before** you do anything else, you need to do a **Review of the Literature**.

A Review of the Literature is where you complete research on topics related to your problem. You may use Internet resources, books, brochures, journal articles, or even interviews with experts to complete your research.

As you do your research, take notes and keep track of the resources you used so that you will be able to write a Bibliography. You need about three (3) sources of information, and it is best if they are from different types of sources rather than all being from the Internet, for example.

Review of Literature

- Write a report of your findings in paragraph form. You should have at least three paragraphs that report on your findings.
- Be sure not to plagiarize (that means copy directly from one of your sources). From you notes, write your review of the literature in your own words.
- Write "Review of Literature" as your title.
- Your Review of Literature will be on a page by itself.

Bibliography

As you did your research, you kept track of your resources. Now it is time to write your bibliography, which lists the sources you used for your research. Write on one page with the title, "Bibliography."

There is a specific way of listing your sources. First, they should be listed alphabetically. Second, each type of source is written according to a specific format known as APA or MLA styles. Below are a few examples:

Example for a book:

Brown, T. (1997). *People in organizations: An introduction to organizational behavior.* New: McGraw-Hill.

Example of an Encyclopedia Article:

Bergmann, P. G. (1993). Speed. In *The encyclopedia Britannica* (Vol. 26, pp. 501-508). Chicago: Encyclopedia Britannica.

Stand-alone Web Document (no author, no date):

Rate of Speed. (n.d.). Retrieved December 3, 2016, from http://wwwsciencetoday.

You may also use online "bibliography makers."

Noodle Tools: http://noodletools.com/login.php or

Citation Machine: http://citationmachine.net/index.php?reqstyleid=2

Hypothesis

Now that you have done some research and know more about your topic, it is time to write your **Hypothesis**!

A hypothesis is like an educated guess. You are making a prediction regarding what you THINK the answer to your problem will be. You should not worry about whether or not your hypothesis ends up being "correct" or "incorrect." In science there really isn't any "correct" or "incorrect" hypothesis! Regardless of the final outcome of your experiment, you will have learned valuable information one way or the other!

Write your hypothesis as a statement starting with "I think . . . ." If you like, you may add a "because" phrase as to why you think as you do.

Example: I think the plant watered with mineral water will grow better than the one watered with tap water because _____."

Materials

Make of list of ALL materials and supplies you will need to complete your experiment. Either bullet or number your materials.

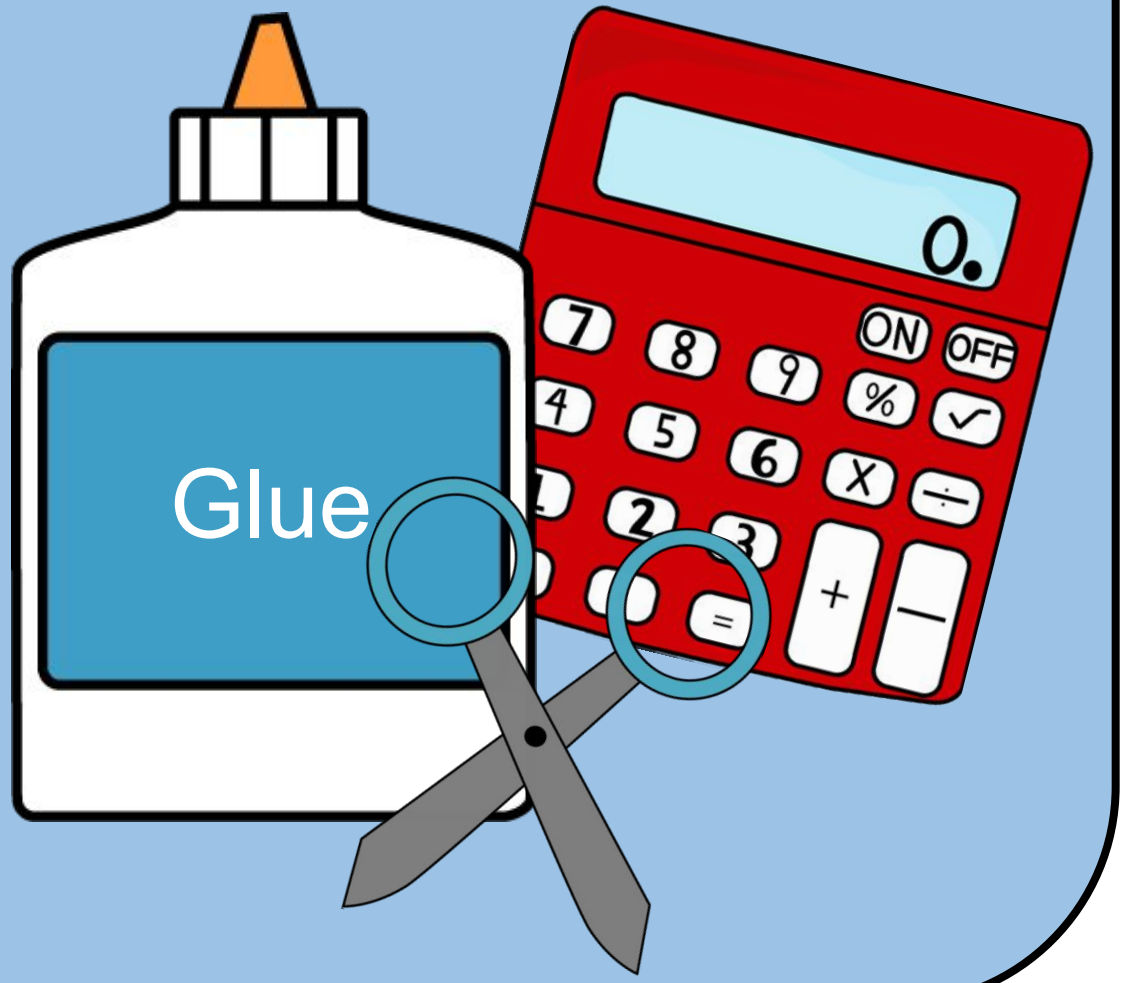
Example:

