Science Fair Planning Guide

Turn the page and start your award winning Science Project!!!!

Wait…. before you turn the page, as an adult to help you with your project.

My adult's name is _____.

From now on think like a Scientist…

Table of Contents

Types of Science Projects:

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

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 is also has a project that shows testing being done and the gathering of data.

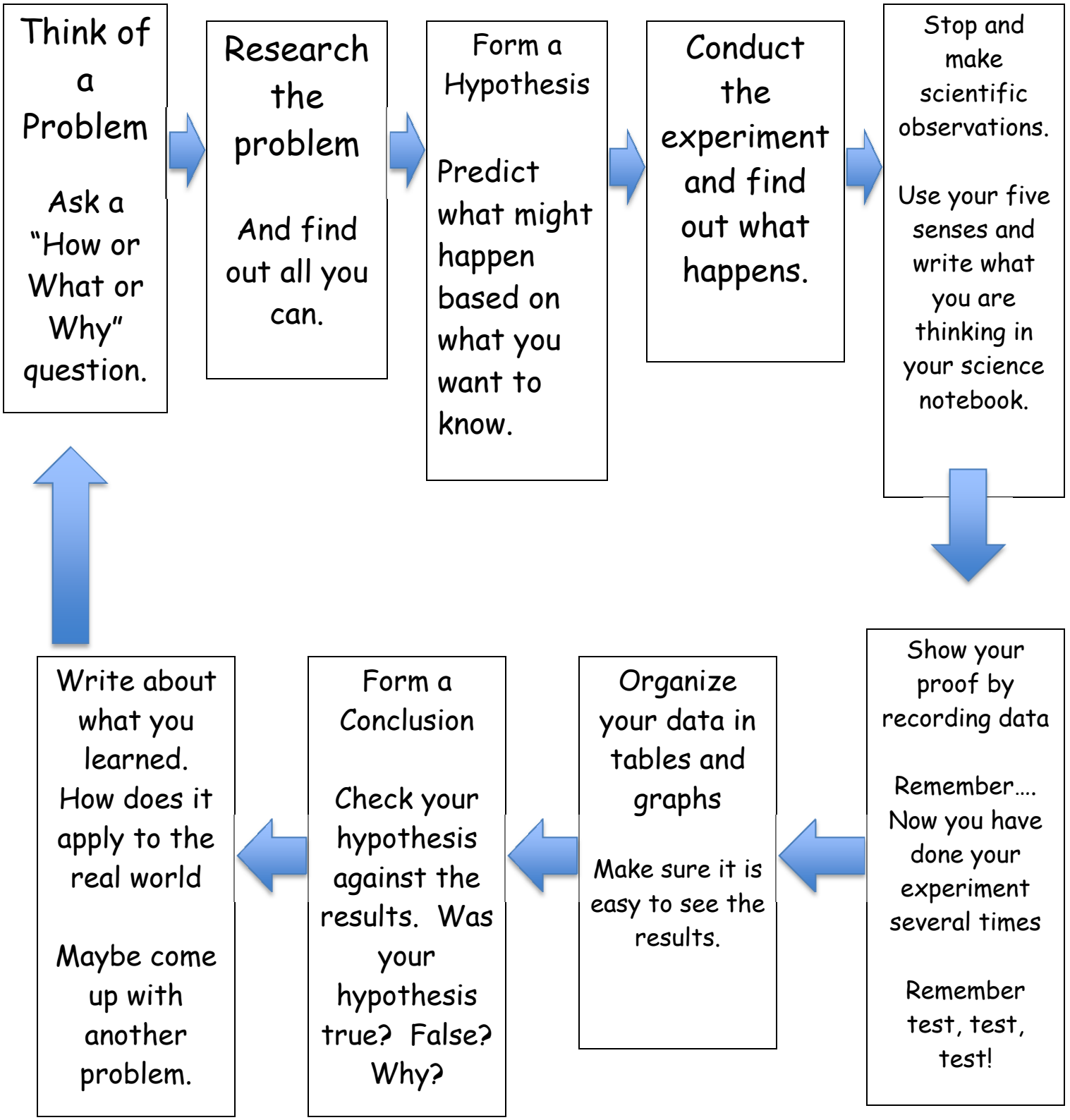
Examples of experiments can be: "the effects Detergent on the Growth of Plants", "Which Paper Towel is more Absorbent" or "What Structure can Withstand the Most Amount of Weight"

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

So What Types of Project Should I Do?

