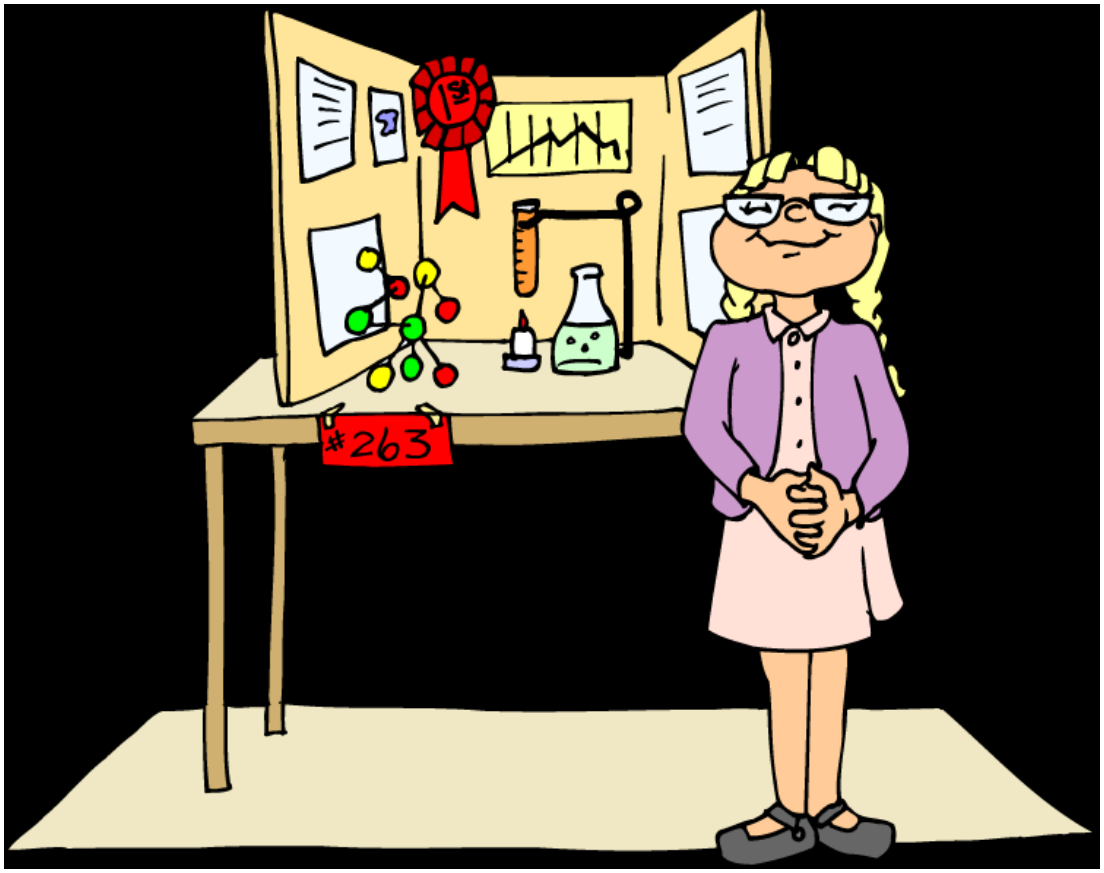
Farnham Elementary School

Science Fair Planning Guide



Just follow these easy steps and you too can create a wonderful science project, created entirely by you!

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The Farnham Elementary School Science Fair Planning Guide