Materials

- stopwatch
- water
- paper cups
- cardboard

or

- stopwatch
- water
- paper cups
- cardboard



Procedure

The **Procedure** is the step-by-step explanation of how you did your experiment. Most students make the mistake of making this too brief. It should give the exact step-by-step directions so that someone else could duplicate your experiment exactly as you did it by following your procedure. Give details! Write your procedure in a numbered step-by-step fashion!

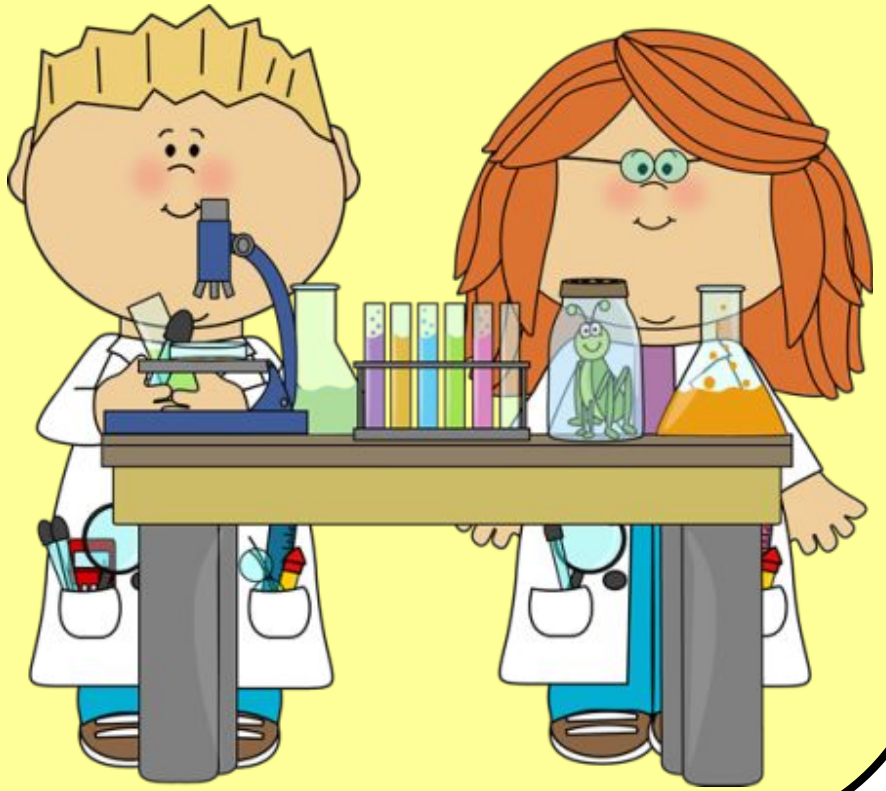
Controlling the Variables

When designing your procedure, make sure that you control the variables! A variable is something that changes. You should only have ONE variable, one thing that changes in your experiment. Everything else should remain the same! **For example:**

If you were testing to find out if coke, milk, orange juice, or water would make a seed sprout the fastest, the **variable** would be the type of liquid (coke, milk, orange juice, or water). It should be the ONLY thing that changes.

