Los Angeles County
Science & Engineering Fair
9300 Imperial Highway
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TEACHER/STUDENT HANDBOOK

Los Angeles County Science Fair

Recognizing the achievements of talented students in science, mathematics, and engineering.

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Teacher/Student Handbook

Purpose of the Los Angeles County Science Fair

- Provide traditional motivation for young people to apply creativity and critical thought to the solution of science, engineering, and mathematics problems;

- Encourage students, teachers, parents, scientists, and engineers to meet, exchange knowledge and ideas, and discuss career opportunities;

- Publicly recognize the achievements of talented science students, grades 6-12, in the greater Los Angeles area; and

- Foster school-community cooperation in developing the scientific potential and communication skills of tomorrow's leaders.

Over 800 student projects are exhibited at the fair each year from public, parochial, and private schools. Some 250 awards –1st, 2nd, 3rd place winners and Honorable Mention are presented. Special Awards are also given in addition to Sweepstakes Finalists in both Junior and Senior Divisions.

For effective science education, the multifaceted nature of science must be addressed. The Science Framework for California Public Schools sets forth four major goals:

1. Attainment of positive attitudes toward science
2. Attainment of rational and creative thinking processes
3. Attainment of manipulative and communication skills
4. Attainment of scientific knowledge

All of these goals are experienced by students while preparing, following and completing a science fair project.

There are also a number of specific benefits to classroom teaching, curriculum, students, and the community which are the results of through science research projects.

<u>Benefits to Classroom Teaching</u>

- Involves students directly in science activities to better understand the developmental aspect of science.

- Allows opportunity to work beyond regular classroom content and/or depth of study.

- Stimulates student curiosity.
- Encourages students to investigate on their own initiative.

Benefits to the Curriculum

- Integrates science with other curriculum areas including mathematics, computers, and language arts.
- Provides opportunities for interdisciplinary development in reading, writing, and library research skills.

Benefits for Students

- Encourages students to explore topics of special interest.
- Helps develop managerial skills such as organizing activities and materials and meeting a timeline.
- Acquaints students with various science-related careers.
- Assists students in making realistic decisions about preparing for careers in science, taking into account the abilities and interests of the student.
- Provides a forum for students to demonstrate their work to peers and teachers.
- Indicates an achievement level on college admissions forms and scholarship applications.

Community/Public Relations Benefits

- Shows what schools are doing to motivate students.
- Demonstrates community/business support through assistance in project development or financial support of a science fair.
- Gives publicity to gifted science students.

Starting a Science Fair

To establish a Science Fair, the teacher must decide the type of organization most suitable for his/her students. Teachers can help formulate the student's thinking by answering the following questions, considering the ability and maturity of the students and time constraints:

- How much class time do you wish to devote to science projects? Should class time be concentrated in one unit or used intermittently to check projects?
- What types of projects will be allowed: Experiments, demonstrations, review papers, and research projects?
- Will the project be required of all students for a grade or encouraged as extra credit?
- Are other teachers in your school willing to participate on various levels? Will English teachers accept a science project paper as a writing assignment? Can participation in the science fair be a department or school policy?
- How supportive is the administration? Is a secretary available to assist with typing? Is space available to house a science fair? How many projects can be displayed -- and for how long?
- How much support will be available from community organizations? Will parents help with the fair? Will community members with technical expertise counsel students? Will organizations provide funding?

A school-wide science fair with prizes in each category is ideal, but not necessary. It is more important that the students learn the processes of science and are proud of their individual efforts. This can be accomplished very simply by one teacher displaying projects of selected students in one classroom. As your fair continues to grow, plans might include an exhibit area, specific judges, a reception for parents and students, prizes, and an awards ceremony.

Once you have decided on the scope of your science fair, organization of the various elements of the fair follows. The more pre-planning, the more efficiently the fair will be run. Pre-planning might include:

- Develop a Science Fair Calendar to include introducing the idea of a science fair to students, collecting project proposals, checking on progress, previewing the project notebook, and setting up the completed project display.
- Schedule the science fair on the school master calendar to reserve the facility and to tie in with other activities.
- Write a list of necessary tasks and determine who will complete each task.

- Decide the number and kind of forms to be used.

- Collect magazines and books from the library that may provide help to formulate project ideas. Search the Internet for ideas. Many local, regional, state and national science fairs have web sites.

- If possible, form a committee of interested teachers, parents, principals, and community members to assist in the organization of the fair.

- Check the References and Resources section in this Handbook for ideas.

Getting Ready for Science Projects

A Science Fair project must be viewed by students as part of the science curriculum. From the beginning of the year, students must work on developing the skills necessary to complete a good project.

- When performing activities or experiments point out the important elements: Introduction, Procedure, Data Gathering and Conclusion.

- Graph simple relationships using bar and line graphs.

- Use vocabulary such as variable, control group, and hypothesis.

- Assign an open-ended inquiry to be done as homework. As an example: Perform and write up an experiment to measure the friction of three different surfaces.

- Assign group projects of topics to research or demonstrations to perform with classroom presentations.

Getting started with an idea that is both broad enough to be interesting and narrow enough to be possible is the challenge. A thorough introductory presentation to students will assist them in finding a practical and interesting topic. The following are various methods to open a discussion of science fair projects:

- Show slides or CD-ROM of projects from previous years. (Some are available from the Los Angeles County Office of Education).

- Show the film “Science Fairs” by Handel Films (1983) available from the Los Angeles City Schools and the Los Angeles County Office of Education.
- Request a presentation from students who have participated in previous science fairs.

- Display magazines and books with ideas of experiments and special topics that might be explored.

