Pleasant Valley School
Science Fair 2007

Student / Parent Handbook

<u>Table Of Contents</u>

<u>Topic Categories</u>

Every fair has a list of categories, and you need to seek your teacher's advice when deciding in which category you should enter your project. It is important that you enter your project in the correct category. Since science fair judges are required to judge the content of each project based on the category in which it is entered, you would be seriously penalized if you were to enter your project in the wrong category. Listed here are common science fair categories with a brief description of each. Some topics can correctly be placed in more than one category. For example, the structure of plants could be in botany or anatomy. The categories are:

Astronomy:
The study of the solar system, stars, and the universe.

Biology:
The study of living things.

1. **Botany:** The study of plants and plant life. Subtopics may include the following:
   - **Anatomy:** The study of the structure of plants, such as cells and seed structure.
   - **Behaviourism:** The study of actions that alter the relationship between a plant and its environment.
   - **Physiology:** The study of life processes of plants, such as propagation, germination, and transportation of nutrients.

2. **Zoology:** The study of animals and animal life. Subtopics may include the following:
   - **Anatomy:** The study of the structure and use of animal body parts, including vision and hearing.
   - **Behaviourism:** The study of actions that alter the relationship between an animal and its environment.
   - **Physiology:** The study of life processes of animals, such as molting, metamorphosis, digestion, reproduction, and circulation.

3. **Ecology:** The study of the relationships of living things to other living things and to their environment.

4. **Microbiology:** The study of microscopic living things or parts of living things.

Earth science:
The study of the Earth.

1. **Geology:** The study of the Earth, including the composition of its layers, its crust, and its history. Subtopics may include the following:
   - **Fossils/Archaeology:** Remnants or traces of prehistoric life forms preserved in the Earth's crust.
   - **Mineralogy:** The study of the composition and formation of minerals.
   - **Rocks:** Solids made up of one or more minerals.

- **Seismology:** The study of earthquakes.
- **Volcanology:** The study of volcanoes.

2. **Meteorology:** The study of weather, climate, and the Earth's atmosphere.

3. **Oceanography:** The study of the oceans and marine organisms.

4. **Palaeontology:** The study of prehistoric life forms.

Engineering:
The application of scientific knowledge for practical purposes.

Physical science:
The study of matter and energy.

1. **Chemistry:** The study of the materials that substances are made of and how they change and combine.

2. **Physics:** The study of forms of energy and the laws of motion. Subtopics include studies in the following areas:
   - **Electricity:** The form of energy associated with the presence and movement of electric charges.
   - **Energy:** The capacity to do work.
   - **Gravity:** The force that pulls celestial bodies, such as planets and moons, toward each other; the force that pulls things on or near a celestial body toward its center.
   - **Magnetism:** The force of attraction or repulsion between magnetic poles, and the attraction that magnets have for magnetic materials.

Mathematics:
The use of numbers and symbols to study amounts and forms.

1. **Geometry:** The branch of mathematics that deal with points, lines, and planes and their relationships to one another.

Three Steps to a Topic

So you're entering the science fair, but you're not sure where to begin. The first step, coming up with your project idea, could be the most important. Just remember, you'll have a lot more fun (and probably learn more) if you start with a topic that interests you! Here are a few hints for coming up with a project idea:

1. Think of a topic you're interested in. For example:

- People
- Animals
- Plants
- Rocks
- Space
- Weather
- Electricity

2. Of course, you could develop a hundred projects on any one of those topics. Now try to focus on one aspect of one topic in particular. For example:

- People: What makes a person an adult?
- Animals: How can I best train my pet?
- Plants: How can plants best be protected from animals?
- Rocks: What do the different colors in rocks mean?
- Space: What is in the night sky?
- Weather: How does the weather change?
- Electricity: How does electricity work?

3. That's much better! Now use this same idea, but be more specific. What would you really like to figure out or show? Think of the most exact information you can discover and be very specific. In science, information has to be exact if it's really going to matter. For example:

- People: How do eighth graders compare with adults?
- Animals: Does the length of an animal training session make a difference?
- Plants: Can companion planting protect beans from beetles?
- Rocks: How do you detect minerals in rocks?
- Space: Create a personal sky chart of the night sky.
- Weather: Show how different instruments measure weather.
- Electricity: Can a worn-out battery do work?

