Middle School Science Fair Project Packet

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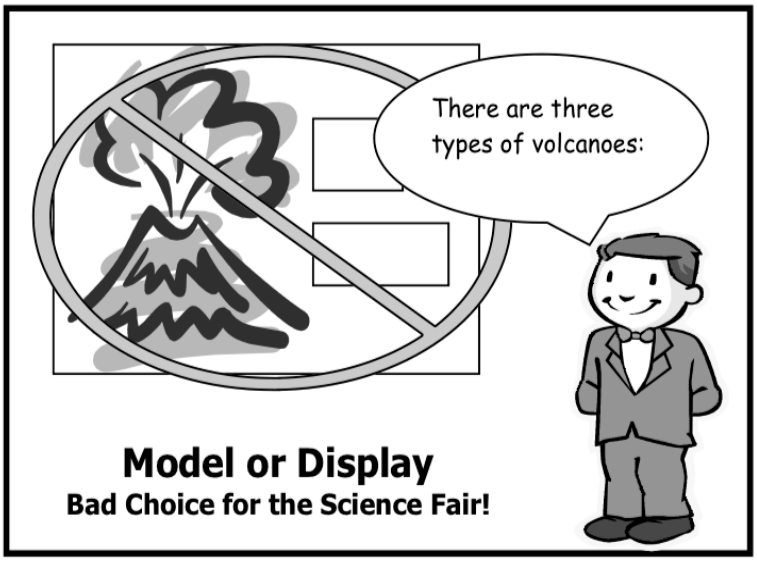
Introduction:

It's that time again! Every year we come to the time set aside for science fair, and this nifty guide was created to help you through the entire process. But first, why do a science fair project? Science fair projects help to promote critical thinking, problem solving, and research. Not only that, but it is also interdisciplinary. This means that you do a little bit of every core subject when you complete a science fair project. Your written portions consist of ELA concepts. Your charts and graphs consist of mathematical concepts. Your research of the scientists who may have worked on something similar to your project consist of social studies/history concepts. There is so much to gain from working through and completing a science fair project!

You will have all summer to complete your project. Projects are due when we return to school from summer break. Your science teacher will provide you with instructions on the first day of class on submission information. If you have any questions while completing your project, your teacher can be reached via email.

Types of Science Projects:

There are two types of science projects: Models and Experiments. Here is the difference between the two:



BORING !!!!!
DON'T DO THIS.....

A Model, Display or Collection:

Shows how something works in the real world, but doesn't really test anything

Examples of display or collection projects can be: "The Solar System", "Types of Dinosaurs" , "Types of Rocks", "My gum collection..." Examples of models might be: "The solar system" or "How an Electric Motor Works", "Tornado in a Bottle"

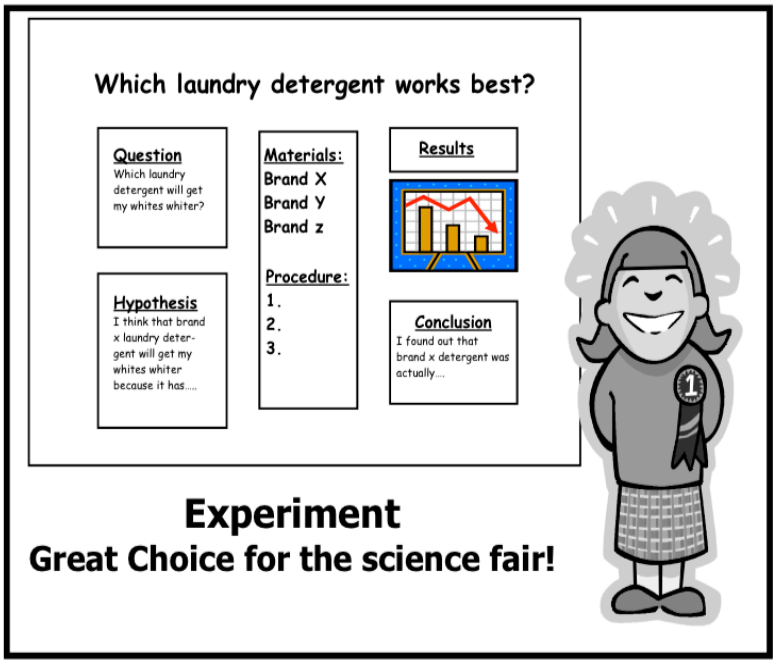
COOL!!!!! DO THIS

An Experiment:

Lots of information is given, **but it also has a project that shows testing being done and the gathering of data.**

Examples of experiments can be: "The Effects of Detergent on the Growth of Plants", "Which Paper Towel is more Absorbant" or "What Structure can Withstand the Most Amount of Weight"

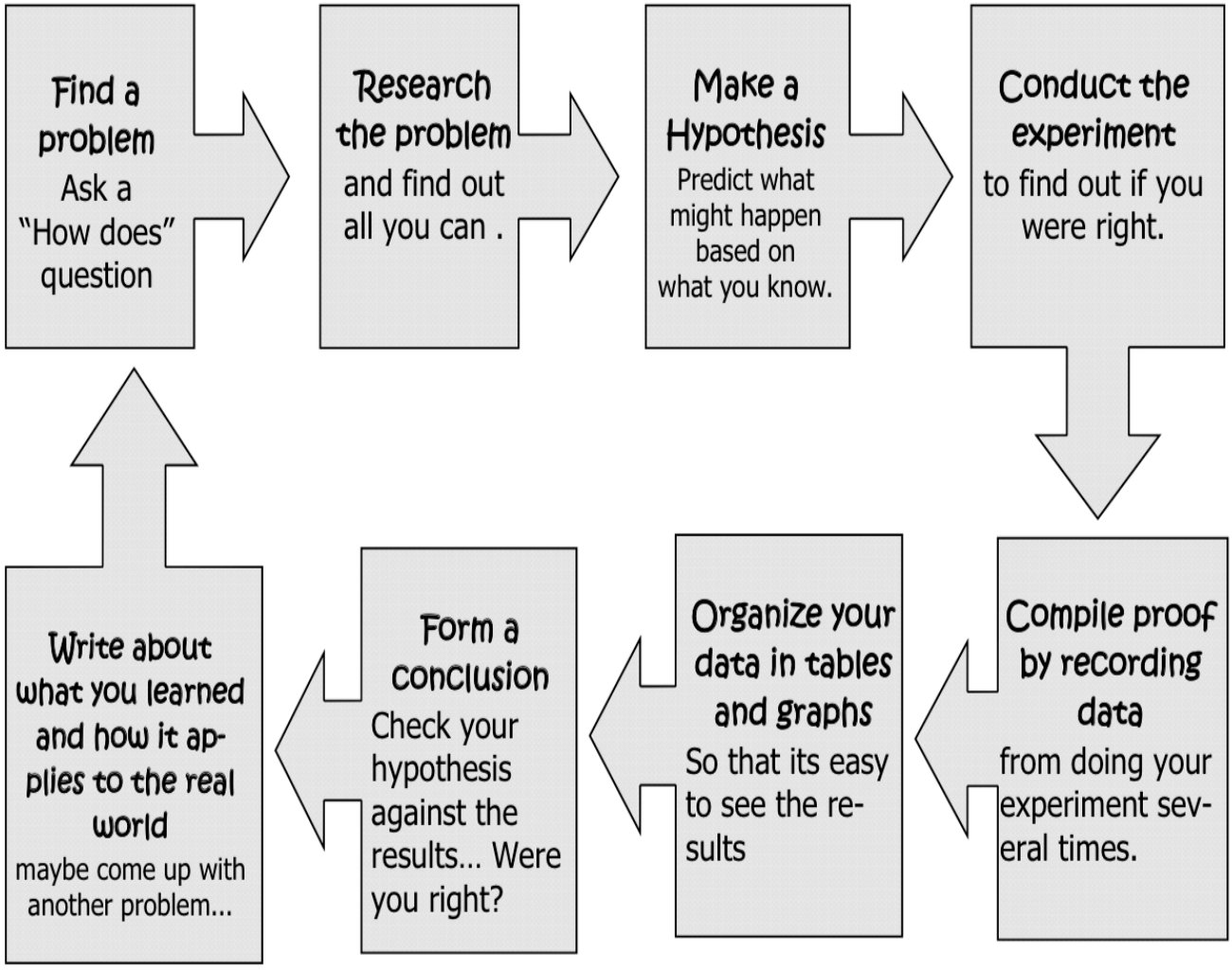
You can tell you have an experiment if you are testing something several times and changing a variable to see what will happens. We'll talk about variables later....



So What Type of Project Should You Do?