Even though you can learn a lot form building a model or display, we recommend that you do an Experiment or Investigation!!! 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.

What 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 four different categories of the Science fair to choose from. They are:

Life Science: This category 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 harm 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…

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 an 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 and adult to help you out.

Earth and Space Science: 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!!!

Engineering or Technology: This category is so amazing because it is science applied to everyday life. Technology begins with a task or a system that hasn't been done or is already being done and it allows new equipment or gadgets to work better or more efficiently! Engineering is figuring out a better way to make an idea work. Think of how it could work better or faster if you changed something. In technology, think of something you do every day and divide that into the separate steps that make it happen. This is the foundation for technology. Now what are the steps to make it happen? For example, when cell phones were invented. People already talked on the phone, but with cell phones they could carry a phone with them to make a call right away. This made communication faster and easier, right? Making cell phones smaller or less expensive is an example of engineering. Then smart phones took advantage of technology in a new way.

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 is is_____
(Life Science, Physical Science, Earth and Space Science, or Engineering Technology)

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 the problem of you topic. To give you an idea of what we mean you can start off by filling in the question blanks:

The effect Question:

What is the effect of_____on_____?

*Examples:

sunlight	the growth of plant
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_____?

*Examples:

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)_____?

*Examples

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

Engineering or Technology Question:

What interests me_____(noun)_____?

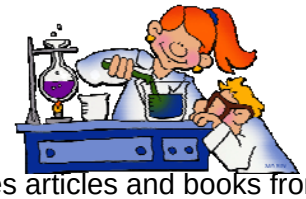
* Example: How can I make it work (faster or better, at a lower cost or in a new way)

Create your Science fair question using one of the three options above!

Step #2: Doing the Research and forming a Hypothesis…

You have picked your category and you have chosen a topic. You also wrote a question and now its time to do some **RESEARCH!!!** You will do so much that you will become an expert at your topic just like real scientist do in real labs.

How do you become an expert??



You READ!!!!!

It is important that you read about your topic. You can read encyclopedias, magazines articles and books from the library. Also, read articles from the Internet. Don't forget to take notes of any new things you learn including words so you can use them. It will make you sound like a real scientist!! Keep track of all the books and articles you read, you will need them later.

You DISCUSS!!

It is important to talk about your topic with your parents, teachers, and experts in the field like veterans, doctors, weathermen or others who work in the things you are studying. Sometimes websites will give you an email addresses to experts who can answer questions… **But don't forget to ask an adult to supervise** before you write to anyone on the Internet. Also, take pictures of any interviews you do with people.

Finally…

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

Form a HYPOTHESIS…

Now it is time to predict what you think will happen if you test your problem… This type of "Educated Guess" or PREDICTION is what real scientist calls a HYPOTHESIS. This will have you thinking like scientist.

How do you begin? Well, just answer the following question…

What do you think will happen? (Before you start your experiment)

Example of problem: Which paper towel is more absorbent?

Example of 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 their predictions.)

Now it's your turn:

Write down the problem and form your Hypothesis based on your research.

Problem: _____

Research: My problem is about this subject: _____
(Sample topics could be magnetism, electricity, buoyancy, absorbency, taste, plant growth, simple machines, building and testing a contraption, creating a set of instructions for a computer or robot that can be tested, 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 great 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 it's 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.

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 it.

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.

Observation is a ***very important part of this step***! Remember to use your five senses to gather information as you conduct your investigation. Then record the information in careful detail. Don't forget to record everything! See Science Journal below.

