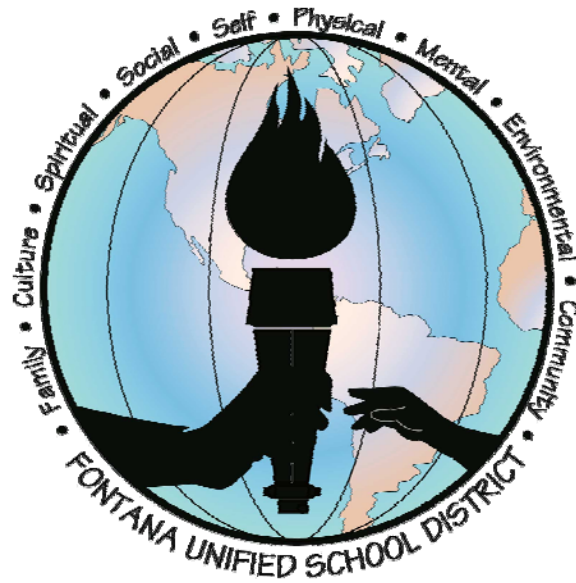




*Fontana Unified School District
Instructional Services*

*Science Fair
Handbook
2009-2010*

Site Coordinator



Board of Education

Laura Abernathy Mancha
Gus Hawthorn
Julie A. Ramos
Kathy Binks
BarBara L. Chavez

District Administration

Cali Olsen-Binks, Superintendent
Richard Stedry, Ed.D., Deputy Superintendent, Business Services
Yolanda, Mendoza, Associate Superintendent, Human Resources
Oscar Dueñas, Interim Associate Superintendent, Instructional Services
Linda Del Giudice, Ed.D., Assistant Superintendent

Department of Secondary Instruction

Kimberly MacKinney, Director
Kelly Allen, Coordinator
Stella Jimenez, Senior Secretary II

Special Thanks to:

Theresa Pearce, Live Oak Elementary School
Martha Hunter, Science Enrichment
Harold Potter, Fontana Middle School

Mission Statement

Participation in the Fontana Unified School District's Science Fair provides students a practical way to apply the Investigation and Experimentation California Science Content Standards. In the context of a long-term research problem, students make concrete associations. This is accomplished by exploring a meaningful scientific topic in a systematic way that allows students to express their curiosity, creativity and ingenuity.

The objectives of the Science Fair are:

- To support high academic standards
- To support hands-on learning that supplements direct instruction
- To encourage students to gain a greater understanding of the discipline
- To support students inquiry as a catalyst for developing critical thinking
- To encourage students to recognize the relevance of science outside of the school contest, its interrelationship with technology and the possibility for social input
- To recognize student's accomplishments and excellence

Helpful Hints for Coordinators

- DON'T TRY TO DO EVERYTHING YOURSELF!!!
- Meet with your Principal and/or Assistant Principal to earn their support
- Be on the agenda for staff / department meetings
- Keep your colleagues informed and involved
- Share event information at your School Site Council / ELAC Meetings
- Hold a parent night
- Establish a committee at your site to:
 - Generate ideas
 - Provide staff development for new teachers & help set-up displays
 - Attend meetings if you cannot

Elementary and Secondary Science Fair Coordinator Timeline 2009-2010

TIMELINE	THINGS TO DO
September-November	<ul style="list-style-type: none"> ● Meet with administration to determine level of site involvement and set date for the site competition. ● Site Competition Date _____ ● Share information at staff/department meeting. ● Form site "Committee" ● Begin to generate student interest <ul style="list-style-type: none"> ~ Library display ~ Poster ● Speak at SSC/ELAC or PTO(A) meeting about event ● Include Science Fair Event info in your site newsletter
November/December	<ul style="list-style-type: none"> ● Ask for time on staff/department meeting agenda ● Speak to staff, answer questions, give reminders ● Check in with colleagues ● Ask administration/department chair to include reminder in site bulletin, email, to staff/department ● Hold a family Science Fair information night
December/January	<ul style="list-style-type: none"> ● Collect B track projects ● Collect C track projects
Completed by Early February	Hold your Site Competitions , hand out and collect student information packets, entry forms and permission forms.
February 5, 2010	Turn in the following to Stella Jimenez, (Ext. 7240) in the Office of Secondary Instruction, located in the Administration Building (Building #1). <ul style="list-style-type: none"> ● All Student's Entry Project Applications (for team entries, one must be completed for each student) ● List of Judges and Volunteers
Friday, February 26, 2010 2:00 – 5:00 p.m.	<i>Eve of District Science Fair</i> Project Set-Up and Public Viewing. NO PROJECTS WILL BE ACCEPTED ON THE DAY OF THE SCIENCE FAIR.
Saturday, February 27, 2010 7:00 a.m.	<u>DISTRICT SCIENCE FAIR</u> Attend District Science Fair (Coordinators serve as Judges) Judging 8:00 to Noon, Public Viewing from 2:00 to 3:30 and awards at 3:30 p.m.
March (TBD)	County Competitors <u>must register online</u> .
March (TBD)	Registration forms are due to the Office of Secondary Instruction