Even though you can learn a lot from building a model or display, we recommend that you do an **Experiment!!!** Why? Well, they are fun, they are more interesting and most of all, they take you through the **SCIENTIFIC METHOD,** which is the way real scientists investigate in real science labs. Besides that, the **scientific method** is what the judges are looking for!!

So What the Heck is the Scientific Method?



Choosing a category that interests you...

All Great Projects start with great questions but before you get started on a great question you need to pick a subject or topic that you like. There are three different categories of the Science Fair to choose from. They are:

Life science: This category deals with all animal, plant and human body questions that you might have and want to do an experiment about. Remember that it is against Science Fair Rules to intentionally hurt an animal during an experiment. If you are dealing with animals, please let an adult assist you. It is okay to do experiment on plants, as long as they don't belong to someone else, like don't do an experiment on your mom's rose bushes unless you ask her first...

Life science also includes studying behaviors, so its a perfect category to try taste tests, opinion surveys, animal behavior training (or even training behavior in humans...like baby brothers or sisters...)

Physical Science: If you like trying to figure out how things work, then this is the category for you! It includes topics about matter and structure, as well as electricity, magnetism, sound, light or anything else that you might question, "How does it work and what if I do this to it, will it still work?" *But remember, you always need to ask an adult first (and always make sure there is one of those adult guys with you when you try it.)*

Physical Science also includes the composition of matter and how it reacts to each other. These are the science experiments that may have bubbling and oozing going on, like figuring out what is an acid and what is a base. It is a perfect category to try to mix things together to see what will happen. *Again, if you are experimenting with possibly dangerous things, you need to recruit an adult to help you out.*

Earth and Space Sciences: This category is really awesome because it covers all sorts of topics that deal with the Earth or objects in space. This includes studying weather, Geology (which is the study of everything that makes up the Earth, like rocks, fossils, volcanoes, etc..), and the study of all that is in space, including the stars, our sun and our planets. Unfortunately this topic is also where most kids mess up and do a collection or model project instead of an "Experiment," so be careful!!!

Now It's Your Turn:

Write down your favorite Science Fair Category and what it is you want to learn more about:

My favorite Category was _____

(Life Science, Physical Science, Earth and Space Science)

I want to do an experiment involving

_____

_____

_____

_____

Step 1: Coming up with a Good Question…

Now that you have picked out a topic that you like and that you are interested in, it's time to write a question or identify a problem within that topic. To give you an idea of what we mean you can start off by filling in the question blanks with the following list of words:

The Effect Question:

What is the effect of _____ on _____?

sunlight	on the growth of plants
eye color	pupil dialation
brands of soda	a piece of meat
temperature	the size of a balloon
oil	a ramp

The How Does Affect Question:

How does the _____ affect _____?

color of light	the growth of plants
humidity	the growth of fungi
color of a material	its absorption of heat

The Which/What and Verb Question

Which/What _____ (verb) _____?

paper towel	is	most absorbent
foods	do	meal worms prefer
detergent	makes	the most bubbles
paper towel	is	strongest
peanut butter	tastes	the best

Now its your turn:

Create your Science Fair question using either the "Effect Question", the "How does Affect Question" or the "Which/What and Verb Question":

_____

_____

_____

Step 2 : Doing the Research and forming a Hypothesis

So you've picked your category and you've chosen a topic. You even wrote a question using our cool fill in the blank template. Now it is time to research your problem as much as possible. Becoming an expert at your topic is what real scientists do in real labs.

So How do you become an expert?

YOU READ!!!!
READ about your topic. READ encyclopedias. READ magazine articles and books from the library. READ articles from the internet. Take note of any new science words you learn and use them. It makes you sound more like a real scientist. Keep Track of all the books and articles you read. You'll need that list for later.

YOU DISCUSS!!
Talk about it with your parents. Talk about it with your teachers. Talk about it with experts like Veterinarians, Doctors, Weathermen or others who work with the things you are studying. Sometimes websites will give you e-mail addresses to experts who can answer questions…. *But again, do not write to anyone on the internet without letting an adult supervise it.* (*hint: take pictures of yourself interviewing people)

Whew…..

Then when you think that you can't possibly learn anymore and the information just keeps repeating itself.. You are ready to...

Write a Hypothesis

Now it is the time to PREDICT what you think will happen if you test your problem. This type of "SMART GUESS" or PREDICTION is what real scientists call A HYPOTHESIS. Using this fancy word will amaze your friends and will have you thinking like a full fledged scientist.

