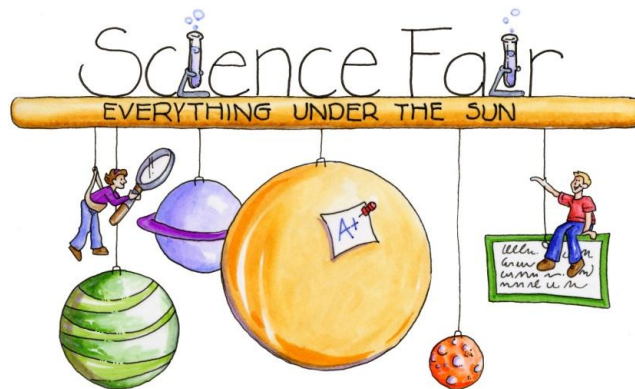


HARMONY SCHOOL OF Excellence - Endeavor

SCIENCE FAIR HANDBOOK 2011- 2012

Elementary



STUDENT NAME: _____

PARENT'S NAME: _____

My child and I have read this booklet in its entirety and will refer to it during the science fair process. We know and understand when each section is due and that it is the student's responsibility to turn work in on time.

PARENT SIGNATURE: _____ STUDENT SIGNATURE:

(The first science fair grade will be taken from your signature.)

Parent/Guardian phone number: _____

Parent/Guardian e-mail address: _____



_____ Science Fair - Elementary (2011- 2012)

Dear Parents,

As you know, science, technology and engineering are basic skills expected by employers. As Twenty First Century citizens, these students will also have to make some of the toughest decisions of any generation, based on their understanding of emerging science and technology.

Science fairs involve students in the practices of science and engineering, requiring them to apply those skills to a topic of interest to them. Doing science is key to understanding science.

Our school is holding a science fair on _____ and all students in grades **4 and 5** have been invited to participate. Hands-on scientific investigation and invention are the focus at our particular fair. Over a _____ period, your child will design, test, analyze, and present a project that uses scientific methods to solve a problem. The sky's the limit!

Please note that the bulk of the work will be done at home. Students will be given project guidelines and timelines at school, and teachers will check in with them periodically. However, much of the work will be self-directed. Parents are encouraged to offer emotional support and reminders but to allow children to do the projects by themselves. Please remember that this is multipart project and students must participate in all aspects of any science fair related work to receive credit.

We encourage you to visit the Parents Resources section of the Discovery Science Fair or Science Buddies website for valuable information designed especially for parents like you.

<http://school.discoveryeducation.com/sciencefaircentral/Parent-Resources.html>

http://www.sciencebuddies.org/science-fair-projects/parent_resources.shtml?From=Tab

<http://sciencefairproject.virtualave.net/>

These websites are only a suggestion. There are many more web based resources or books that you may search for and find helpful information.

Please do not hesitate to call or e-mail with any questions. Thank you in advance for all your support!

Sincerely,

Mr. Cassity

5th-6th Science/Science Fair Director

tcassity@harmonytx.org

Science Fair Project Timeline (2011- 2012)

September 1, 2011	Students receive Science Fair Booklet, Including Parental Notification Form and Calendar
September 9, 2011	Deadline to return science fair booklet parent signature.
September 12, 2011	Research Question & Purpose Due. Students will choose 3 topics at home and bring completed form to the teacher.
September 15-16, 2011	Parent meeting for Science Fair (4-5 th Grade on the 15 th , 6-8 th on the 16 th)
September 23, 2011	Background Research & Bibliography Due. Research must be done at home prior to this date. The paragraphs may be handwritten or typed
September 27, 2011	Hypothesis, Variables, Procedures, & Materials Due *Students will start these in class & will need to finish at home.
Start experimenting after you receive approval of your hypothesis and materials list.	
October 21, 2011	Data Collection Due *Students will need to bring in all of their data from their experiment. They will be graphing it during class.
October 31, 2011	Final Report Due. *This will include ALL the work above plus the conclusion drawn from the data analysis. It needs to be typed.
November 11, 2011	Display Board Due.
November 14-15, 2011	Presenting Projects to Classmates
December 3, 2011	Proposed Science Fair Grades 4-8 th



The scientific method is the blueprint" of the science experiment you will do for your science fair project.

