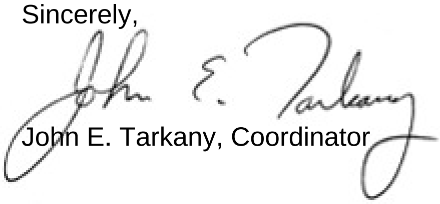
Welcome to the Ventura County Science Fair

We have come a long way since a handful of students competed in our first county science fair in 1955. Now with nearly 1,000 students participating, the science fair continues to experience tremendous growth, both in participation, sponsorship, and the development of the Science Career Expo, an interactive expo with a strong focus on local industry including biotechnology and agriculture.

With categories from Animal Behavioral and Social Sciences to Zoology, the science fair is designed to promote, encourage, showcase and reward the achievements of our students in the various fields of science. By developing skills in science, technology, engineering and mathematics, students are laying the groundwork for their future success.

Spreading the excitement of science is a cooperative education effort. Without the help and support of our sponsors, volunteers, parents, and teachers, this worthwhile event would not be such a great success. On behalf of my office and the Ventura County Science Fair, I thank you for your participation and hard work, and look forward to a fun, successful, and educational event.

Sincerely,



John E. Tarkany, Coordinator

New On-Line Science Fair Project Registration Procedure:
Register projects on-line at: www.vcoe.org/sc, click on *Science Fair* and then click on *2010 Ventura County Science Fair On-Line Registration*

Dates and Deadlines:

February 24: Ventura County Science Fair Project Registration Deadline. Registration Confirmation and Payment must be in our office by 4:00 PM. NO REGISTRATIONS WILL BE ACCEPTED AFTER THIS DEADLINE.

April 13:	**Project Set Up at Seaside Park: 10 W. Harbor Blvd., Ventura**	Noon – 7:00 PM
April 14:	**Judging Day**	
	Judges' Breakfast and Orientation	8:00 AM – 9:00 AM
	Judges review projects, interview students, finalize awards	9:00 AM – 4:00 PM
	Students arrive for Student Orientation	9:45 AM
	Student Orientation	10:00 AM - 10:15 PM
	Project Judging and Science Career Day activities (Times differ for Life Sciences, and Physical Sciences)	
	Oral Presentations: Life Sciences	10:15 AM – 11:45 AM
	Career Expo: Physical Sciences	10:15 AM – 11:45 AM
	Lunch Followed by Project Viewing: Life Sciences	11:45 AM – 1:00 PM
	Project Viewing Followed by Lunch: Physical Sciences	11:45 PM – 1:00 PM
	Oral Presentations: Physical Sciences	1:00 PM – 2:30 PM
	Career Expo: Life Sciences	1:00 PM – 2:30 PM
	Dismissal	2:30 PM
	Public viewing of projects	4:00 PM – 7:00 PM
April 15:	**Science Fair Project Removal.** If you wish to keep your science fair project now is the time to save it. Any projects left behind after 6:00 PM will be properly disposed of.	Noon – 6:00 PM
	Science Fair Awards Night – Anacapa Hall at Seaside Park	6:30 PM – 8:00 PM

May 17-18: California State Science Fair. Register Online at: www.usc.edu/CSSF/. For more Information Contact: E-mail CalifSF@usc.edu or California State Science Fair Coordinator: Veronica Simpkins, (213) 744-7516.

Project Set Up and Removal:

Set Up: All projects must be delivered and set up between Noon and 7:00 PM on Tuesday, April 13. Science Fair staff will not admit projects outside of this scheduled set up time. Projects may be delivered and set up by a parent, teacher, or other designated person if the entrant is unable to do so personally.

Removal: Projects must be removed from the exhibit area between Noon and 6:00 PM on Thursday, April 15. **The Science Fair is not responsible for projects left after this time.**

Science Fair Contact Information:

Science Fair Coordinator: John E. Tarkany
Science Fair Project Specialist: Victoria Brown

5189 Verdugo Way
Camarillo, CA 93012
Ph: (805) 437-1501
Fax: (805) 437-1503
E-mail: jtarkany@vcoe.org
www.vcoe.org/sc

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Ventura County Science Fair
"Science for Change"
Poster Competition

Each year the Ventura County Science Fair, presented by the Ventura County Office of Education, holds a competition to find a new design for its posters and booklets. The winning design is used on the posters and literature associated with the fair, and on the awards presented to the fair winners.

Any full-time student in grades 6-12, residing in Ventura County, may enter the competition. Teachers should make the students aware that this is a competition and entries should reflect the students' best attempt. Some schools hold their own competition to select entries to send to the Science Fair Committee.

The design should include:

Theme: The design should illustrate this year's theme **"Science for Change"**. The words **"Science for Change"** need not be used. Any or all areas of physical and life science may be incorporated. The design may be historic, current or futuristic.

Format: The design must be in **BLACK** and **WHITE**, on stiff white card stock. Overall size must be 14" X 14" with a 1" border. Poster must be dark-lined for clarity and may be modified for printing. Do not shade in your artwork.

Original Work: The design must be original work done by the student, no clip art or collage material from commercial or private sources will be accepted. Any two-dimensional medium, including computer software, following the guidelines above, is acceptable.

Signature: The student's signature should appear within the design.

Student Info: Entries must include the following information on the back of the poster: Name, age, home address, home telephone, school and teacher.

Entry Deadline: All entries must be delivered no later than **Friday, October 9th, 2009, 4:00 PM**.

Awards: A plaque will be presented to the winning student at the Science Fair Awards Ceremony. The winning design will be selected by the Science Fair Committee.

Mail or Deliver all Entries to:

Ventura County Science Fair
C/O John E. Tarkany
5189 Verdugo Way
Camarillo, CA 93012

Questions: (805) 437-1501

Special Awards at the Ventura County Science Fair

Special Awards are those awards given by companies, businesses and agencies within our county to deserving recipients at our County's Science Fair. These awards are both judged and presented separately from regular science fair awards. Frequently, these awards are monetary; however, plaques, subscriptions, memberships, tours, gift certificates or any other award that is supportive of our students' efforts are encouraged as well. Listed below are some examples of past special awards contributors:

Air & Waste Management Association: Channel Islands Chapter

The Air & Waste Management Association will provide $300 to be shared between 4 or 6 recipients: 1/2 from the Junior and 1/2 from the Senior Divisions.

