Barnett Science Fair
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Participating in a School Science Fair

by Barry Van Deman

Science Fair Success

Science fairs can be rewarding or frustrating for teachers, parents, and students. The key to success is deciding on the desired outcomes and planning accordingly. When a science fair turns out badly, it is usually because there is confusion about expectations for student projects. The result is a hodgepodge of projects—everything from volcano models and posters of dolphins to demonstrations and experiments. Judging these disparate projects often results in confused judges, disappointed students, and disgruntled parents.

First Step — Project Categories

The first step for science fair success is to decide the outcome you expect for students and what kinds of projects will lead them there. Projects usually fall into one of the following four categories:

Poster Displays

Students draw or cut and paste picture on posters. They select a topic, such as dolphins, dogs, or space, and read about it so that they are able to explain to others what they have learned. An outcome for students is that they learn about a science topic.

Models

Students make models of, for example, a volcano, the solar system, or a bridge. They might make poster displays to accompany their models, and they might demonstrate how the models work. Outcomes for students include learning about a science topic and gaining skill in constructing models.

Demonstrations

Students perform a science demonstration, such as mixing baking soda and vinegar to demonstrate a chemical reaction. They might make poster displays to illustrate the demonstrations. Outcomes for students include learning about a science topic and gaining practice in using science inquiry skills.

Experiments

Students conduct a controlled experiment, such as testing the effects of plant food on potted plants. They usually make poster displays to show the stages of their experiments. Since experiments involve using many science inquiry skills, an outcome for students is that they grow in their understanding of scientific methods.

One way to eliminate confusion for all is to limit students to only one category of projects. If projects are to be judged, judging criteria should align with the project category. That is, criteria for projects that involve models should differ from criteria used to judge experiments.

While projects in any of the categories provide valuable experiences for students, projects that involve experiments help them understand scientific methods and develop multiple inquiry skills. In the pages that follow, this guide will focus on experimental projects.

Second Step — Communication

The second step to science fair success is to communicate your expectations to students and to their parents or guardians. A letter you can send to parents at the start of the project is included in the following pages. It will help parents to know how to guide their children without doing the projects for them. Be sure to keep parents informed as preparations for the science fair continues.

Science Fair Project Ideas

Working on science fair projects can help your students gain experience in applying the scientific methods and science inquiry skills learned through their interactions with *Science by Harcourt School Publishers.*

For additional ideas for Science Fair Projects see pages in the back of the *Lab Manual.*

Science Fair Project Time Line

Date of the Science Fair ________________________________

Date Due	Date Completed	Things to Do
		Choose a topic and write a project question.
		Research the topic by using books, the Internet, and other resources.
		Write a hypothesis.
		Design an experiment to test the hypothesis.
		Conduct the experiment and record observations.
		Make a table, or chart, for data. Draw one or more graphs of the data.
		Write the project report.
		Make the project display, or exhibit.
		Present the project at the science fair.
		Other:

Science Fair: School-Home Connection

Dear Parent or Guardian,

We will be holding our school science fair on __________. Participating in a science fair is an enjoyable way for students to learn how to conduct experiments to solve problems. Students will make displays that show how they went about conducting their experiments.

This science fair is not quite like the science fairs you may have experienced. While models and modeling are important to science, we are not encouraging students to display models of such things as volcanoes and the solar system. Instead, we are encouraging them to ask questions and then to set up experiments to answer those questions. In this way, they learn to approach science as scientists do.

I will be sending home more information from time to time, but in the meantime, I would like to suggest how you might support your child's progress on his or her project.