That's a great list! Now you just have to choose one...

Project Ideas

Remember, your science fair project should start with a question. What topic interests you most? What have you always wondered about that topic? Once you've decided the question you want to answer, everything from the hypothesis to the procedure will flow from there.

Animals and Insects

- How does electricity affect fruit flies?
- How do different types of liquids affect fruit-fly growth?

Earth, Sun, and Stars

- What evidence can we find about the rotation of the earth from star trails?
- What is the size of the earth? (Eratosthenes method)
- How does the color of a background affect its absorption of solar insolation?

Food and Our Bodies

- Is there a relationship between eating breakfast and school performance?
- On which foods does fungus grow best?
- How does ethylene affect ripening fruit?

Oceans, Rivers, Streams

- Does the amount of water affect the size of the wave?
- Where is the current of a stream the fastest?
- Is there a relationship between phases of the moon and our weather?

Plants and Gardening

- What kind of soil is best for water retention?
- Will antacids help soil polluted by acid rain?
- Does human hair affect the growth of plants?
- How does a garden mist spray affect plant growth?
- How does the duration of insolation affect plant growth?
- What is the percentage of water in various fruits and vegetables?
- Which plants and vegetables make the best dye?
- Which type of wildflower grows best under artificial light?
- How does temperature affect the water uptake in celery plants?
- Does the type of water affect the growth of plants?
- Is soil necessary for plant growth? (hydroponics study)
- How does rotation affect plant growth?
- Does music affect plant growth?
- Does a plant grow best in sunlight or artificial light?
- Can plants deprived of sunlight recover?

- What is the relationship between root and stem growth?
- Which color of light causes green beans to grow best?
- Can potatoes be grown without soil?
- How do worms affect plant growth?
- What affect do Epsom salts have on plant growth?

Water Quality

- What is in our drinking water?
- Are our local waters acidic?
- Do our soils show the effects of acid rain?
- What is the lime content of various samples of water?

Weather

- How can we prevent the weathering of our sidewalks and driveways?
- How does topography affect weather conditions?
- Does the topography of an area affect its local weather?
- How do changes in air pressure affect the weather?
- How are all weather factors related?

Other

- Are safe homemade cleansers as effective as commercial cleansers?
- How does particle size affect settling rates?

<u>Scientific Method</u>

A science project is an investigation using the scientific method to discover the answer to a scientific problem. Before starting your project, you need to understand the scientific method. This section uses examples to illustrate and explain the basic steps of the scientific method. The scientific method is the "tool" that scientists use to find the answers to questions. It is the process of thinking through the possible solutions to a problem and testing each possibility to find the best solution. The scientific method involves the following steps: doing research, identifying the problem, stating a hypothesis, conducting project experimentation, and reaching a conclusion.

Research

Research is the process of collecting information from your own experiences, knowledgeable sources, and data from exploratory experiments. Your first research is used to select a project topic. This is called topic research. For example, you observe a black growth on bread slices and wonder how it got there. Because of this experience, you decide to learn more about mold growth. Your topic will be about fungal reproduction. (*Fungal* refers to plant-like organisms called fungi, which cannot make their own food, and *reproduction* is the making of a new offspring.) CAUTION: If you are allergic to mold, this is not a topic you would investigate. Choose a topic that is safe for you to do.

After you have selected a topic, you begin what is called project research. This is research to help you understand the topic, express a problem, propose a hypothesis, and design one or more project experiments—experiments designed to test the hypothesis. An example of project research would be to place a fresh loaf of white bread in a bread box and observe the bread over a period of time as an exploratory experiment. The result of this experiment and other research give you the needed information for the next step—identifying the problem.

Do use many references from printed sources—books, journals, magazines, and newspapers—as well as electronic sources—computer software and online services.

Do gather information from professionals—instructors, librarians, and scientists, such as physicians and veterinarians.

Do perform other exploratory experiment related to your topic.

