Yucaipa-Calimesa Science Fair Handbook

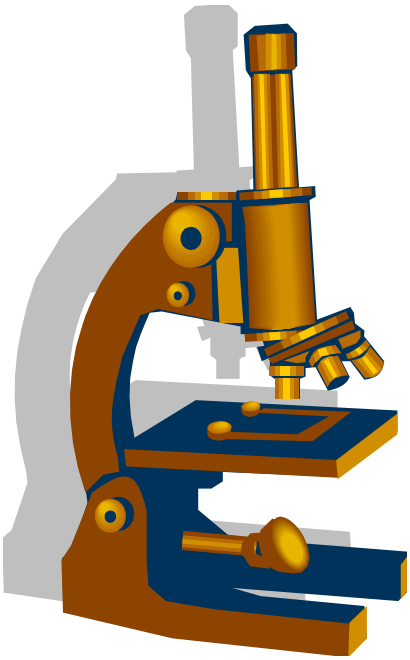


Table of Contents

Congratulations on your decision to participate in the Science Fair! The rest of this booklet will help you create an amazing project. Please be aware that all of the writing this booklet describes should be kept together in a **3-ring binder**, labeled for each section. It is very important to keep a complete and organized notebook (just like a professional scientist) that will eventually be part of your project presentation at the fair.

Happy investigating!

Research Projects

The best kind of project is a research project. Research is what real science is all about. The title of a research project is usually in the form of a question. However, you don't know the answer to the question before you begin the project.

A research project involves conducting an experiment and making observations. The experiment and observations help you to answer the question yourself. In some projects you still may not know the answer when the project is completed. Rather, you discover what is not the answer instead.

Students are not expected to do original research, something that has never been done before. The answer to almost any question a student might develop is probably known by at least some scientists. It is not so much the question that is important, or the answer to the question, but the process the student uses in solving the problem.

Demonstrations that show how things work (e.g., how volcanoes erupt) or displays (e.g., models of the solar system) are not appropriate projects for the science fair.

Questions do not have to be difficult ones; usually simple questions make the best projects. It would be foolish for students to try to solve such questions as "What are the causes of cancer?" or "What chemicals are found in a cell?" It is better that students do a good job on a little question than a poor job on a big question!

All research projects involve a problem solving method known as the SCIENTIFIC METHOD. The scientific method is used by scientists to find the answers to their questions. It is simply a step-by-step procedure for conducting experiments and testing ideas. A chart showing the scientific method is shown on the next page.

Possible Questions for Research Projects

What kind of mulch conserves the most water?
How does temperature affect plant growth?
Will artificial colors alter a cat's food preference?
What bridge design will hold the most weight?
Do plants grow better with music?
Does sugar in water of cut flowers extend their life?
Can natural substances remove tarnish from silver?
Which kind of wood gives off the most heat?

The Scientific Method

1. Ask a Question
2. Research the Topic
3. Form a Hypothesis
4. Test the Hypothesis
5. Observe and Record Results
6. Organize and Analyze Results
7. Share Results and Conclusions

The Scientific Method

1. ASK A QUESTION

You can't solve a problem unless you see that one exists. Scientists recognize problems and ask questions. For example, will roots grow in light? Does freezing before planting affect the growth of seeds? What conditions favor the rusting of iron? Think of a question that you would like to study.

2. RESEARCH THE TOPIC

Before a scientist does anything, he/she usually spends a lot of time reading. A scientist attempts to find out what other work has already been done that relates to his/her question. Research conducted all over the world is published in journals, books, and magazines. Direct your child to the library and to experts or individuals who may have information that will help him/her to understand the question he/she will be working on. Students should write down what they have learned in their journals and also where they found the information.

3. FORM A HYPOTHESIS

A hypothesis is a suggested or proposed answer to a question. Before the student begins the experiment, he/she should develop a trial answer to his/her own question. For example, if the question were, "Which vitamins help plants to grow?" the hypothesis might be, "I think Vitamin A will help plants to grow the tallest."

4. TEST THE HYPOTHESIS

PLANNING THE EXPERIMENT. Before students actually begin to experiment or build equipment, they should do some planning. They should write down what they are going to do to solve their problem. Then they should make sure that their experiment will answer the question and prove or disprove their hypothesis. For the hypothesis about vitamins and plants,

the plan might be to feed plants various vitamins--A, B, C, D, E, and none--to see which plants grow the tallest. Have someone else review the plan before experimenting to avoid problems later.

KEEPING A JOURNAL. Students should keep a log or journal of everything they do for their science fair project. The journal will include information they collected from their research, the plan for their experiment, lists of materials, steps of the experiment, what they observed, the results, etc. The journal is a diary of the entire process from start to finish.

EXPERIMENT TO TEST THE HYPOTHESIS. The student must set up an experiment that will either support or disprove the hypothesis. Each step of the process should be written in his/her journal in a way that someone else could do it EXACTLY as it was done. The student should keep careful records of how much and what kinds of materials he/she used.