So how do you begin? Well, just answer this very simple question:

What do you think will happen, (even before you start your experiment)?

Example Problem: *Which Paper Towel is more absorbent?*

Example Hypothesis: *I think Brand X will be more absorbent because it's a more popular brand, it is thicker and the people I interviewed said that the more expensive brands would work better*

(This hypothesis not only predicts what will happen in the experiment, but also shows that the "Scientist" used research to back up his prediction.)

Now its your turn:

Write down the problem and create a Hypothesis based on what you have researched.

Problem:_____

_____

Research: My problem is about this subject: _____
(sample topics could be magnetism, electricity, buoyancy, absorbency, taste, plant growth, simple machines or other scientific topics that relate to your problem. If you are having problems finding out what the topic is, ask your teacher or an adult to help you on this one….)

Books I found in the library on my topic are:
Title: Author:

_____

_____

_____

Internet sites that I found on my topic are:

_____

_____

_____

People I talked to about my topic are:

_____

_____

_____

Some important points that I learned about my topic are

- _____
- _____
- _____
- _____

Hypothesis: I think that _____

(will happen) because (my research shows…)_____

_____

_____

Step 3: Testing your Hypothesis by doing an experiment

Now we've come to the good part. The part that all scientists can't wait to get their grubby little hands on… you guessed it… The EXPERIMENT!

Designing an experiment is really cool because you get to use your imagination to come up with a test for your problem, and most of all, you get to prove (or disprove) your Hypothesis. **Now Science Fair Rules state that you cannot perform your experiment live, so you'll have to take plenty of pictures as you go through these seven very simple steps.**

First: ***Gather up your materials***: What will you need to perform your experiment? The safest way to do this is get that adult you recruited to help you get the stuff you need. Oh, did we mention to take pictures or draw pictures of your materials. This will come in handy when you are making your board display.

Second: ***Write a PROCEDURE***. A procedure is a list of steps that you did to perform an experiment. Why do you need to write it down? Well it's like giving someone a recipe to your favorite dish. If they want to try it, they can follow your steps to test if its true. Scientists do this so that people will believe that they did the experiment and also to let other people test what they found out. Did we mention to take pictures of yourself doing the steps?

Third: ***Identify your variables.*** The variables are any factors that can change in an experiment. Remember that when you are testing your experiment you should only **test one variable at a time** in order to get accurate results. In other words, if you want to test the affect that water has on plant growth, then all the plants you test should be in the same conditions, these are called **controlled variables:** same type of dirt, same type of plant, same type of location, same amount of sunlight, etc. The only variable you would change from plant to plant would be the amount of water it received. This is called the **independent or manipulated variable.** The independent variable is the factor you are testing. The results of the test that you do are called the **dependent or responding variables.** The responding variable is what happens as a result of your test. Knowing what your variables are is very important because if you don't know them you won't be able to collect your data or read your results.

Fourth: ***TEST, TEST, TEST.*** Remember that the judges expect your results to be consistent in order to be a good experiment, in other words, when you cook from a recipe you expect the outcomes to be the same if you followed the directions (or procedure) step by step. So that means you need to do the experiment more than once in order to test it properly. We recommend five times or more. More is better! Don't forget to take pictures of the science project being done and the results.

Fifth: ***Collect your DATA.*** This means write down or record the results of the experiment every time you test it. Be sure You also need to organize it in a way that it is easy to read the results. Most scientists use tables, graphs and other organizers to show their results. Organizing makes the results easy to read, and much easier to recognize patterns that might be occurring in your results. (Besides, it impresses the judges when you use them.) But don't make a graph or table because we asked you to, use it to benefit your project and to help you make sense of the results. There is nothing worse than having graphs and tables that have nothing to do with answering the question of a science project.

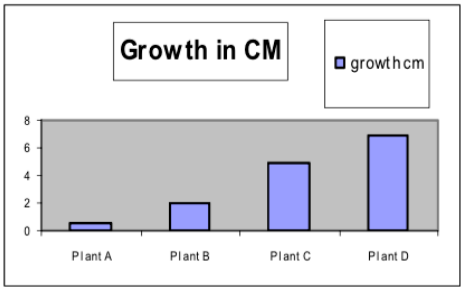
Time out: How Do You Collect Data?!?