Fifth: **Collect your DATA:** This means write down or record the results of the experiment every time you test it. Be sure 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. (And, don't forget, 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.

Hold On. How Do You Collect Data?

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 (should be a week or more).

- Observations
- Collect research
- Draw/diagram pictures
- Questions

Tools:

Make sure you have the things you need to take accurate measurements. Metric is the recommended standard of measurement in science. (meters, liters, Celsius, grams, etc.)

- Rulers
- Meter tapes
- Thermometers,
- Graduated cylinders
- Measuring cup

Tables, Charts and Diagrams:

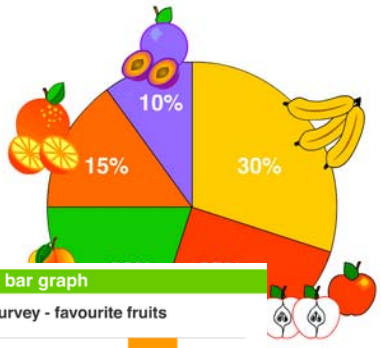
The way a scientist keeps track of experiment trials.

- At least 5 trials
- Organized in columns and rows
- Must use labels or headings
- Shows Independent variable (what was tested)
- Responding variable (result)

Types of Graphs to Use to Display Your Data:

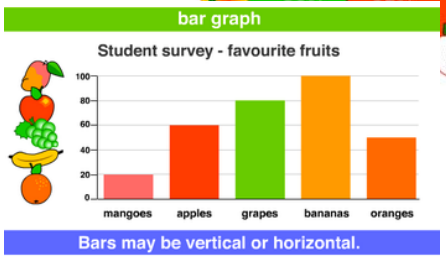
Pie Graph

- Percentages of groups
- Pieces add up to 100
- Great for surveys



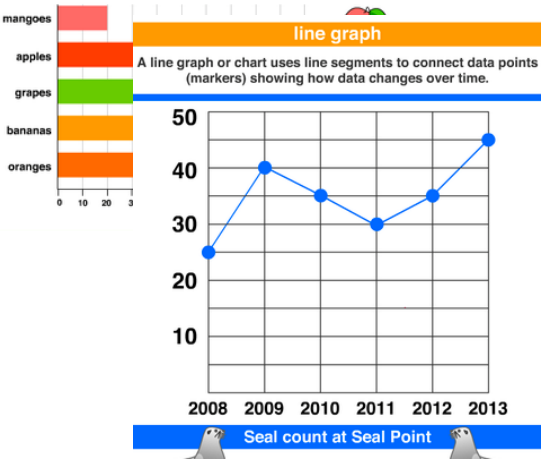
Bar Graphs:

- Comparing amounts
- Results at a glance
- X axis (Horizontal)
- Y axis (Vertical)



Line Graphs

- Shows change
- X axis (time increments)
- Y axis (measurements



<u>...And now back to the Experiment Steps</u>:

<u>Sixth</u>: Write a conclusion: Tell us what happened. Was your hypothesis right, wrong, or neither? Would you change anything about the experiment or are you curious about something else now that you've completed your experiment? TELL WHAT YOU LEARNED FROM DOING THIS.

<u>Seventh</u>: UNDERSTAND ITS APPLICATION. Write about how this experiment can be used in real life. How will this help in the future? Why was it important to know about this?

Now It's Your Turn!

Materials:

List the materials that you will need for your science experiment here:
(TAKE PICTURES!)

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

<u>Variables:</u>

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

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

_____

My independent variable is (the things(s) that change(s) from one experiment to the next; or what you are testing):

_____

My responding variables might be (the results of the experiment):

_____

Procedure:

List the steps that you have to d in order to perform the experiments here
(Don't forget to take pictures at each step):

1st:_____

_____

2nd: _____

_____

3rd: _____

_____

4th: _____

_____

5th:_____

_____

Design a table or chart here to collect your information
(Don't forget pictures!)