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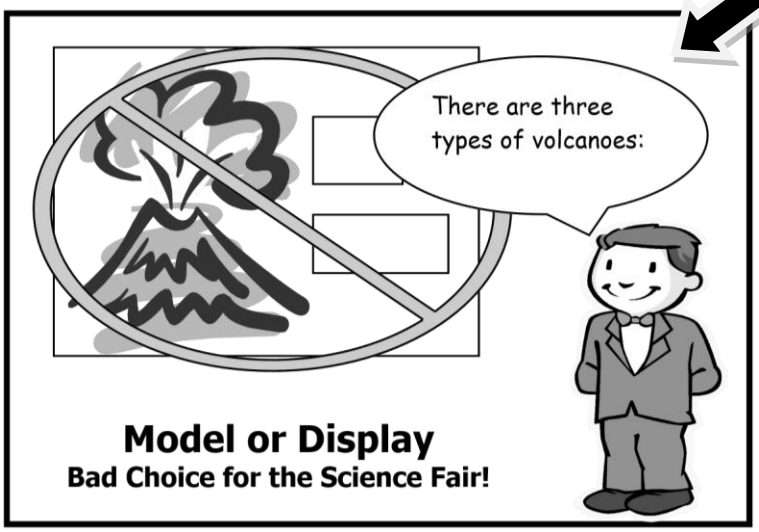
Types of Science Projects

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



3rd Graders <u>may</u> do this.

<u>A Model, Display or Collection:</u>

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", "How an Electric Motor Works", or "Tornado in a Bottle."

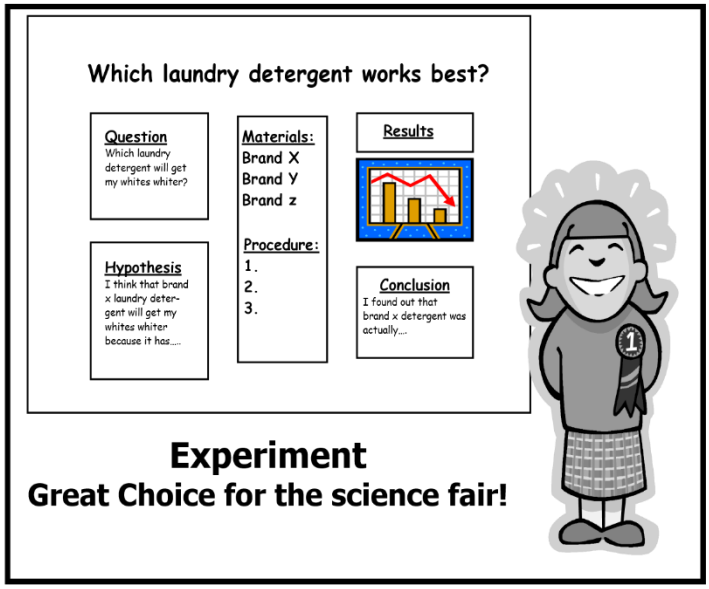
4th and 5th Graders <u>have</u> to do this…
3rd Graders <u>can</u> do this…

<u>An Experiment:</u>

Lots of information 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 Absorbent" 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 variant to see what will happen. 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, <u>we recommend that you do an **Experiment!!!**</u> 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 is the Scientific Method?

1. Find a Problem

Ask a "How does" question.

2. Research the problem

and find out all you can.

3. Make a Hypothesis

Predict what might happen based on what you know.

4. Conduct the experiment

to find out if you were right.

5. Compile proof by recording data

from doing your experiment several times.

6. Organize your data in tables and graphs so that it's easy to see the results.

7. Analyze your results

Check your hypothesis against the results… Were you right?

8. Write a conclusion about what you learned and how it applies to the real world.

Maybe come up with another problem…

Science Notebook

Make sure to put all your drafts in your science notebook. It is a record of your thinking, trials and errors, data, and reflections. It will be messy and that is OK.

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 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 and animal during an experiment. If you are dealing with animals, please let an adult assist you. It is okay to do experiments 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 it's a perfect category to try taste tests, opinion surveys, animal behavior training.

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 **if I do this to it, will it still work?" But remember, you always should ask an adult first.**

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're 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!!!

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 dilation
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 it's your turn:

Create your Science Fair question using one of the types of questions above. Make sure to put all your drafts in your science journal/notebook. It is a record of your thinking, trials and errors, data, and reflections. It will be messy and that is OK.