- Suggest that students consider their personal interests and hobbies to discover an idea for inquiry.

Check project proposals to see that necessary materials for the project are easily obtained. The projects can be similar to an activity or experiment scheduled for later in the year within the regular curriculum.

Students should keep the problem simple; complicated technology is not required. ***A winning project is one that combines creativity, attention to detail, and sound scientific thought.***

For a more complete introduction to science projects, discuss the ***Selecting a Topic*** section with students.

Suggested Timeline

October: Schedule the date of your school science fair (prior to the Los Angeles County Science Fair).

Reserve exhibit space for your local school Science Fair.

Check rules for County Science Fair so that teachers are well informed on regulations, requirements and timelines.

November: Work with students to understand the components of a science fair project.

Assist students in selecting a suitable topic.

December: Assist students in writing a project purpose.

Help students conduct a review of the literature using previously identified library and Internet sources.

January: Advise students regarding contacting professionals who can help guide their project and supply necessary background.

Help students develop a list of materials needed for projects.

Discuss the nature of experimentation with students, explaining the difference between controlled and uncontrolled experiments.

Review the process if observing, measuring, and collecting data.

January: Provide time, space, and guidance for experimentation.

Make arrangements for regular (weekly) progress reports from students. (Special forms may have to be completed.)

Check to ensure that all projects conform to safety rules and proper care of human subjects, animals, tissue, etc. (Any experiment where an animal or human being might be injured or experience pain should not be allowed.)

February: Develop a judging sheet that incorporates your expectations.

Determine the number of projects and categories expected.

Arrange for judges (provide judges with criteria).

Help students develop conclusions and organize and assemble the final report.

March Arrange for a review of student's journal by language arts teachers.

Publicize your fair to the community, including parents, city officials, Board of Education members, administrators, faculty and the local newspaper.

Plan physical layout of the space for the science fair.

Design printed program to include a list of judges, projects, where each student's project is located and a map.

Confirm time and date with judges.

Assist students to develop final copies of report.

Review exhibit construction with students.

Review qualities of a good exhibit including construction, lettering, color, etc.

Review, with students, the criteria for a successful oral presentation. Schedule a practice session in class.

Arrange for volunteers to work during the fair.

Late March: **SCIENCE FAIR DAY**

Set up tables with project numbers attached.

Secure public address system (if needed).

Late March: Prepare judging sheets and make necessary copies.

Prepare nametags for judges.

Arrange coffee and refreshments for judges.

Review judging criteria for judges.

Don't forget to thank judges and volunteers.

April: Los Angeles County Science & Engineering Fair

May: California State Science Fair

Selecting a Topic

Science begins with wonderment. Students should make a list of things they are curious about. This will start the thinking process toward selecting a topic.

Choose a topic in which you are genuinely interested. The topic may be one related to a long-time hobby or something entirely new for which you would like to have a better understanding. Some scientific displays like collections, illustrations or models are NOT science fair projects. Listed below are five types of science fair projects.

Demonstrations show scientific principles but are not research projects or projects that extend applications. Demonstrations seldom receive even an Honorable Mention Award.

A Science Research Project seeks to find new knowledge. A science project is one way of asking a question and answering it via the scientific method. One recent winning project asked, "What frequency of sound wave would travel through water with the least intensity?"

An Engineering Project uses scientific principles to improve or create new applications. The project may be theoretical or an experimental study on a model.

Computer Projects may deal with a unique method of programming. An existing program may be improved to run faster and use less memory.

A Mathematics Project deals with math not usually covered in the classroom. The project should represent a new point of view of a known topic.

Try some of these sources for topic ideas:

Magazines	Lab Manuals
Demonstration Books	Newspapers
Encyclopedias	Educational Periodicals
Science Fair Handbook (See pages 29-31)	Talks with teachers, friends, professional people

Consider the practical aspect of doing a project. Can the necessary materials be easily obtained? Can equipment or material be borrowed from school? If not, what expense is involved with the project? Costs should be kept to a minimum.

Keep safety in mind. Are the materials and equipment safe enough for you to handle on your own, or must you have adult supervision? Be especially careful of lasers, high pressure gases, high temperatures, high electrical currents, and certain biological specimens. In accordance with the California State Education Code 51540, experiments involving live vertebrate animals (including humans) cannot in any way cause pain or harm to the animal. Projects involving live vertebrate animals should not be repetitive. If, for example, the experiment has been done repeatedly in the past with the same results, it is not an ideal choice for a science fair project.

KEEP IT SIMPLE. It is NOT necessary to use elaborate equipment or technology. Remember that our wealth of scientific information was built by many men and women discovering small and simple facts over a long period of time.

Literature Search

Find out what has been written about the selected topic. Search the library for at least five good references. Take notes on your reading. Be certain to record all the information required for a bibliography from the books or magazines used as references.

The literature search can help further define the research problem. If an enormous amount of material is available on the topic, it is probably still too general. If a student cannot find anything on the topic, he should ask the teacher for assistance in determining the subject category. Mentors may be available at other science fair web sites.

Talk to teachers and specialists in the field. If there are specific questions, write them down. Call nearby scientific companies, engineering firms, hospitals, or universities and ask if there is someone to help answer questions. It may be surprising how willing people are to help, if the student can tell them exactly what he/she needs to know. Include an acknowledgment of assistance from specialists in the project write-up.

Developing a Hypothesis

Science begins with a refined testable question. The "If..then" statement designs the experiment. With a well-stated hypothesis the rest of the experiment follows easily. The hypothesis tells you what data to look for and what it will mean when it is found.