General Rules

1. All projects must be pre-approved by a certificated staff member and meet acceptance criteria. A previously investigated topic may continue under investigation but data previously displayed must be treated as 'research'. New data must be generated, displayed and conclusions drawn based on the new data.
2. Construction must be durable with all parts firmly attached. All projects must be either table or floor displays. No wall displays will be allowed. Maximum size is:

Table Project: 4 feet wide x 2 ½ feet deep x 6 ½ feet tall

Floor Project: 4 feet wide x 2 ½ feet deep x 9 feet tall

No items may be displayed outside the 4' x 2.5' space. All functions should be shown in photographs (no faces). Projects must be secure standing alone and not easily tipped over or knocked down.

4. No living or non-living plants, mold, viral or bacterial materials may be on display in any manner other than in photographs.
5. Open flames are not permitted in the display. No gas, water or extension cords for power will be provided.
6. In accordance with California Education Code, no project may use consumable alcohol, tobacco, or illegally obtained narcotics and/or controlled substances. This includes surveys that compare use of the stated substances.
7. No live motors or rocketry components will be permitted as a part of a display.
8. A student may participate in only one project.
9. Teams are limited to no more than 3 students within the same division.
10. All experimental works must be completed by the student. A strong focus on the research and investigation aspect rather than the display of results will help. Adults may supply materials, advice and consultation and their contributions must be recorded in the student journal...Questionable projects will not advance to the Inland Science Fair.
11. The district reserves the right to refuse any exhibit that it deems unsafe, unsuitable for public exhibition that fails to adhere to any or all regulations, or is in direct conflict with the California Education Code.
12. The District assumes no responsibility for loss or damage to any exhibit or part thereof.
13. Refer to the RIMS Science Fair Rules and Regulations for more information.

Judging Criteria

Originality: - 20%

Original ideas and the creative use of resources are usually impressive. This originality may be in the scientific concept, a new approach to solve an old problem, or a new interpretation of data. However, an original project must be well executed. Original projects are those that go beyond the textbooks and explore new ground and innovative techniques.

Comprehension – 30%

Comprehension is the understanding and appropriate use of scientific theory, terms, techniques and methodologies. Students should have a depth of knowledge about the scientific and engineering principles and practices, which can be shown by the ability to extrapolate what was learned from the project to the subject in general. Depth includes understanding the basic science behind the project topic, comprehension at a finer level of detail, and awareness of the influence that the project has on related material in the subject topic.

Organization and Completeness: - 30%

The project should have a well-defined goal or objective. The materials, methods, and experimental design should be sufficient to answer all the appropriate questions. A second component of organizations is thoroughness, which includes not only the issue of how well the original questions have been addressed, but also the issue of how fully questions arising during the project have been addressed. It is the duty of all scientists to provide evidence in support of their claims. The burden of proof does not rest with the observer. Without supporting results or data, the science project is not a completed work.

Effort & Motivation: - 10%

The amount of time a student has spent doing the actual science project and the amount of time the student has spend reading and learning the subject should both be considered. While motivation and effort are not the same, the amount of effort that goes into a project is usually an indication of a student's motivation. It is important to know if a student enjoyed the experience and is interested in learning.

Clarity: - 10%

Written and oral communications skills are very important in science and engineering. Ideas should be clearly presented and easy to understand. The experiments should have well-defined goals which indicated clear understanding of the basic science. A well-written abstract, easy to follow visual aides, and clear and concise answers all add to the quality of a project.

Additional Considerations within the Judging Criteria

Originality

- New approach
- New interpretation
- Goes above and beyond
- Explores new ground
- Innovative techniques

Comprehension

- Appropriate use of Scientific Method
- Demonstrates *depth* of knowledge and understanding
- Conclusions based on results
- Extensions to the real world
- Possibilities for further research and application
- Evidence of science learned

Organization & Completeness

- Well defined goal or objective
- Thoroughness
- Sufficient sample size
- Repetition of experiment
- Provides evidence and proof based on supporting results or data
- Research included
- Clear procedure
- Data is summarized in tables or graphs

Effort & Motivation

- Spent time *doing* the project
- Spent time *reading and learning*
- Appeared to enjoy the experience
- Interested in learning more

Clarity

- Well-written abstract
- Includes journal with notes and observations
- Ideas clearly presented
- Easy to follow display

Display

- Effective communication
- Attractive
- Nice use of color
- Clear graphs, charts, tables
- Neat
- Free of errors

Use of Math

- Uses grade level mathematical techniques
- Higher level of sophistication
- Ample data analysis
- Meaningful calculations
- Impressive graphs

