HARMONY SCHOOL OF EXCELLENCE - HOUSTON

4th and 5th Grade
SCIENCE FAIR HANDBOOK

2010-2011

Student Name _____

Parent's Name_____

I have read this booklet with my child and will consult it during the science fair process.

Parent's Signature_____Date_____

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

Science Fair Central

Parent Letter

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 **December 11th** and all students in grades **4th to 8th** will be participating. Hands-on scientific investigation is the focus at our fair. Over a **14 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 http://school.discoveryeducation.com/sciencefaircentral/Parent-Resources.html website for valuable information designed especially for parents like you.

Don't hesitate to call or email with any questions. Thank you very much in advance for your support!

Sincerely,

Virginia Arens

Harmony School of Excellence

Science Fair Coordinator

varens@harmonytx.org

Harmony School of Excellence

Science Fair Parent Orientation

Dear Parents and Students,

Each year we have a mandatory school-wide Science Fair at Harmony Schools. This year Science Fair will be held on Saturday, December 11th, 2010.

This week, your child will receive a science fair package. The package provides information regarding the requirements and guidelines that need to be followed.

All Harmony students are required to prepare a Science Fair Project. Students will possibly receive credit from their English Language, Computer, and Art teachers. Due to the high number of points possible for the project, students who do not complete a parts of the project will be affected severely for each grading period. We will try to work with each student individually, but the ultimate responsibility belongs to students.

Please check the deadlines of each step of the Science Fair Project Schedule carefully. Students are highly encouraged to submit their assignments before these deadlines. This way they will have a good chance to make improvements if something is missing or needs fine tuning. Informative Science Fair Meeting for Parents (Science Fair Orientation) is scheduled as following:

- For 4th and 5th grades parents: Wednesday, September 1st between 5:30pm and 6:30 pm.
- For 6th-8th grade parents: Thursday, September 2nd between 5:30 pm and 6:30 pm.

If you, or anyone you know, is interested in judging at the science fair please contact me via email at varens@harmonytx.org . We ask that you have a background in science in order to judge. I will take judges on a first come, first serve basis so please contact me as soon as you know that you would want to volunteer. You will receive a judging invitation when we put our lists together. Thank you for your support!

4th and 5th Grade Science Fair Schedule

August 27, 2010	Students will receive Science Fair Booklet and Parental Notification Form, and Calendar
September 1, 2010	Deadline to show science fair booklet signature for a grade and to attend **Parent Science Fair Orientation from 5:30-6:30pm**
September 8, 2010	Science Fair Topic Form Due. Students will choose 3 topics at home and email or bring form to the teacher.
September 22, 2010	Background Research and Bibliography Form is Due. Form will be given to students during class; they will need to do the Research at home prior to this date. This must be typed.
September 29, 2010	Hypothesis, Variables, Procedure and Materials List Due *Students will need to submit these typed.

Start experiment after receiving approval of your hypothesis and materials list.

November 3, 2010	Data Collection Due *Students will need to bring in all of their data from their experiment. They will be graphing it during class.
November 17, 2010	Research Paper Due *This needs to be typed and can be emailed to both the English and Science teacher.
December 1, 2010	Display Board is Due *The art teacher might take a grade on this.
December 1-8, 2010	Presenting Projects to Classmates
December 11, 2010	School Science Fair Grades 4-8

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 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 to 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.
Safety	Avoid harmful accidents by using safe practices. • 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

1. Uses numbers to describe the amount of something.
2. Involves tools such as rulers, timers, graduated cylinders, etc.
3. Uses standard metric units (For instance, meters and centimeters for length, grams for mass, and degrees Celsius for volume.
4. May involve the use of a scale such as in the example below.