These are the steps that you need to follow:

Purpose: Pick a topic that interests you.

Question: Put your topic into a question that will be answered by your research.

Research: Find out background information about your topic so that you can predict an answer to your question.

Hypothesis: After you've done your research, make a prediction as to what you think the answer to your question is. This is your **hypothesis**.

Important: *A hypothesis doesn't have to be right for the experiment to be correct.*

Experiment: This is the actual experiment that you will conduct for your science fair project. It is your materials and procedure including your **constants** (control) and **variables**. It is what we call a "controlled experiment."

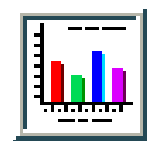
Analysis: This is the **data** you have collected. You will be comparing this information and you may display it in a table, graph, pictures, photographs, or a combination of all of these.

Conclusion: Look at your **data**.

- *Was your hypothesis correct?*
- *If not, why do you think it was not?*
- *What would you do differently next time?*
- *Do not worry about "negative results," or results that came out differently than you expected. Why do you think you got them?*



$$E=MC^2$$



Student Name _____

Final Grade _____

Project Title (to be added after approval) _____



Ask a question that you can answer through observation or experimentation.

What is your purpose, your reason, for asking this question? What are you trying to discover?

State the Research question (remember to choose three possible topics)

1) _____

2) _____

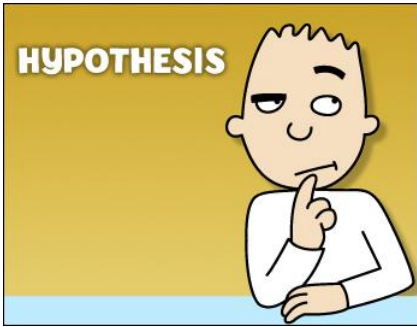
3) _____

—

Teacher Comments / Suggestions

Parent Acknowledgement / Signature _____

Scientific Process



A hypothesis is a statement that predicts how an experiment will turn out and why it happened that way. It is based on what you already know and what you believe will be that the answer to your question. Hypotheses do not have to be correct – they just need to be formed in a way that they can be tested. Hypotheses are often written in an “If..., then..., (because...)” format.

Make a Hypothesis

Teacher Comments / Suggestions

List your materials

Variables are the things that are changing in your experiment. There are values that are controlled or selected by the person experimenting (independent, or manipulated, or controlled), values that are affected by the controlled variable and so we measure their changes (dependent or observed), and values that do not change at all (constant)

List your variables

Independent (Manipulated) _____

Dependent (observed) _____

Constant _____

Teacher Comments / Suggestions

HARMONY SCHOOL OF _____

SCIENCE FAIR HANDBOOK 20__ - 20__

Middle School (6-8th Grade)



STUDENT NAME: _____

PARENT'S NAME: _____

My child and I have read this booklet in its entirety and will refer to it during the science fair process. We know and understand when each section is due and that it is the student's responsibility to turn work in on time.

PARENT SIGNATURE: _____ STUDENT SIGNATURE:

(The first science fair grade will be taken from your signature.)

Parent/Guardian phone number: _____

Parent/Guardian e-mail address: _____



_____ Science Fair (20__-20__)

Dear Parents,

As you know, science, technology and engineering are basic skills expected by employers. As Twenty First Century citizens, these students will also have to make some of the toughest decisions of any generation, based on their understanding of emerging science and technology.

Science fairs involve students in the practices of science and engineering, requiring them to apply those skills to a topic of interest to them. Doing science is key to understanding science.

Our school is holding a science fair onand all students in grades _____ have been invited to participate. Hands-on scientific investigation and invention are the focus at our particular fair. Over a _____ week period, your child will design, test, analyze, and present a project that uses scientific methods to solve a problem. The sky's the limit!