American Petroleum Institute

The American Petroleum Institute will award 1st ($100) and 2nd ($50) place prizes to projects related to the Energy Industry in the following Categories: EA, EE, EN, ET and EV.

California Association of Professional Scientists

The California Association of Professional Scientists (CAPS) will present a Science Achievement Plaque during the awards ceremony as well as a $100 check to be mailed in mid-June. CAPS judges are looking for projects which illustrate that the student has applied good scientific methodology.

California State University Channel Islands

California State University Channel Islands (CSUCI) will present a special award, a $75 prize, and a $500 per year scholarship for 2 years at CSU Channel Islands. CSUCI will seek recipients in the Senior Division in the following categories of AS, ME, MI, PS, CH, BI, EV, MA, EE, EN, ET, CS and PH.

Coast Geological Society

Will have a sum of money to distribute among those chosen by their judges. The judges will be looking for the best application and execution of the Scientific Method showing a basic understanding of the chosen subject within Earth Science or Geologic theme. The individual awards will include a certificate of recognition and include a monetary award up to $400 depending on the quality and content.

Conejo Valley Audubon Society

The Conejo Valley Audubon Society will present, in honor of Dr. Elliott McClure, 2 awards consisting of a certificate and a $100 check. The Awards will be given to projects demonstrating excellent research in the areas of environmental sciences, environmental education or conservation.

NACE International

Cash Awards will be given to projects dealing with corrosion in the amount of: 1st Place, $200; 2nd Place, $100; 3rd Place, $50

Society of Women Engineers

The Society of Women Engineers invites and recognizes the award recipients during an evening dinner with the Society.

Southern California Society of Toxicology and Chemistry

The Southern California Chapter of the Society of Environmental Toxicology and Chemistry will present a one year student membership in the chapter, $50, certificate, and an invitation to attend the chapter's annual meeting for high school projects dealing with environmental toxicology and/or environmental chemistry principles.

United Water Conservation District

The United Water Conservation District awards $100 and $50 Savings Bonds to two projects dealing With water and water conservation.

Ventura County Air Pollution Control District

The Ventura County Air Pollution Control District will award: 1st; 2nd; and 3rd place to air pollution, air quality, climate change or other related, "air" topics.

Ventura County Psychological Association

The Ventura County Psychological Association will present 4 awards of $50 each for psychology related projects.

Science Fair Goals:

1. Encourage student awareness of the importance of science and engineering.
2. Reinforce and extend the Science Content Standards for California Public Schools.
3. Recognize and reward students who pursue scientific inquiries or engineering projects.

Science Fair Project Registration Procedure: **Utilizing the Science Fair Project Registration Checklist (Pg. 20) will increase the likelihood that your Registration will be accepted.**

1. Get permission from your Parent or Guardian to fill out the On-Line 2010 Ventura County Science Fair Project Registration Form.
2. Go to: www.vcoe.org/sc; click on the *Science Fair* button at the top of the page, then click on the *2010 Ventura County Science Fair On-Line Registration* button located at the top of the page.
3. Completely fill in all requested information. You will need the following:
   - Advisors Name, Phone Number and E-mail address
   - School Name and Address
   - Project Abstract
4. When you finish filling in the form and click on the *FINISH* button you **MUST** do the following to complete your registration:
   - Print a copy of the *Confirmation Page*
   - Have the *Confirmation Page* signed by all of the required people
   - Mail the *Confirmation Page* along with the $15 per student fee to:

     Ventura County Science Fair
     C/O John E. Tarkany
     5189 Verdugo Way
     Camarillo, CA 93012

The *Confirmation Page* and payment must be received by our office no later than 4:00 PM, February 24th, 2010 to complete your Science Fair Project Registration.

Incomplete projects will be returned to applicant. If your registration is rejected for any reason, the applicant may resubmit their registration with the necessary changes prior to the February 24th, 2010 deadline for reconsideration.
NO REGISTRATIONS WILL BE ACCEPTED AFTER THIS DEADLINE.

Science Fair Policies:

1. The relationship of science fairs at the school, county, and state level: Local science fairs for grades 6-12 will be used to select the best-qualified projects to participate in the Ventura County Science Fair. If a school does not have a science fair, projects screened by teachers may be submitted.

2. Science Fair Awards: Based upon merit, awards will be given for first, second, third and honorable mention in each of the categories for the junior (grades 6-8), and senior divisions (grades 9-12).

   Only students in grades 6 - 12 will be able to participate in the California State Science Fair. Projects earning 1st, 2nd and sometimes 3rd place awards will have the opportunity to go to the California State Science Fair.

   The committee reserves the right to split categories with large numbers of projects into smaller sections and to group categories with few projects into a combined judging group. The decisions of the committee are final.

   In addition to the Science Fair Awards, Special Awards are often given by companies, businesses and agencies from within our county. These awards are judged and presented separately from the Official Ventura County Science Fair Awards. Often these awards are monetary; however, plaques, subscriptions, memberships, tours, and gift certificates have also been awarded in the past.

3. Experimental And Testing Regulations: Projects submitted to the Ventura County Science Fair must be in compliance with all local, state and federal: codes, laws and regulations governing controlled substances, human subjects, tissue sample sources, and humane treatment of live vertebrate animals.

   The display of live or preserved animals is not permitted. Projects may not display photographs of procedures detrimental to the health and well being of vertebrate animals. Photographs of surgical procedures may not be exhibited.

   Student researchers must adhere to all local, state and federal: codes, laws and regulations governing controlled substances, human subjects, tissue sample sources, and humane treatment of live vertebrate animals. For further research and information the following resources are suggested:

   California Department of Education: Education Code
   - www.cde.ca.gov/resources/legal.html
   - Legal Office: 916-319-0860

   State of California: California Law
   - www.leginfo.ca.gov/calaw.html

- § State of California Information: 916-657-9900

United States Government: National Archives and Records Administration: Code of Federal Regulations

- § www.gpo.gov/nara/cfr/index.html
- § Code of Federal Regulations: 888-293-6498

4. Safety Regulations:
   a. Fire regulations prohibit the hanging of charts, cloth, or paper decorations from the table below the exhibit.
   b. The following rules for 110-volt operations must be observed: All wiring, switches, and metal parts that carry high voltage must be located out of reach of observers and must be designed with an adequate overload safety factor. High voltage equipment must be properly insulated and shielded with a grounded metal box or cage to make accidental contact impossible. If electricity is needed, applicant shall provide their own extension cord.
   c. All project displays must adhere to all local, state and federal laws for public safety. Lasers must be appropriately shielded.
   d. No hazardous materials may be exhibited at the project display. This includes, but is not limited to over the counter pharmaceuticals (aspirin, antacids, cold medicines, etc.), acids, hazardous microbes, carcinogenic materials, and unsealed foodstuffs that may attract pests. For these items, the substitution of illustrations or photographs is encouraged. Materials in violation of this rule will be removed without notice to the participant before judging.
   e. The Ventura County Science Fair Committee reserves the right to reject any project deemed unsafe or unsuitable for display. Failure to comply with all policies and regulations will result in denial of application.