- **Keep a science journal:** A science journal is a type of science diary that you can keep especially if your experiment is taking place over a long period of time. We suggest you do that if your experiment is over a period of a week or more. In your journal you can record observations, collect research, draw and diagram pictures and jot down any additional questions you might have for later.
- **Have the right tools to do the job:** make sure you have the stuff you need to take accurate measurements like rulers, meter tapes, thermometers, graduated cylinders or measuring cups that measure volume. The recommended standard of measurement in science is metric so if you can keep your measurements in meters, liters, Celsius, grams, etc, you are doing great!
- **Tables, charts and diagrams** are generally the way a good scientist like you would keep track of your experiment trials. Remember you are testing at least 5 times or more. A table is organized in columns and rows and **ALWAYS** has labels or headings telling what the columns or rows mean. You will probably need a row for every time you did the experiment and a column telling what the independent variable was (what you tested) and the responding variable (the result that happened because of the independent variable)

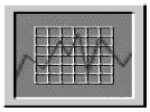
Plant	Amount of water per day	Size it grew in two weeks
(controlled variable)	(independent variable)	(responding variable)
Plant A	none	.5 cm
Plant B	5 ml	2 cm
Plant C	10 ml	5 cm
Plant D	20 ml	7 cm

- **Be accurate and neat!** When you are writing your tables and charts please make sure that you record your data in the correct column or row, that you write neatly, and most of all that you record your data as soon as you collect it **SO YOU DON'T FORGET WHAT HAPPENED!!!!** Sometimes an experiment might be hard to explain with just a table, so if you have to draw and label a diagram (or picture) to explain what happened, it is recommended that you do.
- **Use the right graph for your experiment**. There is nothing worse than a bad graph. There are all types of graph designs, but these seem to be easy to use for science fair experiments.
  - **Pie graphs** are good to use if you are showing percentages of groups. Remember that you can't have more than 100% and all the pieces need to add up to 100%. This type of graph is great if you are doing surveys

  - **Bar graphs** are good to use if you are comparing amounts of things because the bars show those amounts in an easy to read way. This way the judges will be able to tell your results at a glance. Usually the bars go up and down. The x axis (or horizontal axis) is where you label what is being measured, (like plant A, B, C and D) and the y axis (or vertical axis) is labeled to show the unit being measured (in this case it would be centimeters that the plant grew)



  - **Line graphs** are good to use if you are showing how changes occurred in your experiments over time. In this particular case you would be using the x axis to show the time increments (minutes, hours, days, weeks, months) and then you would use the Y axis to show what you were measuring at that point in time.



….And Now back to the Experiment Steps

Sixth: ***Write a Conclusion:*** tell us what happened. Was your hypothesis right or wrong or neither? Were you successful, did it turn out okay? Would you change anything about the experiment or are you curious about something else now that you've completed your experiment. And most of all, **TELL WHAT YOU LEARNED FROM DOING THIS.**

Seventh: ***Understand its Application***. Write about how this experiment can be used in a real life situation. Why was it important to know about it?

Now it's your turn

Materials: (take pictures!)

List the Materials that you will need for your science experiment here:

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____

Variables:

List the variables that you will control, the variable that you will change and the variables that will be the results of your experiment:

My controlled variables are (the stuff that will always stay the same): _____

_____

_____

My independent variable is (this is the thing that changes from one experiment to the next, it is what you are testing): _____

My responding variables might be (in other words, the results of the experiment)

Procedure: (the steps.... Don't forget to take pictures)

List the steps that you have to do in order to perform the experiment here:

1st.... _____

2nd _____

3rd _____

4th _____

5th.... _____

_____

_____

_____

Design a table or chart here to collect your information

(Did we mention that you needed to take pictures of you doing the actual experiment?)

Use the Graph paper at the end of this booklet to make a graph of your results from your table.

Conclusion:

Now tell us what you learned from this and if you were able to prove your hypothesis. Did it work? Why did it work or why didn't it work? What did the results tell you? Sometimes not being able to prove a hypothesis is important because you still proved something. What did you prove?

_____

_____

_____

_____

_____

_____

_____

Application:

(How does this apply to real life?)
Its important to know about this experiment because……

_____

_____

_____

_____

Step 4: The Presentation or Why you needed all those pictures….

But First, a school Fable….