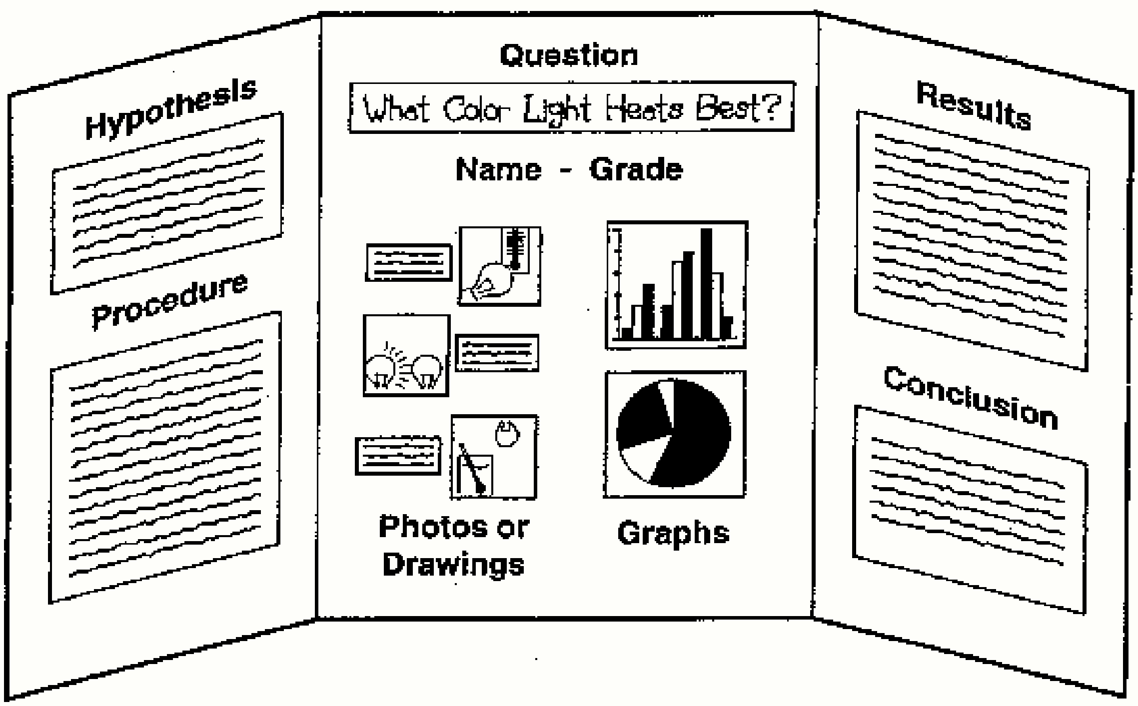
- Talk to your son or daughter about what he or she might be interested in finding out. Work together to formulate a question that can be answered by setting up an experiment.
- Take your son or daughter to the library or help him or her search online for information about the topic.
- Help your son or daughter think about an experiment that would help answer the project question.
- Help gather the materials necessary to conduct the experiment. Observe and ask questions as your son or daughter carries out the experiment, but be careful not to conduct the experiment or draw conclusions.
- Help with gathering materials for the project display. Allow your son or daughter to make the display with only some help from you.

Obviously, we want the projects to be done by the students and not by their parents, but this can be a good time for a parent and child to work together. If you have any questions, please contact me.

Sincerely,

Making Your Project Display

Your project display will communicate to others what your project was all about. The display should be three-sided and have a brief description of the various parts of your investigation. You can make your display from poster board, or use a ready-made project display board. The pages that follow offer you an outline for a summary for your project display and a guide to writing a longer project report. Adapt your display to make it the best for your own project.



Name ______________________ Date ____________

Display Summary

Project Question/Title

____

____

Project Description

Briefly Tell What You Did and What Happened

____

____

____

____

Materials

______________________ ______________________

______________________ ______________________

______________________ ______________________

______________________ ______________________

______________________ ______________________

______________________ ______________________

Procedure

____

____

____

____

Continue your procedure on additional sheets of paper, if necessary.

Name ______________________ Date ______________

Observations

Include a brief written summary of observations. You will want to make large, colorful displays of graphs of any data you collected.

Conclusions

Suggestions for Follow-Up Experiments

Writing Your Science Fair Project Report

Your project report communicates to others how you did your experiment and what you found out from it. This is where you use your notes and observations from your experiment.

An Outline for Your Project Report

1. **Cover Page** In the upper middle of the page, write the title of your project or your project question. Also include your name on the cover page.
2. **Project Question** Begin your report by stating your project question.
3. **Hypothesis** State your hypothesis.
4. **Research** Write about what you found out from books, the Web, and other resources that helped you design an experiment and answer your project question.
5. **Experiment Plan** Describe the design for your experiment. Be sure to describe the variables and how you set up a fair test.
6. **Procedure** Describe how you carried out your experiment and what you found out.
7. **Present Data** Include your data tables and graphs.
8. **Conclusions** Compare your results to your hypothesis. Did your findings support your hypothesis or not?
9. **Bibliography** Write your bibliography. A bibliography includes the names of books, magazines, websites, and other resources you used for your project.