5. Student Participation In the Science Fair:
   a. The fair is open to students in grades 6-12. Please complete all Official On-Line Registration Process at www.vcoe.org/sc, click on Science Fair and then click on 2010 Ventura County Science Fair Registration.
   b. Only one project for judging may be exhibited by a person, and it must represent the work of that person. A project entered into any category, other than Team Projects, under an individual's name but discovered by the judging committee to have been prepared by more than one student, will be disqualified.
   c. Team Projects will be accepted and judged. A Team Project is one in which two to three students have participated and are named on the project as its authors. Participants in a team project may not submit an individual project. These projects will be placed in the appropriate category and will compete against individual projects in that category. **A team project will be judged with higher expectations.**
   d. Parents and teachers **may not** be near displays on Judging Day but are invited to view during Public Viewing hours.
   e. If the number of entries in a given category is too small, the committee reserves the right to group these entries in a related category.

6. Project Display:
   a. All projects must fit within the listed space limitations. This includes elements of the project that may extend or protrude.

      Table Project: 4 feet wide x 2.5 feet deep x 6.5 feet tall (122 cm x 76 cm x 198 cm).
      Floor Project: 4 feet wide x 2.5 feet deep x 9 feet tall (122 cm x 76 cm x 274 cm)

   b. The project display board shall be sturdy and self-supporting, using durable materials, such as heavy self-supporting cardboard (pre-made displays), plywood, pegboard, masonite, celotex, or metal. Absolutely no tag board or construction paper will be accepted as a project display board.
   c. Project may be assembled at the exhibit area, but it **may not** be built there. The applicant must furnish all materials.
   d. The Official Placeholder will be placed at each project's location by the Science Fair Committee, and must not be removed.
   e. The student must place the Research Project Report with the display (preferably attached).
   f. Computers and all equipment are students' responsibilities; they may be brought in and removed the day of judging. IMPORTANT: LOSS OR DAMAGE --- Valuable equipment, such as computers, may be part of the display only if the student entrant accepts full responsibility. It is advised that the laboratory notebook and computer equipment be on display only during the actual judging period.
   g. Post student information on the back upper right hand of your display, no student information should appear on the front of your display. Student information will include: Name of student; name of school; name of teacher; grade level, and project category.
   h. Do not display any local or school awards with your project.
   i. The Science Fair Committee is not responsible for any losses incurred. All items of the project must be identified with the student's name and school. **All items not claimed by 6:00 PM, April 15th will be discarded.**

   Displays <u>must</u> adhere to these guidelines. These guidelines will be rigidly enforced. Projects not meeting these requirements <u>will not be judged</u>, nor permitted for display:

7. Project Presentation:
   a. Each student should come prepared to give a 5-minute oral presentation, which may be away from the project, to judges and peers. Student shall provide all materials for oral presentation.
   b. Be advised that the abstract sheet is the first thing the judge's read. Please be sure that it is neat, typed or printed (in ink), legible, and informative.
   c. It is the hope of the committee that all participants be present at the Awards Ceremony.
   d. If the project is removed prior to the official project teardown time, then the committee reserves the right to disqualify the student or team.

8. Science Fair Judging:

The project submitted should be of a quality at or above the grade level suggested by the *Investigation and Experimentation Standards* set forth in the California State Board of Education publication: Science Content Standards for California Public Schools.

Projects which undertake **Scientific Research** should demonstrate the Scientific Method. Students should design projects that produce quantitative data through experimentation, followed by an analysis of that data.

The Scientific Method may be described differently in different sources but the underlying approach has these steps:

1. State the problem.
2. Research the topic.
3. Form a hypothesis.
4. Test the hypothesis.
5. Collect and record observations.
6. Summarize your observations and data into charts, tables, and graphs.
7. Form a conclusion.
8. Communicate the findings.

Engineering projects which involve designing and developing a device or process with specific objectives should demonstrate the Engineering Goals.

Engineering Goals involve repeated testing and refining as the final goal is approached. A good engineering project should

1. Identify the potential user's needs and state the objective(s) clearly
2. Research what has already been done
3. Prepare preliminary designs and a materials list considering costs, manufacturing and user requirements
4. Build and test a prototype. Consider reliability, repair and servicing.
5. Analyze the performance and compare it the original objectives..
6. Improve design or construction and retest as necessary.
7. Document the results of each step and compile into a report.

The following numerical guidelines should be taken as indications of the importance of each criterion. Always remember, the project is being judged as a whole. Written and oral communication describing the project should clearly demonstrate the depth and breadth of the student’s understanding of the topic and his or her conclusions, based on sound scientific investigation.

Research 30%: Originality of the problem, content, logical presentation, support of hypothesis and bibliography.

Experimental Procedure 30%: Procedure and materials, illustrations, data collection, data analysis and conclusion.

Oral Presentation 15%: Expressed knowledge of subject and background information. Stated value of the project. Demonstrates understanding of scientific or technical procedure. Overall quality of presentation and ability to answer questions effectively.

Display 15%: Creatively designed. Complete. Neat and organized.

Completeness and Overall Quality 10%: Written and oral communication describing the project. Clearly demonstrates the depth and breadth of the students understanding of the topic and his or her conclusions based on sound scientific investigation.

Science Content Standards for California Public Schools:

Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and to help gauge the grade level appropriateness of your students' science fair projects, we have included the *Investigation and Experimentation Standards* set forth in the California State Board of Education publication: Science Content Standards for California Public Schools.

