How to Prepare a Science Fair Project

Published & Distributed by…

AGC/UNITED LEARNING

1560 Sherman Avenue
Suite 100
Evanston, IL 60201
1-800-323-9084
24-Hour Fax No. 847-328-6706
Website: http://www.agcunitedlearning.com
E-Mail: info@agcunited.com

How To Prepare A Science Fair Project

Viewing Time: 25:00
Grades-5-9

INTRODUCTION

A science fair provides a unique opportunity for students to engage in a long-term research project and investigation. It will require the use of the scientific method as well as research and library skills. In addition, it gives students a chance to develop their communication skills as they prepare a written report and oral presentation. Preparing a science fair project requires the use of many skills that future employers are looking for in employees. Students need to choose a topic, conduct research, set up and perform an experiment, collect data, analyze results, write a research paper, design and build a display, and make an oral presentation. Here is a project that is fun, challenging and interdisciplinary in approach.

PROGRAM OBJECTIVES

After viewing the video and participating in the accompanying activities, the students will be able to achieve the following objectives:

- Describe the seven steps to preparing a successful science fair project.
- Conduct scientific research and write an original research paper and bibliography.
- Design an original experiment and carry out the experiment under controlled conditions.
- Identify variables that can affect an experiment and conduct the experiment in such a way as to test only one variable at a time.
- Design and build a display.
- Present an oral presentation to a judge.

SUMMARY OF THE VIDEO

This video is designed to excite students about science fair projects. It begins by describing the on-going work being done at a site in the beautiful Smokey Mountains. At this facility scientists are conducting research on the effects of ozone on plant growth. This experimental site is used to describe the steps and procedures involved in scientific investigation. The procedures carried on by the real scientists are compared with the steps involved in students preparing a science project for their school fair. For purposes of simplicity, the science fair project has been broken down into seven steps. Each step is discussed and illustrated to help students recognize its importance.

INSTRUCTIONAL NOTES

Before presenting this lesson to your students, we suggest that you preview the video and review this guide and the accompanying blackline master activities in order to familiarize yourself with their content.

As you review the materials presented in this guide, you may find it necessary to make some changes, additions, or deletions to meet the specific needs of your class. We encourage you to do so, for only by tailoring this program to your class will they obtain the maximum instructional benefits afforded by the materials.

It is also suggested that the video presentation take place before the entire group under your supervision. The lesson activities grow out of the context of the video; therefore, the presentation should be a common experience for all students.

TEACHER PREPARATION

View the video and review the accompanying activities. Duplicate any blackline masters you wish to distribute. If you plan to

use the Video Quiz, which immediately follows the video presentation, you may wish to have copies of the quiz ready to distribute at the completion of the video program.

Kinds of Projects

There are four categories of science projects: models, demonstrations, collections, and experiments. Each of these has value but only the last category–experiments–really tests a student's ability to emulate a research scientist. The other projects really do nothing to promote the use of the scientific method. You may choose to allow students to develop models, demonstrations, or collections for a science fair; however, we suggest you consider only allowing experimental projects. The other types are often nothing more than a sharing of establishing principles and laws. The experimental project requires students to use methods of research and inquiry similar to those used in the scientific community. In addition, the student is challenged to establish a hypothesis, design an experiment, collect data, interpret the data, and draw conclusions based on that data. An experimental project will promote research and study skills, creativity, and give a student first-hand experience using the experimental process.

The Scientific Method

This is an organized way of thinking about problems. It has evolved over hundreds of years as man has attempted to develop a systematic approach to problem solving. There are five parts to this method:

1. Stating the Problem - A question comes to mind. It is often established from the observation of nature. Why does something appear to happen as it does, or what if this were different?
2. Hypothesis - This is an explanation for the established problem. A student establishes an explanation to be tested.
3. Observation and Experimentation - Observation has led to the original problem and the student's hypothesis or explanation for it. Now an experiment must be designed to test the validity of the hypothesis.

4. Interpretation of Data - During the experiment, measurements and data are collected. The student must evaluate and interpret these results.
5. Conclusions - Finally, the interpretation of results compared to the original problem and hypothesis will lead to the establishment of conclusions. The hypothesis is either supported or disproved and conclusions can be drawn.

Safety Codes and Animal Endorsements
It is very important for you to check with the state about safety codes and endorsements related to the handling of animals and bacteria. Write to the Department of Education in your state to request information. Laws have been established to insure the safety of science fair participants and the animals they may be studying.

Scheduling
A science fair project is a long-term assignment requiring between three and four months of preparation. Consider introducing the fair in October or November and having the actual fair and judging in January or February.

Develop a method for having participants share their progress with you. Because this is the first time many students will have worked on such a long-range project, you should monitor their progress regularly.

Judges
You might be required to recruit judges for the fair. Each project should be evaluated by a team of at least two judges. Each team of judges should be responsible for around seven to ten projects on the day of the fair.

You'll want judges who have had experience working with young people. The fair should be a positive experience for everyone. Judges must know how to interact with students and reinforce the good as well as point out areas for improvement. The judges

should be knowledgeable in the sciences and experimentation. Seek out teachers, administrators, senior citizens, or parents.

Judging

The judges should use some kind of evaluation form such as the one supplied in this package. Encourage the judges to include comments on the evaluation forms. Judges should look for the following:

- Knowledge of project and topic
- Demonstration and use of scientific process
- Knowledge of scientific principles
- Neat and well organized exhibit
- Creative approach to research and exhibit
- Complete abstract and research paper
- A degree of individual commitment and work

Judges should be realistic and realize that these projects were developed by kids.

Awards

Awards, such as ribbons or certificates, can be a good motivation to students and help to recognize their accomplishments and efforts. The awards should not be the sole reason a student participates. Participation in a science fair should be based on an interest to learn more about a particular topic and a desire to conduct an experiment using the scientific method.

Consider handing out awards during an evening assembly so that parents and relatives can attend. The actual judging of the exhibits could take place during the day and then a special assembly could be set up so that visitors can view all the exhibits in the evening. Presentations can be made and then exhibits could be dismantled and taken home so that the school facility isn't overrun with projects for two weeks. The main purpose here is to showcase the fair for family and friends and to provide participants with the recognition they deserve.

Categories

Science fair projects are usually grouped into categories related to the field of science they cover. Here is a suggested list of categories:

Aerospace - the study of the atmosphere and outer space; also the design of aircraft and the study of air flow.

Behavioral Science - the study of animal behavior, learning, perception, and motivation.

Biochemistry - chemical processes such as digestion, respiration, and photosynthesis.

Botany - the study of plants.

Chemistry - the study of matter; includes the study of compounds, gases, analysis of products and atomic theory.

Computer Programming - writing computer programs to carry out a particular task.

Conservation - study and protection of natural resources.

Earth Science - study of the earth; geology, geography, oceanography, and seismology.

Electronics - design of devices that use electrical circuits.

Engineering - design, construction, and operation of buildings and machinery.

Health Sciences - physical and mental health of man.

Microbiology - study of microorganisms.

Physics - study of motion and energy including sound, heat, and light.

Zoology - study of animals.

INTRODUCING THE VIDEO

Ask students to think about how scientists do their work. Hollywood would have us believe that scientists work alone in creepy old castles. In reality, scientists work in teams on research projects that require the use of the scientific method and carefully controlled experiments. The video they will see today will describe how students can mimic that scientific investigation by participating in a school science fair.

BLACKLINE MASTER DESCRIPTIONS

There are eleven Blackline Masters designed to be used as a student reference booklet. There are additional blackline masters intended for teacher use.

• **Video Quiz** is to be used at the end of the video program. At the completion of the video, there is a short quiz. The narrator will read the questions which are displayed on the screen. Students can use this sheet to record their answers. Answers to the questions are provided in the Answer Key, found on page 9.