Please note that the bulk of the work will be done at home. Students will be given project guidelines and timelines at school, and teachers will check in with them periodically. However, much of the work will be self-directed. Parents are encouraged to offer emotional support and reminders, but to allow children to do the projects by themselves.

We encourage you to visit the Parents Resources section of the Discovery Science Fair or Science Buddies website for valuable information designed especially for parents like you.

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http://www.sciencebuddies.org/science-fair-projects/parent_resources.shtml?From=Tab

<http://sciencefairproject.virtualave.net/>

<http://www.juliantrubin.com/fairprojects.html>

Please do not hesitate to call or e-mail should there be any questions.

Sincerely,

Helpful sites for science fair work:

<http://school.discovery.com/sciencefaircentral/>

<https://sites.google.com/site/sciencefairsubmission/> (good help for students in organizing & submitting projects)

<http://www.sciencefairadventure.com/>

<http://www.ipl.org/div/kidspace/projectguide/>

<http://sciencecastle.com/sc/index.php/scienceexperiments/search>

<http://earthquake.usgs.gov/learn/kids/sciencefair.php>

<http://www.ars.usda.gov/is/kids/fair/ideasframe.htm>

<http://www.juliantrubin.com/solarprojects.html>

<http://hunstem.uhd.edu/SEFH/>

<http://www.all-science-fair-projects.com/>

<http://www.sciencebob.com/sciencefair/ideas.php>

<http://www.lasciencefair.org/ideas.htm>

<http://www.easybib.com/> (a good site to help students write their bibliography)

<http://owl.english.purdue.edu/owl/search.php> (info on writing papers)

<http://www.ruf.rice.edu/~bioslabs/tools/report/reportform.html> (excellent research paper guide)

... and many, many more...

... plus books!

SCIENTIFIC INVESTIGATION STEPS

Choose a Project Idea

Choose the topic you're interested in. You can use books, online resources or the objects around you to come up with a topic. **Some** online resources (but not exclusively) are:

<http://school.discoveryeducation.com/sciencefaircentral/>

<http://www.sciencebuddies.org/>

Validate Topic

As students select their topic and form their questions, they will need further guidance. Have them think about their project in terms of:

- | | |
|-------------------------|--|
| Time: | will the investigation or building the design take more than the time allotted between now and the science fair? |
| Materials: | can you obtain the materials that will be required? Will the cost be too much? |
| Safety: | are the tools and other materials safe for you to use? Will an adult be available to help with anything that might not be safe for you to do alone? Are any of the materials ones that someone could be allergic to? |
| Appropriateness: | is the topic something that you can understand? Will the research require you to read things that are too hard? |
| Animal care: | if you are going to do anything with animals, will they be kept safe? Will you be putting anyone in danger who is allergic to the animals? |

Investigation

Students who want to find out things as a scientist, will want to conduct a hands-on investigative experiment. While scientists study a whole area of science, each experiment is focused on learning just one thing at a time. This is essential if the results are to be trusted by the entire science community.

In an investigation, students:

- Ask a testable question
- Research the topic
- Make a hypothesis about the outcome based on the research or their own knowledge
- Design the investigation
- Conduct the investigation
- Collect Data
- Make sense of the data and draw a conclusion
- Present their findings for peer review

What is a Testable Question?

The key to a good and manageable investigation is to choose a topic of interest, then ask what is called a “**testable question.**” Testable questions are those that can be answered through hands-on investigation by the student. The key difference between a general interest science question and a testable question is that testable questions are always about changing one thing to see what the effect is on another thing.

Here are some examples of broader science questions and testable questions:

Broad Questions (lead to science reports)

Testable questions (lead to investigations)

How do plants grow?	What amount of water is best to grow tomatoes? or What type of soil is best to grow petunias? or What amount of sunlight is best to grow daffodils?
What makes something sink or float?	How well do different materials sink or float in water?
How do rockets work?	How does changing the shape of a rocket’s fins change its flight?
How does the sun heat up water?	Does the sun heat salt water and fresh water at the same rate?
What happens when something freezes?	Do different liquids freeze at the same rate?
What makes cars move?	How does the surface on which a car moves affect how fast it goes?