Grade 6

- Develop a hypothesis.
- Select and use appropriate tools and technology (including calculators, computers, balances, spring scales, microscopes, and binoculars) to perform tests, collect data, and display data.
- Construct appropriate graphs from data and develop qualitative statements about the relationships between variables.
- Communicate the steps and results from an investigation in written reports and oral presentations.
- Recognize whether evidence is consistent with a proposed explanation.
- Read a topographic map and a geologic map for evidence provided on the maps and construct and interpret a simple scale map.
- Interpret events by sequence and time from natural phenomena (e.g., the relative ages of rocks and intrusions).
- Identify changes in natural phenomena over time without manipulating the phenomena (e.g., a tree limb, a grove of trees, a stream, a hillslope).

Grade 7

- Select and use appropriate tools and technology (including calculators, computers, balances, spring scales, microscopes, and binoculars) to perform tests, collect data, and display data.
- Use a variety of print and electronic resources (including the World Wide Web) to collect information and evidence as part of a research project.
- Communicate the logical connection among hypotheses, science concepts, tests conducted, data collected, and conclusions drawn from the scientific evidence.
- Construct scale models, maps, and appropriately labeled diagrams to communicate scientific knowledge (e.g., motion of Earth's plates and cell structure).
- Communicate the steps and results from an investigation in written reports and oral presentations.

Grade 8

- Plan and conduct a scientific investigation to test a hypothesis.
- Evaluate the accuracy and reproducibility of data.
- Distinguish between variable and controlled parameters in a test.
- Recognize the slope of the linear graph as the constant in the relationship $y = kx$ and apply this principle in interpreting graphs constructed from data.
- Construct appropriate graphs from data and develop quantitative statements about the relationships between variables.
- Apply simple mathematic relationships to determine a missing quantity in a mathematic expression, given the two remaining terms (including speed = distance/time, density = mass/volume, force = pressure X area, volume = area X height).
- Distinguish between linear and nonlinear relationships on a graph of data.

Grades 9 – 12

- Select and use appropriate tools and technology (such as computer-linked probes, spreadsheets, and graphing calculators) to perform tests, collect data, analyze relationships, and display data.
- Identify and communicate sources of unavoidable experimental error.
- Identify possible reasons for inconsistent results, such as sources of error or uncontrolled conditions.
- Formulate explanations by using logic and evidence.
- Solve scientific problems by using quadratic equations and simple trigonometric, exponential, and logarithmic functions.
- Distinguish between hypothesis and theory as scientific terms.
- Recognize the usefulness and limitations of models and theories as scientific representations of reality.
- Read and interpret topographic and geologic maps.
- Analyze the locations, sequences, or time intervals that are characteristic of natural phenomena (e.g., relative ages of rocks, locations of planets over time, and succession of species in an ecosystem).
- Recognize the issues of statistical variability and the need for controlled tests.
- Recognize the cumulative nature of scientific evidence.
- Analyze situations and solve problems that require combining and applying concepts from more than one area of science.
- Investigate a science-based societal issue by researching the literature, analyzing data, and communicating the findings. Examples of issues include irradiation of food, cloning of animals by somatic cell nuclear transfer, choice of energy sources, and land and water use decisions in California.
- Know that when an observation does not agree with an accepted scientific theory, the observation is sometimes mistaken or fraudulent (e.g., the Piltdown Man fossil or unidentified flying objects) and that the theory is sometimes wrong (e.g., the Ptolemaic model of the movement of the Sun, Moon, and planets).

Science Fair Project Categories: Your assigned category will be determined by the specific focus of your study, not the tools used to perform the study.

Please read the category definitions carefully. These definitions may be different from those used in your school fair. Read your project description. What your project is about defines the category, in which your project belongs, *not the methods that were used*. For example, if you used bacteria to study the effectiveness of different antibiotics, the bacteria were a tool to learn about antibiotics, so the project belongs in Human Biology. However, if the specific effect of the antibiotic drug on the bacteria was studied, the project belongs in Microbiology.

Your project may be placed into a category which is different from the one to which it was assigned at your school Fair. This is not unusual and is done to assure that similar projects are placed together with each other in the same category. Proper category selection optimizes your project's likelihood of recognition through Fair awards.

Life Sciences:

Animal Behavioral and Social Sciences: Animal behavior, social and community relationships—psychology, sociology, linguistics (ie. Dolphin communication), learning, perception, etc.

Human Behavioral and Social Sciences: Human behavior, social and community relationships—psychology, sociology, anthropology, archaeology, ethnology, linguistics, learning, perception, urban problems, reading problems, public opinion surveys, educational testing, etc.

Amgen® Biochemistry: Chemistry of life processes—molecular biology, molecular genetics, enzymes, photosynthesis, blood chemistry, protein chemistry, food chemistry, hormones, etc.

Botany: Study of plant life—agriculture, agronomy, horticulture, forestry, plant taxonomy, plant physiology, plant pathology, plant genetics, hydroponics, algae, etc.

Human Biology: Study of diseases and health of humans— genetics, physiology, dentistry, pharmacology, pathology, ophthalmology, nutrition, dermatology, allergies, speech and hearing, etc.

Microbiology: Biology of microorganisms—bacteriology, virology, protozoology, fungi, bacterial genetics, yeast, etc.

Zoology: Study of animals—animal genetics, ornithology, ichthyology, herpetology, entomology, animal ecology, paleontology, cellular physiology, circadian rhythms, animal husbandry, cytology, histology, animal physiology, invertebrate neurophysiology, studies of invertebrates, etc.

Physical Sciences:

Chemistry: Study of nature and composition of matter and laws governing it—physical chemistry, organic chemistry (other than biochemistry), inorganic chemistry, materials, plastics, fuels, pesticides, metallurgy, soil chemistry, etc.

Earth, Space and Environmental Sciences: Study of earth and celestial bodies with regard to geology, mineralogy, physiography, oceanography, meteorology, climatology, astronomy, speleology, seismology, geography, study of pollution (air, water, and land) sources and their control; ecology etc.

HAAS® Engineering: Technology; projects that directly apply scientific principles to manufacturing and practical uses—civil, mechanical, aeronautical, chemical, electrical, photographic, sound, automotive, marine, heating and refrigerating, transportation, environmental engineering, etc.