Problem

The problem is the scientific question to be solved. It is best expressed as an "open-ended" question, which is a question that is answered with a statement, not just a yes or a no. For example, "How does light affect the reproduction of bread mold on white bread?"

Do limit your problem. Note that the previous question is about one life process of molds—reproduction; one type of mold—bread mold; one type of bread—white bread; and one factor that affects its growth—light. To find the answer to a question such as "How does light affect molds?" would require that you test different life processes and an extensive variety of molds.

Do choose a problem that can be solved experimentally. For example, the question "What is a mold?" can be answered by finding the definition of the word *mold* in the dictionary. But, "At room temperature, what is the growth rate of bread mold on white bread?" is a question that can be answered by experimentation.

Hypothesis

A hypothesis is an idea about the solution to a problem, based on knowledge and research. While the hypothesis is a single statement, it is the key to a successful project. All of your project research is done with the goal of expressing a problem, proposing an answer to it (the hypothesis), and designing project experimentation. Then all of your project experimenting will be performed to test the hypothesis. The hypothesis should make a claim about how two factors relate. For example, in the following sample hypothesis, the two relating factors are light and bread mold growth. Here is one example of a hypothesis for the earlier problem question:

"I believe that bread mold does not need light for reproduction on white bread. I base my hypothesis on these facts:

- Organisms with chlorophyll need light to survive. Molds do not have chlorophyll.
- In my exploratory experiment, bread mold grew on white bread kept in a dark bread box."

Do state facts from past experiences or observations on which you base your hypothesis.

Do write down your hypothesis before beginning the project experimentation.

Don't change your hypothesis even if experimentation does not support it. If time permits, repeat or redesign the experiment to confirm your results.

Project Experimentation

Project experimentation is the process of testing a hypothesis. The things that have an effect on the experiment are called variables. There are three kinds of variables that you need to identify in your experiments: independent, dependent, and controlled.

The **independent variable** is the variable you purposely manipulate (change). The **dependent variable** is the variable that is being observed, which changes in response to the independent variable. The variables that are not changed are called **controlled variables**.

The problem in this section concerns the effect of light on the reproduction of bread mold. The independent variable for the experiment is light and the dependent variable is bread mold reproduction. A control is a test in which the independent variable is kept constant in order to measure changes in the dependent variable. In a control, all variables are identical to the experimental setup—your original setup—except for the independent variable. Factors that are identical in both the experimental setup and the control setup are the controlled variables. For example, prepare the experiment by placing three or four loaves of white bread in cardboard boxes the size of a bread box, one loaf per box. Close the boxes so that they receive no light. If, at the end of a set time period, the mold grows, you might decide that no light was needed for mold reproduction. But, before making this decision, you must determine experimentally if the mold would grow with light. Thus, control groups must be set up of bread that receives light throughout the testing period. Do this by placing an equal number of loaves in comparable-size boxes, but leave them open.

The other variables for the experimental and control setup, such as the environmental conditions for the room where the boxes are placed—temperature and humidity—and the brand of the breads used must be kept the same. These are controlled variables. Note that when designing the procedure of your project experiment, you must include steps for measuring the results. For example, to measure the amount of mold growth, you might draw 1/2-inch (1-cm) squares on a transparent sheet of plastic. This could be placed over the bread, and the number of squares with mold growth could be counted. Also, as it is best to perform the experiment more than once, it is also good to have more than one control. You might have one control for every experimental setup.

Do have only one independent variable during an experiment.

Do repeat the experiment more than once to verify your results.

Do have a control.

Do have more than one control, with each being identical.

Do organize.

Project Conclusion

The project conclusion is a summary of the results of the project experimentation and a statement of how the results relate to the hypothesis. Reasons for experimental results that are contrary to the hypothesis are included. If applicable, the conclusion can end by giving ideas for further testing.

If your results do not support your hypothesis:

DON'T change your hypothesis.

DON'T leave out experimental results that do not support your hypothesis.

DO give possible reasons for the difference between your hypothesis and the experimental results.

DO give ways that you can experiment further to find a solution.