The form is: If...(Followed by a statement of the hypothesis) then...(followed by a logical cause and effect statement that will be true if the hypothesis is correct).

For example: If the work done in drawing a compound bow is greater than that required for a simple bow or slingshot, then the arrow shot from the compound bow should travel further than an arrow shot from a single bow or slingshot.

An additional negative statement is frequently helpful in defining the control: Bean sprouts with no nitrogen in the soil will not grow as fast or as high as normal.

Selecting a Title

Now that you have laid all the groundwork, you can select a working title for your project. The title should describe the project in less than ten words. For example "The Effect of Nitrogen Fertilizers on Bean Sprout Growth."

Experimenting

Materials

Make an exact list of the amount and type of materials needed. Items may be purchased from hardware, drug, or variety stores. Some items may need to be ordered from science supply companies; therefore, planning ahead is necessary. Keep an accurate record of the kind of material and the quality of each used in the experiment. Use metric weights and measures (meters, kilograms, liters, etc.)

Procedure

Plan the list of procedures that will follow in performing the experiment. If there is any question about the safety of any step, ask a knowledgeable adult to review the methods.

The experimental design should include controlled experimentation. In other words, set up an experiment with few variables. The independent variable is the variable changed by the experimenter in performing the experiment. The dependent variable is the variable that changes as a result of the experiment. All other variables must be kept constant so the cause and effect of the two important variables can be noted.

Using the metric system, decide how ant what kind of measurements should be made. Set up log and/or data sheets for recording the anticipated data. Use a camera to take pictures, telling the story of the project and adding interest to the display.

Data Collection

Begin your experimentation/investigation at least two months before the fair to allow yourself enough time to repeat the experimentation if necessary. Keep careful observations in a logbook. Record failures as well as success.

Keep track of all the steps performed and all tests made. Where possible, keep a control group to make comparisons with experimental group. The groups should be identical except for one variable. Repeat the experimentation to remove any doubts over the results. Be sure that measurements are always made in a consistent manner.

As any experimenter, a student will probably find that unexpected questions and problems will arise, and it is this unexpected aspect of science that makes it exciting. It may be necessary to change the experiment or add new tests to answer unsolved problems. The path the experiment takes may be more interesting then the one originally planned. Always record all findings and observations. The negative and hard to explain results may lead to findings as important as the results that support the hypothesis.

Organize the data into charts. Display the numerical results in the way that best summaries and explains the work.

One of the foundations of science is that an experiment can be reproduced by different scientists in different laboratories. Record the experiment in enough detail so that another investigator could perform it.

Common Mistakes of Science Fair Projects

Before continuing a project, the student should check to avoid common mistakes of science fair projects:

- Jumping to a conclusion based on a single observation or test. There is often a tendency to try something once, see what happens, and draw a conclusion from it. How many times did Jonas Salk test his polio vaccine before it could be used? Results must be verified by repeated experiments.

- Failing to include a control in the experiment design. Part of finding out what will happen to the growth of bean seeds if they are fertilized is to also find out what happens if they are not fertilized. The unfertilized seeds are the control part of the experiment.

- Failing to recognize and/or control variables. Not only must experiments be repeated many times over, but also variables must be controlled in the same way each time if the results are to be reliable.

- Not keeping complete and/or accurate records. Science involves a lot of paperwork. Keeping good records while doing a science project involves reading, writing, spelling, and composition. Teflon was invented a full 30 years after DuPont first created it in a laboratory, because he kept accurate records that were easy to read and understand.

In general, science projects must embody those characteristics that yield reliable results. It must be done carefully with attention to detail.

As Alex R. Balian says in "Is Science Fair?", remember . . .

GOOD is better than **BIG**!
SIMPLE is better than **COMPLEX**!
BRIEF is better than **LENGTHY**!
SPECIFIC is better than **GENERAL**!

Analysis of Data and Results

Graphs

Graphics provide a pictorial way to show comparisons. It is, therefore, appropriate to convert tabular data into graphic form. Decide whether bar graphs or line graphs are the most effective way to display information. All graphs must further have a descriptive title. Generally, the independent variable is graphed on the vertical axis. Label each axis, the numerical division along each axis, and the units of measurement.

Interpretations

Interpretation should directly accept or reject the hypothesis. Explain the meaning of your observations and numerical results. Support the meaning of experimental results with the data collected. Discuss the shapes of graphs. Be careful in drawing a conclusion only from data. Data needs to be interpreted.

Statistical Analysis

Do a statistical analysis if possible. The arithmetic mean or chi square test can help show the validity of data. Ask the science advisor if there is a method of statistical analysis that can assist in the presentation of a project. Many spreadsheet programs now offer statistical analysis packages.

Discussion

This is the student's opportunity to give an honest impression of the project. What were the problems? The student can speculate about how the project results might fit into the greater scheme of things. What are the possibilities for future experimentation?

Written Report

Now that the student has:

- Taken notes on library research
- Written a hypothesis
- Listed the type and amount of materials used
- Recorded step by step procedures
- Maintained a log
- Collected data in tabular form
- Created graphs
- Interpreted the findings
- Discussed the general impressions

The report is almost completed. Organization and transitions between areas are remaining. Technical language may be used, but it is more important to be clear and concise, rather than using too much technical terminology. Label each section of the report clearly. The written report must have correct spelling and grammar, be easy to read (double-spaced typing), and appear neat and well organized. Follow the chart on the next page in planning your report.

The Display

The display communicates the essential parts of the project in a quick, visual way. The display should be sturdy, free standing, colorful, simply illustrated, well labeled, and attractive.