Qualitative Data

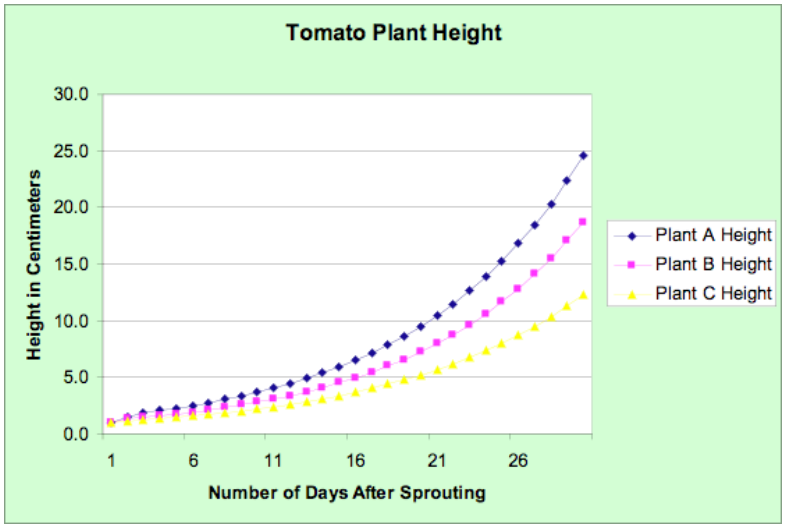
- Uses words to describe the data
- Describes physical properties such as how something looks, feels, smells, tastes, or sounds.

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

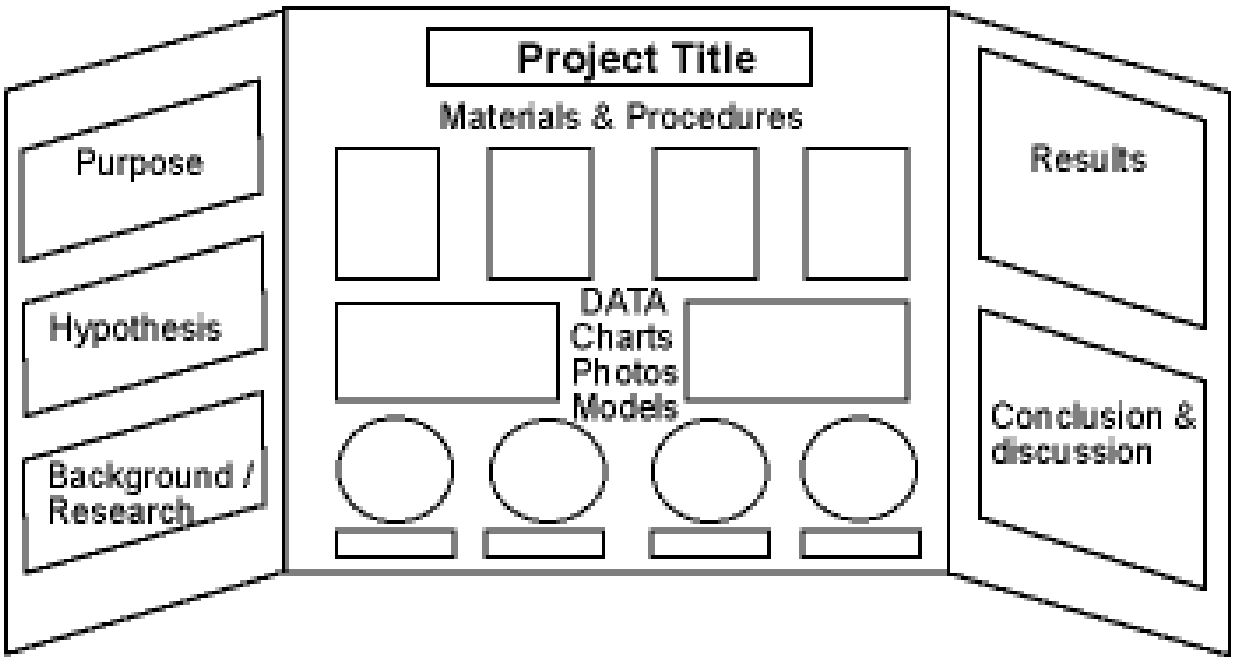
Whether they're the kind of person who loves to design and decorate and dabble with computer graphics, or the one who always opts for the standard black-and-white report cover, this is a time for students to get creative. The stakes are high here and they'll want their personality to shine through.

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.

Please refer to the following websites to see the layout of some display boards:

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

http://www.sciencebuddies.com/science-fair-projects/project_display_board.shtml



- 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.**