Step 2: Doing the Research and Forming a Hypothesis…

So you've picked your category and you've chosen a topic. Now it is time to research your problem as much as possible. Becoming an expert on 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 notes 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 in your science notebook.

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…*Do not write to anyone on the internet without letting an adult supervise it.* (*Hint: Take pictures of yourself interviewing people.)

When you think that you can't possibly learn anymore and the information just keeps repeating itself, then 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.
So how do you begin? 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.)

Step 3: Testing your Hypothesis by doing an experiment…

Now comes the good part… **THE EXPERIMENT!!**
MAKE SURE TO DOCUMENT EVERYTHING IN YOUR SCIENCE NOTEBOOK

Designing, as experiment is really fun 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.

FIRST: ***Gather up your materials.*** What will you need to perform your experiment? Take pictures or draw pictures of your materials. This will help when you are making your board display.

SECOND: ***Write a procedure.*** A procedure is a list of steps that you will do to perform your experiment. Why do you need to write it down? It is like giving a recipe to someone for a favorite dish. If they want to try it they can follow the steps to see if it is true. Scientists do this so that people will believe that they did the experiment and also to let other people test it out also.

THIRD: ***Identify your variables.*** The variables are any factors that can change in the experiment. You should only test one variable at a time. There are three types of variables.

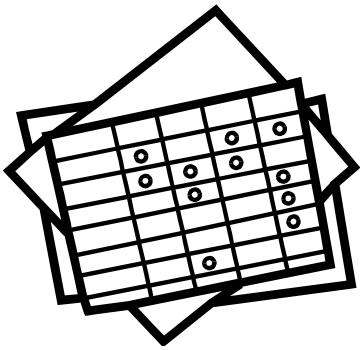
Let's say you want to test the affect that water has on plant growth. All the plants you test should be in the same conditions; these conditions are called **controlled variables.** The plants should have the same type of dirt, same type of plant, same type of location, and the same type of sunlight, etc.

The **independent variable** is the factor you are testing. In this case the only variable you change from plant to plant would be the amount of water it received.

The **dependent variables** are the results of the test, because they "depend" on what happens.

You need to know what your variables are so you be able to collect your data and read your results.

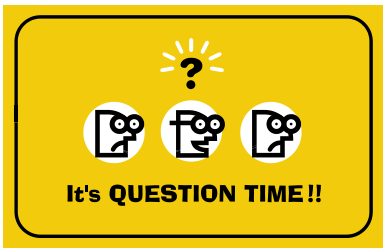
FOURTH: ***TEST, TEST, TEST***. The judges expect your results to be consistent in order to be a good experiment; in other words, when you cook from a recipe you expect the outcomes to be the same if you followed the directions (or procedure) step by step. So you should do your experiment more than once in order to test it properly.



FIFTH: ***Collect your DATA***. This means write down or record the results of the experiment every time you test it. You also need to organize it in a way that 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. Use a graph (or two) to benefit your project and to help you make sense of the results.

See the following page for ideas on how to collect data.

SIXTH: ***Write a conclusion***. Tell us what happened. Was your hypothesis right or wrong or neither? Were you successful? Did the experiment turn out OK? Would you change anything about the experiment or are you curious about something else now that you've completed your experiment. 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?

HOW DO YOU COLLECT DATA?

So…How Do You Collect Data?

- **Make sure you have the right tools for the job:** You need to have the right tools to take accurate measurements like rulers, meter tapes, thermometers, graduated cylinders or measuring cups that measure volume. Most scientists use metric measurement so it is a good idea to try to use metric measurement.

- **Tables, charts, and diagrams** are generally the way a scientist would keep track of your experiment trials. Remember to try to test at least 5 times or more. A table is organized in columns and rows and **ALWAYS** has labels or heading telling what the columns or rows mean.

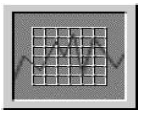
Plant	**Amount of water per day**	**Size it grew in two weeks**
(controlled variable)	(independent variable)	(responding variable)
Plant A	none	.5 cm
Plant B	5 ml	2 cm
Plant C	10 ml	5 cm
Plant D	20 ml	7 cm

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 in your science notebook as soon as you collect it **SO YOU DON'T FORGET WHAT HAPPENED!!** You might also have to draw and label a diagram (or picture) to explain what happened. (Even if something went wrong!)