Use graph paper if you need to make a graph of your results from your table.

Conclusion:

- What did you learn?
- Did you confirm your hypothesis?
- Did it work? Why or why not?
- What did the results tell you?
- What did you prove?

Sometimes not being able to prove a hypothesis is important because you still proved something.

Application:

How does this apply to real life?

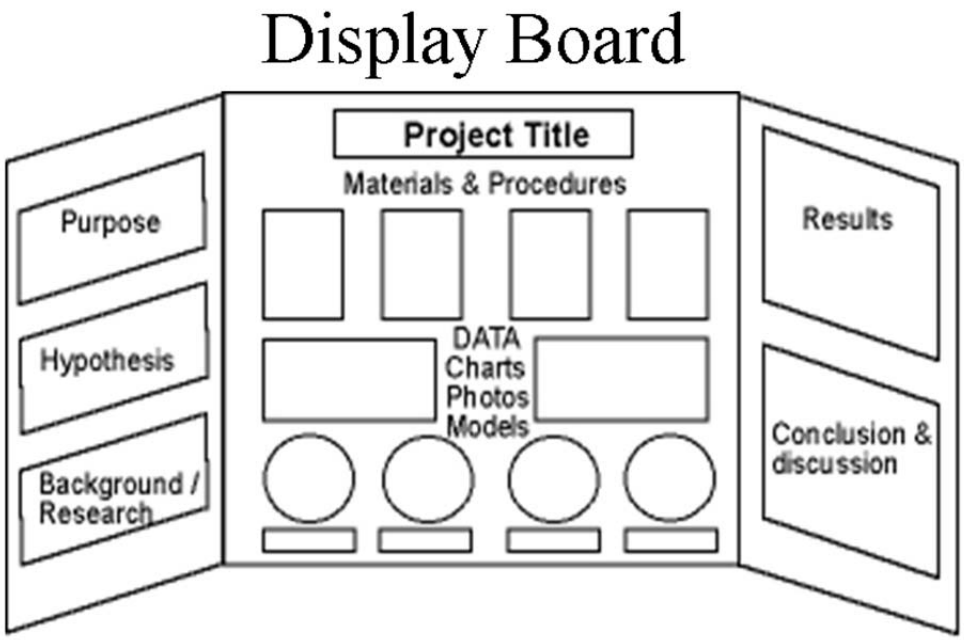
It is important to know about this experiment because…

_____

_____

_____

_____Science Board must be 48" by 36"_____



Arrange information so that it is easy to read and flows in a logical order.

Top to bottom and left to right.

Display Secrets:

- Type information or use best writing
- Use glue sticks or spray ad
- Use readable fonts (no more than two)
- Place information colored paper to make it stand out

RELAX, SMILE AND HAVE FUN! Remember you are the expert and you had fun doing the project. Dress nice that day, be polite and speak clearly and you will show the judges that you have confidence. Don't forget to look them in the eyes; they are very interested in what you have to say. Remember practicing helps a lot.