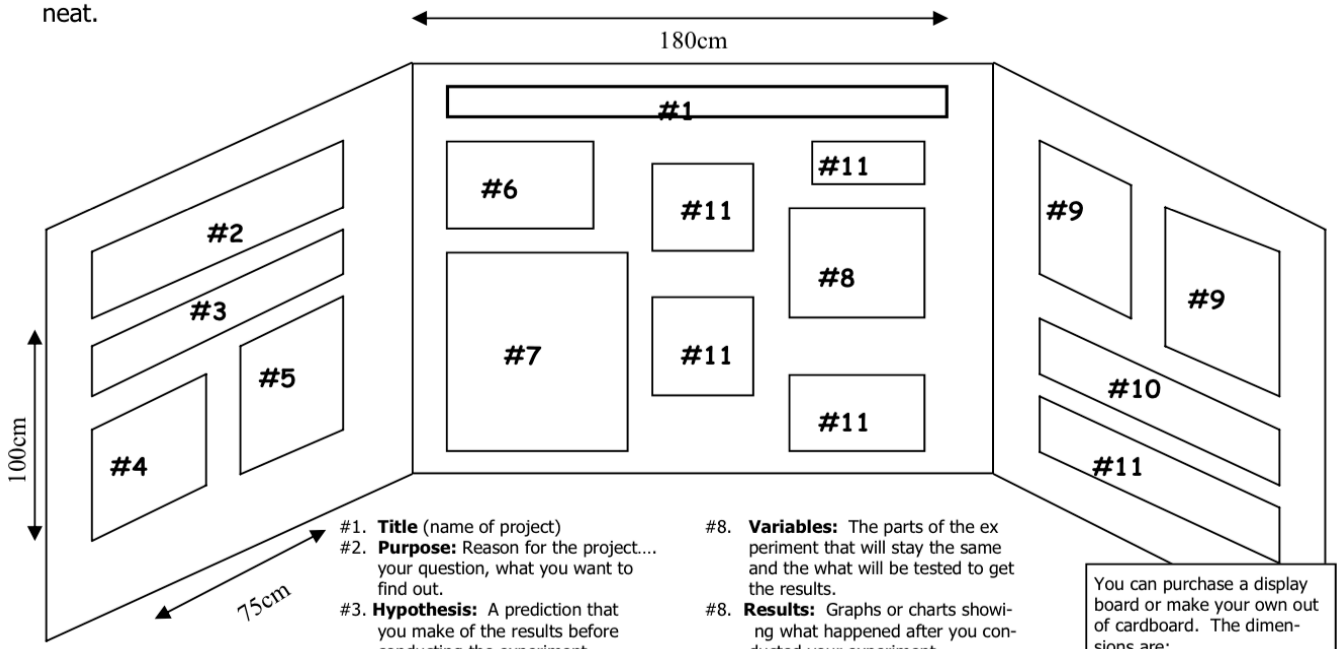
Sammy and Sally both baked cakes for the bake sale with the same cake mix and by following the same directions. When Sammy got his cake out of the oven, he carefully took it out of the pan, smoothed the chocolate frosting neatly and decorated his cake so that it looked delicious. Sally on the other hand, smashed her cake slightly when getting it out of the pan and globbed the frosting on parts of the cake. As you may have already guessed, everyone wanted some of Sammy's cake and no one wanted Sally's. Sally couldn't figure out why, because she tasted both and they both tasted the same…

A good display is a Piece o'cake

You may have become the leading expert of your topic and had the most interesting experiment results, but if you don't make your science project look delicious for the judges eyes to see, well, your chances of winning sweepstakes will crumble like Sally's cake. Your display board is kind of like an advertisement for all your hard work. So take our advice: **BE NEAT!!** The judges like to see a nice, easy to read display, that has neat writing, easy to read graphs and tables and you guessed it…. lots and lots of pictures!! (Did you remember to take pictures?)

MAKING A MOUTH WATERING DISPLAY

This is an example of a neat looking Science Fair Display Board. It is just an example. Depending on your information and the amount pictures, tables and graphs, you may have a different layout. Just make sure it is neat.



#1. **Title** (name of project)
#2. **Purpose:** Reason for the project…. your question, what you want to find out.
#3. **Hypothesis:** A prediction that you make of the results before conducting the experiment.
#4. **A report** of your research on the subject.
#5. **Books and Resources:** A list of the books you read and websites you used. Also list your inter views.
#6. **Materials:** a list of the supplies needed for the experiment.
#7 **Procedure:** The steps or directions that you used to conduct the experiment.
#8. **Variables:** The parts of the ex periment that will stay the same and the what will be tested to get the results.
#8. **Results:** Graphs or charts showing what happened after you conducted your experiment.
#9. **Conclusion:** Telling what happened.. Did it work, were you right about the hypothesis? What did you learn?
#10. **Application:** Explain how your experiment relates to the real world.
#11. **Pictures,** pictures and more pictures...