The backboard may be made of pegboard, masonite, or plywood no larger than 76-cm (2.5 ft.) deep, a maximum of 122-cm (4 ft.) wide, and a maximum of 198 cm. (6.5 ft.) high (if placed on table) or 274 cm. (9 ft.) high (if placed on floor). (Of course, the display does not need to be this large). An easy-to-handle folding design is made from pegboard held together by three notebook rings between each section. Scrap wood can be covered with fabric for an attractive display. Try requesting scraps at lumberyards, construction sites, hardware stores, or yardage stores before spending money. Foam core or folding backboards may also be purchased from science or office supply stores.

The title and section headings on the backboard should be clearly visible and readable from a distance of three to four feet. Use complementary colors as background and bright or dark letters for the titles of each section.

If using a computer to generate headings, use a boldface font of at least 18 points. Cut paper strips and frame and/or mount the title of each section. A photocopier can also be used to enlarge text for titles and section headings. The title should have the largest print on the display board and be neatly done.

Enlarge graphs and use color for the different lines or bars. Use photographs that are clear and sharp, with the correct exposure. A 5 x 7 photo creates a better display. There should be an explanation under each photo and graph.

Set the entire display board flat on the floor and arrange the various parts before beginning the final assembly. Be certain all titles, graphs, photos, and text are lined up properly and in place before gluing them down. Use rubber cement instead of glue so pieces can be replaced if necessary. Make sure the edges of the paper are glued down securely to the backing to prevent peeling or drooping later. All this attention to detail will result in a display board that is attractive, easy to read and as neat as possible.

PLAN AHEAD—A GOOD DISPLAY TAKES TIME TO CREATE!

How Does Your Project Measure Up?

Scientific Thought

- Does the project follow the scientific method?
- Does the project illustrate controlled experimentation and retesting?
- Does it represent real study and effort?
- Does it make appropriate comparisons?
- Does it form conclusions based only on the data gathered?

Originality

- Is the project your own idea?
- Does the project demonstrate your conclusions?

Thoroughness

- Does the project tell a complete story?
- Are the written report and visual display well done?
- Is the project documented by charts, graphs, and/or photos?

Clarity

- Is the hypothesis or problem easily understood by someone who is not technically trained?
- Does the written report explain the project simply and clearly, and show depth of understanding?
- Is the display easy to follow and attractively executed?

Interview

As part of the judging process, a student may be asked to explain the project to judges and/or his teacher. Organize and plan what will be said to the judges in the personal interview.

The judges will want to know:

- How the topic was selected for the project?
- Did the student receive help and if so, how much?
- What has been known about the general subject area of the project?
- What would the student do if there was additional time to spend on the project?
- What has been learned through investigation?
- If this project was continued, what is the next step?

Give the judges as much information as possible. Be enthusiastic! An interview can be fun! The judges are experts in their fields and the interview may also be an opportunity to learn more about a subject.

Los Angeles County Science Fair Information

The Los Angeles County Science Fair grade-level divisions, project categories, and judging criteria are similar to those used by the California State Science Fair

The number of projects entered by each school in the Fair is thirteen (13). Three (3) of the thirteen projects may be Team Projects (only 2-3 participants per team).

Medals will be awarded to 1st, 2nd, 3rd Place and Honorable Mention winners in each of the 40 categories for both the Junior and Senior Divisions, with identical awards in the Team Project categories (Life Sciences and Earth/Physical Sciences). Special awards from business and industry are also granted each year.

Application forms for student projects must be **completely** filled out and submitted **online** by the deadline date. The Site Science Fair Coordinator is responsible for final verification and approval of all student applicants and for submitting all necessary paperwork **IN ONE PACKAGE**. ***Late entry forms and projects will not be accepted at the fair.*** Problems with mail delivery is not an acceptable excuse for late entries. Tbe Site Science Fair Coordinator is responsible for submitting all required paperwork to:

Los Angeles County Science and Engineering Fair
Attn: Dean Gilbert, Science Consultant
Los Angeles County Office of Education
9300 East Imperial Highway
Downey, CA 90242

- ***On the application form, students are required to submit a 100-150 word abstract of their project. This abstract will be used by the judges during the first day of preliminary judging.***

- ***All projects involving vertebrate animals, human subjects or animal/human tissue must have approval prior to the initiation of student research. Projects without prior approval and proper signatures on Certification Form 601-068 will not be accepted at the fair.***

The section in this guide titled *Category Interpretations* will help students determine the category in which their project should be entered.

Rules for Exhibits

Maximum Size

- Table displays: 76 cm (2.5 ft.) deep x 122 cm (4 ft.) wide x 198 cm (6.5 ft.) high
- Floor displays: 76 cm (2.5 ft.) deep x 122 cm (4 ft.) wide x 274 cm (9 ft.) high

Note: Projects exceeding these dimensions will not be admitted to the fair.

Construction

- Projects must be durable with all parts firmly attached. Provide back support for your exhibit.
- No attachment to walls.
- All cardboard over 30 cm must be backed with wood, pegboard, foamboard or hardboard.

Electrical

- All exhibits requiring electricity must be designed for 110 volts (60 cycle) and limited to 500 watts. The popular style of parallel, ground plug (3-prong) must be used. Students must supply their own surge suppressor. <u>No exceptions!</u>

Gas or Water

- No gas or water outlets will be provided.