What are the judges looking for?	What should you do the day of the science fair?
Clearly stated title, purpose and a reasonable hypothesis	**Introduce yourself, point out the title of the display and tell the judge why you chose to study this. State your problem (your question) and tell them about your hypotheses (what you thought might happen).**
Abstract	**Talk about what you learned wile researching your topic**
3 or more resources	**Talk about the sources (books, websites and interviews) that helped you understand your topic (remember at least 3)**
Thoroughly stated procedures and materials	**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.**
Clearly stated variables and controls	**Point out the controlled, independent and responding variables to the experiment (the things you kept the same, the thing you tested and the results)**
Measureable data that includes 3 or more trials or when testing human subjects-10 people or more	**Hand a copy of your report to the judge so that they can review your data. Show them all of the graphic organizers you made, like your tables and charts. Remember to point out the labeled parts of your graph or tables to show that you know what it represents.**
Effective analysis of data-clearly stated results using graphs and tables	**Be sure and explain what your data means. Make sure you can read your graphs and tables. Let them know if were surprised by the results or if you knew what would happen because you studied it.**
In-depth knowledge base of topic with use of related vocabulary at grade level	**Make sure you sound like an expert at your topic. Always use academic vocabulary especially by using works from the Scientific method like: Problem, Hypothesis, Procedure, Variables, Results and Conclusion**
Well elaborated conclusion based on results	**Let the judge know if you were right about your hypothesis. What did you conclude about your problem to investigate based on what you have learned? The conclusion is all about what you learned from doing this.**
How does this apply to real life?	**Judges love this one, because it gives a real world purpose to your topic. It makes you sound like a real scientist – which you are! For example "my experiment about paper towel absorbency could help people save money by buying the right type of paper towels" see how useful that sounds?**
Effective closure of presentation 	**If you get nervous, lost or forget where you are, take a deep breath and 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 then for their time, remember that they are volunteers who want you to do your best!!!**

Science Fair Rubric **Name_____Grade_____**

Project_____

SCORING: 1-Beginning Steps 2-Nearing Proficient 3-Proficient 4-Advanced		
SCIENTIFIC METHOD:	**1.** Your **question or problem** clearly stated**.**	
	2. Hypothesis: An educated guess about the answer to your question or solution to your problem	
	3. Abstract: A brief summary of your investigation.	
	4. Materials and methods: All materials used are listed. You explained what you did, step by step. Variables which affect results is given.	
	5. Results/Observations: recorded in detail in a journal; you presented them usually in the form of data, graphs, tables, charts, and/or illustrations such as photos or drawings	
	6. Analysis: The meaning of results is explained.	
	7. Conclusion: Accept or reject your hypothesis, explain what you learned, tell what new questions your work made you think of. What can you infer from your work?	
PRESENTATION AND DISPLAY:	**1**. Your display is meaningful and addresses the hypothesis.	
	2. Your display follows accepted scientific conventions.	
	3. Your display is clear, neat and follows accepted literary conventions such as correct use of capitals, punctuation and grammar.	
WRITTEN REPORT: (required for 4th,5th) (optional for 3rd)	**1.** Describes your investigation and includes what you learned from your research about your question.	
	2. Makes sense and relates directly to your investigation.	
	3. Follows accepted literary conventions such as correct use of capitals, punctuation and grammar.	
(required for 5th)	**4.** A bibliography of your resources is included.	
STUDENT INTERVIEW:	**1.** You describe your work with confidence and enthusiasm.	
	2. You demonstrate adequate knowledge about your investigation.	
	3. You can express the significance of your investigation to people and the environment.	
ORIGINALITY:	**1.** A unique topic or approach	

Total Points: (3rd Grade: 64 possible); (4th grade: 68 points); (5th Grade: 72 points)

Abstract Guidelines

This is a short version of your research report. It should be about 250 words, fit on one page, and contain a short summary of the following eight items:

1. **Question or purpose:** What was your question or why did you conduct this experiment.
2. **Research:** one sentence about your main research selection.
3. **Hypothesis:** what is your educational guess about how you experiment will turn out.
4. **Materials:** brief list of materials used in your experiment.
5. **Methods/Procedure**: about two sentences on how you conducted your experiment.
6. **Observations/Results**: a short summary (2-4 sentences) about what you observed in your experiment and what happened at the end.
7. **Analysis**: explanation of how you thought about what happened during your experiment.
8. **Conclusion:** a one sentences summary of what happened in your experiment.