You can purchase a display board or make your own out of cardboard. The dimensions are:

Height: 100 CM

Length: 180 CM

Depth: 75 CM

It has to be able to stand on its own

Display Beauty Secrets:

- Use a computer to type out your information, but if you can't, write out your information in your best writing. Printing the titles is usually best. If you are using a computer, make sure the fonts are readable and only use one or two type faces.
- Use spray adhesive or glue stick to paste up your papers. It is less messy
- Mount white paper, pictures, graphs and tables on colored papers (making sure the colored paper is larger so it creates a border for the white paper.) Do not

GUIDELINES FOR SCIENCE FAIR LOG BOOK

LOG BOOK INSTRUCTIONS

What is a Log Book? It is a record of your experiment (like a journal) that is kept in a composition notebook. A composition notebook does not have pages that can be torn out. Everything written in the logbook stays.

What should be in your Log Book? When you **begin** your experiment you need to record the following in your logbook:

1. **All of your research prior to choosing your project.** (Include all books, websites and other sources that you researched)

2. **Proposal** (each section must be labeled). Make sure that all the corrections from the original proposal have been made before you copy into log book.

- The **Problem** (in the form of a question)

- **Hypothesis –** written as an if…. then statement.

- **Independent Variable**
- **Control Variable**
- **Dependent Variable**

- List of the **all the Materials** that you actually use in the experiment. (This may change slightly from your original proposal).

- List and number the **steps/procedures** that you are following for your experiment**.**

- **Drawings or illustrations-** Illustrate the experimental design and work in progress. Include sketches and diagrams of the setup of your experiment.

3. **Data-** You need to record everything that happens in your experiment neatly. Use a ruler to make neat data charts. Be sure to write observations neatly that can be read by others. Please date all entries when they occur. Include photos and drawing if it helps show what has occurred.

    - If you run into problems, **record the problem** and how you plan to solve the problem in your Log Book. Research possible solutions. If it doesn't solve the problem come up with a new plan and try that.
    - Include question and ideas for further experiments or questions for your teacher.

4. Explain in a few sentences the reasons why you choose this topic for your experiment. What about this subject interests you?

Your log book will be graded on how much of the above criteria are included in your log book.

LOG BOOK CHECKLIST

_____ The **Problem** (in the form of a question)

_____ **Hypothesis (**written as an if…. then statement).

_____ **Independent Variable** (only one)

_____ **Control Variable** (must include at least four)

_____ **Dependent Variable** (what is measured)

_____ List of the **all the Materials** that you actually use in the experiment.
(This may change slightly from your original proposal).

_____ List and number the **steps/procedures** that you are following for your experiment.
Put in number format.

_____ **Drawings or illustrations-** Illustrate the experimental design and work in progress.
Include sketches and diagrams of the setup of your experiment.

_____ **Data-** You need to record everything that happens in your experiment neatly.
Use a ruler to make neat **data charts**. Be sure to write observations neatly that can be read by others. Please date all entries when they occur. Include photos and drawing if it helps show what has occurred.

Science Fair Written Report

The written report is a summary of everything that you did to investigate your topic. The written report provides others with vital information on what your project is about as well as its effect on your understanding of the topic. Usually the written report is 5-30 pages in length. All information must be included in the written report. This report provides you with the opportunity to think about all the aspects of our project and share your ideas with others.

Reports should be neatly bounded in an attractive binder. It must be typewritten.

- Typed, doubled spaced. One inch margins, and 12 pt Times New Roman Font
- Remember to put headings/titles on graphs/charts/tables
- All photographs must have captions explaining their significance
- Before you hand in your report make sure to reread, revise, and rewrite
- Recheck your calculations, spelling, and grammar.

All written report for a science fair project should include:

- ✓ **Title Page:** The first page in the report should include the title of the project as well as the name and grade of the student.

- ✓ **Acknowledgment:** Here is where you thank everyone who helped to make your project successful (including Mom and Dad.) Everyone that you interviewed, including teachers, scientists, and other experts in the field should be mentioned here.

- ✓ **Table of Content:** This page provides the reader with a list of the different parts of the project and the page number on which each section can be found.