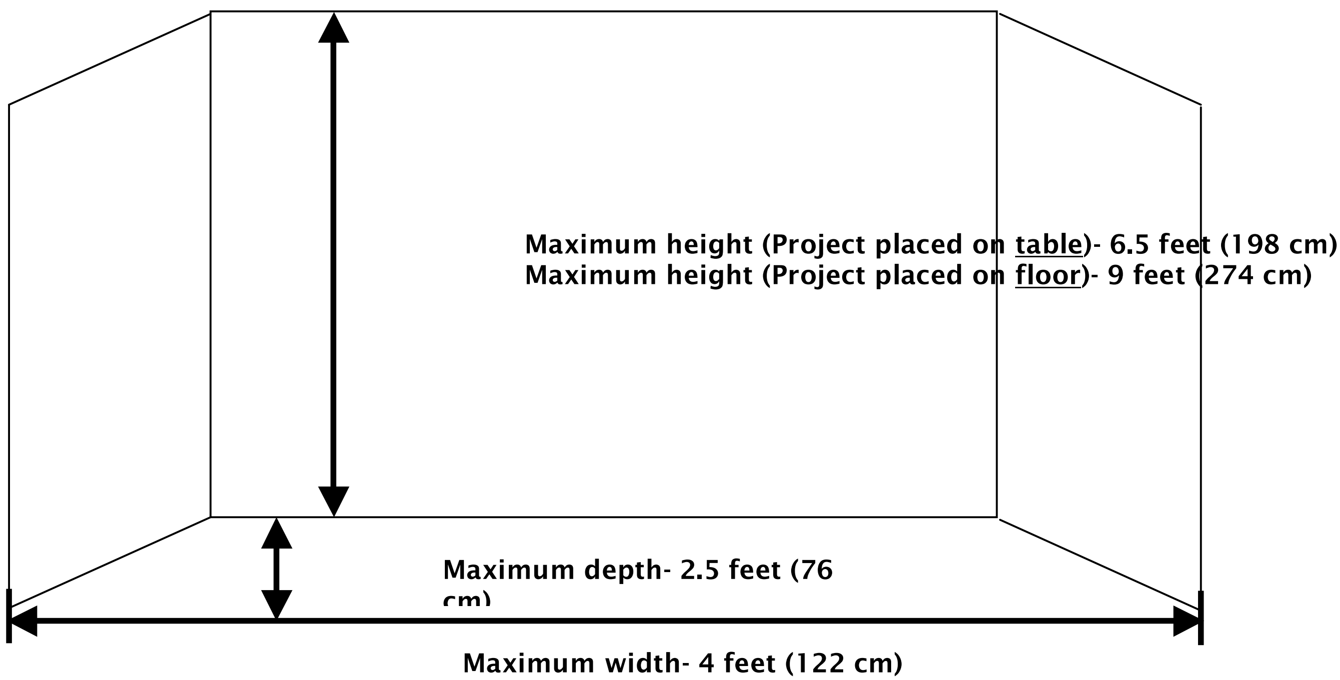
Living Organisms

- Displays of bacterial/viral cultures, molds and live or preserved plants and animals, animal parts, embryos, etc. may not be displayed during the science fair. Photographs may be used.

Suitability for Exhibition

- The Executive Committee of the Los Angeles County Science and Engineering Fair reserves the right to disqualify any exhibit considered unsafe or unsuitable for public exhibition or any project that is considered inhumane treatment of animals or human subjects.

Schematic of Maximum Project Display Dimensions



Responsibility

The Los Angeles County Science and Engineering Fair Committee, its Board of Directors, the Los Angeles County Office of Education, the Board of Supervisors for Los Angeles, California, all participating schools and school districts, volunteers and representatives of sponsoring organizations shall be held harmless for injury or death of persons or damage and/or loss of property occurring in connection with the Los Angeles County Science Fair.

Eligibility and Project Categories

The Los Angeles County Science and Engineering Fair is open to all students in grades 6-12 who have been selected as winners from a local school or district science fair. **Each school may send up to 13 entries.**

Please use the descriptions and the section of this guide titled Category Interpretations when selecting the category for student projects.

Junior Division (grades 6-8) and Senior Division (grades 9-12) categories include:

Jr.	*Sr.*	*TEAM*	*INDIVIDUAL & TEAM PROJECT CATEGORY DESCRIPTIONS*
x	x	x	**1. ANIMAL BIOLOGY:** Studies of evolutionary origins, genetics, growth, morphology, studies of animals in their natural habitat (or reproductions of it).
x	x	x	**2. ANIMAL PHYSIOLOGY:** Studies of major animal organ system functions involving genetics, immunology, neurobiology, pathology, reproduction, or sensory biology in mammals.
	x	x	**3. BEHAVIORAL/SOCIAL SCIENCES:** Studies of behavior, conditioned responses, learned responses, learning, psychiatry, or psychology in humans and other animals, including the effects of chemical or physical stress on mental processes, anthropology and archaeology; Studies or surveys of attitudes, behaviors, or values of a society or groups within a society (e.g., anthropology, archaeology, or sociology)
x		x	**4. BEHAVIORAL SCIENCES- NON-HUMAN:** Studies of behavior, conditioned responses, learned responses, learning, psychiatry, or psychology in non-humans, including the effects of chemical or physical stress on mental processes.
x		x	**5. BEHAVIORAL/SOCIAL SCIENCES- HUMAN:** Studies of behavior, conditioned responses, learned responses, learning, psychiatry, or psychology in humans, including studies or surveys of attitudes, behaviors, or values of a society or groups within a society (e.g., anthropology, archaeology, or sociology), and the effects of chemical or physical stress on mental processes.