Everything else should be the same:

(1) the size container
(2) the type and amount of soil
(3) the seed amount and type
(4) placement in a window or near sun
(5) the amount of liquid with which you water
(6) the time of day when you water



Do the Experiment

Follow your procedure carefully and perform your experiment!

As you go, take notes on things that your observe, problems you have, anything that may indirectly affect your outcomes (for example, "It was a windy day, so that changed the way things should work!" etc.).

Record your measurements, counting, etc., on a chart such as the one below.

Make sure you complete
AT LEAST three (3) trials for each test.

This helps show that one test wasn't just a fluke!

Data Sheets

Drops of "Water"									
Trial 1	Trial 2	Trial 3	Trial 4	Trial 5	Trial 6	Trial 7	Trial 8	Trial 9	Trial 10
Drops	Drops	Drops	Drops	Drops	Drops	Drops	Drops	Drops	Drops

Drops of "Water with Salt"									
Trial 1	Trial 2	Trial 3	Trial 4	Trial 5	Trial 6	Trial 7	Trial 8	Trial 9	Trial 10
Drops	Drops	Drops	Drops	Drops	Drops	Drops	Drops	Drops	Drops

Drops of "Water with Detergent"									
Trial 1	Trial 2	Trial 3	Trial 4	Trial 5	Trial 6	Trial 7	Trial 8	Trial 9	Trial 10
Drops	Drops	Drops	Drops	Drops	Drops	Drops	Drops	Drops	Drops

The Graph

Use the data you gathered on your chart to create a **graph** showing the results of your trials. Be sure to show a title and labels!!!
You should also find the AVERAGE for each of your variable outcomes, if possible.

Which Type of Graph to Use

Bar Graph: Use a bar graph or a double bar graph if you are counting things.

Line Graph: Use a line graph if you are showing change over time.

Circle or Pie Graph: Use a circle or pie graph if you are showing percentages.

You may create your graph using any software, such as Excel or Tom Snyder's Graph Club, etc., or by hand.

Try this free online tool!
Create-a-Graph at
http://nces.ed.gov/nceskids/createagraph/

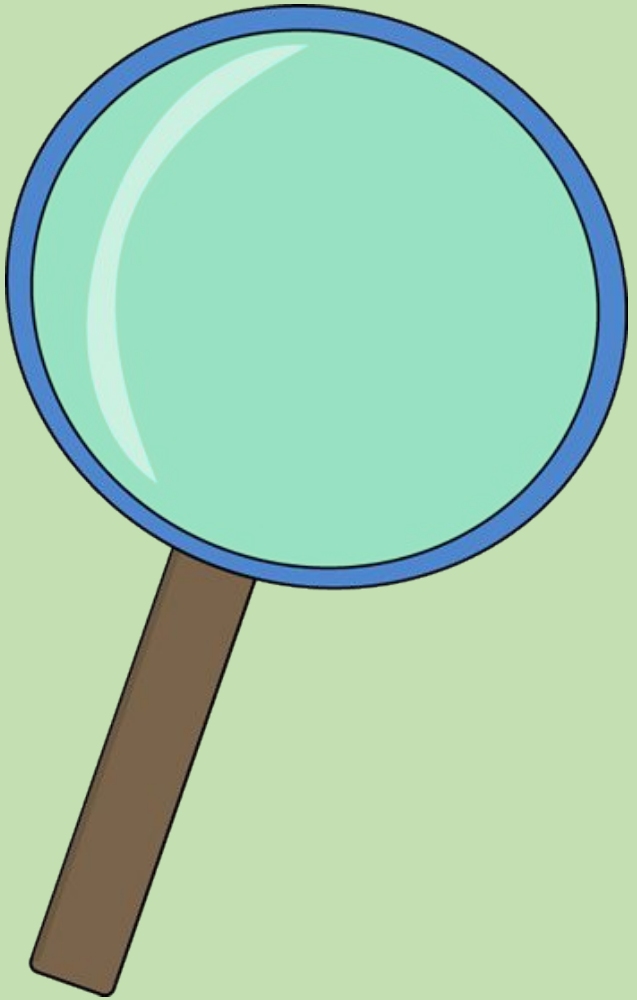
Analysis of Data

In your Analysis of Data, you report on all that you observed and recorded as you performed your experiment. This information will be in the notes that you took and from the charts that you completed.