Elementary projects are placed in the following categories:

1. Behavioral Science
Studies of behavior, conditioned responses, learning, psychiatry or psychology in humans and animals.
2. Biology – Animals
Studies of vertebrate or invertebrate zoology.
3. Biology – Other Kingdoms
Studies of plants, fungi, protists, and bacteria.
4. Chemistry
Studies of chemical and physical properties of organic and inorganic materials.
5. Consumer Science
Examination, comparison, analysis, testing of manufactured devices or trade name chemicals, materials, etc., product quality, safety, and consumer satisfaction.
6. Earth Sciences
Studies of geology, meteorology, oceanography, astronomy, and space travel.
7. Environmental Education
Projects using biological systems/organisms to study the impact of natural and man-made changes in our environment.
8. Math
Studies in geometry, topology, number theory, statistics, computer graphics, artificial intelligence, and modeling or simulations.
9. Physics (PH)
Studies of electricity, magnetism, aerodynamics, energy, physical properties of matter, and applied dynamics

Grade 6-12 projects are placed in the following categories:

See the RIMS Regulations and Information Packet for category descriptions

1. Aerodynamics / Hydrodynamics (Junior Division Only)
2. Applied Mechanics & Structures
3. Behavioral and Social Sciences
4. Biochemistry / Molecular Biology
5. Chemistry
6. Cognitive Science (Junior Division Only)
7. Earth Sciences & Planetary Sciences
8. Electronics & Electromagnetics
9. Environmental Engineering
10. Environmental Science (Junior Division Only)
11. Mammalian Biology
12. Materials Science (Junior Division Only)
13. Mathematics and Software
14. Microbiology
15. Pharmacology / Toxicology
16. Physics and Astronomy
17. Plant Biology
18. Product Science - Biological (Junior Division Only)
19. Product Science – Physical (Junior Division Only)
20. Zoology

Team projects (2-3 students) are judged along with individual projects in the same category.

Fontana Unified School District
Department of Secondary Instruction

Science Fair K-12 Division Information

Primary: Grades K-3 (District Level Only)

Individual, team and class entries must be judged at the site level and meet all acceptance criteria.

Project Limit: No more than 3 individual, class, or team per site.

Project Limit

Individual and team entries must be judged at the site level and meet all acceptance criteria.

Elementary 4-5 Division: No more than 6 individual, class, team per site.

Elementary 4-6 Schools: No more than 9 individual, class, team per site.

Junior 6-8 Division: No more than 9 individual, class, team per site.

Senior 9-12 Division: No more than 12 individual, class team per site.

Please note: For team entries, each student must have equal responsibility and complete their own journal. Each team member must be prepared to answer judges' questions at the RIMS Science Fair.

Special Needs (District Level Only)

Individual, team and class entries must be judged at the site level and meet all acceptance criteria.

Project Limit: No more than 3 individual, class, or team per site.

Judges

Each participating site must send at least 2 volunteer judges.

Applications

Applications must be submitted together as part of a site science fair selection process.

A student may participate in only one project

Teams are limited to no more than 3 students

How to Prepare a Science Fair Project

What is a science project?

A science project is an investigation using the scientific method to find an answer to a scientific problem.

What are the steps of the scientific method?

PROBLEM- The problem is a testable question of your topic. What will you investigate? State this as a question.

RESEARCH- Once you have determined your problem, gather background information on your topic. Use books, magazines, or the internet; or interview an expert who has first hand experience with your topic. Take notes on the information found to write a report and keep a list of the resources used in order to prepare a bibliography (references page).

HYPOTHESIS- The hypothesis is your best guess based upon your research. Explain what you think will happen in your experiment and predict the results.

MATERIALS- Materials is a list of everything you will use to complete the experiment. List what you will need and the amount needed. Use metric units of measurement.

PROCEDURE- The procedure is a step-by-step description of the process needed to complete the experiment. Someone else should be able to follow the steps in order to repeat the experiment. Tell amounts, sizes, times, and the order each step was completed.

DATA & OBSERVATIONS- Daily observations (progress) and/or measurements should be written by hand in the notebook, as journal entries, over time or multiple (repeated) trials recorded. The experiment needs to be repeated at least 3 times. Data is then shown in the form of tables, graphs, or charts. Use a sufficient sample size, especially for human, plant, and animal projects.

RESULTS- Results is a written description (summary) of what happened in the experiment. This should include an analysis of the data.

CONCLUSION-The conclusion is a written description of what was learned by doing the project. When writing the conclusion consider the following questions:

- Based upon the results of my experiment, did I prove or disprove my hypothesis?
- What did not go as I expected?
- What would I change or improve, in attempting the experiment in the future?
- What did I learn?
- How could I use (apply) the new knowledge that I gained?
- What is the importance of this experiment to my life or to the lives of others?
- How could I apply this experiment to real life?
- What further experiments would I try pertaining to this topic?
- What else would I like to know about this topic?