- **Use the right type of graph for your experiment.**
  - **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.

  - **Line Graphs** are good to use if you are showing how changes occurred in your experiments over time.



MAKE SURE YOU HAVE ALL OF THESE ELEMENTS IN YOUR SCIENCE NOTEBOOK.

Remember your notebook is a working document. It is not meant to be neat or perfect. It is for you to keep a record of your experiment and thoughts. Think of it as a project diary/ sloppy copy. Not everything in your notebook will go on your presentation board.

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.)

Books I found in the library on my topic are:
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…)

Materials:

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

Procedure: (the steps)

Design a table or chart here to collect your information:

Conclusion:

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?

Reflection:

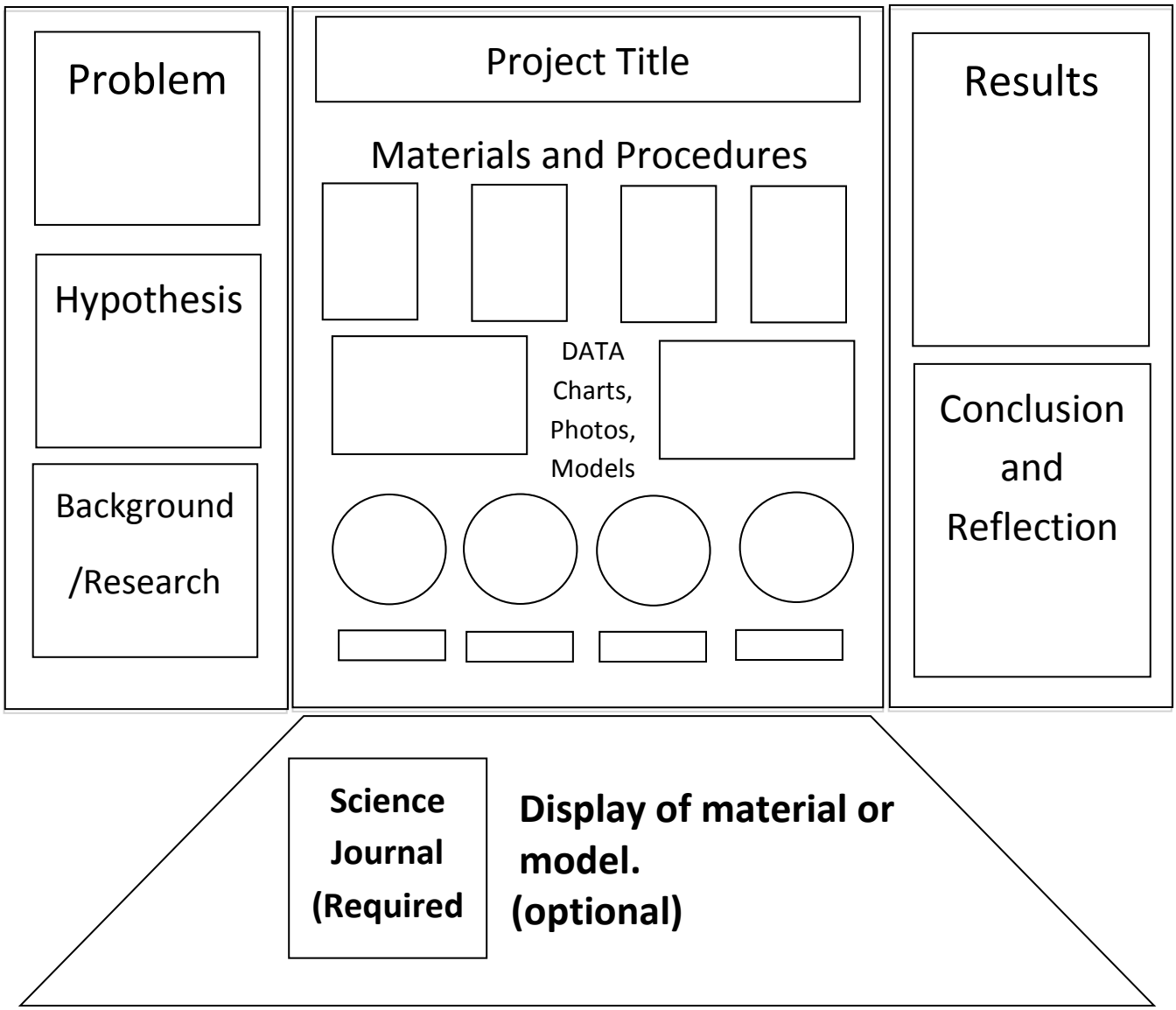
How does this apply to real life?
It is important to know about this experiment because…
I still wonder…
I still have questions…
I had these AHA moments….