**If the Abstract is typed, be sure to double space. If it is handwritten, please skip lines. Please keep it one sided only.*

Research Paper Guidelines

Content: *Your abstract is a summary, an overview of your project, but your Research Paper will go into more detail about your research project. Your research paper should include eight paragraphs, which will be about 2-3 pages, including the bibliography, and have the following information:*

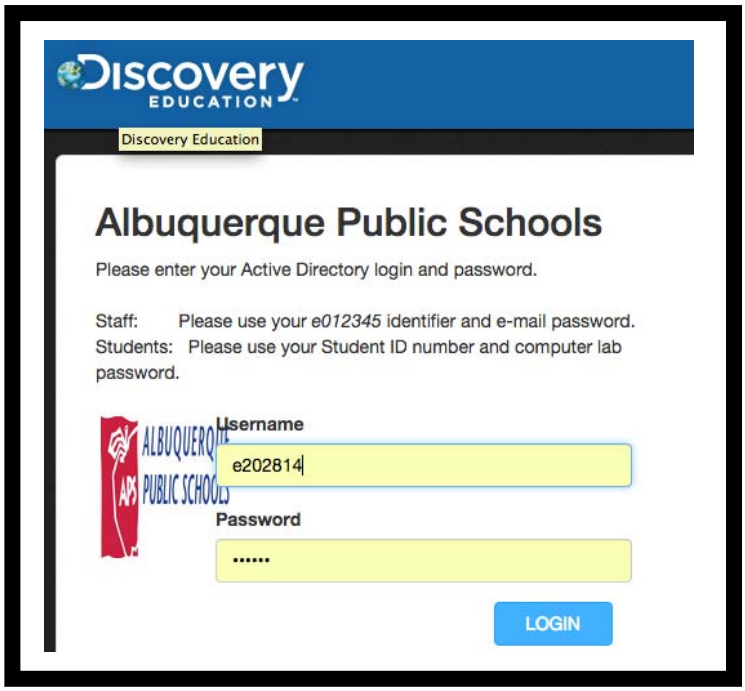
1. **Question/Purpose**: Why did you do your project? What was the question you wanted to answer? What was the problem you tried to solve?
2. **Research:** Briefly explain your research plan. How did you gain information about your project? Who did you talk with? Who helped you find other ways to look for information? What did you find that you did not use in your project and why? This section explains all the work you did to learn more about your topic?
3. **Hypothesis:** This is a "best guess" explanation of what your experiment would prove. Explain why you formed the hypothesis.
4. **Methods/Procedure:** What did you "do" in your experiment? For example, I placed two jars of water in the freezer.
5. **Materials:** A list of what you used in your experiment. You may want to describe anything unique of different about the materials you used, or explain why you used these materials
6. **Experiment:** Mention the goal and outcome of any experiments. Did they prove or disapprove your hypothesis?
7. **Observations & Results:** What were the most important facts learned for the project? List how many times your conducted your experiment. What did your discover when your conducted each experiment. You might want to refer or re-read your science notebook to write this part of your paper. Make sure you include what worked and what did not work. Sometimes the most important part of an experiment is what you did that worked.
8. **Conclusion:** What did your result mean? Could you compare the result to anything else you know? Do you r results give you any ideas for the future research?

**Grammar, Spelling, and Style: Have someone check your spelling and grammar. If your paper is handwritten, be extra neat. Be sure your thoughts are clear. Please see the details for all the above items in the definitions section.*

Website Resources:

Discovery Education:

http://aps.discoveryeducation.com



LOGIN:
Username: Student ID number
Password: les12345

Discovery Ed offers resources (games, videos, tutorials, ideas) to students in a number of content areas!

Internet Pubic Library:

www.ipl.org/div/projectguide

Are you looking for some help with a science fair project? This is a great place to find resources and will guide you through your whole project!

Definitions and Requirements

Scientific Method:

This is the method, or steps scientist follow to answer a question. All steps required!
These steps include:

1. Form a Question/ Find a Problem:

What is something you want to know? Create a question that you want to investigate.
Is there a problem that you have? Find a problem and pose a question.

2. Conduct Research:

You must know everything you can about your question or problem. That is where research comes in! Gather information about your question or problem by interviewing an expert, read books, use the Internet, watch videos. Do anything that will help you learn about your problem!

3. Develop a Hypothesis:

Now you must predict an answer to your question or problem. Create an educated guess, or hypothesis.