Notebook: The steps of the scientific method, an abstract, research report and bibliography are included in the notebook. The notebook also contains original notes of the data and observations/measurements either written as journal entries over time or records of the multiple (repeated) trials performed. Daily journal entries (daily progress) can be kept in a separate spiral notebook or put in the Notebook in the Data section.

Now that I know the steps of the scientific method, how do I begin my project?

Step 1: Select a **topic**. (Example: plant growth in different types of soil)
Look for something of interest, for which you don't already know the answer. Ask yourself, "I wonder how that works? I wonder what would happen if...?"

Write your first daily progress journal entry about why you selected your topic.
Certification forms **must be completed if using live vertebrate (backbone) animals, or human subjects. See a science fair coordinator or RIMS Regulation Packet http://www.sbcss.k12.ca.us/Cnl/cni_DOST_rimsSciEngr.php for these forms **before** beginning the project, to get it approved.**

Step 2: Design a **problem** to investigate. State the problem as a question.

(Example: Will the stems of bean plants grow taller in potting soil, backyard dirt, gravel or sand?)

Step 3: Begin your **notebook** by recording entries over time as journal daily progress entries. Be sure to explain why you chose your topic and problem. Don't forget to include what you expect to discover by investigating the chosen topic. Every time you work on your project, write in your daily progress journal.

(Example: Nov. 3, 2003-Today I chose my topic. I chose to research about plants because I enjoy working in the garden with my mother every weekend. I would like to see what is the best type of soil to help our garden grow. I will look for information on sprouting seeds, soil types, soil content, and the best conditions for plants to grow.)

Step 4: **Research** the topic. Once you have chosen your problem to investigate, it is important to research the written materials available on your subject.

- Read books and articles on your topic. Go to the library. Use the internet. Check for current events in the newspaper.
- Take notes on the information you find to prepare a research report (2 page minimum).
- Keep a record of the resources (books, articles, internet) used to prepare a bibliography.
- You could even talk to experts that know about your topic or visit places about your topic.

(Example: Check out books from the library, search the internet, talk to professional landscapers or people at your local nursery. Interview university professors.)

Step 5: Form your **hypothesis**. Before you begin your experiment you need to state what you think will happen in the experiment. This is an answer to your problem (question) based upon information found in your research. The hypothesis can be written as an If...Then Statement.

(Example: I think that the bean plants will grow taller in potting soil because it has special nutrients to help plants grow. *Or* If I use potting soil to grow my bean plants then their stems will grow taller because of the special nutrients in the soil.)

Step 6: Planning the **experiment**. Design an experiment to test your hypothesis. (Is there anything you haven't considered that could affect your experiment?) Gather all of the **materials** you will need. Plan enough materials to use various samples in each group that you are testing. Write a materials list. Use metric measurements.

Write the **procedure** (method), the step by step process for doing your experiment. Be specific by including exact measurements and list the steps in order. Control your variables. A variable is anything that can change or vary during an experiment. In an experiment everything should be the same each time you test, except the one variable you are testing. Repeat the experiment at least three times.

(Example: Materials- one package of bean seeds, 20 small 10 cm. clay pots without holes in the bottom, 150 ml. tap water for each pot every day, sunlight, 250 g. of each type of soil for each pot, trowel, centimeter ruler, and 500 ml. liquid measuring cup.)

To control my variables I need to put the same amount of soil in each pot, water them the same amount, use the same number of seeds and keep them in the same place in my backyard. The variable I am testing is the different types of soil.)

(Example: Procedure-Step 1- Gather all of the materials. Step 2- Take five pots and place 250 grams of potting soil in each. Label them "potting soil 1," "potting soil 2," "potting soil 3," "potting soil 4." "potting soil 5," Step 3- Repeat the above step with five more pots of sand., 5 pots of gravel, and 5 pots of backyard dirt. . . Step 10-Record data for 6 weeks.)

Don't forget to keep writing your daily progress journal entries.

Step 7: Test your hypothesis. Use the materials to follow your procedures to complete the experiment. Make **observations/measurements** and collect **data** during the experiment. (Measurements must be made using the metric system.) Record this information in your journal. Repeat the experiment through multiple trials or over time. Use a sufficient sample size.

(For example, five plants in each group of the different kinds of potting soil.)

(Example: November 20, 2003-Experimental Day 1- The plants did not sprout today. I watered each plant with 150 ml of water. November 27, 2003-Day 7- I measured each group. The sand group plants are all 4 centimeter tall.)

Step 8: **Organize data**. Make tables or charts as you collect the data. Then use the data to make graphs such as bar, line, or circle graphs. You can average the data from the trials, use percentages, or another form of mathematics to analyze the data. Show your calculations (raw data) in your journal daily progress section of your Notebook.