Conduct Background Research

Once students have a testable question, it is important to do some background research. What do scientists think they already know about the topic? What are the processes involved and how do they work? Background research can be gathered first hand from primary sources such as interviews with a teacher, scientist at a local university, or other person with specialized knowledge. Or students can use secondary sources such as books, magazines, journals, newspapers, online documents, or literature from non-profit organizations. Don’t forget to make a record of any resource used so that credit can be given in a bibliography.

Gathering Background Research

- Helps students gain in depth knowledge about the topic and processes they will be observing during the investigation.
- Sparks ideas about different variables to test when setting up the investigation.
- Provides the basis for predicting what will happen in the investigation when making a hypothesis.
- Provides the understanding needed to interpret and explain the results to others – especially a science fair judge!

Compose Hypothesis

After gathering background research, students will be better prepared to formulate a hypothesis. More than a random guess, a hypothesis is a testable statement based on background knowledge, research, or scientific reason. A hypothesis states the anticipated cause and effect that may be observed during the investigation. Consider the following hypothesis:

If ice is placed in a Styrofoam container, it will take longer to melt than if placed in a plastic or glass container. I think this is true because my research shows that a lot of people purchase Styrofoam coolers to keep drinks cool.

The time it takes for ice to melt (**dependent variable**) depends on the type of container used (**independent variable.**). A hypothesis shows the relationship among variables in the investigation and often (but not always) uses the words *if* and *then*.

Take a look at these additional examples:

- If a mixture of vinegar and baking soda are used, then more stains may be removed. I think this because vinegar and baking soda are used in many different cleaning products.
- When an object has a volume greater than 30 cubic centimeters, then it will sink in water. In the past, I have seen big objects sink.

Design Experiment

Once students formulate a hypothesis for their investigation, they must design a procedure to test it. A well-designed investigation contains procedures that take into account all of the factors that could impact the results of the investigation. These factors are called **variables**.

There are three types of variables to consider when designing the investigation procedure.

- The **independent variable** is the one variable the investigator chooses to change.
- **Controlled variables** are variables that are kept the same each time.
- The **dependent variable** is the variable that changes as a result of /or in response to the independent variable.

Having students talk through the investigation will help them to clarify the different variables involved in the experimental design. What factors will change? What factors will stay the same?

A hands-on way to introduce a fair test is to ask students, “Who can make the best paper airplane?” Once two students are selected to compete, hand one a large piece of construction paper and the other a piece of regular copy paper. Students will immediately note that this is “unfair.” If we want the test to be fair, only the paper airplane design can be different. Everything else, including how hard the airplane is tossed, must be the same.

Step A – Clarify the variables involved in the investigation by developing a table such as the one below.

Testable Question	What is changed? (independent variable)	What stays the same? (controlled variables)	Data Collected (dependent variable)
What detergent removes stains the best?	Type of detergent, type of stain	Type of cloth, physical process of stain removal	Stain fading over time for combinations of detergents and stains

Step B – Make a **list of materials** that will be used in the investigation.

Step C – **List the steps** needed to carry out the investigation.

Step D – **Estimate the time** it will take to complete the investigation. Will the data be gathered in one sitting or over the course of several weeks?

Step E – **Check the work.** Ask someone else to read the procedure to make sure the steps are clear. Are there any steps missing? Double check the materials list to be sure all the necessary materials are included.

Set Up and Collect Data

After designing the procedure and gathering the materials, it is time to set up and to carry out the investigation. When setting up the investigation, students will need to consider...

The location Choose a low traffic area to reduce the risk of someone accidentally tampering with the investigation results—especially if the investigation lasts for several weeks.

Avoid harmful accidents by using safe practices.

Safety

- The use of construction tools or potentially harmful chemicals will require adult supervision.
- Locate the nearest sink or fire extinguisher as a safety precaution.
- Determine how to dispose of materials. For example, some chemicals should not be mixed together or put down a sink drain.
- Wear protective clothing such as goggles and gloves. Tie back loose hair so that it does not get caught on any of the equipment.