Include as much information as you can that describes what happened.

Be sure to include actual numerical data from your chart where you recorded trial data. You do not need to include every trial; **you SHOULD include the AVERAGE for all trials for each test**.

This section should be written in paragraph format.



Conclusion

Almost done with the experiment!!!

In the **Conclusion** you simply make a statement or two summarizing what happened in your experiment. Basically, you are answering your Problem's question.

Conclude with a statement about whether you **Accept** or **Reject** your hypothesis. You **Accept** it if the results of your tests were the same as your hypothesis. You **Reject** your hypothesis if the results were different from your hypothesis.

Examples:

I accept my hypothesis which stated that _____ because _____.
I reject my hypothesis which stated that _____ because _____.

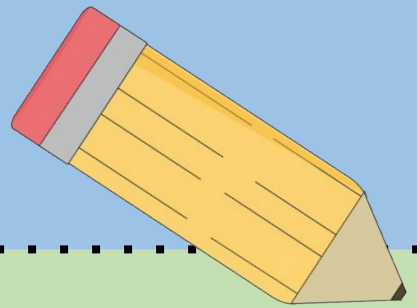
Application

The **Application** is sometimes hard for students, but it need not be!

The application tries to explain how what you learned in your experiment could be **applied to the real world**.

Some Helpful Questions to Get You Thinking

- Who would benefit from this information?
- What area of science, technology, engineering, health, etc., would want to know about what you learned?
- What could they do with this information?
- Is there anything that could be improved from what you found out?
- Should we do something differently based on what you learned?



Abstract

The **Abstract** is a summary of your entire science project. It is written in paragraph form. Use the format as shown below to write your abstract.

Abstract

First Paragraph: Tells about your **problem** and **hypothesis**. For example: I wanted to find out _____. My hypothesis stated that _____ because I think _____.

Second Paragraph: Tells about the **materials** you used and your **procedure**.

Third Paragraph: Tells about your **observations**, what happened during your experiment, etc. Be sure to include data, especially your averages.

Fourth paragraph: Tells about your **conclusion** and **application**. Example: I found out that _____. I found out that _____ because _____. Therefore, I (reject, accept) my hypothesis which stated that _____ *(restate hypothesis).* I can apply this to the real world by ___.

Final Report

It's time to assemble your final report! You've already done the work! Below is the order of your pages in your final report:

1. A Title Page. Include the title and date. No names, please!

2. A Table of Contents.

Table of Contents

Abstract . . . . . p. 3
Review of Literature . . . p. 4
Bibliography . . . . . p. 5