Step 4: The Presentation Board

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 good for the judges to see, it will be hard for them to see that. 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.

MAKING A GOOD DISPLAY

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



Science Fair Rules and Regulations

1. Each student may enter only one project. Use the Name plaque your teacher gave you to mark your name, grade level, and classroom on your display.

2. Entry forms must be submitted before beginning your project.

3. Adults can provide guidance, but students must do the actual work. We are not looking for perfection, we are looking for evidence of the scientific process and a reflection of the student's thinking.

4. All experiments using vertebrate animals or humans as the subject must cause no harm or undue stress to the subject. These projects ust have the written approval of the committee before beginning the project. Supervision by an adult will be required.

5. No live vertebrate animals may be exhibited at the Science Fair. Models, stuffed animals, or photographs may be used instead.

6. No dangerous or combustible chemicals may be displayed at the Science Fair.

7. No open flames will be permitted.

8. No electrical outlets will be provided.

9. Expensive or fragile items should not be displayed. Valuable items essential to the project should be simulated or photographed.

10. Items to be displayed in front of a backboard should be adequately secured to a piece of plywood.

11. Carefully pack all materials when transporting to and from the Science Fair.

While supervision will be provided, the Science Fair Committee and staff cannot be responsible for theft or breakage. (see rule 9)

What the Judges are looking for:

What you should do the day of the Science Fair.

(5th grade)

Here is the stuff on the judges form that they want you to do:

Here are the things you need to do during the presentation of your science fair project to meet the criteria of the judges' form.

CRITERIA	POINTS POSSIBLE	
		HINT: Dress nicely. If you look sharp, you will feel sharp. Be polite and speak clearly. Don't forget to look the judges in the eyes.
1. Clearly stated title, problem, and reasonable hypothesis.	**3 points** →	Introduce yourself, point out the title of your display and tell the judge why you chose to study this. State your problem that you studied (your question) Also tell them about your hypothesis (what you think might happen.)
2. Science journal	**3 points** →	Point out your science notebook to the judge so that they can review your research if they wish. Talk about what you learned while researching your topic.
3. Thoroughly stated procedures and materials	**3 points** →	Tell about your experiment, the steps you took to do it. Be sure to mention all the materials involved and point out all of those lovely pictures!
4. Clearly stated variables and controls	**3 points** →	Point out the variables to the experiment, (You know, the stuff you kept the same, the thing you tested, and the results)
5. Measurable data that includes a minimum of three trials	**4 points** →	Be sure to show them that you tested your experiment at least 3 times. Show them all of the cool graphic organizers that you made, like your tables and charts. Remember to point out the labeled parts of your graph or table to show that you know what it represents.
6. Effective analysis of data clearly stated results (graphs, charts, and tables)	**4 points** →	Be sure and explain what your data means. Make sure you can read your graphs and tables. Let them know if you were surprised by the results, or if you knew what would happen because you studied about it.
7. In-depth knowledge base of topic with use of related vocabulary at grade level	**4 points** →	Make sure you sound like an expert at your topic. Always use the appropriate vocabulary especially by using words from the Scientific Method like: Problem, Hypothesis, Procedure, Variables, Results and Conclusion.
8. Well elaborated conclusion and reflection	**4 points** →	Let the judge know if you were right about your hypothesis. What did you conclude about your problem? Did you find another problem to investigate based on what you learned? The conclusion and reflection are all about what you learned from doing this.
9. Effective closure of presentation	**3 points** →	Nothing makes a judge feel worse than to make a kid so nervous that they repeat themselves or they stop their presentation before they are really done. If you get lost or forget where you are, look at your display and follow it piece by piece. It is better to discuss everything than to forget to tell the judge something. When you are done, shake hands with the judge and thank them for their time, remember that they are volunteers who care about you!
10. Presentation board demonstrates organization, planning, and effort	**3 points** →	That speaks for itself.