Documentation Making a rough sketch or recording notes of the investigation set up is helpful if the experiment is to be repeated in the future.

Carrying out the investigation involves data collection. There are two types of data that may be collected—quantitative data and qualitative data.

• **Quantitative Data**

- Uses numbers to describe the amount of something.
- Involves tools such as rulers, timers, graduated cylinders, etc.

- Uses standard metric units (For instance, meters and centimeters for length, grams for mass, and degrees Celsius for volume.
- May involve the use of a scale such as in the example below.

- **Qualitative Data**

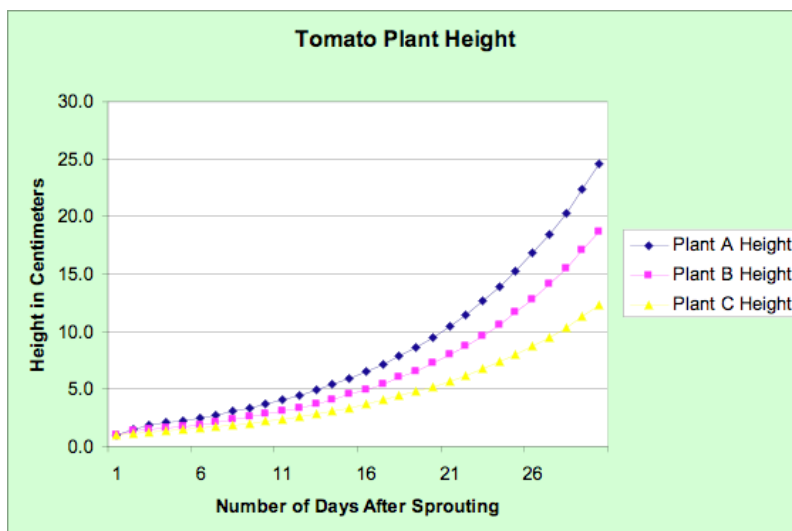
- Uses words to describe the data
- Describes physical properties such as how something looks, feels, smells, tastes, or sounds.

As data is collected it can be organized into lists and tables. Organizing data will be helpful for identifying relationships later when making an analysis. Encourage students to make use of technology such as spreadsheets to organize their data.

Analyze Data and Draw Conclusions

After students have collected their data the next step is to analyze it. The goal of data analysis is to determine if there is a relationship between the **independent and dependent variables**. In student terms, this is called “**looking for patterns in the data.**” Did the change I made have an effect that can be measured?

Besides analyzing data on tables or charts, graphs can be used to make a picture of the data. Graphing the data can often help make those relationships and trends easier to see. Graphs are called “pictures of data.” The important thing is that appropriate graphs are selected for the type of data. For example, bar graphs, pictographs, or circle graphs should be used to represent categorical data (sometimes called “side by side” data). Line plots are used to show numerical data. Line graphs should be used to show how data changes over time. Graphs can be drawn by hand using graph paper or generated on the computer from spreadsheets for students who are technically able.



You can use these questions to help guide students in analyzing their data:

- What can be learned from looking at the data?
- How does the data relate to the student's original hypothesis?
- Did what you changed (**independent variable**) cause changes in the results (**dependent variable**)?

After analyzing the data, students will be able to answer these questions as they draw some conclusions. Students should not to change their hypothesis if it does not match their findings. The accuracy of a hypothesis is NOT what constitutes a successful science fair investigation. Rather, Science Fair judges will want to see that the conclusions stated match the data that was collected.