4. Gather and list Materials:

It is important to know what materials you will need to do you experiment. Make sure you have everything on your materials list!

5. Use a specific Method/Procedure to test the hypothesis:

How did you do your experiment? Steps and a procedure is important for a successful experiment.

6. Record Observations and Results:

Making sure you have everything you did in your experiment is very important. Make sure to write down every detail when doing your science fair project.

7. Analyze the Results:

Collecting data for your results is important. But what does it all mean? Studying and analyzing the data collected will help come up with the answer to your question.

8. Accept or reject the hypothesis in a written sentence.

Was the hypothesis correct? Or Wrong? You decide based on your results. Coming up with a conclusion about your experiment is the answer to the question you asked at the beginning.

Science Fair

Variables:

Variables are conditions that change. You must discuss any variables that affect or could affect the results of your investigation. Scientists use variables on purpose to see if they can change the results. For example, if I am trying to grow carrots in 90 days, I might try watering some carrot seeds once a week, while watering other carrots seeds 3 times per week so that I can observe and record which works best. The amount of water is the variable. Other variables are changes that you did not expect, for example the weather. You would need to record the changes in the weather, because they affect your investigation.

Observations:

Scientific observation has two parts:
First, use your five senses to gather information as you conduct your investigation;
Second, record that information in careful detail.

Journal/ Science Notebook:

A binder, spiral notebook or composition book where you record every aspect of your investigation. Your journal is where you record everything listed on these pages. You can also record your thinking, new questions that come up, and problems that you have. You should date every entry. Enter data neatly and label everything, so that it is readable when you need to create charts, tables or graphs for your display/ presentation.

Results:

The detailed information you record as you observe during your experiment or investigation in the form of data, photos, drawings, recordings, etc. In your display, your data must be presented in a way that helps the reader understand how your results prove or disprove your hypothesis. Sometimes a chart is adequate, but often a graph helps the reader understand faster. What you use depends on the type of investigation you conducted.

Analysis:

An analysis is a paragraph in your display, which explains the results of your investigation in detail. It includes a discussion of how the variables influenced the results.

Conclusion:

A Conclusion is a paragraph in your display in which you interpret, or explain your results as they relate to your hypothesis. Did your investigation prove or disprove your hypothesis? Do you think you need to conduct more experiments to find out? Do you need to change your investigation in some way to get the results you were hoping for? What new questions popped into your head during this investigation? What can you infer from your investigation?

Display:

It is the visual presentation of your investigation. Your presentation should display what you did for each step of the Scientific Method during your investigation. Your display should make sense and relate directly to your hypothesis. You should follow accepted rules for writing such as correct capitalization, punctuation and grammar.

Written Report:

(Required for 5th grade, optional for 3rd and 4th grade) 1 to 2 pages reviewing what you learned from the research you did before you began your investigation and summarizing each step of the Scientific Method for your investigation. Also it can include other information, such as why you chose your question, difficulties you had, changes you made or might make next time, such as using different variables, and whether you think your investigation was useful. You need to edit your report for correct capitalization, punctuation and grammar.

Bibliography:

(Required for 5th grade) Fifth graders must include a third page at the end of their written report on which they list their sources for their research. Sources must be listed alphabetically according to the author or experts' last name, and include the title, full website or "Interview", and the copyright, website use date, or interview date.

Student Interview:

A judge will ask each student questions about their investigation. If you put off doing your investigation until the last days before they are due, you may have a difficult time during your interview. If you have taken the time to research your question and follow each step of the Scientific Method, you will be well prepared and confident. You will enjoy talking with the judge.

Originality:

An investigation might be judged unique if you investigate a common problem from an uncommon point of view, if you come up with an unusual solution that works, or if your hypothesis addresses an important question most people don't think about.

Safety

If there are dangerous aspects of your experiment, like using sharp tools or experimenting with electricity, please have an adult help you or have them do the dangerous parts.