Jr.	*Sr.*	*TEAM*	*INDIVIDUAL & TEAM PROJECT CATEGORY DESCRIPTIONS*
x	x	x	**6. BIOCHEMISTRY & MOLECULAR BIOLOGY:** Molecular biology, molecular genetics, enzymes, photosynthesis, blood chemistry, protein chemistry, food chemistry, hormones.
	x	x	**7. CHEMISTRY:** Physical chemistry, organic chemistry (other than biochemistry), inorganic chemistry, materials, plastics, fuels, pesticides, metallurgy, soil chemistry.
x		x	**8. CHEMISTRY-APPLIED:** Measures and comparisons of materials durability, flammability, effectiveness for intended use, and product testing for real world applications.
x		x	**9. CHEMISTRY-GENERAL:** Physical chemistry, organic chemistry (other than biochemistry), inorganic chemistry, materials, plastics, fuels, pesticides, metallurgy, soil chemistry. This implies knowledge of the chemical structure of the materials being tested.
x	x	x	**10. EARTH/SPACE SCIENCES:** Geology, geophysics, physical oceanography, meteorology, atmospheric physics, seismology, petroleum geology, geography, speleology, mineralogy, topography, solar physics, astrophysics, orbital mechanics, observational astronomy and astronomical surveys.
x	x	x	**11. ECOLOGY:** Interaction of abiotic and biotic elements within any environmental investigation (habitats, food webs, oxygen, carbon & nitrogen cycles, biogeography, biomes), pollution sources (air, land, water), impact studies, resource access, environmental alteration (caused by heat, light, irrigation, erosion, etc.).
x	x	x	**12. ENGINEERING APPLICATIONS:** Project in which a potentially useful product is created (e.g., strengthening concrete, satellite reception improvement, solution to traffic jams, bionic heart/respiration monitors).
x	x	x	**13. ENGINEERING RESEARCH:** Engineering analysis, tests of devices and their operations, other than product comparisons.
x	x	x	**14. ENVIRONMENTAL MANAGEMENT:** Conservation of natural resources and usage modalities (crop rotation, use of renewable energy sources, terrace farming, recycling, clear cutting, etc.), environmental protections (emissions control, sewage and solid waste disposal, etc.)
x		x	**15. MATERIALS SCIENCE:** Studies of materials characteristics and their static physical properties. Includes measurements and comparisons of materials durability, flammability, and insulation properties (thermal, electrical, acoustic, optical, electromagnetic, etc.).
x	x	x	**16. MATHEMATICS & COMPUTER SCIENCES:** Calculus, geometry, abstract algebra, number theory, statistics, complex analysis, probability, topology, logic, operations research, and other topics in pure and applied mathematics, computer programs, languages, new developments in software or hardware, information systems, computer systems organization, computer methodologies, and data (including structures, encryption, coding, and information theory).
x	x	x	**17. MICROBIOLOGY:** Studies of prokaryotes, protists (excluding algae), and fungi (mycology), including genetics, growth and reproduction, and response to chemical, and physical stress. Includes bacteriology.
x	x	x	**18. PHARMACOLOGY:** Effect of any drug or chemical on any living animal, especially though not exclusively, humans. Studies should be at the cellular or organism level.
	x	x	**19. PHYSICS:** Experimental or theoretical studies of the physical properties of matter in all forms, Computer simulations of physical systems are appropriate in this category.

Jr.	*Sr.*	*TEAM*	*INDIVIDUAL & TEAM PROJECT CATEGORY DESCRIPTIONS*
x		x	**20. PHYSICS- AERODYNAMICS/HYDRODYNAMICS:** Studies of aerodynamics and propulsion of air, land, water, and space vehicles; aero/hydrodynamics of structures and natural objects. Studies of the basic physics of fluid flow.
x		x	**21. PHYSICS- ELECTRICITY & MAGNETISM:** Experimental or theoretical studies with electrical circuits, electro-optics, electromagnetic applications, antennas and propagation, and power production.
x		x	**22. PHYSICS- GENERAL:** Experimental or theoretical studies of the physical properties of matter and energy in all forms (with the exception of fluids, electricity, and magnetism); computer simulations of physical systems are appropriate in this category.
x	x	x	**23. PLANT BIOLOGY:** Agriculture, agronomy, horticulture, forestry, plant taxonomy, plant genetics, hydroponics, and phycology (algae).
x	x	x	**24. PLANT PHYSIOLOGY:** Studies of major plant organ system functions involving genetics, immunology, pathology, and reproduction.
x		x	**25. PRODUCT SCIENCE:** Comparison and testing of natural and man-made products regarding effectiveness for their intended use in consumer-oriented applications.

Category Interpretations

It is impossible to develop category descriptions that can be applied to all projects without some interpretation. The increasingly interdisciplinary nature of science and engineering means that, in many categories. It may be necessary to identify the primary emphasis of the project.

For example, Limnology is defined as the scientific study of the physical, chemical, meteorological, and biological conditions in fresh waters. Therefore, a project in Limnology would have to be considered from the point of view of its primary emphasis (physics, chemistry, etc.) to be placed in the appropriate category.

The following project areas, provide a basis for interpretations of the category descriptions. (Partial List)

Instruments: The design and construction of a telescope, bubble chamber, laser, or other instrument would be properly placed in Engineering applications if the design and construction were the primary emphasis of the project. If a telescope were constructed, data gathered using the telescope, and an analysis of the data presented, the project would be placed in Earth/Space Sciences.

Marine Science: Behavioral/Social Sciences (schooling of fish), Plant Biology (marine algae), Animal Biology (sea urchins, cnidarians, prehistoric animals), or Earth/Space Sciences (geological ages).