Mathematics, Computer Science and Electronics: Development of formal logical systems, numerical and algebraic computations, and their applications, semiconductors, development of hardware and/or software for communications, graphics, simulations, and information theory…

Physics: Theories, principles, and laws governing energy and the effect of energy on matter—solid state, optics, acoustics, particle, nuclear, atomic, plasma, superconductivity, fluid and gas dynamics, thermodynamics, semiconductors, magnetism, quantum mechanics, biophysics, etc.

Student Section

Welcome to the Ventura County Science Fair! If you are a student in Ventura County in grades 6-12 then you are eligible to compete.

Your mission, should you choose to accept it, is to have a great time exploring something that you enjoy and sharing that exploration with others.

Oh! And along the way, you will learn how to *'Do'* science like a scientist using the Scientific Method.

The following pages should provide you with a great start on your science project. Be sure to work closely with your teacher or Advisor. If you don't understand something, please ask, after all science is all about asking questions.

Visit us online for even more great resources and links at: www.vcoe.org/sc

Relax and have fun doing science!

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Scientific Method:

The Scientific Method is the logical way in which a scientist goes about trying to solve a problem. A student needs to understand the scientific method, and the words that are used to describe the process. The actual descriptions of the steps of the scientific method will vary from source to source, but the underlying process remains the same. The steps of the scientific method are as follows:

1. State the problem.
2. Observation and research.
3. Form a hypothesis.
4. Test the hypothesis.
5. Collect and record observations.
6. Summarize your observations and data into charts, tables, and graphs.
7. Form a conclusion.
8. Communicate the experiment.

Let's review a real life example of how you might use the scientific method:

1. State the problem: *"Grass won't grow in that area of my lawn!"*; Suppose you notice an area in your front lawn where the grass is not growing correctly. The rest of your lawn has thick, green grass, but this one area has very sparse grass. This, then, is your problem.

2. Observation and research: *"The sparse area is surrounded by several evergreen trees, which drop needles and block much of the sunlight. The soil appears just as rich as the soil in other areas, but the pH is lower. All areas seem to be getting similar amounts of water. The temperature in the shaded area is lower than the areas that are not shaded.";* You would then go outside and look at that area. What makes that area different from the areas where the lawn is growing nicely? Does one area get more or less sun? What is the soil like? Compare as many likely factors that you can think of.

3. Form a hypothesis: *"If the pH of the soil was higher, then my grass would grow properly."*; Based on the information that you gathered, and your knowledge of Biology, you are ready to form a hypothesis. Remember, a hypothesis is an educated guess. It is only your background knowledge in this subject that separates a true hypothesis from what would merely be a guess. Now, considering the observations you made, you might decide that pH of the soil in the sparse area is the problem. You form a hypothesis and put it in what is called "if . . . then" format.

4. Test the hypothesis: *"I took 200 small pots and used them to grow 200 samples of grass. I split the 200 pots into 5 groups of 40, and I adjusted the pH of the soil with calcium oxide (lime) until the five groups had pH readings of; 3,5,7,9, and 11 respectively. In all of the samples I used the same amount and type of soil and the same type and number of grass seeds. Each sample was kept in the same room with identical conditions as far as light, temperature and water.";* Now you want to design an experiment that can be used to test your hypothesis. It is important that your experiment be controlled, that you keep all conditions between groups the same, except for that condition which you are testing. It is also important that you conduct your experiment on several different samples, so that your results may prove conclusive.

5. Record your observations: *"I counted the number of seeds which sprouted and recorded the numbers in my journal. I took pictures of each sample weekly to determine density of growth. I began measuring weekly growth after the third week and observed the density of growth in each pot….";* If you conduct your experiment carefully, you will probably find differences between the groups of grass that you grew. If you don't see anything that leads you to believe that the higher pH would cause growth problems in your lawn, then you may reject your original hypothesis and form a new one, maybe one that is based on the difference in sunlight. If your experiment supports your hypothesis, then you may be on to something, but more testing would be required before you could say for sure.

6. Summarize your observations and data into charts, tables, and graphs: *"By arranging my measurements into tables, it was easy to make graphs. The graphs agreed with what my photos and observations proved.";* Utilizing your research, observations, measurements, photos and graphs, you can now write what you found out.

7. Form your conclusion: *"Based on my experiment, I was able to determine that … showed the most density and … showed the least density supporting/rejecting my hypothesis."*

8. Communicate your results: Write a report that includes all you did with an abstract at the beginning.

In real life, by the time you were done with the above experiment, it may be winter and you would no longer be worried about your lawn. It is not a realistic way of solving this problem, when it would be much easier to ask a gardener about the problem, or read more about lawn care. Although the experiment may not carry over realistically, the scientific method does. You would still want to change only one thing at a time, when trying to improve the grass in that area. The lesson is that all problems should be approached in a logical manner.

Engineering Goals:

Engineering projects which involve designing and developing a device or process with specific objectives should demonstrate the Engineering Goals. Engineering is the discipline, art and profession of acquiring and applying technical, scientific and mathematical knowledge to design and implement materials, structures, machines, devices, systems, and processes that safely realize a desired objective or inventions. The American Engineers' Council for Professional Development has defined engineering as follows:

> “[T]he creative application of scientific principles to design or develop structures, machines, apparatus, or manufacturing processes, or works utilizing them singly or in combination; or to construct or operate the same with full cognizance of their design; or to forecast their behavior under specific operating conditions; all as respects an intended function, economics of operation and safety to life and property.”

Some of the Steps that are involved in Engineering Goals are as follows:

1. Identify the potential user's needs and state the objective(s) clearly
2. Research what has already been done
3. Prepare preliminary designs and a materials list considering costs, manufacturing and user requirements
4. Build and test a prototype. Consider reliability, repair and servicing.
5. Analyze the performance and compare it to the original objectives.
6. Improve design or construction and retest as necessary.
7. Document the results of each step and compile into a report.

Let’s review a real life example of how you might use Engineering goals:

Producing clean water is an important aspect of disease prevention in many countries. We'll use this as an example of how the engineering goals might be applied to a project. The following steps should be recorded in a project notebook as well as written up in the final report.

1. <u>Identify the potential user's needs and state the objective(s) clearly</u>: Poor people in under-developed countries need an inexpensive, reliable source of clean water that is powered by locally available fuel. The objectives are to provide a system: which costs less than $100; requires cleaning once a month or less often; uses a readily available, non-polluting fuel; produces at least 5 liters of clean water each day.