• There is a Blackline Master cover and ten pages that are intended to be given to each student as a reference booklet for the entire project. The ten pages are numbered and include the fol lowing topics:

1. Seven Steps to Prepare a Science Fair Project
2. Stay Organized With A Schedule
3. Getting The Info
4. A Controlled Experiment
5. Recording Observations and Data
6. Graphs and Charts
7. The Abstract and Research Paper
8. The Exhibit or Display
9. Developing a Bibliography
10. Presentation to Judges

• **Monitoring Forms** can be used to keep track of student progress. Distribute these forms at various times to see what progress students are making.

• **Ideas for Science Fair Projects** lists the titles of some popular science fair projects.

• **The Criteria Sheet** could be handed out a few weeks before the fair to have students conduct a quick self-evaluation.

• **Abstract Form** is patterned as a typical abstract form. This form would be filled out and attached to the front of the research paper. The abstract contains one paragraph on the Purpose, one paragraph on the Procedure, and one paragraph on the Conclusion.

• **Judges' Score Sheet** could be used by judges during the evaluation of science fair projects.

INTERNET ACTIVITIES

1. Science Fairs Homepage - Project of the Eastern Newfoundland Science Fairs Council at:
http://www.stemnet.nf.ca/~jbarron/scifair.html

2. EduZone Science Fair Tips
http://www.eduzone.com/tips/science.htm

3. Eric
http://ericir.syr.edu/

4. A Science Fair Project Resource Guide: The Internet Public Library
http://www.ipl.org/youth/projectguide/

DISCUSSION QUESTIONS

1. Discuss the importance of planning and budgeting time over the duration of this long range project. For many students, this is the first time they have worked on a project involving three major presentations: research paper, visual display, and oral presentation. Reinforce the need to not wait until the last minute to work on the project.

2. Review places to get ideas for the science project. For most students, choosing a topic is the hardest part of the entire project.

ANSWER KEY

- **Video Quiz**

1. The control group is set up as a method for comparison. The control group is set up just as all the other test groups, but will not be influenced by the variable being tested.
2. Variables are conditions or elements of an experiment. In a controlled experiment, we want to test only one variable at a time; so all other factors that could be a variable must be controlled and kept the same. For instance, in the truss experiment, only the design or pattern of the truss is being tested, so wood quality, amount of glue, and size of truss are all kept constant.
3. Soil, seeds would come from the same package, same amount of water, same amount of light, same amount of heat, same type of container.
4. The time exposed to x-rays would vary with each test group.
5. There would be a control group which receives no x-rays, other groups would receive different amounts of x-ray exposure. Each group would have at least three seeds. After exposure to the x-ray machine, the seeds would be planted in different containers and given equal amounts of water, soil, sunlight, and warmth.
6. You need three or more test items for each group because there may be undetected problems with individual items. If there are multiple test items in a test group, the individual results can be averaged for comparison with the control group.
7. A research paper, a display, and an oral presentation are usually required for science fair participation.
8. An abstract is a single page that provides a quick explanation or summary of a science fair project. It includes a paragraph about the purpose, a paragraph about the experiment, and a conclusion.
9. You don't want to read directly from a prepared speech. The index cards will provide a reference and will help you be more natural. No one wants to listen to someone read a speech.

10. A hypothesis is an educated guess of what will be the outcome of an experiment. It is an explanation of why something happens the way it does.

SCRIPT OF VIDEO NARRATION

These unusual plastic domes are being used to conduct experiments in the beautiful Great Smoky Mountains. The scientists working at this facility are comparing the effects of ozone on plant growth. Each dome receives a different amount of ozone pumped into it during computerized cycles. Every day, measurements are made and recorded about individual plants in the domes. Data is then compared and analyzed to determine how levels of ozone effect the overall growth and performance of various plant types inside the domes. Everything about the domes is constant, only the level of ozone present is altered and carefully controlled. All the plants receive the same amount of sunlight, water, and soil nutrients. One dome is set up as the control. It has no hoses releasing ozone gas into its environment. However, everything else is constant.

When scientists are conducting experiments, they must have something to use as a basis for comparison. That is the purpose of a control group. It's set up just like all the other test groups, but the control group will not be exposed to the element being tested. In this case, the scientists want to see if ozone found at ground level has an adverse or bad effect on plant growth and development. That is why they have set up so many domes. They are testing the effect of different amounts of ozone on the plants. Some domes receive a little ozone gas and some receive a great deal of ozone gas.

Part of the data being collected has to do with determining the amount of photosynthesis taking place by the different test plants. This equipment can measure the level of gas exchange happening in a plant's leaves, and therefore, can be used to measure the amount of photosynthesis, or food production, occurring in plants.

So these scientists are conducting an on-going investigation of the effects of ozone gas on plant activity. They will be collecting data for years before they are ready to share their results. They are using the scientific method of recognizing a problem to investigate, conducting preliminary research into the subject area, establishing a hypothesis to be tested, creating an experiment, building the necessary equipment, conducting the experiment, collecting data, and evaluating the data to establish a conclusion concerning the original problem under investigation. To do this, the scientists had to find funding for their project and establish a network of support through grants and corporate sponsorship.

You have an opportunity to see what it is like to work as a scientist without having to find funding and sponsorship. You can prepare a science fair project and participate in the same kind of process that professional scientists have been using for years to advance our scientific understanding and knowledge. You can use the same techniques and strategies to conduct your own scientific investigation.

Many schools have an annual science fair competition. You should check with your school sponsors to find out what the specific rules and regulations are for the science fair.

Most fairs will require three things: a research paper, an exhibit or display, and an oral presentation to judges. The rules may pertain to the kinds of topics accepted, the length of the research paper, the amount of space allowed for display, and the time frame for doing research and conducting experiments.

A science fair project will require organization, commitment, and personal effort. You can't wait until the last minute and expect things to fall into place the night before the fair. You must carefully plan how the project can be spread out over a series of weeks. Specific check points, or due dates, must be assigned to keep things organized. Build in some extra time for unforeseen problems.

The first step is to decide on an idea, or topic, for your project. Ideas can come from many sources. The idea for the ozone experiment came to a scientist when he observed the damage to plants along the highways and roads that weave through the Smokey Mountains.

Give yourself time to consider many alternatives. Often a hobby will spark an idea. Or discussing possibilities with teachers, parents, or friends may be helpful. If you are having trouble deciding on a topic there are places you can go. The library is an excellent source of ideas. Look through science magazines, newspapers, or encyclopedias, or ask the librarian to help you find the section on the bookshelves that contains material on science fair projects. The Internet is a wealth of ideas. Do a search with the key words "science fair projects" to find all kinds of sites with great science fair topics.

Museums and zoos can also be terrific sources for topics. Just remember that you should choose a topic that is of interest to you. It should be something you wish to learn more about. And it should be as specific as possible. Topics such as "Plant Growth" or "Aerodynamics" are much too broad. You wouldn't know where to begin or what you want to accomplish or test. These could be rewritten to represent more specific ideas. "The Effects of Different Amounts of Fertilizer on Plant Growth" and " Which Paper Airplane Design is Best," those are specific and clear. A person could take these topics and know exactly what to do and where to go with them.

Another problem associated with selecting a topic is that you must pick something that can realistically be accomplished. A topic on "Acceleration of Subatomic Particles" or "Life on Other Worlds" would be beyond your resources, unless, of course, you have access to a particle accelerator or space probes. Otherwise, those topics would become nothing more than a report of what others have found. There would be no opportunity for you to test a hypothesis through personal experimentation.

Once you have selected a topic, it's time to hit the books. This is the research stage of your project. Use encyclopedias to give you a general overview of the subject. Then find books, magazines, newspapers, or Internet sites that contain information on the topic.

Take notes on 3" by 5" or 5" by 8" cards. Write one idea per card and be sure to include the name of the source and author for future reference. These cards will be very helpful when it's time to write the research paper.