If your results support your hypothesis:

You might say, for example, "As stated in my hypothesis, I believe that light is not necessary during the germination of bean seeds. My experimentation supports the idea that bean seeds will germinate without light. After seven days, the seeds tested were seen growing in full light and in no light. It is possible that some light reached the 'no light' containers that were placed in a dark closet. If I were to improve on this experiment, I would place the 'no light' containers in a light-proof box and/or wrap them in light-proof material, such as aluminum foil."

Project Report

Your report is the written record of your entire project from start to finish. When read by a person unfamiliar with your project, the report should be clear and detailed enough for the reader to know exactly what you did, why you did it, what the results were, whether or not the experimental evidence supported your hypothesis, and where you got your research information. This written document is your spokesperson when you are not present to explain your project, but more than that, it documents all your work.

Much of the report will be copied from your journal. By recording everything in your journal as the project progresses, all you need to do in preparing the report is to organize and neatly copy the journal's contents. Neatly and colourfully prepare tables, graphs, and diagrams. If possible, use a computer to prepare some or all of these data displays.

Check with your teacher for the order and content of the report as regulated by the local fair. Generally, a project report should be typewritten, double-spaced, and bound in a folder or notebook. It should contain a title page, a table of contents, an abstract, an introduction, one or more experiments and data, a conclusion, a list of sources, and acknowledgments. The rest of this section describes these parts of a project report.

Title Page

The content of the title page varies. Some fairs require that only the title of the project be centered on the page. Normally your name would not appear on this page during judging. Your teacher can give you the local fair's rules for this. The title should be attention-getting. It should capture the theme of the project but should not be the same as the problem question.

Table of Contents

The second page of your report is the table of contents. It should contain a list of everything in the report that follows the contents page, as shown in Figure 1

Contents

1. Abstract
2. Introduction
3. Experiment(s)
4. Data
5. Conclusion
6. Sources
7. Acknowledgments

Figure 1: A Table of Contents

Abstract

The abstract is a brief overview of the project. It should not be more than one page and should include the project title, a statement of the purpose, a hypothesis, a brief description of the procedure, and the results. There is no one way to write an abstract, but it should be brief, as shown in Figure 2. Often, a copy of the abstract must be submitted to the science fair officials on the day of judging, and it is a good idea to have copies available at your display. This gives judges something to refer to when making final decisions. It might also be used to prepare an introduction by a special award sponsor, so do a thorough job on this part of your report.

> **Abstract**
> **Up and Down:**
> **Seasonal Temperature versus Sun Ray Angle**
>
> The purpose of this project was to find out whether the angle of the Sun's rays at noon affects seasonal temperatures. The experiments involved measuring the air temperature and the angle of the Sun's rays at noon during different seasons. This was done by recording air temperature and measuring the angle of shadows
> at noon on the first day of the month from October through April.
>
> The measurements confirmed my hypothesis that as the angle of the Sun's rays decreases during the year, the outdoor temperature increases. These findings led me to believe that seasonal temperatures are the result of the difference in the angle of the Sun's rays. As the ray angle decreases, sunlight is more concentrated on an area, resulting in a higher temperature.
>
> I discovered that during seasons with high temperatures, the angle of the Sun's rays is lower than during seasons with low temperatures.

Figure 2: An Abstract

Introduction

The introduction is a statement of your purpose, along with background information that led you to make this study. It should contain a brief statement of your hypothesis based on your research. In other words, it should state what information or knowledge you had that led you to hypothesize the answer to the project's problem question. Make references to information or experiences that led you to choose the project's purpose. If your teacher requires footnotes, then include one for each information source you have used. The introduction shown in Figure 3 does not use footnotes.

Introduction

The air temperature generally changes quite a bit during the day, but any change from one day to the next at the same time of day is, as a rule, relatively small. But the temperature of some regions changes significantly over the course of a year, resulting in different seasons.

While reading about my project topic, the effect of the angle of the Sun's rays at noon on seasonal temperatures, I thought about my own experience of the Sun's high noon altitude and small shadow angles occurring at the same time as high summer temperatures. Further research provided the facts that as the angle of the Sun's rays decreases, the more concentrated the rays, thus the hotter the area of Earth receiving them. I reasoned that the angle of the Sun's rays at noon must change during the year.