Rockets: Chemistry (rocket fuels), Earth/Space Sciences (use of a rocket as a vehicle for meteorological instruments), Engineering Applications (design of a rocket), Physic (computing rocket trajectories), or Plant Physiology (effect of rocket acceleration on plants).

Genetics: Biochemistry & Molecular Biology (studies of DNA), Plant Biology (hybridization), Microbiology (genetics of bacteria) or Animal Biology (fruit flies).

Vitamins: Biochemistry & Molecular Biology (how the body deals with vitamins), Chemistry (analysis), and Pharmacology (effects of vitamin deficiencies).

Crystallography: Chemistry (composition of crystals), Mathematics & Computer Sciences (symmetry), and Physics (lattice structure).

Ecology – Pollution: In a study of the eutrophication of lakes: Behavioral/Social Sciences (human beings who caused the problem), Chemistry (process of eutrophication), Plant Physiology (growth of algae), Environmental Management (water purification systems), Microbiology (effects on microorganisms), Animal Biology (fish populations), and Ecology (organisms and pollution).

Pesticides: Biochemistry & Molecular Biology (mechanisms of toxic effects), Plant Physiology (plant intake and concentration), Chemistry (composition of pesticides), Earth/Space Sciences (mechanisms of runoff), Pharmacology (effects on human beings and animals), and Ecology (effects of pesticides on the environment).

Speech and Hearing: Behavioral/Social Sciences (reading problems), Engineering Applications (hearing aids), Animal Physiology (speech defects), or Physics (sound).

Radiometry: Biochemistry & Molecular Biology, Animal Biology and Plant Biology could all involve the use of radioactive tracers. Earth/Space Sciences or Physics could measure radioactivity. Engineering Applications could be the design and construction of detection instruments.

Space-Related Projects: Many projects involving "space" do not go into Physics. Plant Physiology (effects of zero gravity on plants), Animal Physiology (effects of gravity on humans), Engineering Applications (closed environmental system for space travel), Earth/Space Sciences (studies of planets).

Computer-Based Projects: Computers would go into Mathematics & Computer Sciences unless the computer is a tool for a project in some other category. Computer programs and language might be Mathematics & Computer Sciences unless developed to facilitate analysis for a project in some other category.

Product Science Projects: Comparison and testing of natural and man-made products regarding their effectiveness for intended use in consumer-oriented applications. Studies of basic material characteristics and physical properties not related to a consumer product application belong in Materials Science.

Materials Science Projects: Studies of materials characteristics and their static physical properties. Includes measurements and comparisons of materials durability, flammability, and insulation properties (thermal, electrical, acoustic, optical, electromagnetic, etc.). Studies comparing and testing natural and man-made products regarding effectiveness for intended use in consumer-oriented applications belong in Product Science.

Judging and Criteria for Awards

The initial reward for participating in the Los Angeles County Science Fair is the opportunity to display a science project, meet with other exhibitors, and share information and views. A certificate of merit is given to each student exhibitor in recognition of his or her efforts.

First, second, third place and honorable mention awards, consisting of medals and ribbons, are awarded for exhibits in each category in both Senior and Junior Divisions. In addition to awards for place winners, a number of special awards are presented from organizations and the business community.

For specific details on judging criteria for all project categories, please see the Los Angeles County Science Fair Judge's Worksheets that follow in the Appendix.

Form 601-076 – Individual and Team
Form 601-077 – Mathematics and Computers

California State Science Fair

Projects placing, first, second, or third in the Los Angeles County Science and Engineering Fair are eligible to enter the California State Science Fair. This fair is usually held at the California Science Center approximately two weeks after the Los Angeles County Science and Engineering Fair.

Safety Precautions

1. Fire regulations prohibit use of highly flammable materials or decorations in project displays. Background panels must be of masonite, pegboard, hardboard, wood or foam core board, to which poster paper, cardboard or fabric may be attached.

2. No dangerous or combustible solids, liquids or gases may be exhibited. Cylinders, tanks and/or other containers that have held such substances, unless thoroughly cleaned and/or purged with carbon dioxide, are also prohibited. Rockets MUST NOT contain fuel. No flames, open or concealed, are permitted in the display building.

3. No syringes, pipettes or similar devices may be displayed.

4. Devices producing temperatures in excess of 100 C must be adequately insulated.

5. The following electrical safety rules must be observed:

- Wiring must be properly insulated and fastened.
- Wiring, switches and metal parts of high voltage circuits must be located out of reach of observers and must include an overload safety device.
- High voltage equipment must be shielded with a grounded metal box or cage to prevent accidental contact.
- Approved connecting cords of the proper load-carrying capacity must be used for 110-volt operation of lights, motors, transformers and other equipment.
- Standard switches must be used for 110-volt circuits. Open knife switches or bell-ringing push buttons are not acceptable for circuits exceeding 12 volts.
- Batteries with open top cells (wet cell batteries) are not permitted
- Electrical connections in 110-volt circuits must be soldered or fixed under approved connectors and have connecting wires properly insulated.
- Electrical circuits for 110-volt AC must have an Underwriters Laboratory approved cord (or proper load carrying capacity) at least 2 meters long and equipped with a standard grounded plug.

6. Devices (vacuum tubes, lasers, etc.) which generate dangerous rays must be properly shielded.

7. Only Class I and Class II lasers may be operated at the Fair. These lasers must (1) have a protective housing or barricade preventing human access to the beam during operation, (2) be disconnected from the power source when not in operation, (3) be operated only in the presence of the exhibitor, and (4) when displayed, be accompanied by the following sign: LASER RADIATION; DO NOT STARE INTO BEAM.