This brings us to the next step–the purpose of the project. You identify a topic, conduct research, and then establish a purpose. The purpose is a statement of what you intend to do. It should include a hypothesis, which is an educated or scientific guess of what you believe will happen. In the ozone experiment described earlier, the hypothesis was that plants exposed to increased amounts of ozone gas will not grow, develop, and carry on photosynthesis as normal.

Here's a project that compares the strength of various roof truss patterns. Aaron has been interested in architecture for a few years and may become an architect. This interest led him to wonder about the roof supports called trusses. There are different designs for these trusses, so he set out to see which supports the most weight. Aaron hypothesized that the *modified queen post* would be the best.

With the hypothesis established, it is now clear that the task is to set up and conduct an experiment, or series of experiments, to test this prediction. The experimentation is designed to provide evidence either in support of or against the hypothesis. Aaron had to build a jig so that all truss models would be the same size. He also had to use wood that was identical.

Aaron made three test trusses for each of the five kinds of trusses he was testing. The reason for so many test items is that you

need to run the test multiple times and then average the results. Once all the truss samples were constructed, it was time to conduct the actual experiment.

Aaron needed a way to record at which point each truss would break under pressure. He designed a method of placing a board across the truss and, by adding pressure on the board, he could finally break the trusses. He needed someone to help by watching the scale which was placed in such a way as to record the amount of pressure exerted on the board. Some of the trusses were so strong that Aaron needed help applying force to the board.

Make all your measurements in metric units. All countries use this system for scientific inquiry. The scale Aaron used can record weight in English or metric units.

Experimentation should be conducted under controlled conditions. There are many variables that might affect an outcome or behavior. So you must strive to maintain control over those variables and conditions. For instance, the same type of wood, taken from the same production batch, must be used to build each of the test items for the roof design experiment. The same amount and kind of glue would be used during construction. During testing, the conditions must be the same. Each test item would be tested with the same apparatus and with the same measuring tools and devices.

It's important to conduct an experiment more than once, so three similar trusses were constructed for each trust design. Each truss was deliberately broken and the amount of pressure was recorded.

Keep track of data and experimental results in a notebook that's only used for this experiment. Don't try to maintain records and results in your school notebook. It could be disastrous! Think of this dedicated notebook as a scientific log.

You may wish to organize the data you collect in charts, tables,

or graphs. And, in some instances, you will record observations as phrases or short sentences.

The data collected will either support or disprove your hypothesis. Remember that a project is not a failure if the hypothesis is rejected or disproved. Actually, much is gained by this process and often results from one experiment will lead to a new hypothesis and new experiments.

When experimentation is complete, results are in, and the conclusions have been drawn, it is time to write the research paper. There are eight sections to the paper. The purpose of your research is identified. People who have helped with the project are recognized in the acknowledgements. The research of others is outlined and discussed in section three. The materials for your investigation are listed. The procedure for setting up and conducting your experiment are provided in section five. The data and results of your experiment are shared. Your conclusions, based on your test results, are presented. And, finally, a reference section should be included at the end to provide a list of sources of your research and study. Also, the paper should have a title page which states the title of your topic and includes your name, school, and the date. There should also be a table of contents.

Many science fairs ask that participants create an abstract that will be placed on top of their research paper. The abstract is a one page summary of your project intended to supply interested people with an overview of your project, and should include the purpose, procedure, and results of the project. It is designed so that someone can learn about your project without reading through the entire research paper.

One of the most exciting parts of the science project is the development of the exhibit. It gives you a chance to let your creativity shine through. You want it to be interesting as well as functional. Consider including photos, sketches, and other materials to help portray what you've worked on. Let photographs

help tell your story. Many displays are organized around a self-standing three-sided arrangement of heavy cardboard or plywood. These backboards can often be purchased at educational supply stores or art supply stores. Use the center area for the title, credits, and photos or drawings. One side of the display can have statements about the purpose and procedures and the other side can have results and your conclusions. This type of display sits on a table which leaves space on the table surface for a display of materials and equipment.

As judges come around, be prepared to introduce yourself and your project. Speak clearly and loud enough for all to hear. Smile and present each judge with a copy of your written report and abstract.

Don't memorize a speech, but practice does help. Use index cards as a reference but maintain eye contact as much as possible. Don't write a lot on the cards. No sentences, just quick phrases which will cue you as to what you want to say next. One card might simply have the words "title" and "name." Another card may contain the names of people who helped you and what they contributed toward your project.

Tell how you became interested in this topic. Give some background information about the topic and tell what you found out from your review of literature. State your purpose and give credit to those that helped you.

Describe how you conducted your investigation and explain the results of your experiment. Point to sections of your display and refer to charts, graphs, and photographs. Let the judges examine any equipment you have on display. Discuss your conclusions and any further plans you might have for continuing research on this topic.

Ask the judges if they have any questions and don't be afraid to admit that you don't know an answer. Thank the judges for their

time and any suggestions they have offered to improve your project.

Don't do anything that would distract the judges, such as fidget, shuffle your feet, or chew gum. Instead, stand up straight, make good eye contact and, speak enthusiastically.

In summary, the seven steps to preparing a science fair project are: First, select a topic. This should be something you're interested in. Talk to teachers, parents, or librarians for ideas. Look through science books, and magazines, or visit museums or zoos.

Once you have selected a topic, it's time to do some research. Talk to experts and visit the library to find out as much as possible about your subject. Take notes, and keep things organized on 3" by 5" or 5" by 8" cards. Put one idea on a card and then record the source and any other reference information.

After you're satisfied that the topic you have selected is a good one, then think about a purpose and hypothesis for your project. The purpose describes what you will attempt to do. The hypothesis is an educated guess as to what you think will happen.

The fourth step is to plan and organize your experiment. Determine the materials you will need and remember to perform the experiment under controlled conditions. Keep careful records in a special notebook that is only used for this project.

The fifth step is to write your research paper. This report will provide interested readers with a comprehensive look at your topic and research. It includes information collected during your research as well as a complete description of your experiment, data, and conclusions.

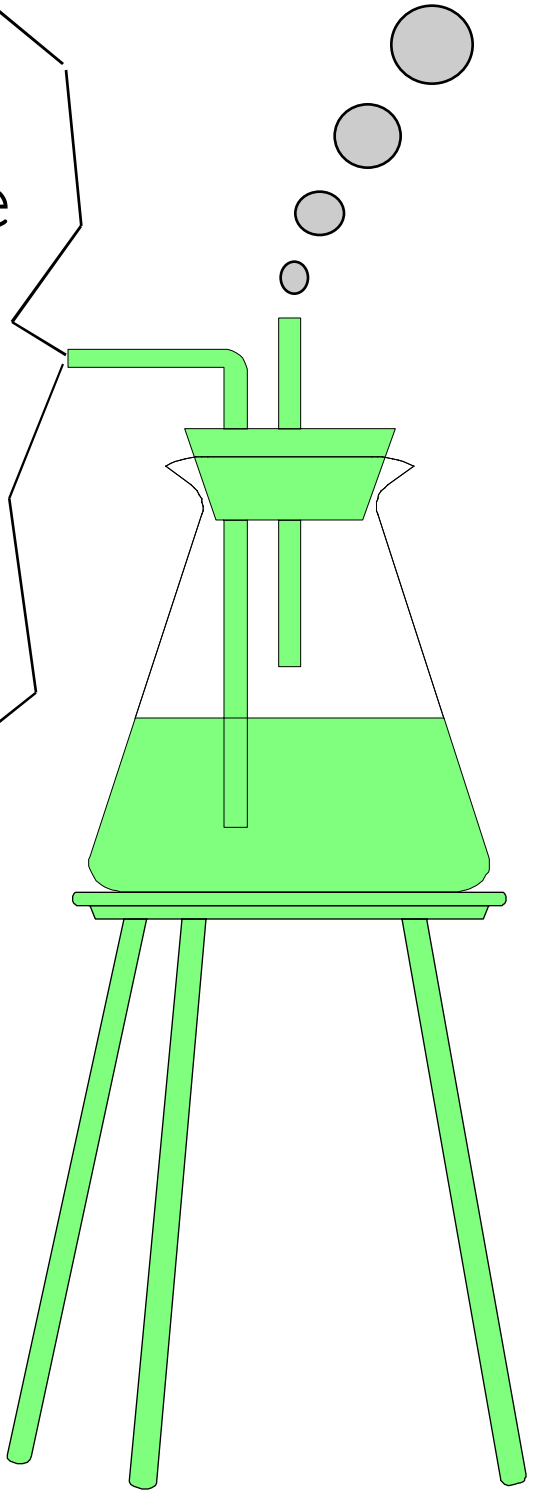
Next is the exhibit or display. You want to prepare this carefully. This is an important way to share your project.