Example: Plant Growth

Soil Types	Day 1	Day 7		Day 1	Day 7
Potting soil #1	no	6 cm	Backyard #1	no	3 cm
Gravel #1	no	1 cm	Potting Soil #2		
Sand #1	no	4 cm	Gravel #2		Etc.

Step 9: Write a summary/narrative, describing the **results** of the experiment, and analyze the data gathered through your observations and measurements.

(Example: After six weeks, the five plants in the potting soil were 15 centimeters tall on average. etc.)

Step 10: State your **conclusions**. Look at your data and decide what it tells you about your hypothesis. (See the scientific method steps for further explanation of what to include in your conclusion.)

(Example: Based upon the results of my experiment, I proved my hypothesis was correct. I learned that if the soil has enough nutrients the plants grow taller. Next time, I would see how the root systems reacted to different soil types. etc...)

Step 11: Organize your **notebook**. It should include the following sections in sequential order:

- Title Page- This page states the title of your project, name, grade, school, and teacher.
- Table of Contents- This page provides the reader with a list of the different parts of the project and the page number on which each section can be found.
- Abstract-The abstract is just a summary of your whole project. Write it after you finish your project but put it in the front of your Notebook. It also goes on the board on the top left corner of the left side panel.
 - Include the following subtitles:
 - Objectives/Goals:
 - Methods/Materials:
 - Results:
 - Conclusions/Discussion:
 - It should not be longer than one page.
- Problem- This page states the testable question that you are investigating.
- Research & Bibliography- This is the report of all of the background information you collected about the chosen topic, written in your own words. Bibliography- This page lists the resources used to research the project. Books, magazines, and/or internet resources need to be listed in alphabetical order. Experts interviewed needed to be cited here. Use a minimum of three to five resources other than encyclopedias and textbooks. No wikipedia.
- Hypothesis- This page states the hypothesis as previously defined. You make an educated guess about the answer to your testable question.
- Materials- This page states the materials used in the experiment and their amounts.
- Procedure- This page lists and describes the steps to complete the experiment.

- Data & Observations- These pages include the entries of observations/measurements made over time, data from the multiple (repeated) trials of the experiment and the graphs, charts, or tables. All data needs to be in original form and not copied. Your daily progress journal entries may also be put in this section or they can stay in a separate spiral notebook.
- Results- This page describes what happened in the experiment by analyzing the data.
- Conclusion- This page describes what was learned from the project.
- Acknowledgements- This page is where you thank all of the individuals who assisted in the research or development of the project. A description of what each person did also needs to be included. (For example, I would like to thank my mom for helping me put my board in order.)
- Appendix-This section can include any internet articles or other notes used to write your research report.

All sections of the Notebook may be typed with the exception of the journal daily progress entries which should be handwritten. **Please note: You must include handwritten notes of any sections that you choose to type.

Sample Bibliography:

-Citing Books:

Author's last name, Author's first name. Title of Book. City of Publication: Publisher, Year of Publication.

Smith, James. Potting Soil. Los Angeles: Scholastic Inc., 1999.

-Citing Articles:

Author's last name, Author's first name. "Title of Article." Title of Magazine. Volume Number (Year of Publication): Page Numbers.

Jones, Wilma. "Growing Plants." Home & Garden. 44 (2000): 1-7.

-Citing Websites:

Author's last name, Author's first name. (Year of Publication). Title of Article. Retrieved date from the World Wide Web: website

Missene, Beto. (2001). Growing the Best Plants. Retrieved November 22, 2003 from the World Wide Web: <http://www.plants.com>