My curiosity about the relation of angle of the Sun's rays to temperature resulted in a project that has as its purpose to discover how the angle of the Sun's rays affects air temperature during the year and thus causes seasons. Based on previous stated research and the fact that it is cooler in the morning when the angle of the Sun's rays is least due to the Sun's low altitude, my hypothesis was that as the angle of the Sun's rays increases during the year, the outdoor temperature increases, causing seasons.

Figure 3: Introduction

Experiment and Data

List each project experiment in the experiment section of the report. Experiments should include the problem of the experiment, followed first by a list of the materials used and the amount of each, then by the procedural steps in outline or paragraph form, as shown in Figure 4. Note that the experiment described in Figure 4 determines the average monthly angle of the sun's noon rays during seven consecutive months. A second experiment is needed to measure the average temperature of each month. Write the experiments so that anyone could follow them and expect to get the same results.

Following each experiment, include all the measurements you took and all the observations you made during each experiment. Graphs, tables, and charts created from your data should be labelled and, if possible, colourful. Figure 5 shows a table and Figure 6 a bar graph for the experiment shown in Figure 4. If there is a large amount of data, you may choose to put most of it in an appendix, which can be placed in a separate binder or notebook. If you do separate the material, place a summary of the data in the data section of the report.

Experiment

Purpose

To determine the angle of the Sun's rays at noon (standard time) during different seasons.

Materials

yardstick (meterstick)

cup with pencil and string prepared in the Sample Experiment

protractor

Procedure

1. At around 11:45 A.M., set the measuring stick on a flat surface in a sunny area outdoors with its pointer end facing the horizon directly below the Sun.
2. Set the cup in the middle of the stick. Move the pointer end of the stick so that the shadow cast by the pencil falls on the stick.
3. At 12:00 P.M. (noon), move the cup back and forth along the stick until the end of the shadow touches the measuring line. *NOTE: If the shadow is longer than the measuring stick, place two measuring sticks end to end.*
4. Hold the cup in place and extend the string from the top of the pencil to the measuring line. Ask a helper to use the protractor to measure the angle between the pencil and string.
5. Repeat steps 1 through 3 one or more times each week during 6 or more consecutive months.
6. Average the angles measured for each month.

Figure 4: An Experiment

SUN RAY ANGLES AT NOON

Month	Average Monthly Angle (degrees, □)
October	40
November	31
December	24
January	31
February	40
March	48
April	56

Figure 5: A Table

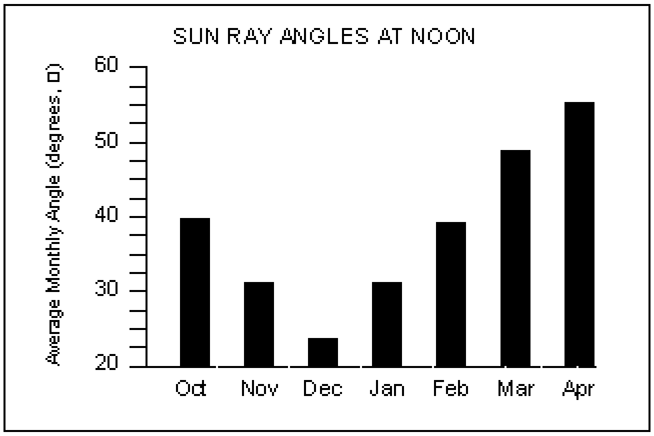

Figure 6: Example of a Bar Graph

Conclusion

The conclusion summarizes, in about one page or less, what you discovered based on your experimental results, as shown in Figure 7. The conclusion states the hypothesis and indicates whether the data supports it. The conclusion can also include a brief description of plans for exploring ideas for future experiments.

Conclusion

As stated in my hypothesis, I believe that the size of Sun ray angles at noon cause seasonal temperatures, small angles causing warm temperatures and large angles causing cold temperatures. The experimental data supported my hypothesis, indicating a direct relation between the angle of the Sun's rays and the air temperature. This direct relation between the ray angles and the temperatures was found to apply over different seasons. The smaller the ray angle, the warmer the season, and the greater the angle, the cooler the season. Experimental data also showed an inverse relation between the Sun's noon altitude and the angle of the Sun's rays; thus, as the altitude of the Sun increases, its ray angle decreases. The experiments confirmed that more direct Sun rays (those with the least angle) heat the earth more.