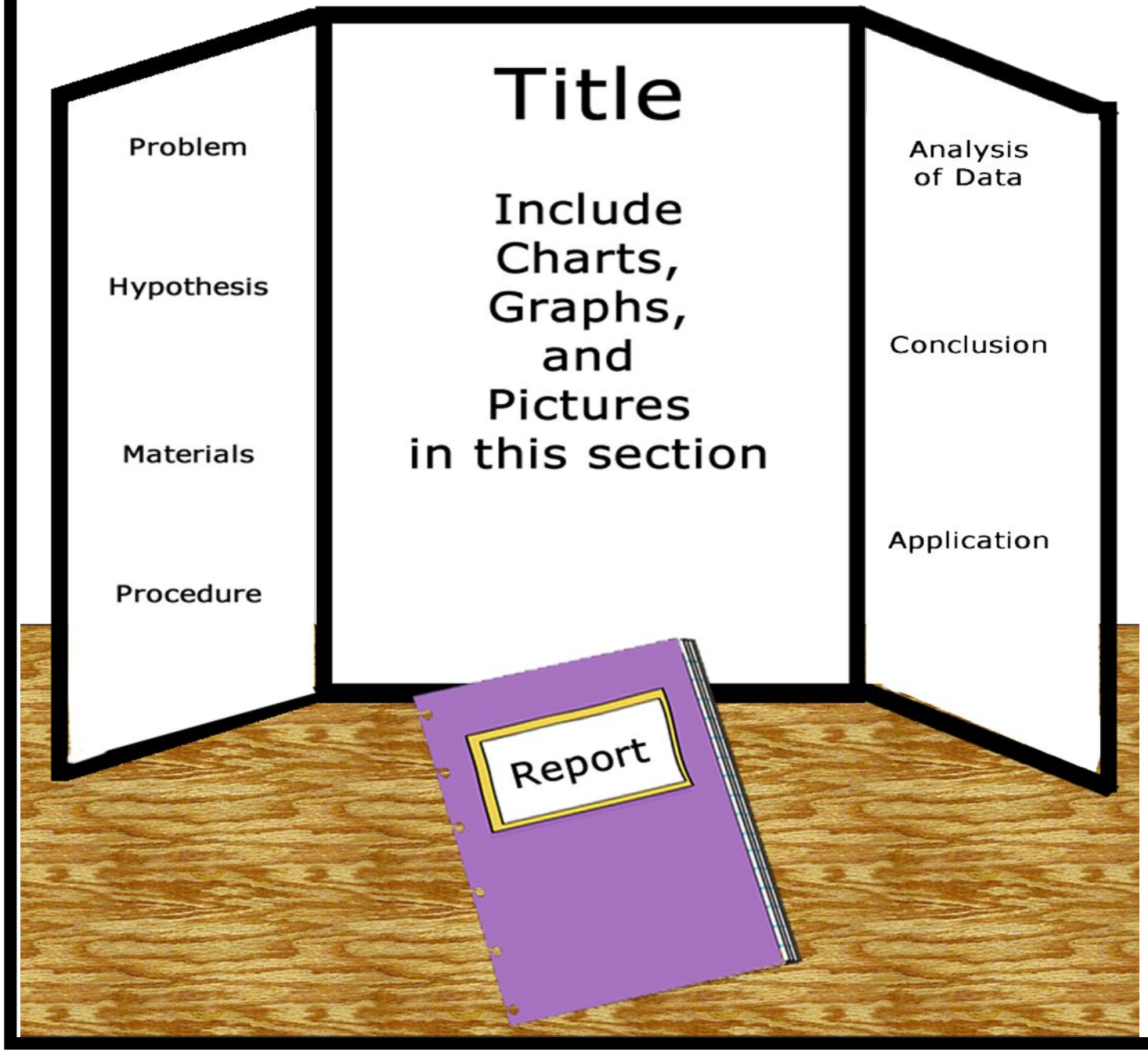
3. Abstract

4. Review of Literature

5. Bibliography

Title Date School 1st page	Table of Contents 2nd page	Abstract 3rd page	Review of Literature	Bibliography 5th page
Page 1	Page 2	Page 3	Page 4	Page 5

Staple all five pages with ONE staple in the upper left corner.



Display

This is the basic design.

NOTE: The report sits on the table in front of the display board.

Parts of the Display Board

The purpose of the Science Fair Board is to offer a visual summary of your entire project in a simple format for a judge or observer to see. The display is the first thing a judge or observer sees! Make a good first impression!

Title: Catchy and centered across the top/center of your board.

Problem: The statement should be written in question form.

Hypothesis: The statement about what you think will occur.

Materials: List in bulleted or numbered format.

Procedure: List in bulleted or numbered format. This is for the board only. It is narrative form for the abstract.

Data: Charts or graphs that give visual representation of all the data collected. If a graph or chart is not appropriate, then photographs should be included, but only to show progression over time. Pictures of students are not allowed.

Analysis of Data: Written in paragraph form, just like in the abstract. However, the board should also contain a graphic depiction of the data, which is NOT included in the abstract.

Conclusion: Briefly tell what you found out and talk about the original hypothesis – just like in the abstract. One nice paragraph is appropriate.