DEMONSTRATIONS

How heat is transmitted
An energy-efficient home
What makes a hot air balloon rise?
Expansion of solids, liquids& gases when heated
How a thermostat works
How a toaster works
The steam engine
The periscope
Kaleidoscopes
How binoculars work
How a microscope works
How a telescope works
What makes rainbows?
Different types of mirrors
Lenses and what they do
How a camera works
How Polaroid glasses work
What causes light to bend?
How photocells work
How a prism works
The pinhole camera
The Doppler effect
What causes echoes
How a record player works
How an electric motor works
How a generator works
Batteries, how they work
The telegraph
What is a transformer?
What is a transistor?
Electronic components and their functions
Hydroelectric power
The series circuit and the parallel circuit
How airplanes fly
How a wing works
Hero's engine
How rockets fly
Looping rollercoasters –How they work
How a canal lock works
Primitive clocks
Distillation
Solar still
Water filtration
pH and how to measure it Acids, bases and pH
How elements combine to make compounds
Capillary action
Radioactive and Geiger counters
The sextant
What is density?
What is surface tension?
Weather forecasting
How a barometer works
Cloud chamber
Effects of air pressure
Fermentation
Osmosis
Phases of the moon
Eclipses
How a geyser works
Harvesting the wind with windmills
How clouds form
Different types of earthquake faults
Sedimentation
How a sundial works
How does the human heart work?
The circulatory system
The ear
Tooth decay
Why a fish has fins
Bird wings, how they work
Photosynthesis
Hydroponics
The action of yeast in bread
How yogurt is made
How cheese is made
Paper recycling
Aluminum recycling
Glass recycling
Oil wells-how they work
The submarine

Nebo School District Science Fair
Judging

Name of Student(s), Project, Grade

Station #

(Name and Project Sticker Here)

	Possible Points	Judge's Score
Part I: Journal (science log)		
*The student has kept records of the project including what was done and the dates of when it was done. Includes evidence of background research and references. *If this was done as team, responsibilities are outlined and divided equally.	10	______
Part II. Display:		
*Neat, and edited and shows creativity.	10	______
*Each step of the scientific process is described.	10	______
*Organized and easy to follow.	10	______
Part III. Creativity: Creativity and originality were shown in each of the following areas...		
* Creative research topic or area.	10	______
*Graph or data is easy to understand and appropriate.	10	______
Part IV. Skill:		
*Project is up to this grade level.	10	______
*Demonstrate knowledge and skill of subject.	10	______
*Applied useful and appropriate testing methods.	10	______
Part V. The Interview:		
*Clearly describes what was done.	10	______
*Demonstrates knowledge of the subject. **If team project, all participants demonstrate knowledge of subject**	10	______

****

10-Outstanding work **5-Average for projects at this science fair** **0-Requirement not attempted**

Rate this project on a scale of 1-10, 5 being the average project at this show.	10	______
Grand Total	**120**	______

Judge's Name______________________________ **Judge's Number**

(Display Do's and Don'ts)

*Must have display which includes:

A. Title or description of project.
B. Hypothesis.
C. Description of procedures.
D. Results of what happened **(include graph).**
E. Conclusions.
F. Application: How this information useful to you or others.
G. Journal (including background research, pictures, data table and hours spent.)

*Display cannot exceed:

108 inches high
48 inches wide
30 inches deep
(Cardboard tri-fold display boards make excellent displays.)

*Display cannot contain:

Plant or animal matter (plant matter may be dried and sealed in acrylic).
Microbes.
Food (human or animal).
Soil or waste.
Poisons.
Drugs.
Water or chemicals.
Highly flammable materials.
Sharp or dangerous material.

Copyrighted material or information copied from the internet.

(If you feel you need any of these items consider taking pictures of them and include the pictures on your display)

*Human or animal subjects require prior approval.
*No pictures of people or animals in inhumane conditions.
*Pictures of people require written approval, yourself and immediate family are the exception.

SCIENCE FAIR PROJECT RULES

My Experiment will Involve the Following (check all that apply):

☐ Human Subjects

All human research projects must be **reviewed and approved** by a science teacher, a school administrator and one of the following: a psychologist, psychiatrist, medical doctor, physician's assistant or registered nurse **before the student begins experimentation.** If they determine that there is more than minimal psychological or physical risk to the human subjects involved in the project, the student must receive written consent from each of the participants and written parental consent for students under 18 years old. If they determine that there are unacceptable risks involved the student must revise his or her project. Please attach a copy of the surveys or tests you intend to use with your research plan. Students may not publish or display information that identifies the human subjects.