2. <u>Research what has already been done</u>: There are several different approaches including mechanical filtering, activated charcoal, ultraviolet light and distillation. You compare these methods and conclude that the last method seems safest but requires more energy than the others.

3. <u>Prepare preliminary designs</u>: Your research shows that burning any fuel will cause an unacceptable amount of air pollution, so you design a distillation system that uses a solar collector that is large enough to provide a liter of clean water for every hour of full sun. Your design includes a list of materials and quantities, with their costs; details of construction with diagrams and instructions for operating and maintaining the system.

4. <u>Build and test a prototype</u>: Once your system is operational, make careful measurements of the amount of water produced under different weather conditions and use a water testing kit to check for impurities. Take photographs to document the construction.

5. <u>Analyze the performance and compare it to the original objectives</u>: It's likely that your prototype did not perform as you expected. Perhaps the solar collector had to be repositioned to follow the sun or needed to be larger. Maybe maintaining a steady water flow was difficult. Make careful notes of your conclusions.

6. <u>Improve design or construction and retest as necessary</u>: Use your conclusions from step 5 to guide the necessary changes and continue to observe and measure the system's performance.

7. <u>Document the results of each step and compile into a report</u>: Organize your research, design details, photographs, measurements and observations, improvements and final performance assessment into a project report.

   Engineering projects may involve actual construction, like our example, or writing a computer program or designing a more efficient procedure. The success of the project usually depends on how well the objectives were described at the start. Try to make them quantitative, "..costs less than $100", and easily measured, " … 5 liters …".

Plan the steps of your project

Use this sheet to plan the time you will spend on your project.
Follow **S** for a scientific research project and **E** for an engineering project

Activity		Planned Date Of Completion
1) **Pick your topic (S & E):** Ideas can come from a hobby, local or world events, family activities or special needs. Pick a question or problem that is not too broad and that can be answered through scientific investigation. Think in advance of how you would make measurements or what you would do to answer the question(s).	(1 week)	________
2) **Research your topic (S & E):** Go to the library or internet to learn more about your topic. Look for unexplained or unexpected results. Also, talk to professionals in the field.	(2 weeks)	________
3) **Focus (S & E):** organize your information and write a testable hypothesis or engineering objectives.	(1 day)	________
4) **Plan your experiment (S):** Give careful thought to your procedure. Plan to change only one independent variable and measure the effect on the dependent variable. Make a note of the experiment constants that do not change. Some experiments need a control which is treated exactly like the experiment but the independent variable does not change. Make sure that you include sufficient numbers in both control (if applicable) and experimental groups for you to calculate averages and other statistics. Make measurements using **metric units**.	(1 week)	__________
Make a preliminary design (E): Plan the steps you will take to achieve your objectives. Draw up a materials list; find sources for the materials you will need, consider the cost, time for construction and user requirements	(1 week)	________
5) **Consult with your Advisor and get approval (S & E):** You must discuss your project planning with an Advisor and obtain their approval. You and your Advisor should consider safety, cost and the feasibility of your project. *Complete the Certificate of Compliance* (p. 20).	(1 day)	________
6) **Conduct your experiment (S):** During experimentation, keep detailed notes of each and every experiment, measurement and observation in a log book. Use data tables or charts to record your quantitative data.	(Estimate how long this will take)	________
Build and test a prototype (E): Keep an engineering log describing the progress of your work. There should be an entry in the log describing what you are trying to do and what was accomplished each time you work on the prototype. Measurements and other data should be organized in tables.	(Estimate how long this will take)	
7) **Analyze your results (S):** Organize your data into tables, calculate averages from repeated trials, draw graphs to show the relationship between your dependent variable (on the y-axis) and independent variable (on the x-axis). Describe the patterns that your graphs show and discuss whether your hypothesis is supported.	(1 week)	__________
Make adjustments and retest your prototype (E): make improvements so that your design performs more closely to the stated objectives. Continue to keep a log of your work.	(1 week)	
8) **Draw conclusions (S):** Discuss whether your results matched what you expected. Consider whether you have sufficient data; if there are experimental errors or improvements to be made. Think of practical applications of this project in the real world.	(1 week)	________
Review your design and construction process (E): Identify the most and least successful parts of your approach, any improvements needed and the practical applications.	(1 week)	________
9) **Compile your report and create a display board (S & E):** Use the next section as a guide to presenting your work for the Science Fair.	(1 week)	________

COUNTY SCIENCE FAIR REGISTRATION DUE DATE: 4:00 PM February 24th, 2010

Presenting your work for the Science Fair

1) **Project Data Book:** Conducting your experiment or completing an engineering project may take several days or weeks. A project data book containing accurate and detailed notes will show consistency and thoroughness to the judges and will help you when writing your report. Be sure the quantitative data recorded is accurate and that units are included in the data tables. Make sure you date each entry.

2) **Report:** A good report includes the following sections.

   a) **Title Page and Table of Contents:** The report should have numbered pages

   b) **Research:** This includes an explanation of what prompted your research; the information that you collected before designing your experiment or engineering project; your hypothesis, or engineering goals.

   c) **Materials and Procedure:** Describe in detail the methodology you used to collect data, make observations or create your prototype. Your report should be detailed enough so that someone would be able to repeat the work from the information in your paper. Include photographs or careful drawings of original equipment.

   d) **Results:** For an experimental project, the results include data tables, statistics and graphs. For an engineering project, a compare the engineering goals with the actual performance.

   e) **Discussion:** For an experimental project, compare your results with theoretical values and/or expected results. Include a discussion of possible errors. Did the data vary between repeated observations? Were your results affected by uncontrolled events? How would you improve or extend the project?