Display Board

Your display can reflect your personality:

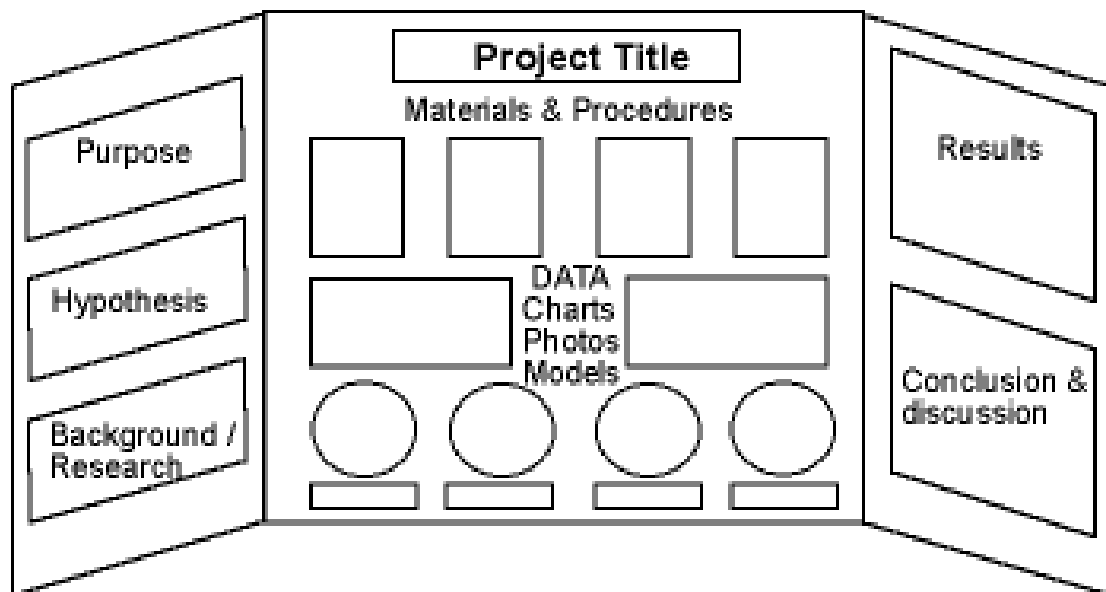
Is every inch of my locker or bedroom covered with magazine clippings, posters, stickers, and sticky notes? Or am I more of a minimalist? What's my idea of a good time: scrapbooking or skateboarding? Is the presentation the part of the science fair I've been waiting for, or is that the part I dread?

Stand Out from the Crowd

Whether they're the kind of person who loves to design and decorate and dabble with computer graphics, or the one who always opts for the standard black-and-white report cover, this is a time for students to get creative. The stakes are high here and they'll want their personality to shine through.

They can learn how to edit their text down to the essentials, pick and choose the best photos and graphics, and display them all in the most clear and compelling way possible. Through creative use of color, type and graphic elements, your students can make their ideas pop and bring their projects to life.

There are many searchable poster board examples online and in reference books. This is an example:



- Instead of the purpose have your testable question.
- Your results can refer to your data and analysis.
- You MUST have graphs or tables on your board.
- You don't need to follow this order exactly but it must be organized and easy to read.
- Please don't bring your project to the fair unless it is very small and can sit in front of the project without covering anything.
- No live animals please.
- When in doubt ASK YOUR TEACHER!

Oral presentation for your classmates

The student will present their project to the rest of the class in order to practice talking to judges. The presentation should be 3-5 minutes long, briefly covering most of the parts of the project. This will be done some time very close to the science fair and you will use your display board to do it.

On Science Fair Competition Day

Your teacher will give you more details regarding dress code, the time and where the fair will be held at a later date. You will not bring anything but a book, homework or paper for drawing during the judging period. No electronics of any kind. These will be professionals coming to judge you so you need to ask as professional as possible. We will talk more about this in class. **A grade will be taken on your attendance at the fair, not on the awards won.**

Another big portion of your grade will come from your scientific research journal for your project. Please make sure you keep it neat and organized.