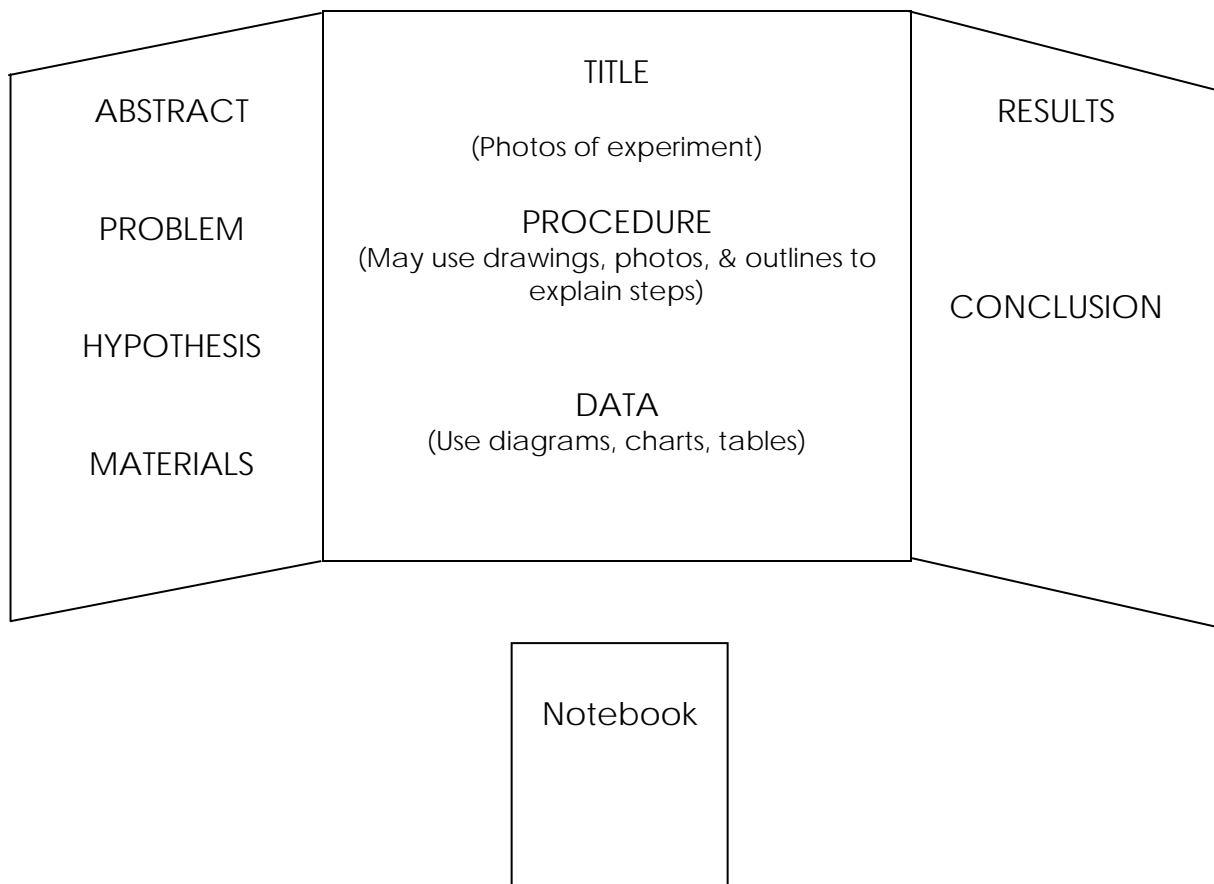


Step 12: Designing the **display** board for your project.

- Include a title. This should be something catchy or interesting that has to do with your topic. It is not your problem (question). (Example: Plant Preferences)
- All the steps of the scientific method are included on the board, except the research which only goes in the Notebook. The order of the board needs to follow a logical progression.
- The display needs to be neat, clean and organized. It can be typed or hand written neatly with the steps of the scientific method written separately as subheadings. (See drawing below. Construction paper can be used to border each step of the project. Pictures of the experiment should also be used on the display board. No faces of test subjects or experimenter. Be creative and consider good use of color and design.
- The Notebook needs to be set in front of the project. It may be attached to the board.
- Living or non-living plants, mold, viral or bacterial materials may not be displayed. You can use pictures, plastic, or plaster.

The display board must be able to stand up by itself. It consists of three sides, and the physical dimensions of the display should be such that it occupies a space no longer than 30 inches deep, 48 inches wide, and the top stands (including table) not more than 90 inches from the floor. You may assume that the tables used in the science fair are about 29-30 inches in height.

SAMPLE DISPLAY



Science Project Websites

Don't just use these ideas. Take these ideas and try to add something of your own.

California State Science Fair

<http://www.usc.edu/CSSF/>

-Ideas to get you started on a science project. Gives you links to other science project websites.

Science Buddies

<http://www.sciencebuddies.org/>

-Topic selection wizard to help you get ideas for your science project, an Ask an Expert online bulletin board, and topics arranged in science project categories.

NCES Kids' Zone

<http://nces.ed.gov/nceskids/>

-Create a graph by clicking on the graph icon or take a graphing tutorial.

The Kids' Guide to Science Projects

www.ipl.org/div/projectguide/ or <http://www.ipl.org/youth/projectguide/>

-Find project ideas, sample projects, and how to do research. Includes links to project ideas, research sites and links to "ask an expert," for more research information.

All Science Fair Projects

<http://www.all-science-fair-projects.com/>

Science Fair Central

<http://school.discovery.com/sciencefaircentral/>

-Everything you need to know about creating a science fair project.

Thinking Fountain

<http://www.sci.mus.mn.us/sln/tf/nav/thinkingfountain.html>

-Index of ideas in order from A to Z.

Rocks for Kids

<http://www.rocksforkids.com>

-erosion, soil

Environmental Protection Agency

<http://www.epa.gov/students/waste.htm>

-environmental ideas, research

CMS Science Fair

<http://www.qacps.k12.md.us/cms/sci/fair/IDEASFR.HTM>

-Project ideas within their scientific categories.