      For an engineering project, discuss the more and less successful aspects of the project. What improvements could be made to the design process or the finished prototype?

   f) **Conclusions:** Briefly summarize your results. State your findings in relationships of one variable with the other. Support those statements with examples of data. Be specific, do not generalize. Never introduce anything in the conclusion that has not already been discussed. Also mention practical applications.

   g) **Acknowledgments:** You should always credit those who have assisted you, including individuals, businesses and educational or research institutions.

   h) **References/Bibliography:** Your reference list should include any documentation that is not your own (i.e. books, journal articles, websites, etc.). See an appropriate reference in your discipline for format. For instance, **APA style**:

      i. **Journal article, one author –** Bekerian, D.D. (1993), In Search of the Typical Eyewitness. American Psychologist, 48. 574-576.
      ii. **Reference to an entire book** – Cone, J.D., & Forster, S.L. (1993. Dissertations and Thesises From Start to Finish: Psychology and Related Fields. Washington, DC: American Psychological Association.
      iii. **This is MLA Format.** Bibliography is alphabetical and not numbered. First line is at the margin and the second line of same reference is indented.
      iv. **Article from a magazine** - SPIRAL STRUCTURE, DUST CLOUDS, AND STAR FORMATIONS. Frank H. Shu in *American Scientist*, Vol. 61, pages 524-536; 1973
      v. **Book with an author –** THE LARGE-SCALE STRUCTURE OF THE UNIVERSE. J.P.E. Peebles. Princeton University Press, 1980
      vi. **Book with an editor –** INTERSTELLAR MOLECULES. Edited by B.H. Andrew. D. Reidel Publishing Company, 1980
      vii. **Online website –** Planning for College and Academic Planning. The College Board. 7 June 2000 http://www.collegeboard.org/features/parentgd/html/academic.html

3) **Abstract:** This is a maximum of 250 words on one page.
   It should include the a) purpose of the project, b) procedures used, c) data, and conclusions. It also may include any possible applications. The following page gives an example of an appropriately written Abstract.

   The main purpose for writing a science project abstract is to give both you and the reader a very brief summary and overview of your project. If written well, the abstract can tie your project together and, most importantly; it will give your project a sense of continuity and clarity. Read the **sample abstract on Pg.17.**

You should keep a couple main points in mind as you write it:

1. The abstract should definitely NOT be longer than one page.
2. Summarize everything; do not burden the reader with too much content.

The following is a suggested outline for writing the abstract; please replace this page with your actual Abstract:

- Label Clearly: On the top of your Abstract it should clearly state the title of your project. Below the title, note the division (grades 6 - 8 are Junior; grades 9 - 12 are Senior), list the student name(s), school and teacher.

- Theme and Purpose (Objectives): This short introductory paragraph should give a little background and describe the purpose (or objectives) of your project. Try to capture the interest of the reader.

- Methodology: Describe your procedure making the independent and dependent variables clear.
  Or: Give an overview of what was done to achieve the engineering objectives.

- Results: Explain the relationships that your data supported.
  Or: Describe the successes and shortcomings of your design

- Conclusions: Relate your findings to the purpose of the project. Were the results what you expected?
  Or: Explain how you would change your engineering design or process to improve the outcome.

- Further work: Note any questions that have arisen from your project. Only include questions that can be used as a starting point for future projects. This is an important section as tells the reader that you recognize the limits of your study and know how to find more complete answers.

  On the project display board, the Abstract should be placed just below the Title of your project.

Sample Abstract

Effects of Marine Engine Exhaust Water on Algae
Jones, Mary E.
Hometown High School, Hometown, PA

This project in its present form is the result of bioassay experimentation on the effects of two-cycle marine engine exhaust water on certain green algae. The initial idea was to determine the toxicity of outboard engine lubricant. Some success with lubricants eventually led to the formulation of "synthetic" exhaust water which, in turn, led to the use of actual two-cycle engine exhaust water as the test substance.

Toxicity was determined by means of the standard bottle or "batch" bioassay technique. *Scenedesmus quadricauda* and *Ankistrodesmus* sp. were used as the test organisms. Toxicity was measured in terms of a decrease in the maximum standing crop. The effective concentration - 50% (EC50) for *Scenedesmus quadricauda* was found to be 3.75% exhaust water; for *Ankistrodesmus* sp. 3.1% exhaust water using the bottle technique.

Anomalies in growth curves raised the suspicion that evaporation was affecting the results; therefore, a flow-through system was improvised utilizing the characteristics of a device called a Biomonitor. Use of a Biomonitor lessened the influence of evaporation, and the EC 50 was found to be 1.4% exhaust water using Ankistrodesmus sp. as the test organism. Mixed populations of various algae gave an EC 50 of 1.28% exhaust water.

The contributions of this project are twofold. First, the toxicity of two-cycle marine engine exhaust was found to be considerably greater than reported in the literature (1.4% vs. 4.2%). Secondly, the benefits of a flow-through bioassay technique utilizing the Biomonitor was demonstrated.

4) **Display Board:** Most displays or boards have three sections and are made to stand on a table. Your display should make it easy for interested spectators and judges to understand your study and its results. It should be eye-catching, neat and organized. This is the first thing that the judges will see so you will want to convince them that your study is worth a closer look.

Helpful hints for display:

a) **Current Year:** Make sure the board reflects the current year's work only.
b) **Good Title:** Your title should simply and accurately describe the nature of your project. A good title will make the casual observer want to know more.
c) **Take Photographs:** Many projects involve elements that may not be safely exhibited at the Fair, but are an important part of the project. You might want to take photographs of important parts/phases of your experiment to use in your display.
d) **Be Organized:** Make sure your display follows a sequence and is logically presented and easy to read.. A glance should permit anyone (particularly the judges) to locate quickly the title, abstract, procedure, results and conclusions. The hypothesis or engineering goals should be clear.
e) **Eye-Catching:** Make your display stand out with neat, colorful headings, charts and graphs. Pay special attention to the labeling of graphs, charts, diagrams, photographs, and tables to ensure that each has a title and appropriate label describing what is being demonstrated. Anyone should be able to understand the visuals without further explanation.
f) **Correctly Presented and Well-Constructed:** Be sure to adhere to the size limitations and safety rules when preparing your display. Display all required forms for your project. Make sure your display is sturdy, light but strong.

Please Note: The judges are judging your research, not the display. So don't spend an excessive amount of time or money on the board. You are being judged on the science not the show!

5) **Meeting the Judges:** The judges are interested in
1) what the student did in the current year;
2) the detail and accuracy of the topic research
3) whether the experimental or engineering procedures were well planned
4) how well a student followed the scientific method or engineering methodologies;
5) how well the student can discuss his / her project

Judges look for thorough research and a well-planned experiment or engineering project . They look at how significant your project is in it's field and how much of it is your own design. Initially, judges read your abstract, display board and report, but the oral presentation is very important. Judges want students to speak freely and confidently about their work.