Experiments are usually designed with both a CONTROL group and an EXPERIMENTAL group. For example, suppose a student wanted to find out if plants grow better with fertilizer. The EXPERIMENTAL group would be given fertilizer. The CONTROL group would not be given any fertilizer. Having two groups allows the student to see if there are differences in the way the two groups of plants grow. Be sure to repeat your experiment several times, or with several test groups, to be sure that your results are accurate.

5. OBSERVE AND RECORD RESULTS

Throughout the experiment the student should keep accurate records of what happened. This information is called DATA. The best observations are those that involve some kind of measurement, number, or count; for example, measure the height of plants grown with and without fertilizer.

Students will often rely on descriptions only, such as "The plants in the control group are growing better," or "There is less water in the flower pot containing gravel alone." While these observations are important, they are also a matter of opinion. Help your child to make observations which show measurement, such as "The plants in the control group are 2" taller than those given half as much water," or "There are 4 ounces less water in the flower pot containing gravel alone than in the pot containing gravel mixed equally with potting soil."

Sometimes measurements cannot be made in an experiment. Taking pictures periodically throughout the experiment may be the answer. Each science fair project will come with its own set of problems. Thus, planning in advance is very important!

6. ORGANIZE AND ANALYZE RESULTS

The results, or data, should be organized in chart or graph form for display on the project. Samples of tables and graphs are included on the pages that follow. The student should also have a written description summarizing what took place in his/her journal. If something unusual happened, like all of the plants freezing during cold weather, this should also be stated.

7. SHARE RESULTS AND CONCLUSIONS

When the experiment has been completed, the student should be able to reach some conclusions and answer his/her original question. Do the results prove or disprove the hypothesis? Conclusions should be written based on what actually happened. Sometimes, students will obtain results which are the opposite of what they expect to happen. Some students will tend to ignore this data and will write a conclusion based on what they thought would happen instead. You can assist your child by helping him/her to understand what the data show and to guide him/her to write a conclusion based on the results alone.

At the end of an experiment a student might still be unable to answer the question he/she asked in the beginning. Sometimes the data might not be clear enough to draw a conclusion. Students should be aware that some experiments will be unsuccessful. Honesty and a willingness to admit that the experiment was unsuccessful or the results unclear are part of the scientific process. This kind of situation will not count against your child in the judging of his/her project.

Data Tables

A properly constructed data table follows these guidelines:

1. has a descriptive title
2. contains labels describing what information has been collected
3. lists numbers telling how results were measured
4. can be read and understood by someone not familiar with the project
5. is clear and neat

Sample Data Table

Average Height of Plants in Inches Over Time

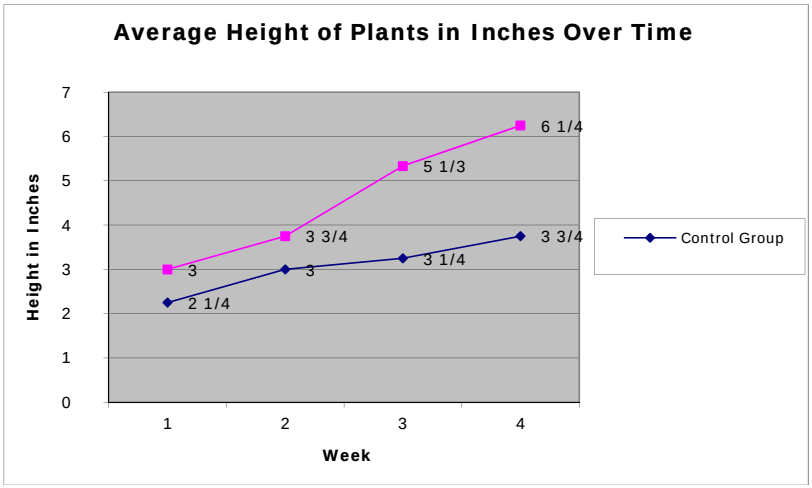
Date of Measurement	Experimental Group Average Height	Control Group Average Height
Week 1 January 15, 2011	2 1/4 “	3”
Week 2 January 22, 2011	3”	3 3/4”
Week 3 January 29, 2011	3 1/4”	5 1/3”
Week 4 February 5, 2011	3 3/4”	6 1/4”

Line Graphs

A properly constructed line graph follows these guidelines:

1. has a descriptive title
2. labels the side and bottom lines of measurement
3. plots each point neatly and clearly
4. draws lines between points with a ruler
5. is drawn on graph paper or on a computer

Sample Line Graph



Rules

1. Each entry must come from one individual student.

2. The work on the project should be done by the student. If any outside help or assistance was given, it must be described in the project notebook (journal).

3. Exhibits must be free standing and must be constructed of durable materials.

4. No living or non-living animals, viruses, molds, or bacteria may be displayed. Use photographs or drawings instead.

5. Dangerous chemicals, drugs, or open flames may not be displayed. All electrical equipment must conform to standard electrical safety laws.

6. Students and parents should be aware that, although care will be taken, damage could possibly occur to projects while on display. The district will not be responsible for lost, stolen, or damaged items. Do not include valuable items in displays.