Sample Abstracts

Project Abstract Examples http://www.usc.edu/CSSF/Info_GenI/Abst_Ex.html

*The Frequency of Antibiotic Resistant *E. coli* in Alimentary Tracts*

Objective: The objective is to determine if the average American has ampicillin- and tetracycline-resistant strains of *E. coli* in their alimentary tract.

Materials and Methods: Informed consent was obtained from 100 randomly selected people, 50 men and 50 women ranging in age from 10 to 92 years. An isolate of *E. coli* was obtained from the stool of each subject and grown in the presence of tetracycline and ampicillin. The area of inhibition was measured and compared to that of a non-resistant strain of *E. coli*. The percentage of sensitive and resistant organisms was determined by age and sex.

Results: Thirty percent of the men and 24% of the women were found to have ampicillin-resistant *E. coli*. The majority of the sample population was found to be under the age of 50. Slightly more people age 50 and over were found to be resistant than those under 50. Only 12% of both men and women were found to have tetracycline-resistant *E. coli*, with the older population again having a somewhat higher incidence of resistance.

Discussion: Penicillin and its derivatives such as ampicillin, were the first commercially available antibiotics. Tetracycline was introduced later. The length of exposure to the antibiotics is reflected in the greater percentage of subjects with ampicillin-resistant *E. coli* (24% to 30%), compared to those with tetracycline-resistant organisms (12%). In addition, subjects age 50 and over who would have a longer life-time exposure to both antibiotics were more likely to harbor antibiotic resistant *E. coli*. These data suggest that antibiotics should be carefully dispensed and monitored by health care professionals.

The Effect of Surface Finish on Rocket Drag

Objective: My project was to determine if surface finish has an effect on the drag of a model rocket. I believe that a model with a smooth surface will have lower drag and will reach higher altitudes.

Materials and Methods: Five model rockets with identical size and shape, but different surface preparations, were constructed. One rocket was left with an unfinished surface, three had surfaces finished to various degrees of smoothness, and the fifth rocket had its surface sealed, primed, sanded to 600 grit, painted, and covered with clear gloss. The rockets were ballasted to weigh the same and flown 10 times each with B5-4 motors.

Results: The rocket with the clear gloss finish consistently reached the highest altitudes of all 5 rockets, while the unfinished rocket consistently reached the lowest altitude.

Conclusions: My conclusion is that surface finish has an important role in model rocket drag and rockets with carefully prepared surfaces will reach higher altitudes.

Data & Observations Vocabulary

Control Group-Part of a science experiment that has no variables added. Information from the Control Group is used to compare results.

Experimental Group: the group in which the independent variable is changed.

Variables-Anything in an experiment that is changed from the Control Group in order to solve the problem statement.

Independent variable-the one you change

Dependent variable-the one that you observe or measure (the one that may be affected by the independent variable)

Constant variables: other variables which could affect the dependent variable but which you keep constant

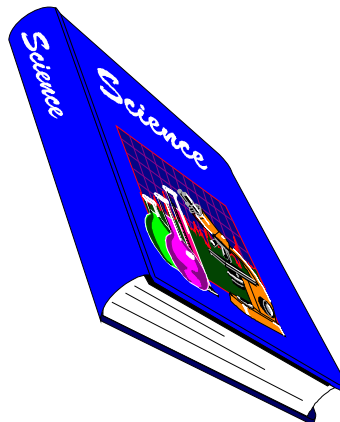
For example: Time is an independent variable. You control the amount of time that it takes to conduct your experiment. Changes that occur over time are the dependent variable. When you change the independent variable, a corresponding change occurs in the dependent variable. The dependent variable is plotted on the **y-axis**. This is the vertical axis. Scale each axis appropriately. Each interval (square on the graph paper) must represent the same amount.

Data-Display your data in the form of graphs, charts, or pictures to show the reader what you observed during the experiment. When constructing a graph, be sure that you give it a title. Label the **x and y-axes** and indicate the unit of the quantity being graphed. The independent variable is plotted on the **x-axis**. This is the horizontal axis. The independent variable is usually the variable controlled by the experimenter.

Line graph-Demonstrates change over time.