Through my research as well as experience, I discovered that the length of each day is not exactly the same. Ideas for a future experiment would be to determine the effect of day length on the average daily temperature.

Figure 7: A Project Conclusion

Sources

Sources are the places where you obtained information, including all of the written materials as well as the people you have interviewed.

For the written materials, write a bibliography. List people that you interviewed, separately, in alphabetical order by last name. Provide their titles and with permission give their business addresses and telephone numbers, as shown in Figure 8. Do not list home addresses or home telephone numbers.

Source Interviewed

Lynn, Jennifer
Astronomer
100 Rainy Drive
San Francisco, California 00001
(001)222-0000

Figure 8: An Interview Source

Acknowledgments

Even though technically your project is to be your work alone, it is permissible to have some help. The acknowledgments is not a list of names, but a short paragraph stating the names of people who helped you and how, as shown in Figure 9.

Note that when listing family members or relatives, it is generally not necessary to include their names.

Acknowledgments

I would like to thank the members of my family who assisted me with this project; my mother, who proof-read and typed my report, and my father and sister, who assisted in the construction of the display board.

A special note of thanks to Dr. Lauren Russell, professor of astronomy at Lacey University, and to Davin Wade, her assistant, for their expert guidance.

Figure 9: Acknowledgments

The Display

Your science fair display represents all the work that you have done. It should consist of a backboard, the project report, and anything that represents your project, such as models made, items studied, photographs, surveys, and the like. It must tell the story of the project in such a way that it attracts and holds the interest of the viewer. It has to be thorough, but not too crowded, so keep it simple.

The maximum allowable size and shape of the display backboard is 48 inches (122 cm) wide, 30 inches (76 cm) deep, and 108 inches (274 cm) high (including the tables they stand on). These are maximum measurements, so your display may be smaller than this. A three-sided backboard is usually the best way to display your work. Sturdy cardboard or other heavy material is easier to work with and is less likely to be damaged during transportation to the fair. Wooden panels can be cut and hinged together. Some office supply stores sell inexpensive premade backboards. If these are not available in your area, you can order inexpensive premade backboards from science supply companies. Purchased backboards generally come in two colors, black and white. You can use a different color by covering the backboard with self-stick, coloured shelving paper or cloth. For items placed on the backboard, select colors that stand out but don't distract the viewer from the material being presented. For example, if everything is in fluorescent colours, the bright colours, instead of your work, will be what catches the eye.

The title and other headings should be neat and large enough to be read at a distance of about 3 feet (1 m). A short title is often eye-catching. You can purchase, at office supply stores, self-sticking letters of various sizes and colors for the title and headings and stick them to the backboard. You can cut your own letters out of construction paper or stencil the letters for all the headings directly onto the backboard. You can also use a word processor to print the title and other headings.

Some teachers have set rules about the position of the information on the backboard. The following headings are examples: Problem, Hypothesis, Experiment (materials and procedure), Data, Results, Conclusion, and Next Time. The project title should go at the top of the center panel, and the remaining material needs to be placed neatly in some order. Figure 10 shows one way of placing the material. The heading "Next Time," though not always required, may be included if desired. It would follow the conclusion and contain a brief description of plans for future development of the project. You could include this information in the conclusion rather than under a separate heading.

You want a display that the judges will remember positively. So before you glue everything down, lay the board on a flat surface and arrange the materials a few different ways. This will help you decide on the most suitable and attractive presentation. Figure 1 shows what a good display might look like.