Finally, you should plan how you will explain your project to the judges. Look neat, speak up and clearly, and don't fidget or do other distracting things. In other words, have fun!

The following questions can be answered on the Blackline Master entitled Video Quiz or on a separate sheet of paper.

1. In most scientific investigations a control group is required. What is the purpose of the control group?
2. What are variables?
3. If you were doing an experiment to determine the effect of x-rays on seed germination, what variables would you need to keep the same for all test groups?
4. In the effects of x-rays on seed germination experiment, what would be the variable being tested?
5. A dentist might allow you to use his x-ray machine to expose seeds to different amounts of x-rays. How would you set up the experiment?
6. Why have three or more test items or subjects in each test group?
7. What are the three things most science fairs require?
8. What is an abstract and what purpose does it serve?
9. When using index cards for your oral presentation, why is it a good idea to write single words or short phrases instead of your entire speech?
10. What is a hypothesis?

How To Prepare a Science Fair Project



This booklet belongs to: _____

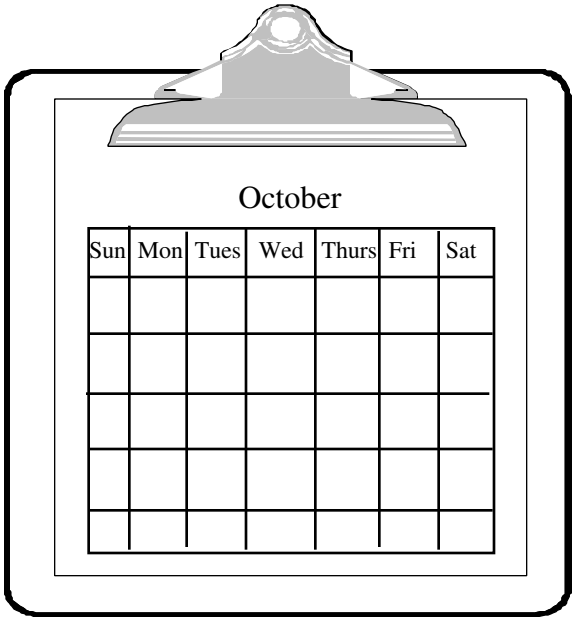
AGC/United Learning • 1560 Sherman Ave., Suite 100, Evanston, IL 60201 • **800-323-9084**

Name _____
Date _____

HOW TO PREPARE A SCIENCE FAIR PROJECT
Stay Organized With a Schedule

This may be the first time you have attempted a long range project, so it is very important to prepare a schedule and stay organized. Science fair projects often require several weeks for completion. For that reason, organizational meetings are often set up months before the actual fair. Don't let a due date that is many weeks away throw your planning off; there are many things to do. Here is a suggested schedule that provides ample time to complete all phases of the project:

CHECK OFF	WEEK	WHAT YOU SHOULD BE DOING
[ ]	1 - 2	Identify your topic and establish a purpose.
[ ]	3 - 4	Use the library to research your topic.
[ ]	3 -4	Plan experiment and collect supplies.
[ ]	5 - 6	Conduct your experiment and collect data and results.
[ ]	7	Analyze results and establish conclusion.
[ ]	8	Write the research paper and abstract.
[ ]	9 - 10	Build your display and practice presentation for judging.



AGC/United Learning • 1560 Sherman Ave., Suite 100, Evanston, IL 60201 • **800-323-9084**

Name _____
Date _____

HOW TO PREPARE A SCIENCE FAIR PROJECT
Seven Steps To Prepare a Science Fair Project

1. **SELECTING A TOPIC:** Choose something you're interested in and something you want to learn more about. Talk to teachers, parents, or librarians for ideas. A hobby might lead to a good topic. Don't forget to look through science books, magazines, or visit museums or zoos for ideas.

2. **RESEARCH:** After the topic has been selected, start the research process. Encyclopedias will provide an overview of your topic, but go beyond that and collect information from books and magazines. Contact experts or companies that might be able to supply information. Don't forget to check the internet.

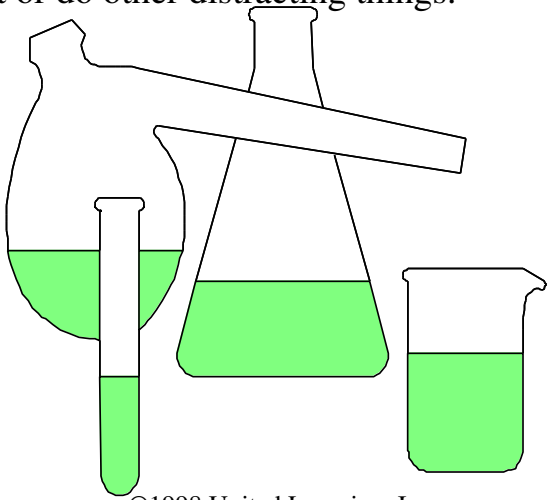
3. **PURPOSE AND HYPOTHESIS:** The purpose is a description of what you will do. The hypothesis is an educated explanation as to what you think will happen.

4. **EXPERIMENT:** Plan and organize an experiment. Perform the experiment under controlled conditions. Keep careful records in a specials notebook that is used only for this paper.

5. **RESEARCH PAPER:** This report will provide interested readers with a comprehensive look at your topic and research. It includes information collected during your research as well as a complete description of your experiment, data, and conclusions. Don't forget the one page summary called an abstract.

6. **EXHIBIT:** This is the visual presentation of your project, so prepare it carefully. Use graphs, charts, and clear bold lettering to highlight this display.

7. **JUDGING:** Plan how you want to explain your project to the judges. Look neat, speak clearly, and don't fidget or do other distracting things.



AGC/United Learning • 1560 Sherman Ave., Suite 100, Evanston, IL 60201 • **800-323-9084**

Name _____
Date _____

HOW TO PREPARE A SCIENCE FAIR PROJECT
Getting The Info

Once you've identified your topic, the next step is to conduct your research. You want to collect as much information as possible. Begin by getting an overview of your topic. Encyclopedias contain general information about many topics and are a good starting point. However, they should be used only to get a general idea. Most libraries have a computerized system that allows you to type in a topic and then it searches its database to identify available books and magazines on the subject.

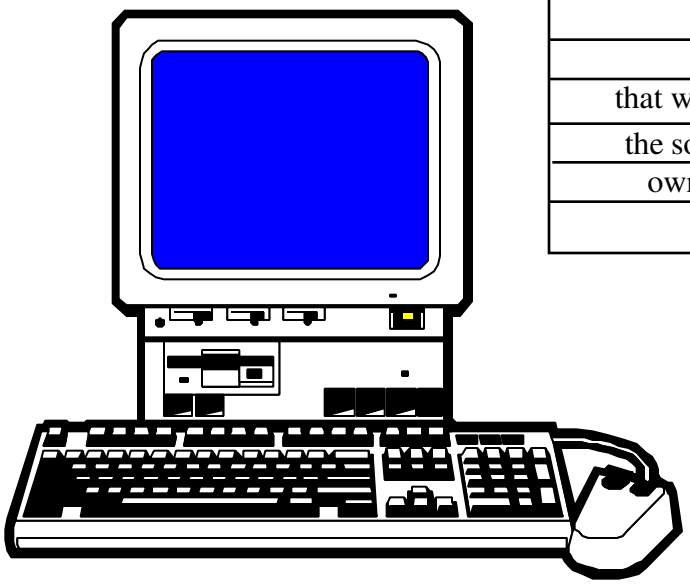
When you find a book on your topic, don't feel you have to read the whole thing. Look at the table of contents and the index for information related to your subject. Check the book's bibliography for other sources you may wish to review.