- ✓ **Statement of Purpose:** State the purpose of the project **in the form of a question.**

- ✓ **Hypothesis:** You must have a hypothesis before you complete the project. A hypothesis is an educated guess about what you think will occur as a result from completing your experiment.

- ✓ **Research:** This is the part of the report that contains all the background information that you collected about your topic. Any books or articles read from the internet/journal, authorities on the topic that you talked to, or outside materials collected should be summarized in this section. **This section should be written in your own words and NOT copied from your resources.**

- ✓ **Materials:** This is a list of all the materials and supplies used in the project. Quantities and amounts of each should also be indicated.

- ✓ **Procedure:** You will list and describe the steps you took to complete the project. Usually this is listed in a numbered sequence. This part shows the stages of the project so that another person can carry out the experiment.

- ✓ **Observations and Results:** In this section, you will tell what you learned from the project. It is also IMPORTANT to include all graphs, charts, or other visual data (pictures) that helps to show your results.

- ✓ **Conclusion:** This is a brief statement explaining why your project turned out the way it did. You should explain why the events you observed occurred. Using the word "because" is a good way to turn an observation into a conclusion. The conclusion should tell whether the hypothesis was proven or not proven. Also give the reason(s) why you chose to learn more about the subject. You could also add what you know now that you didn't know before you completed your project.

- ✓ **Reference Page:** The bibliography should list all the printed materials the student used to carry out the project. Items should be listed in alphabetical order in a standard format. These website are a great place to go to find the proper way of writing a bibliography. http://www.bibme.org/ , http://www.easybib.com or http://www.knightcite.com Also http://www.Icyte.com lets you "tag" information from Internet sources as you research.

Science Project Grading Rubric

POINTS **Display**

____/15___ Is the display neatly organized and the design pleasing? (-1 to -5)
Are the Scientific Question, Hypothesis, Materials, Procedures, Results, and Conclusion labeled? (-2 each)
Is there a Title If not, -5 Is it in the proper location? (-1 each)
Is the student's name, teacher's name, and grade level below the Title? (-1 each)
Are there at least 3 appealing pictures that pertain to the experiment? (-1 each)

____/10___ **Scientific Question**
Is there a Scientific Question? (-10)
Is the Scientific Question labeled? (-2)
Does the question end with a "?" (-1)
Does the question make sense? (-1 to -5)

____/10___ **Hypothesis**
Is there a Hypothesis? (-10)
Does the Hypothesis end with a period? (-1)
Does the Hypothesis relate to the experiment performed? (-1 to -7)
Does the Hypothesis answer the scientific question? (-5)
Does the Hypothesis make sense? (-1 to -5)

____/10___ **Materials**
Is there a list of materials? (-10)
Is it difficult to read the list? (-2)
Are all the items included that were necessary for the experiment? (-2 each)

____/10___ **Procedures**
Is there a list of procedures (-10)
Are the procedures numbered? (-2)
Does each procedure make sense? (-1 per confusing procedure)
Can the list be followed to replicate the experiment? (-1 to -4)

____/10___ **Results**
Are the results on the board? (-10)
Are the results easy to read? (-3)
If TABLE or GRAPH is used, Is the table or graph constructed accurately? (-10)
If GRAPH, is the Y axis properly labeled (-2 partial, -4 not at all)
If GRAPH, is the X axis properly labeled (-2 partial, -4 not at all)
If TABLE, is the table properly labeled? (-4 partial, -8 not at all)

____/5___ **TRIALS**

Is there evidence of at least 3 experimental trials? (-1 for each missing trial)

____/10___ **Conclusion**

Is there a conclusion? (-10)
Does the conclusion respond to the question? (-2 to -5)
Does the conclusion fit given the hypothesis? (-2 to -5)

____/10___ **Background Information**

Is there Background Information? (-10)
Is the Background Information clearly labeled using headings? (-1)
Does the Background Information speak to the experiment topic? (-1 to -9)

____/5___ **Bibliography**

Is there a bibliography? (-5)
Is the bibliography in the proper location? (-1)
Is the bibliography clearly labeled? (-1)
Is the bibliography accurate? (-1)

____/5___ **Log or Journal (on table in front of the display)**

Is there a log or journal included (scientific notes)? (-5)
Is the log hand written? (-1)
Is the log or journal clearly labeled? (-1)
Does the log or journal include all results reported regarding the experiment? (-1 to -3)

_____ **Total Points (possible 100)**