Total points possible: 34 Points
Superior= 31-34
Excellent= 28-30
Commendable = 25-27

Websites that you can check out for some science fair projects ideas:

Internet Public Library
http://www.ipl.org/div/kidspace/projectguide/ Are you looking for some help with a science fair project? If so, then you have come to the right place. The IPL will guide you to a variety of web site resources, leading you through the necessary steps to successfully complete a science experiment.

Discovery.com: Science Fair Central
http://school.discovery.com/sciencefaircentral/ "Creative investigations into the real world." This site provides a complete guide to science fair projects. Check out the 'Handbook' which features information from Janice VanCleave, a popular author who provides everything you need to know for success. You can even send her a question about your project.

Science Fair Idea Exchange
http://www.halcyon.com/sciclub/cgi-pvt/scifair/guestbook.html
This site has lists of science fair project ideas and a chance to share your ideas with others on the web!

Cyber-Fair
http://www.isd77.k12.mn.us/resources/cf/welcome.html
This site has one-sentence explanations of each part of a science fair. One of the steps described is presenting your project to judges. This may or may not be a part of your science fair. The site also has an explanation of what makes a good project and an explanation of how to come up with your own science fair project.

Try Science
http://tryscience.com
Science resource for home that gives you labs to try and 400 helpful links all related to science

The Yuckiest Site in the Internet
http://yucky.kids.discovery.com/
Brought to you by Discovery Kids, this site gives you lots of ideas on how to do the messiest yuckiest experiments.

Gateway to Educational Materials: Science Fair Projects
http://members.ozemail.com.au/~macinnis/scifun/projects.htm
The Gateway to Educational Materials extensive and detailed step-by-step guide to doing a science fair project.

Science Fair Primer
http://users.rcn.com/tedrowan/primer.html
A site to help students get started and run a science fair project.

Science Fair Project Guidebook
http://www.energy.sc.gov/K-12/science_fair.htm
The State of South Carolina publishes a K-12 science fair guidebook. It can be viewed using Adobe Acrobat Reader.

Science Project Guidelines
http://www.thesciencefair.com/guidelines.html
The scientists at the Kennedy Space Center have participated in judging local school science fairs for many years and have some great suggestions for student research projects. This information by Elizabeth Stryjewski of the Kennedy Space Center is now provided on a commercial site.

The Ultimate Science Fair Resource
http://www.scifair.org/
A variety of resources and advice.

What Makes A Good Science Fair Project
http://www.usc.edu/CSSF/Resources/Good_Project.html
A website from USC that gives a lot of good tips and ideas to think about regarding what makes a good science fair project. Advice for students as well as teachers and parents is included.

Mr. McLaren's Science Fair Survival Page
http://www.ri.net/schools/East_Greenwich/Cole/sciencefair.html
Tips from Archie R. Cole Junior High school on what makes a good project.

Experimental Science Projects: An Introductory Level Guide
http://www.isd77.k12.mn.us/resources/cf/SciProjIntro.html An excellent resource for students doing an experiment-based science fair project. There are links on this page to a more advanced guide and an example of an actual experiment-based project

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