☐ Non-Human Vertebrate Animals

All projects involving non-human vertebrate animals must be **reviewed and approved** by two science teachers and a biomedical scientist (ex. a local veterinarian) **before the student begins experimentation.** Alternatives to the use of vertebrate animals must be explored and included in the student's research plan. Experiments involving laboratory animals (rats, mice, hamsters, gerbils, rabbits, etc) cannot be conducted in a student's home except for behavior studies on pets. Proper animal care must be provided daily, including weekends, holidays and vacations. Experimental procedures that cause unnecessary pain or discomfort are prohibited. Experiments designed to kill vertebrate animals are not permitted. Students may not perform euthanasia, except in emergency situations. Alcohol, acid rain, insecticide, herbicide and heavy metal toxicity studies are prohibited. Experiments with a death rate of 30 percent or higher are not permitted. Behavioral studies or supplemental nutritional studies involving pets or livestock may be done at home.

☐ Controlled Substances (Prescription Drugs, Tobacco, Alcohol, etc)

All projects involving controlled substances must be **reviewed and approved** by two science teachers and a school administrator or biomedical scientist **before the student begins experimentation**. Students must adhere to all federal, state and local laws when acquiring and handling controlled substances. Only under the direction of a qualified scientist or designated supervisor may a student use federally controlled or experimental substances for therapy or experimentation. Students under 21 may not handle or purchase smokeless powder or black powder for science projects.

☐ Hazardous Substances or Devices (Chemicals, Firearms, Welders, Lasers, Radioactive Substances, Radiation)

Students must adhere to federal and state regulations governing hazardous substances or devices. An adult must directly supervise experiments. Students working with hazardous substances or devices must follow proper safety procedures for each chemical or device used in the research.

☐ Potentially Hazardous Biological Agents

(Bacteria, Mold, Fungi, Viruses, Parasites, Recombinant DNA (rDNA), Human or Animal fresh tissues, blood or body fluids, etc)
All projects involving potentially hazardous biological agents must be **reviewed and approved** by two science teachers and a biomedical scientist **before the student begins experimentation.** It is the responsibility of the student and the adults involved with the project to conduct a risk assessment. Risk assessment defines the potential level of harm, injury or disease to plants, animals and humans that may occur when working with biological agents. Risk assessment involves:

1. Assignment of the biological agent to a biosafety level risk group. **Students in grades 5-8 may only conduct research with biological agents determined to be at Biosafety Level 1 (BSL-1).** BSL-1 agents pose low risk to students or the environment and are highly unlikely to cause disease in healthy people, animals or plants. Examples of BSL-1 Microorganisms include: *Agrobacterium radiobacter, Aspergillus niger, Bacillus thuringiensis, Escherichia coli strain K12, Lactobacillus acidophilus, Micrococcus leuteus, Neurospora crassa, Pseudomonas fluorescens, and Serratia marcescens.* **Studies involving unknown microorganisms can be determined BSL-1 if the organism is collected in a plastic Petri dish or other non-breakable container and is sealed and remains sealed during the entire experiment.** Examples of BSL-1 rDNA studies include: Cloning of DNA in *E. coli K12, S. cerevesiae*, and *B. subtilis* host vector systems. Examples of BSL-1 Tissue studies involve the collection of non-infectious fresh tissues (not including blood or blood products) with little likelihood of microorganisms present. Projects involving blood or blood products are considered Biosafey Level 2. Plant tissues, established cell lines and cultures, meat from food stores or restaurants or packing houses, hair, teeth that have been sterilized, and fossilized tissue do not need to be treated as potentially hazardous biological agents.

2. Determine the level of biological containment available to the student researcher. **Biosafety Level 1 projects can be performed in a school laboratory but are prohibited in the home environment.** Standard microbiological practices must be used and all hazardous agents must be properly disposed of at the end of experimentation. The experiment must be supervised by a qualified scientist or a trained designated supervisor.

***For a complete list of rules regarding all of the subjects listed above please visit the following website:**
http://www.sciserv.org/isef/document/rule2008.pdf