Works cited:

This document was created through the collaboration of teachers at Harmony Schools and with the help of resources from:

<http://school.discoveryeducation.com/sciencefaircentral/>

<http://www.sciencebuddies.org/>

<http://www.education.com/>

<http://www.juliantrubin.com/fairprojects.html>

Science Fair Rubrics

Problem/Question	Points
Are the changes to the variables measurable? (Present/Not present or quantity such as count, length, weight, voltage, etc.)	/20
Is it possible to control other factors that might influence the data that is collected during the experiment, so that they do not interfere with the results?	/20
Is the experiment safe to perform?	/15
Are the materials easily accessible and at reasonable cost? For behavior or sociology projects, does the student have a large enough sample of subjects for proper results?	/15
Does the student have enough time to do the experiment more than once before the science fair?	/15
Is the text clear and with correct grammar?	/15
Score	/100

Research Paper	Points
Have all important terms and concepts for this project been defined in the research paper?	/10
Does the research provide enough background to make a prediction of what will occur in the experiment?	/10
Does the research offer enough information to understand why the experimental results might occur?	/10

Has all copied information (text or pictures) been referenced or cited? Are they in the correct format?	/10
Are all key research components present? (Title page, intro, body, etc...)	/10
Are there at least 3 written sources listed (OTHER than Web pages)?	/10
Is there a variety of sources? (Books, magazines, scientific journals & articles, video clips, websites, etc)	/10
Are the resources relevant to the project topic? Do they cover the critical terms and concepts for the project?	/10
Is all necessary information included to properly identify the source? (author's name, title, date, publisher, etc.)	/10
Has the student used proper spelling, grammar, and punctuation?	/10
Score	/100

Variables, Hypothesis, Materials, Procedures	Points
Are the independent and dependent variables measurable?	/10
Can the student change the independent variable during the experiment?	/10
Has the dependent variable been identified and is it caused by the changes of the independent variable(s)?	/10
Can all controlled variables be held at a steady value during the experiment?	/10
Does the hypothesis include the independent and dependent variables? Has it been worded in such a way that it can be tested?	/10
Are all necessary materials listed in the Materials List with sufficient description?	/10
Is there a step-by-step list of all procedures?	/10
Is there sufficient explanation of how the independent variable will be changing?	/10
Is there sufficient explanation of how the dependent variable will be measured?	/10
Does the procedure detail the number of times the experiment will be repeated (trials) and are those trials sufficient to have reliable data?	/10
Score	/100

Data Tables, Graphs, Results, Conclusion	Points
Is there enough data to know whether the hypothesis is correct?	/10
Are all charts/tables labeled appropriately, identifying the data types collected and the units of measurement for each??	/10
Is the data plotted correctly and clearly on graphs, with the appropriate scale?	/10
Do all graphs have a title and does the title clearly describe what the data is about?	/10
Is the independent variable on the x-axis and the dependent variable on the y-axis?	/10
Does the student summarize the results and use it to support the findings?	/15
Does the student summarize and evaluate the experimental procedure, making comments about its success and effectiveness?	/15
Does the student suggest changes in the experimental procedure or possibilities for future studies?	/10
Has proper spelling, grammar, punctuation been used?	/10
	<p style="text-align: right;">Score /100</p>

Experimental Investigation Planning and Approval Sheet

Project Title: _____

Student Name: _____ **Date:** _____

1. Identify a testable question:

Problem: _____

____ Approved

2. Research the topic:

What have people learned about _____ **?**

____ Approved

Compose a 1-2 pages research paper stating what others have found and how this might lead to your hypothesis. It needs to be typed, using 12" Times New Roman or 11" Arial, and double spaced, following MLA format. Be sure to record where you got your information. (Add paper on the back of this page if extra space is needed as you do your research.)

My sources:

___ Approved

3. Write a hypothesis:

What I will do: (*If...*) _____

What I think will happen: (*then...*) _____

___ Approved

4. Design a Procedure:

What I will change (independent variable): _____

What I will keep the same (controlled variables): _____

What I will measure (dependent variable(s): _____

Steps in my procedure: _____

___ Approved

Final Approval to Begin Project:

Project Approved: _____
(Student Signature) (Date)

Project Approved: _____
(Parent Signature) (Date)

Notes from teacher/approver(s):

Science Fair Project Timeline (2011- 2012)

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