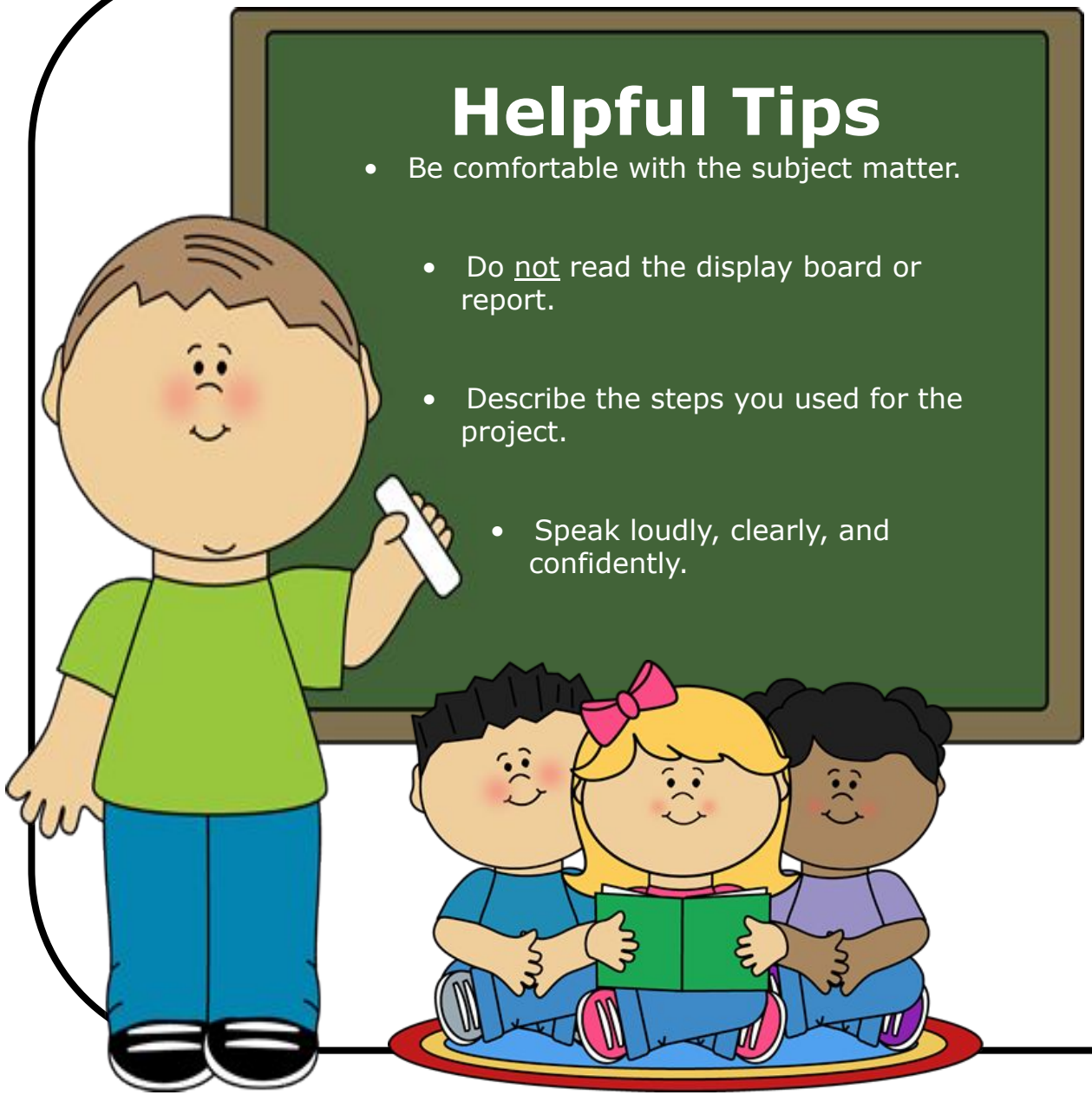
Application: Should be included on the board as well.

Tips for a Winning Display Board

1. Size of Display Board: Standard 36 in. by 48 in.
2. Choose a color scheme/theme and stick with it.
3. Place a border around the board.
4. Use pre-cut lettering, large typed lettering, or neatly hand drawn lettering for the title and subtitles.
5. Type your information in a large enough font to be easily seen and read.
6. Plan your layout before gluing anything down to make sure it all fits.
7. All pictures and visuals should be mounted on construction paper or colored paper before attaching them to the display board. NOTE: You cannot be in any of the pictures!
8. Use rubber cement for mounting. Excess glue can easily be rubbed off, and it is very "forgiving."

Almost there!

Oral Presentation



You should present your project orally to your teacher and your class. This is an opportunity for you to share the information you have learned with your classmates.

If your school has a Science Fair, you may also be making an oral presentation for the judges!