Figure 10: Example of a Good Display

Project Display Checklist

You should start planning your display as soon as you begin your project. Some of the items that should be on display are:

1. Pictures taken during the experiment
2. Data notebook or background research notebook
3. Any equipment or material used in the experiment (that is not excluded by rules)
4. Abstract
5. Title (as a header at the top of the display board)
6. Hypothesis
7. Procedure
8. Results
9. Conclusions
10. Applications
11. Charts, graphs, tables, or other visual aids
12. Statistics, where appropriate

Other Display Tips

- Arrange your table to fit the space available.
- Allow plenty of space between the rows so students, parents, and judges can pass through easily.
- Cover your tables with thin vinyl or butcher paper in school colours.
- You are an important part of the display, too. You are representing your school to the public and should be dressed appropriately, should not chew gum or listen to music, and should respect other students and judges. Also, be sure you are prepared to describe your project to a judge in a clear, succinct presentation.

Display Do's and Don'ts

Do use computer-generated graphs.

Do display photos representing the procedure and the results.

Do use contrasting colors.

Do limit the number of colors used.

Do display models when applicable. If possible, make the models match the color scheme of the backboard.

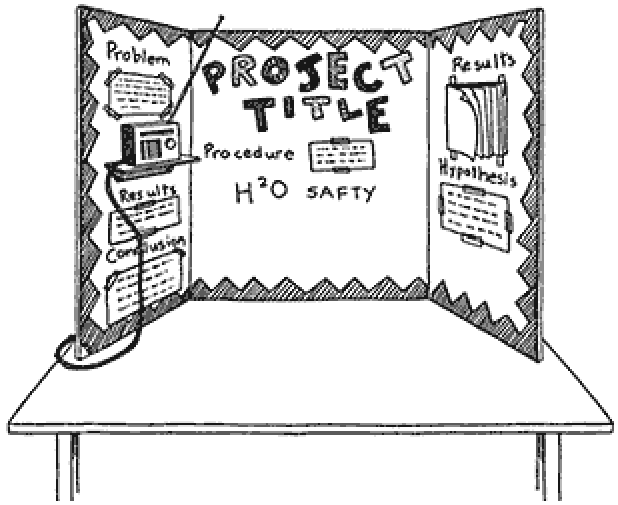

Figure 2: Example of a Bad Display

Do attach charts neatly. If there are many, place them on top of each other so that the top chart can be lifted to reveal the ones below.

Do balance the arrangement of materials on the backboard. This means evenly distributing the materials on the board so that they cover about the same amount of space on each panel.

Do use rubber cement or double-sided tape to attach papers. White school glue causes the paper to wrinkle.

Don't leave large empty spaces on the backboard.

Don't leave the table in front of the backboard empty. Display your models (if any), report, copies of your abstract, and your journal here.

Don't hang electrical equipment on the backboard so that the electric cord runs down the front of the backboard.

Don't make the title or headings hard to read by using uneven lettering, words with letters of different colors, or disorganized placement of materials.

Don't hand-print the letters on the backboard.

Don't attach folders that fall open on the backboard.

Don't make mistakes in spelling words or writing formulas.

Presentation and Evaluation

Your teacher may require that you give an oral presentation of your project for your class. Make it short but complete. Presenting in front of your classmates may be the hardest part of the project. You want to do your best, so prepare and practice, practice, practice. If possible, tape your practice presentation on a tape recorder or have someone videotape you. Review the tape or video and evaluate yourself. Review your notes and practice again.

Practicing an oral presentation will also be helpful for the science fair itself. The judges give points for how clearly you are able to discuss the project and explain its purpose, procedure, results, and conclusion. The display should be organized so that it explains everything, but your ability to discuss your project and answer the questions of the judges convinces them that you did the work and understand what you have done. Practice a speech in front of friends, and invite them to ask questions. If you do not know the answer to a question, never guess or make up an answer or just say "I don't know." Instead, say that you did not discover that answer during your research, and then offer other information that you found of interest about the project. Be proud of the project, and approach the judges with enthusiasm about your work.

You can decide on how best to dress for a class presentation, but for the local fair, it is wise to make a special effort to look nice. You are representing your work. In effect, you are acting as a salesperson for your project, and you want to present the very best image possible. Your appearance shows how much pride you have in yourself, and that is the first step in introducing your product, your science project.