When collecting information from books and magazines, use index cards. Put only one idea on a card and be sure to include information for your bibliography. You'll need to list the title of the article, the name of the magazine or book, the author, the issue, the date, and the publisher.

The Internet can be an excellent resource of ideas and information. (Look at the Bibliography page in this booklet to see what information you will need when siting an Internet site).

Index Cards can be very helpful for note taking.

Title of Article, Name of Magazine, Author,
Issue, and Publisher
Only one idea per card -
that will help you to avoid copying from
the source. You must put things in your
own words unless you use quotation
marks.



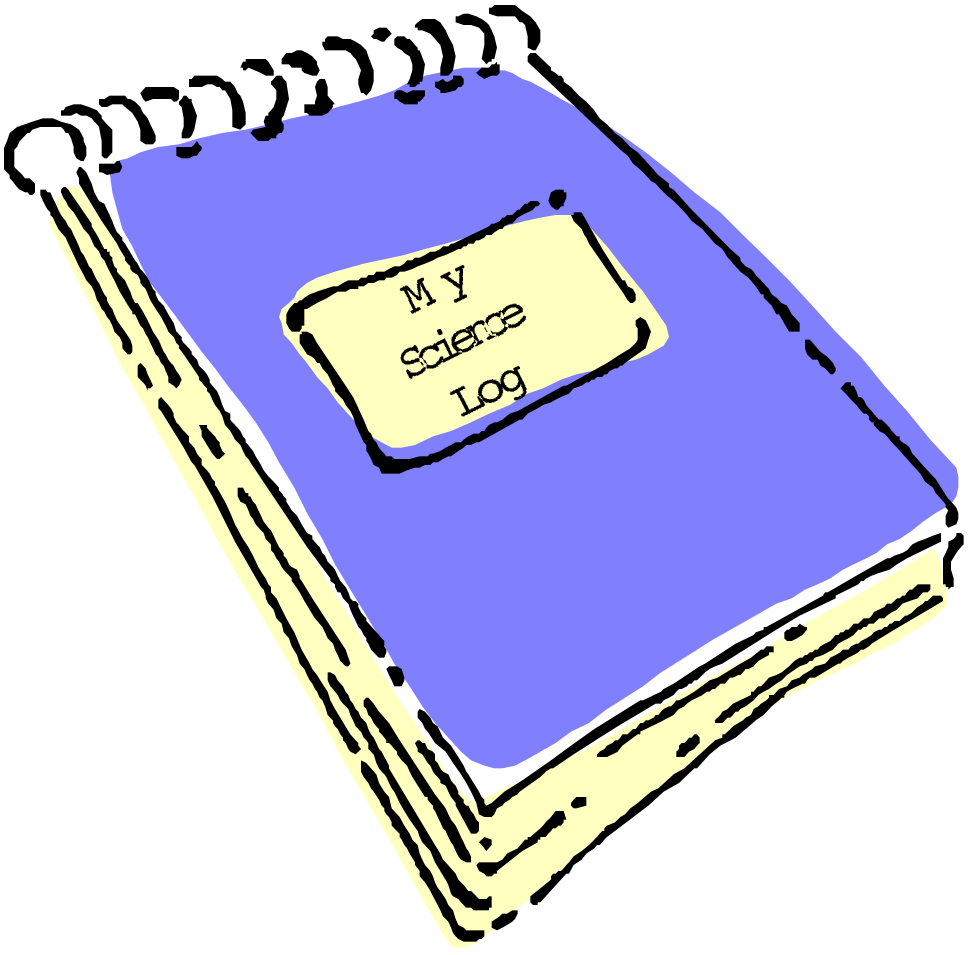
AGC/United Learning • 1560 Sherman Ave., Suite 100, Evanston, IL 60201 • **800-323-9084**

Name _____
Date _____

HOW TO PREPARE A SCIENCE FAIR PROJECT
Recording Observations a nd Data

Use a separate notebook for recording all measurements and observations. Record information on a daily basis and consider the following things:

- Make sure that accurate metric measurements are given in your data. Give masses in grams, volumes in milliters, and linear measurements in centimeters.
- It is better to have too much data than not enough so keep a lot of notes.
- When making an observation, write down the date and time.
- Keep track of the materials used, their quantities and cost.
- Consider taking photographs to be used in your research paper or as part of your display.



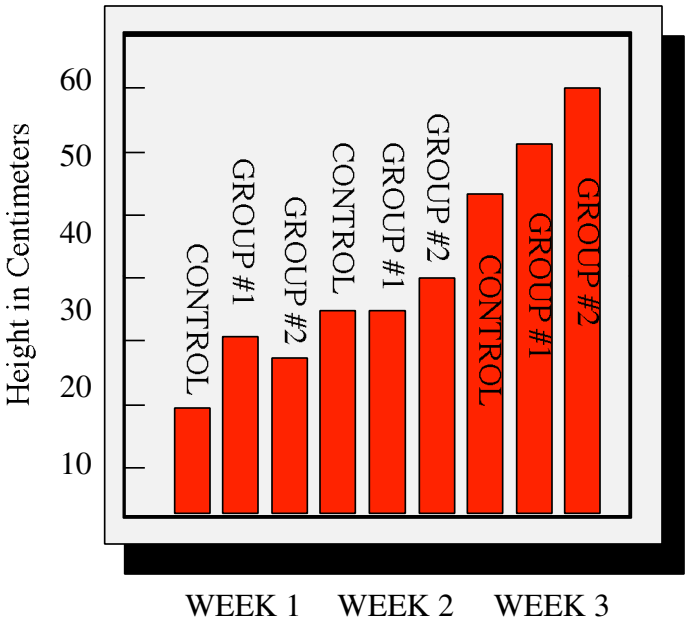
AGC/United Learning • 1560 Sherman Ave., Suite 100, Evanston, IL 60201 • **800-323-9084**

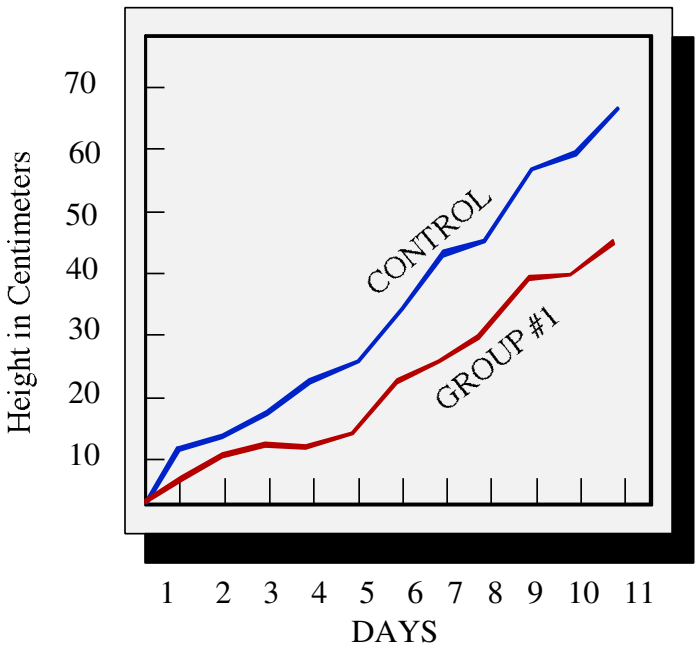
Name _____
Date _____

HOW TO PREPARE A SCIENCE FAIR PROJECT
Graphs and Charts

Your daily log of observations will be the best means for sharing the data and information collected during the experiment. Charts and graphs will provide a fine way to share data in an easy to read and understand fashion. There are different kinds of charts and graphs. Here are some examples:

BAR GRAPH





LINE GRAPH

AGC/United Learning • 1560 Sherman Ave., Suite 100, Evanston, IL 60201 • **800-323-9084**

Name _____
Date _____

HOW TO PREPARE A SCIENCE FAIR PROJECT
A Controlled Experiment

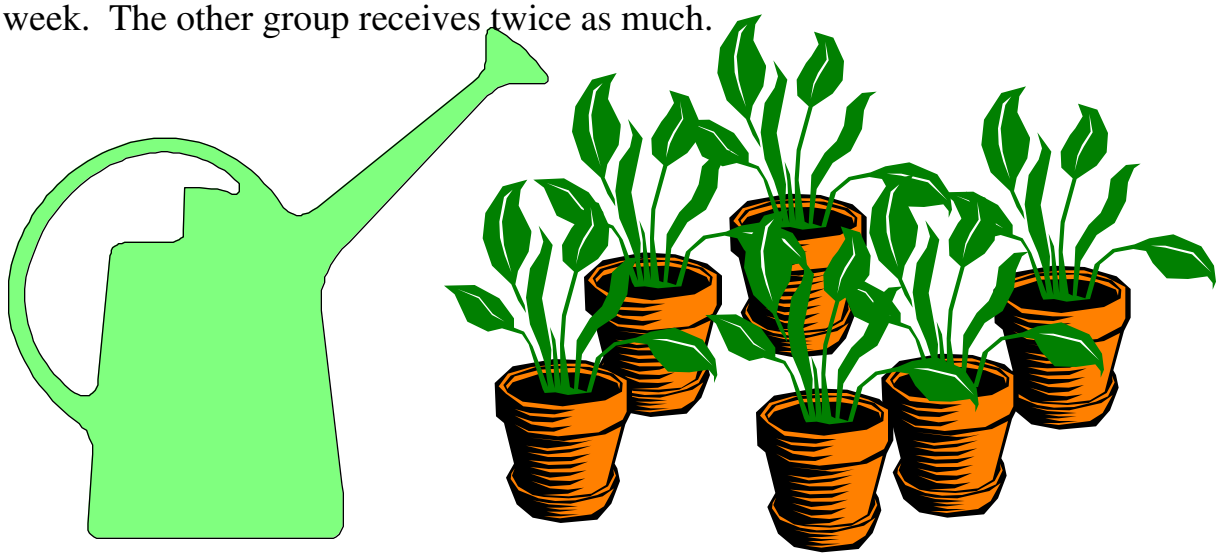
To conduct a scientific investigation, care must be taken to follow experimental procedures. You must design an experiment to test your hypothesis. When planning your experiment, remember to keep everything the same except for the single variable being tested. A variable is something that can be changed in the experiment. It is what you are testing. Everything else must be the same and only one variable or condition is altered or changed. A control group should be used when conducting an experiment. This group receives the same attention as the test groups; however, it will not be influenced by the variable the other groups are testing.

Here is an example:
PURPOSE: How the amount of fertilizer used will affect plant growth.

HYPOTHESIS: Increased dosages of fertilizer will cause greater growth in tomato plants.

The test variable will be the amount of fertilizer used. So all other variables and conditions must stay the same. That means the following:

1. The seeds must all come from the same package and should be randomly selected.
2. All seeds must be planted in the same sized pots with similar soil.
3. All plants must receive exactly the same amount of water and light.
4. The temperature should be the same for all test plants.
5. More than one plant should be used in each test group.
6. Set one group as the CONTROL GROUP. This group is not given any fertilizer.
7. Set up two other test groups. One receives a certain amount of fertilizer each week. The other group receives twice as much.



AGC/United Learning • 1560 Sherman Ave., Suite 100, Evanston, IL 60201 • **800-323-9084**

Name _____
Date _____

HOW TO PREPARE A SCIENCE FAIR PROJECT
The Abstract and Research Paper

It is important to be able to share your project with others. One way to share information is in written form. Here are some guidelines for writing the abstract and research paper.

1. The abstract is a one-page summary of your work. It should include:
   a) a statement of purpose,
   b) a brief description of the procedure,
   c) a conclusion based on results collected.

2. The research paper should be typed with double spacing. It should include:
   a) title page which should include your topic, your name, school's name, grade, sponsor, city, state, and zip code.
   b) table of contents.
   c) purpose - This is a statement of what you plan to do. It can include a hypothesis or educated guess as to what you think the outcome will be.
   d) acknowledgements - In this section you can identify people who have helped you.
   e) review of literature - Here you describe the work and findings of others related to your topic.
   f) materials and methods of procedure - Describe the materials you used and then provide a step-by-step explanation of how you conducted the experiment. Include drawings or photographs to help clarify your procedures.
   g) results - The outcome of your experiment and the data collected is shared in graphs, charts or as a daily log of observations.
   h) conclusion - In this section you will interpret your findings and results. Refer back to your purpose and indicate whether or not your findings support your hypothesis.
   i) bibliography - List the books, magazines, pamphlets, or other communications you used to research your topic.

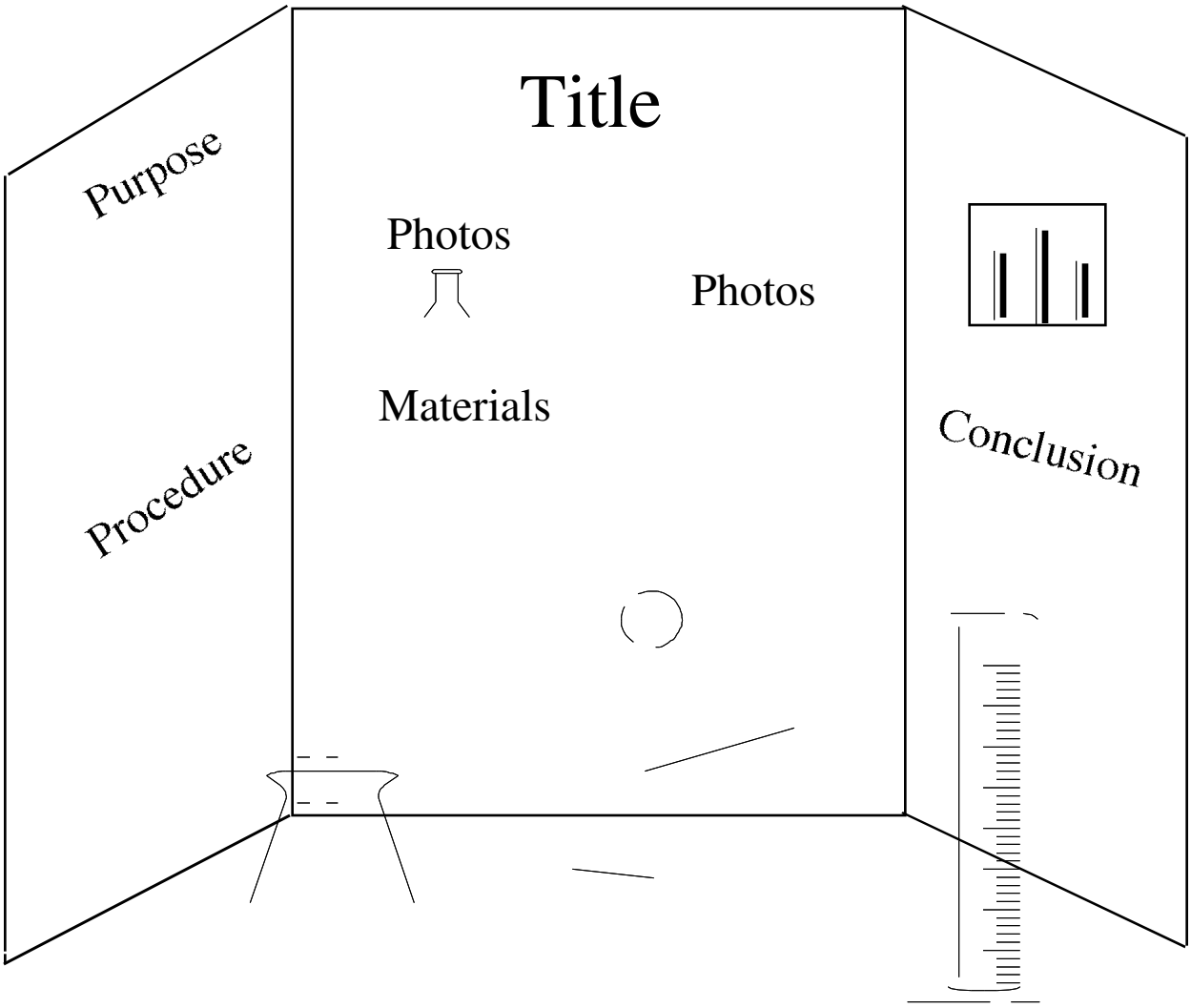
AGC/United Learning • 1560 Sherman Ave., Suite 100, Evanston, IL 60201 • **800-323-9084**