Your presentation should be organized and clearly presented. Practice at home so that you can face your audience and present it without reading.

Remember, your teacher wants to know what **you** know.

Your presentation must be no longer than 5 minutes.

Science Fair Timeline

It is **highly recommended** that students create a Science Fair folder in a word processing program (Microsoft Word) and save every step of the project with the name of what is being turned in on the due date. This makes it so much easier to just go back, correct, save, and print. **The project must be typed!** Always refer to the Science Fair packet for how to correctly complete each step in the scientific method.

✓ Done	Due Date:	Part of the process due:
		Write the **problem** you want to solve in question form.
		Research your subject using at least 2 references. Write at least 2 paragraphs using your research. Write your bibliography using APA format. **Review of Literature and Bibliography** is due!
		Write your **hypothesis.** Tell what you think will happen and why. *Your hypothesis is based on your research.*
		Write your **procedure** which includes the list of **materials** and step-by-step instructions on how to perform your experiment. This must include a **chart or table** for recording your data. The chart or table will have a title, column headings, and row headings, but no data filled in until the experiment is conducted three times.
		Do your **experiment** 3 times! Record your observations on your data collection chart or table. Use **metric** units.
		Write your **analysis** of the data, a narrative statement, in paragraph form, telling what your actual research and results indicated. Report the averages for the three tests.
		Write your **conclusion** about whether or not you accept or reject your hypothesis. Tell what **applications** there may be for your findings. This means how your findings apply to the real world.
		Write your **abstract** using all of the paragraphs you have already written. Follow the directions in the Science Fair Packet.

		Prepare your attractive **project board**, making sure to include each essential component. Turn in the **five page packet** that will be displayed in front of the project board. The five page packet is for a grade! The project board is an extra credit grade!
		Be prepared for **oral presentations** and questions. Having these projects ready in advance enables the students to make corrections and improvement prior to the actual Science Fair. However, grades will not be changed. The oral presentation is for a grade!
		Science Fair Day

Science Fair Score Sheet

Name_____ Project Total _____

Rating Scale: 3-Excellent 2-Acceptable 1-Needs Improvement 0-Poor/Non-existent

_____ This project is a demonstration or is non-measureable. Does not require a score sheet.

The Project Design: Scientific Method	
Problem (Testable/Measureable)	3 2 1 0
Hypothesis (Correctly stated)	3 2 1 0
Procedure & Materials (Numbered/Bulleted, Clearly Explained, Units given)	3 2 1 0
Analysis of Data (Narrative stating observations, averages of data used)	3 2 1 0
Conclusion (I found out __ because. I accept/reject my hypothesis ____.)	3 2 1 0
Application (How it applies to real world.)	3 2 1 0
Were there at least 3 tests/trials?	3 2 1 0
Did student control variables?	3 2 1 0
Does the project have a graph, table, or chart? (all trials AND averages)	3 2 1 0
Is the project especially creative or original?	3 2 1 0
TOTAL POINTS	_____ / 30

The Display Board	
Sections labeled and in order	3 2 1 0
Balance and symmetry displayed	3 2 1 0
Spelling and grammar correct	3 2 1 0
Color used effectively	3 2 1 0
Has a neat and organized look	3 2 1 0
TOTAL POINTS	_____ / 15

The Report	
Has a title page and table of contents	3 2 1 0
Abstract (Content is thorough and understandable; about 250 words, readable font, font size10-14, "Abstract" title centered page; paragraph form)	3 2 1 0
Review of Literature (Content is relevant to the project's purpose; at least 2-3 paragraphs; uses correct grammar, spelling, and punctuation; "Review of Literature" title centered on page; paragraph form)	3 2 1 0
Bibliography (At least 3 references; APA format; ABC order; "Bibliography" title centered on page)	3 2 1 0
Is it the judge's feeling that the project is primarily the work of the child?	3 2 1 0
TOTAL POINTS	_____ / 15

PROJECT TOTAL	_____ / 60

Point Range: 0-10 11-20 21-30 31-40 41-50 51-60

Comments:

Science Fair Categories

For a list and descriptions of Science Fair Categories, click on the link below or copy the URL to visit the site "**Student Science: Intel ISEF categories and subcategories.**"

Science Fair Categories

https://student.societyforscience.org/intel-isef-categories-and-subcategories?pid=470

Credits

Suzanne's Classroom

http://www.canstockphoto.com/

MyCuteGraphics