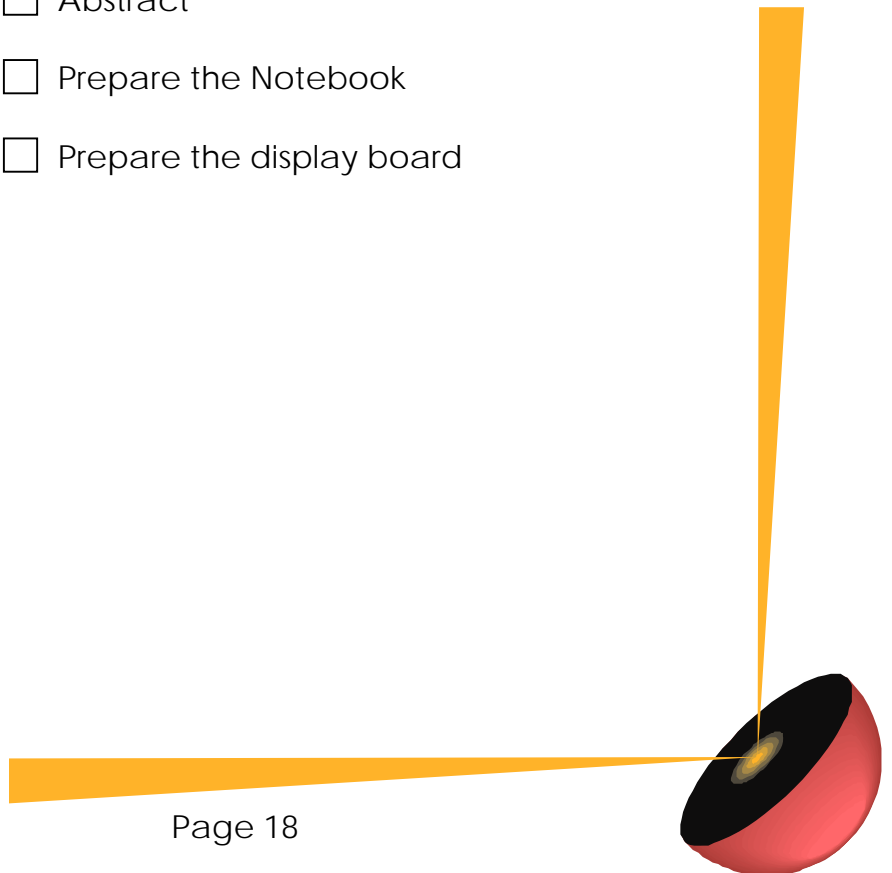
Bar/picture graph-Demonstrates a comparison between two or more things.

Circle/pie graph compares parts to the whole.



Acceptance Criteria Checklist:

- Start journal (daily progress) entries
- Problem
- Research & Bibliography
- Hypothesis
- Materials
- Procedure
- Data & Observations
- Results
- Conclusion
- Abstract
- Prepare the Notebook
- Prepare the display board



SUPPLEMENTAL SCIENCE PROJECT RESOURCES

Discovery Education Streaming Video-
How Scientists Work: What is the Scientific Method?
(21 minutes in 14 segments, grades 6-8)

Sample Problems-
Try putting different words in these blanks. . .

What is the effect of _____ on _____?
detergent germination of seeds
temperature the volume of air

How/To what extent does the _____ affect _____?
humidity growth of fungi
color of a material its absorption of heat

Which/what _____ (verb) _____?
food do gerbils prefer
detergent makes the most bubbles

Sample Hypothesis-
"If" this is done, "then" this should happen.
If soil particle size is smaller than 0.1mm, then water infiltration will not occur.

Name: _____

Date: _____ Period: _____

Classroom Activity: Practice Posing Our Own Questions

Directions: Examine each statement below. Identify the subject, the manipulated (The one you Change) variable, and the responding (The one you measure or observe) variable. Then, for each statement, pose a scientific question using one of the two question starters ("What is the relationship between.....?" or "What is the effect of.....?").

1. Hot water will cool at a faster rate than cool water. Subject: _____ Manipulated Variable: _____ Responding Variable: _____ Question: _____ _____
2. Different amounts of water freeze at the same temperature. Subject: _____ Manipulated Variable: _____ Responding Variable: _____ Question: _____ _____
3. Water with sugar dissolved in it evaporates slower. Subject: _____ Manipulated Variable: _____ Responding Variable: _____ Question: _____ _____
4. The larger the quantity of water, the higher temperature at which the water will boil. Subject: _____ Manipulated Variable: _____ Responding Variable: _____ Question: _____ _____
5. Mice will weigh more if their diet consists of junk food. Subject: _____ Manipulated Variable: _____ Responding Variable: _____ Question: _____ _____

Sample Classroom Activity-**Objective-Students will develop a specific materials list and procedure.****Materials List and Procedures Demonstration*****Making a peanut butter and jelly sandwich***

Begin this demonstration asking students to help you develop a materials list of the items you need to make a peanut butter and jelly sandwich. Have the items at school but out of student view.

Materials needed:

1. Plate
2. Loaf of bread
3. Knife
4. Spoon
5. Jar of peanut butter
6. Jar of jelly

Ask leading questions so students realize they need to be thorough in their list of materials.

Procedure: Make a sandwich. Take suggestions from the class as to the order or procedure of making a peanut butter and jelly sandwich. Be as literal as possible. If students tell you to put the jelly on the bread before they have told you to open the jar, place the whole jar on the bread. Continue to take instructions until you finally complete the sandwich. Students should be writing down procedures as the class makes the sandwich.