Name _____
Date _____

HOW TO PREPARE A SCIENCE FAIR PROJECT
The Exhibit or Display

This is a visual way to communicate to others so take your time and do a good job.

Be sure to check with your teacher or sponsor about the rules for dimensions of the exhibit. Most exhibits will have three sections and be expected to stand on their own. Displays are often placed on card tables so there will be limits to their size. Use sturdy material, such as plywood, masonite, or heavy cardboard, for the backboard. Use hinges or strong tape to hold the three sections together.



AGC/United Learning • 1560 Sherman Ave., Suite 100, Evanston, IL 60201 • **800-323-9084**

Name _____
Date _____

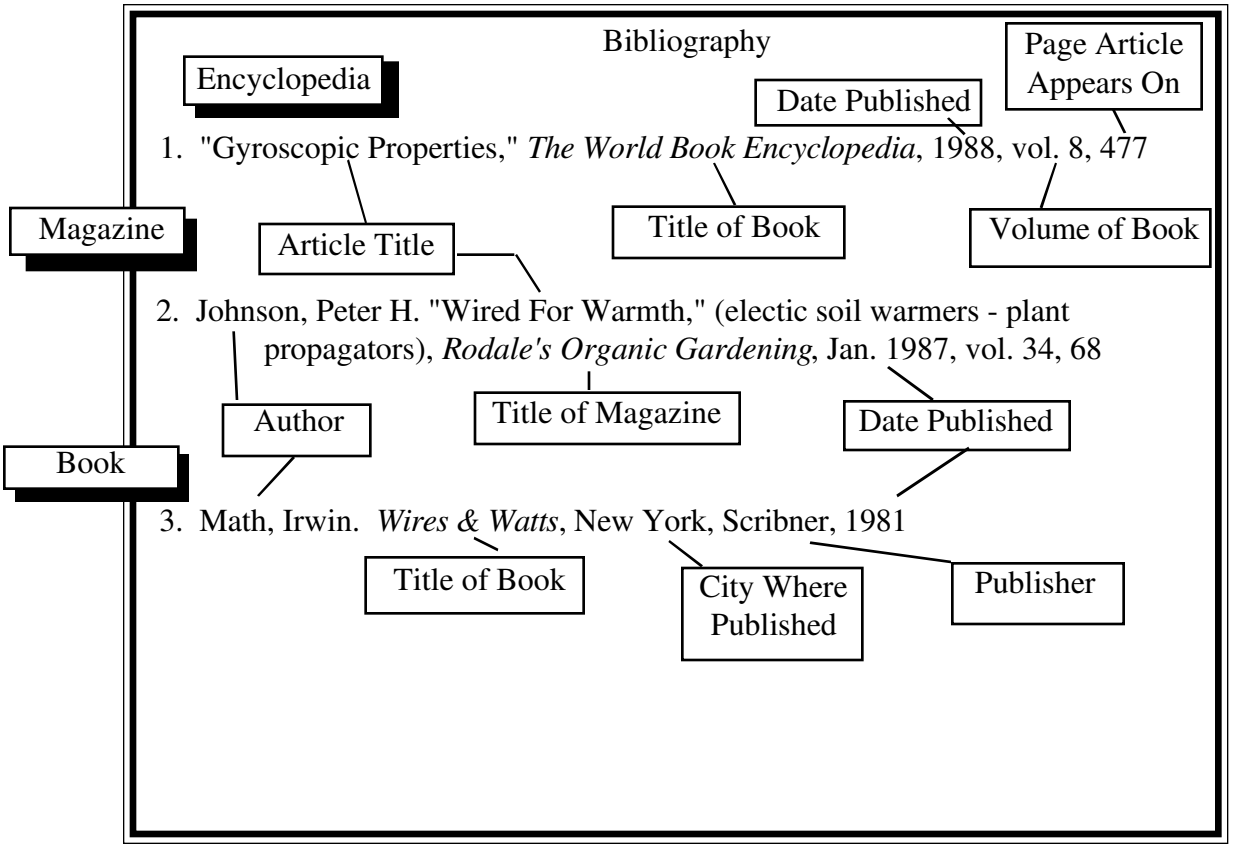
HOW TO PREPARE A SCIENCE FAIR PROJECT
Developing a Bibliography

A bibliography is a listing of the resources adn references used during the research of your project. It should include information about the magazines and books you used. That information is organized so that interested readers could seek out and find the books and articles you refer to.

In the case of a book, you must supply the title of the book, its author, publishing company, the city where the publishing company is located, and the date the book was published.

For a magazine article you must supply the title of the article, the author, the magazine it appeared in, the date of the magazine issue, the volume of the magazine, and the pages the article appeared on.

Here is an example of a bibliography:



AGC/United Learning • 1560 Sherman Ave., Suite 100, Evanston, IL 60201 • **800-323-9084**

Name _____
Date _____

HOW TO PREPARE A SCIENCE FAIR PROJECT
Presentation to Judges

This is an important part of your project so take the time to plan and practice the presentation you will make to the judges. Plan in advance what you want to say but don't memorize your presentation. Write key phrases or ideas on index cards and use them as a reference but don't depend heavily on them.

Here is an approach you may wish to use for making your oral presentation.

1. Greet the judges and introduce yourself.
2. Give them a copy of your abstract and research paper.
3. Give the title of your project, your grade, school, and sponsor (teacher).
4. Tell how you became interested in this topic.
5. Give some background information about the topic.
6. State the purpose of your investigation.
7. Discuss your review of literature.
8. Describe, in a step-by-step fashion, the procedure you followed for conducting your investigation. Point to sections of your display and refer to charts, graphs, and photographs. If you have equipment on display, allow the judges to examine it.
9. Explain the results of your experiment and be sure to discuss controls and variables. Remember to keep all measurements in metric units.
10. Identify the conclusions that you could logically draw from the experiment.
11. Discuss any future plans you may have to continue research or experimentation related to your topic. Include a few statements about any changes you made in your scientific approach during your early investigation.
12. Ask the judges if they have any questions. Remember, if you don't know an answer, say so and indicate you will look into it. If judges insist on asking questions in unrelated areas, redirect the conversation back to your specific topic.
13. Thank the judges for their time and any suggestions they may have offered to improve your project.

Good manners, nice clothes, and enthusiasm for what you're doing will help to impress the judges. Here are some tips:

1. Wear nice clothes.
2. Be polite and practice good manners.
3. Make good eye contact with your judges and be sure to give each judge your attention. Don't just look at one.
4. Stand up straight and to the side of your exhibit.
5. Speak with enthusiasm, clarity, and assuredness.
6. Don't do anything to distract the judges.
7. Relax, smile and have FUN.