7. Exhibits should not exceed the following dimensions: 48 inches long x 30 inches wide x 96 inches high. (See below.)

8. Projects must be removed by the specified date and time or they will be disposed of.

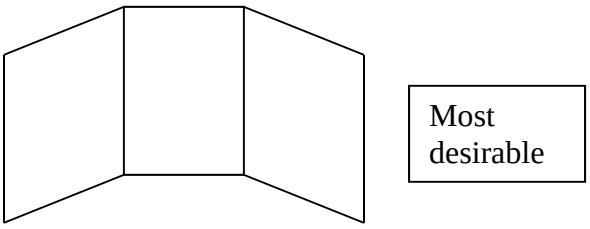
The district reserves the right to reject projects which are unsuitable for display.

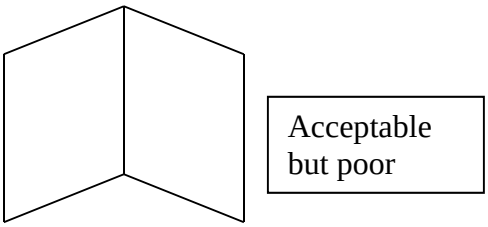
DISPLAYS

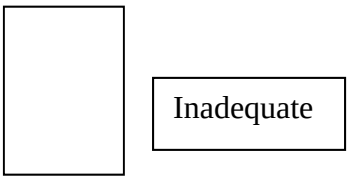
Check with your school office to see if Science Fair boards are for sale, and if not, your local office supply store will be helpful.

Display Maximum Dimensions: 48 inches long x 30 inches wide x 96 inches high.

Sample Display Materials: plywood, masonite, paneling, hardboards, cardboard display box.







Helpful Hints for Developing a Successful Science Fair Project

1. START EARLY. A typical project from start to finish will take from two to four weeks. Starting early will allow students time to make mistakes, to gather sufficient data, and to develop good displays.

2. KEEP GOOD RECORDS. Most of the judges will look at the student log book (journal). It is very important that the student maintain accurate records. The journal should be neatly handwritten.

3. USE ILLUSTRATIONS AND/OR PHOTOGRAPHS to illustrate the procedures, record data, show experimental set-up or design, etc.

4. MAKE STURDY DISPLAYS. The project display should be very sturdy. Students may purchase foam board, cardboard, wood, or other sturdy materials.

5. SPEND TIME MAKING DISPLAYS. The display should be neat, clearly labeled, attractive, and organized. A good project on a poor display can be overlooked when being evaluated. The project notebook (journal) should be well organized and neatly written.

6. JUDGE YOUR CHILD'S PROJECT. Go through the scoring rubric on the next page. Make sure that your child does not overlook any of these important criteria.

7. ROLE PLAY A JUDGE. Ask your child questions about his/her project and ask him/her to explain the difference between the control and the experimental groups. He/She needs to know why the results of his/her experiment support the conclusion.

8. ASSIST BUT DON'T DO. You may help and assist your child, but do not do the project for him/her. A judge can easily determine whether the child did the project or his/her parents or another family member did it.

Scoring Rubric

Every student will be interviewed by the judges about his/her project. Students will have up to 3 minutes to describe their projects to the judges. The judges will then have 2 minutes to ask questions. Every project will receive a blue, red, or white ribbon based on achievement in six areas.

Ribbon Levels:

Blue ribbon: Meets or exceeds criteria in all 6 categories
Red ribbon: Meets criteria in 4 or 5 categories
White ribbon: Meets criteria in 1, 2, or 3 categories

1. **DISPLAY (See page 7 for a sample.)**
   - is neatly prepared and well-organized
   - is free of misspellings and corrections
   - is visually attractive
   - shows clearly labeled parts of the scientific method and materials used

2. **SCIENTIFIC CONTENT**
   - follows the steps of the scientific method:
     asks a scientific question
     researches information about the question
     states a hypothesis
     tests the hypothesis through experiments
     observes and records results from experiments
     organizes and analyzes the results
     shares the results and conclusions
   - lists all materials used and procedures that were followed in a logical and organized way
   - summarizes results on tables, graphs, or charts
   - draws logical conclusions from the data

3. **PROJECT NOTEBOOK (JOURNAL)**
   - shows student consulted several sources in his/her research and lists what they were
   - is neat, organized, and reflects the steps the student used in creating the project
   - records observations of the experiment over a period of time
   - is written in the students' own language and handwriting

4. **THOROUGHNESS**
   - shows an appropriate level of research for the grade level of the student
   - repeats experiments or tests large enough numbers to show valid conclusions
   - analyzes the data in a manner that is accurate, appropriate, and shows thought

5. **SKILL**
   - shows a level of difficulty that is appropriate for the grade level
   - demonstrates that the work was done by the student
   - can talk clearly about his/her project and can answer questions from the judges

6. **CREATIVITY**
   - is original or unique in its approach
   - uses materials and/or equipment in a new way

The PTA Council would like to thank the Yucaipa-Calimesa Joint Unified School District for its continued support with providing the facilities to hold our events.

Our special thanks go to the administrators, community members, and parent volunteers who gave many hours and helped to make the district fair possible this year.