Judging Information

Most fairs have similar point systems for judging a science fair project, but you may be better prepared by understanding that judges generally start by thinking that each student's project is average. Then, he or she adds or subtracts points from that. You should receive more points for accomplishing the following:

1. Project Objectives
    - Presenting original ideas
    - Stating the problem clearly
    - Defining the variables and using controls
    - Relating background reading to the problem
2. Project Skills
    - Being knowledgeable about equipment used
    - Performing the experiments with little or no assistance except as required for safety
    - Demonstrating the skills required to do all the work necessary to obtain the data reported
3. Data Collection
    - Using a journal to collect data and research
    - Repeating the experiment to verify the results

- Spending an appropriate amount of time to complete the project
- Having measurable results

4. Data Interpretation
    - Using tables, graphs, and illustrations in interpreting data
    - Using research to interpret data collected
    - Collecting enough data to make a conclusion
    - Using only data collected to make a conclusion
5. Project Presentation (Written Materials, Interviews, Displays)
    - Having a complete and comprehensive report
    - Answering questions accurately
    - Using the display during oral presentation
    - Justifying conclusions on the basis of experimental data
    - Summarizing what was learned
    - Presenting a display that shows creative ability and originality
    - Presenting an attractive and interesting display

Do's and Don'ts at the Fair

Do bring activities, such as puzzles to work on or a book to read, to keep yourself occupied at your booth. There may be a lengthy wait before the first judge arrives, and even between judges.

Do become acquainted with your neighboring presenters. Be friendly and courteous.

Do ask neighboring presenters about their projects, and tell them about yours if they express interest. These conversations pass time and help relieve nervous tension that can build when you are waiting to be evaluated. You may also discover techniques for research that you can use for next year's project.

Do have fun.

Don't laugh or talk loud. This may affect the person nearby who is being judged.

Don't forget that you are an ambassador for your school. This means that your attitude and behavior influence how people at the fair think about you and the other students at your school.

Parent Information

Helping Your Young Scientists

Your child will be participating in a science fair — an opportunity to explore the mysteries of the world around us. As a parent, your involvement and support could mean the difference between a stressful experience and an exciting learning adventure. Remember that the most important outcome of your child's science project is the joy and learning that comes from scientific discovery — not winning a competition!

A good place to begin is the student section of this handbook, which provides a wealth of tips and rules for science fairs. Below we've suggested specific sections within the Handbook that may be most helpful to parents.

How do we come up with a project idea?
If your child has entered the science fair, the first question is likely: "What will my project be?" A good starting point is the Three Steps to a Project section. This section encourages students to start with a topic that interests them, then narrow down their topic to a specific question.

They should also visit the Great Project Ideas section, where they'll find a wealth of questions that can be turned into science fair projects.

How much time will we need?
A science fair project may seem like an overwhelming undertaking. The Science Fair is scheduled for 25-27 April 2007. Establishing a schedule for the next 4 weeks will help your child think through the various stages of the process and set reasonable deadlines.

How do we start the project?
Begin by reviewing the section on the Scientific Method. Every science fair project should follow the Scientific Method, which includes: Research, Problem, Hypothesis, Experiment, and Conclusion.

For specific resource suggestions, see:

http://school.discovery.com/sciencefaircentral/scifairstudio/links.html

Here they'll find a wealth of publications and Web sites on topics from space to physics.

What should the final project look like?
The final project is the culmination of all your child's work-and they'll want to create something they're proud to show. The Project Report section provides a clear outline and suggestions for the science fair written report. You can also find helpful hints, do's and don'ts and safety tips for the

display.

What else can I do to help?

Your support and encouragement will be your most important contribution to your child's science fair effort. Of course, your supervision with regard to safety will be vital, especially with projects involving electricity, poisons, dangerous chemicals, or fire. Your child will also need your help with transporting the project to the fair, although it's best if students can set up and take down their exhibits with minimal assistance.

Your child may also welcome your assistance with the following:

- Suggesting project ideas (these may be related to your work).
- Transportation to libraries, museums, nature centers, universities or other sources of project information.
- Technical work, such as construction or photography.
- Help with project expenses.

Guide your child whenever and wherever you can, but **let the final project reflect your child's individual effort and design**. Do not worry about the project's performance at the science fair, since the real measure of success is how much an individual student accomplishes and learns. And remember, above all: have fun!