AGC/United Learning • 1560 Sherman Ave., Suite 100, Evanston, IL 60201 • **800-323-9084**

FORM A: TOPIC SELECTION

Due Date: _____

Student's Name _____

Grade: _____ Category: _____

Topic Title: _____

FORM B: HYPOTHESIS

Due Date: _____

Student's Name _____

Grade: _____ Category: _____

Topic Title: _____

Hypothesis: _____

FORM C: REVIEW OF LITERATURE

Due Date: _____

Student's Name _____

Grade: _____ Category: _____

What books and magazines have you consulted? _____

List your bibliography: _____

_____

_____

FORM D: DESCRIPTION OF EXPERIMENT

Due Date: _____

Student's Name _____

Grade: _____ Category: _____

Topic Title: _____

What materials will your experiment require? _____

_____

How will you set up the experiment and keep it scientific? (Use the back of this form)

AGC/United Learning • 1560 Sherman Ave., Suite 100, Evanston, IL 60201 • **800-323-9084**

ABSTRACT FORM

STUDENT'S NAME _____

GRADE _____ SCHOOL _____

CITY _____

SPONSOR _____

CATEGORY _____

TITLE _____

(Type the abstract–single spaced–include three paragraphs: Purpose, Procedure, and Conclusion)

AGC/United Learning • 1560 Sherman Ave., Suite 100, Evanston, IL 60201 • **800-323-9084**

IDEAS FOR SCIENCE FAIR PROJECTS

What is the best home insulator?
Regeneration in planaria.
Colors' effect on heat absorption.
Wing design for balsa planes.
What is the best chemical battery?
How can you prevent iron from rusting?
Electroplating.
Distillation of alcohol.
Building a homemade hygrometer.
Conductivity of various substances.
Comparison of reaction time.
Effects of temperature on density.
Effects of ultraviolet light on bacteria.
Kite design with respect to aerodynamics.
ph comparison of antacids.
What is the best design for reduced wind drag?
Does color affect memory?
What is the best smoke detection system?
Does sound affect plant growth?
Mineral content of drinking water.
Probability.
Percent of body fat.
Taste sensitivity of smokers and non-smokers.
Which bleach works best?
Testing for nutrients.
How does lack of sleep affect behavior?
Design of robotic equipment.
Testing for ESP.
Earthworm distribution in a field.
How different paints hold up to weathering.
Social behavior of ants.
Best nose cone shape for model rockets.
Is it possible to learn while sleeping?
Does temperature affect crystal growth?
Making fabrics fire resistant.
Getting the viscosity of a liquid using a sphere.
How acids affect metals.
Which detergent works best.
Designing a solar engine.
Which is better–front or rear wheel drive?
Does oil stain or oil paint provide better protection?
Does cigarette smoke affect house plants?
Solar distillation.
Porosity of soils.
Sugar content of food.
Effect of light on reproductive growth of paramecia.
Comparison of blood pressure variation.
Effects of fertilizer on earthworms.
Plant tolerance to salt.
Fat content of margarine.
What material is best for road construction?
How does television viewing affect behavior?
Are rats social animals?
How are seeds affected by radiation?
Suspension bridge design.
Flammability testing of household goods.
Color preference of gerbils.
Effects of junk food on mice.
Paper recycling.
Temperature's effect on seed germination.
Which soil type is best for plant growth?
Design of a color blindness test.
Purifying water.
Spider web construction.
Comparison of biodegradable detergents.
Airplane wing design for greatest lift.
Does magnetism affect seed germination?
Does TV change kids' moods?
Optical illusions.
Search for the best natural filter for ground water.
Desalting water.
What are the spectra of elements and compounds?

AGC/United Learning • 1560 Sherman Ave., Suite 100, Evanston, IL 60201 • **800-323-9084**

SCIENCE FAIR CRITERIA SHEET

Directions: Use this sheet to help you decide wheat areas of your science fair project still need attention. Have your parents assist in filling out this form. Use the following point scale:

5 well done and complete
4 almost complete
3 needs improvement
2 lacking
1 not done

_____ 1. ABSTRACT – 3 parts: purpose, procedure, and conclusion – typed and easy to read.

_____ 2. RESEARCH PAPER – title page, table of contents, purpose, acknowledgments, review of literature, materials and procedures, results, conclusions, bibliography.

_____ 3. EXHIBIT – attractive, self-standing with proper dimensions, and clear bold lettering.

_____ 4. ORAL PRESENTATI0N – well planned and rehearsed.

_____ 5. TOPIC – not too broad or complicated, yet displaying a sufficient degree of difficulty.

_____ 6. CREATIVITY – unique design, project has pizzazz!

_____ 7. CONTROLLED EXPERIMENT – all factors are kept the same except for the one factor or variable being tested.

_____ 8. VALIDITY OF RESULTS AND CONCLUSIONS – measurable results supported by enough trials.

_____ TOTAL POINTS

35- 40 Everything looks great - bring on the fair.
30-34 Some additional time and work required,
35-29 Get cracking; there's work to do and soon.
Below 25 Check with teacher or sponsor immediately.

AGC/United Learning • 1560 Sherman Ave., Suite 100, Evanston, IL 60201 • **800-323-9084**

JUDGES' SCORE SHEET

Student's Name _____

Grade _____ **School** _____

Category _____

Title of Project _____

(circle score next to each category - 10 is highest)

1. Knowledge Gained **1 2 3 4 5 6 7 8 9 10**
(Has the student acquired knowledge doing this project?)

2. Information **1 2 3 4 5 6 7 8 9 10**
(Is the information collected through research valid and appropriate to the grade level?)

3. Scientific Approach **1 2 3 4 5 6 7 8 9 10**
(Was a scientific approach and controlled variable used in conducting the experiment?)

4. Collection of Data **1 2 3 4 5 6 7 8 9 10**
(Were measurements accurately taken and given in metric units?)

5. Conclusions **1 2 3 4 5 6 7 8 9 10**
(Were stated conclusions logical and valid?)

6. Written Work **1 2 3 4 5 6 7 8 9 10**
(Was the abstract present and the research paper organized and complete?)

7. Oral Presentation **1 2 3 4 5 6 7 8 9 10**
(Was it well planned and interesting?)

8. Exhibit **1 2 3 4 5 6 7 8 9 10**
(Was it visually appealing, neat, and attractive?

9. Effort **1 2 3 4 5 6 7 8 9 10**
(Was the degree of individual effort demonstrated?)

10. Creativity and Originality **1 2 3 4 5 6 7 8 9 10**
(Does the project show creative approach or thought in design or presentation?)

Comments: _____
_____
_____
_____

Outstanding 95-100
First 90- 94
Second 80-89
Third 70-79
Honorable Mention - 1-69

Total score _____ Place _____

_____ _____
Judges' Signatures

Name _____
Date _____

HOW TO PREPARE A SCIENCE FAIR PROJECT
Video Quiz

Directions: Use this sheet to write your answers to the questions asked at the end of the video. Use the back if necessary.

1. In most scientific investigations, a control group is required, What is the purpose of the control group?

2. What are variables?

3. If you were doing an experiment to determine the effects of x-rays on seed germination, what variables would you need to keep the same for all test groups?

4. In the effects of x-rays on the seed germination experiment, what would be the variable being tested?

5. A dentist might allow you to use his x-ray machine to expose the seeds to different amounts of x-rays. How would you set up the experiment?

6. Why have three or more test items or subjects in each test group?

7. What are the three things most science fairs require of each project?

8. What is an abstract and what purpose does it serve?

9. When using index cards for your oral presentation, why is it a good idea to write single words or short phrases instead of your entire speech?

10. What is a hypothesis?

AGC/United Learning • 1560 Sherman Ave., Suite 100, Evanston, IL 60201 • **800-323-9084**