Start the interview off right by greeting the judges and introducing yourself. Neat appearance, good manners and enthusiasm for what you are doing will impress the judges. Their questions may include: "How did you come up with this idea?", "What was your role?", "What didn't you do?", "What further plans do you have to continue research?" and "What are the practical applications of your project?" The judges want to know that you: understand the basic science; have correctly measured and analyzed the data and you know the possible sources of error in your project.

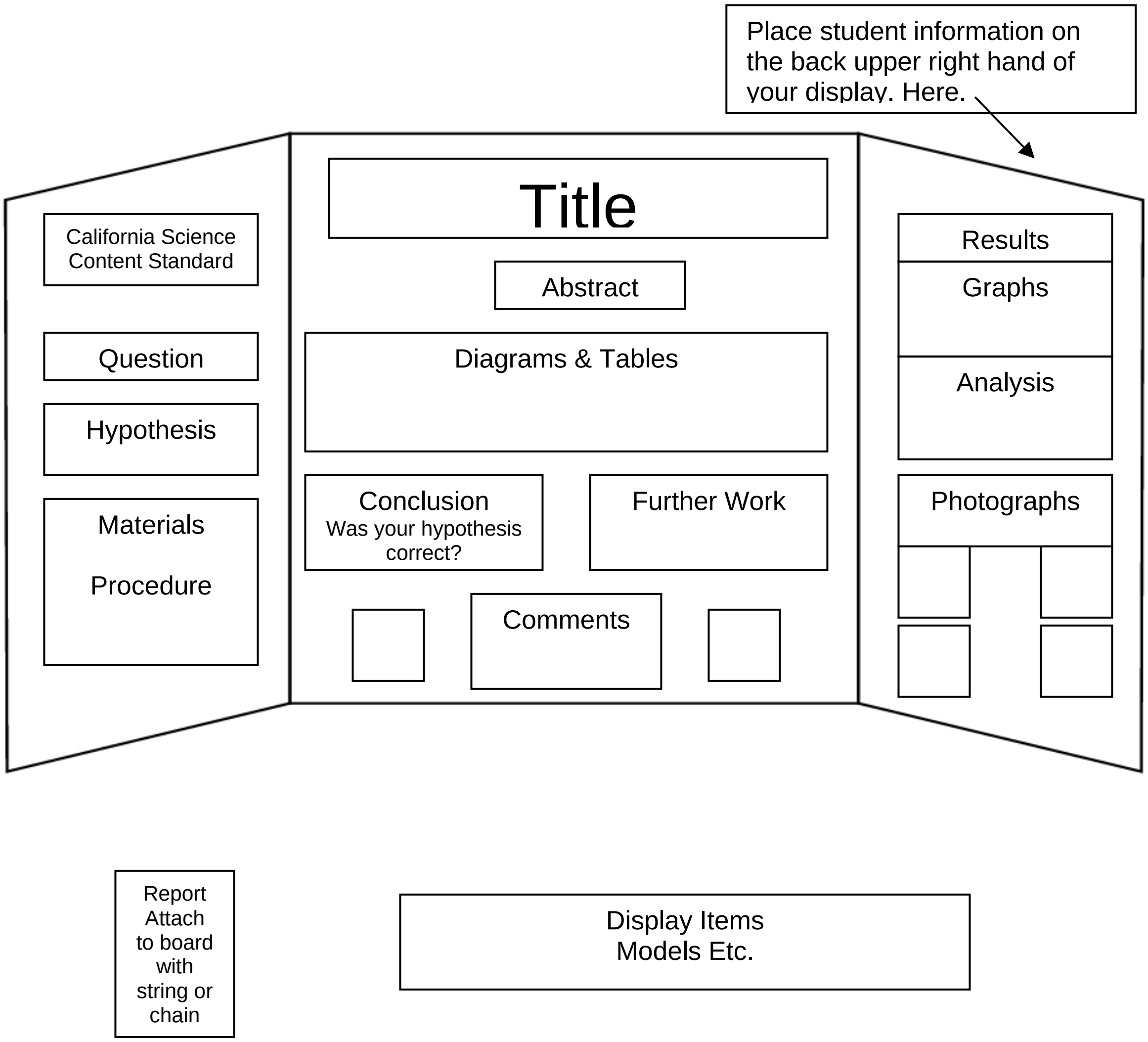
The judges seek to encourage your interest in science so relax, smile and enjoy your chance to learn from them.

The first five pages of your report should look like this:

Title	Abstract	Contents	Question	Research
By Student: Jane Smith Teacher: Mrs. Jones Western School		Question & Hypothesis..……..1 Research….……..2 Experiment………6 Data & Graphs…..8 Conclusion……..11 Bibliography……12 Acknowledgements.13	Hypothesis	

Creating Your Display: Sample Layout

Note: This layout is only an example. There are as many different layouts as there are projects.



Use this label to post your student information on the back upper right hand of your display, no student information should appear on the front of your display. Student information will include: Name of student; name of school; name of teacher; grade level, and project category.

Student Name(s): ______________________________

____

____

School: ______________________________________

Teacher Name: ________________________________

Grade Level: ___________ Project Category: _______

Science Fair Project Registration Checklist

To register you project for the 2010 Ventura County Science Fair you will need to complete the following steps:

1. Go to: www.vcoe.org/sc; click on the *Science Fair* button at the top of the page, then click on the *2010 Ventura County Science Fair On-Line Registration* button located at the top of the page.

2. Completely fill in all requested information. You will need the following:
   - Advisors Name, Phone Number and E-mail address
   - School Name and Address
   - Project Abstract

3. When you finish filling in the form and click on the *FINISH* button you **MUST** do the following to complete your registration:
   - Print a copy of the *Confirmation Page*
   - Have the *Confirmation Page* signed by all of the required people
   - Mail the *Confirmation Page* along with the $15 per student fee to:

     Ventura County Science Fair
     C/O John E. Tarkany
     5189 Verdugo Way
     Camarillo, CA 93012

The *Confirmation Page* and payment must be received by our office no later than 4:00 PM, February 24th, 2010 to complete your Science Fair Project Registration.

Incomplete projects will be returned to applicant. If the registration is rejected for any reason, the applicant may resubmit their registration with the necessary changes prior to the February 24th, 2010 deadline for reconsideration.
NO REGISTRATIONS WILL BE ACCEPTED AFTER THIS DEADLINE.