8. No, live or preserved plants, vertebrate or invertebrate animals or parts (including embryos, microbial cultures or fungi, (whether known to be disease causing or not) may be exhibited at the Fair. Sealed insect collections will be permitted on display.

9. Human parts, other than teeth, hair, nails, histological sections and liquid tissue slides may NOT be exhibited.

10. Photographs or other visual presentations depicting humans or vertebrate animals in other than normal conditions may not be displayed on the student's exhibit.

11. The use of Controlled Substances (drugs, chemicals, anesthetics, etc), are regulated by the Comprehensive Drug Abuse Prevention and Control Act of 1970 and must conform to existing local, state and federal laws. Such substances may not be exhibited at the Fair.

12. All Recombinant DNA research must be carried out in accordance with the revised NIH Guidelines for Research involving Recombinant DNA Molecules. Only research normally conducted without containment in a microbiological laboratory and performed under the supervision of an appropriately qualified scientist is permitted. The facility to be used must be described in the research plan. Research requiring containment is prohibited.

13. Research involving gasohol must conform to Department of the Treasury, Bureau of Alcohol, Tobacco and Firearms (ATF) regulations. For specific information, call the Western Region Office, (415) 436-8020.

Possible Projects for Each Category

Animal Biology
Analysis of owl pellets for determining owl diet and mammal distribution
Feeding behavior of flies
Regeneration experiments with Planaria
Mimicry- a study of look-alikes
How do microwaves affect the genes of *Drosophila*?
What happens if both juvenile and molting hormones are artificially introduced into an insect larva?
How are stem cells induced to turn into specific tissues?
Given a choice, which dog food do toy poodles prefer?
Are Channel Island foxes really separate SPECIES or sub-species?
Are coyote densities in Southern California increasing?

Animal Physiology
What type of weight lifting increases muscle mass the quickest?
Can *Drosophila* become immune to pesticides?
Do video games increase hand-eye coordination?
Do neuroinhibitors effect metamorphosis in insects?
In which group will stretching exercises show the greatest increase in flexibility: non-athletes, runners or ballet dancers?
Can breathing exercises improve a singers ability to hold a note?
What is the most cost-effective food to feed bait fish to gain the greatest and fastest growth?
Which abdominal exercise machine decreases waist size the fastest?

Behavioral/Social Sciences
How do students communicate non-verbally to their teachers?
Effects of loud music on hearing acuity
Do television commercials control buying habits?
Insect learning- How many trials are necessary for crickets to learn a simple maze?
Does UV light attract insects better than wavelengths in the visible spectrum?
Does the density of ovipositing females to available eggs affect a female insects behavior?
Can a chicken tell a fertile egg from an infertile egg?
What is the relationship between damselfish densities on a reef and the size of their territories?
Do garibaldi fish recognize intruders to their territory by color or by shape of an intruding fish?
What color of walls in a study room will demonstrate the greatest retention of long-term memory?
Can an earthworm learn simple, consistent choices when confronted with alternatives?
Are honeybees more attracted to flower color or sugar concentration when locating a new food source?
Attitudes towards smoking- Should all restaurants have a non-smoking area?
Survey of smog control removal from autos
Survey of households that make some effort to conserve water

Can studying collaboratively in groups rather than alone improve a student's standardized test scores?
Does taking Cornell notes increase test scores compared to random note-taking style?
Are females called on more frequently inn class than males by male teachers?
What specific body types in adolescent males attract the greatest number of adolescent female admirers?

Biochemistry & Molecular Biology
Organic Dyes- Can pigments from lichens be extracted to make dyes?
An analysis of the pH of saliva of students from your school
Analysis of reducing sugars in common foods
A new method of building synthetic peptides
Separation of blood proteins
Can antibiotics be identified by paper chromatography?
What esters are common in basic flavors?
Can proteins be denatured by mechanical forces?
DNA extraction techniques from beef liver

Chemistry
Analysis of oil samples- Techniques of fractional distillation of oil
How much dissolved oxygen is present at various depths of a lake or ocean?
What pollutants are present in the air?
An experiment to illustrate the production of simple amino acids in an early atmosphere
Testing the mineral concentrations in hard and soft water
Analysis of pollutants found in the Los Angeles or San Gabriel River
Investigation of pH variations of soils
Negative ion (cations) can be separated and analyzed with exchange resins
Can light energy influence chemical reactions?
What is the most effective household product to take organic stains out of clothes?

Mathematics & Computer Sciencess
Providing geometric theorems by using concrete objects
Finding a practical application of triangles
A new mathematical system for analyzing solutions
Investigation of numeration systems with negative base
Do left-handed people perceive differently than right-handed people?
Compare and contrast the modular to the real number field
Develop a "successive sum" theory of Pascal's Triangle
Find all the primitive triplets
Create a 3-D model of mountains and valleys to simulate optimal topography for wind turbines.
Create a simulation showing the discharge and diffusion of heavy metal contamination from a point source in a nearby river system.
Create a program to track the data from current meters in the Southern California Bight and show seasonal patterns

Create a modeling program to show yearly fluctuations in the wolf and moose population on Isle Royal
Create a program to compare exponential growth in mice, cockroach, sparrow and human populations
Create a 3-D model of the Southern California Bight to show temperature fluctuations in an El Nino event
Create a 3-D visualization of continental drift, showing predicted movements of plates in the future

Earth/Space Sciences
Cloud chamber investigation of particles and cloud formation
Are the "leaky acres" helping to recharge the Los Angeles County ground water?
Did mastodons really roam near Los Angeles thousands of years ago?
Can soil erosion be stopped?
Analysis of the Mt. St. Helens eruptions as compared to the Hawaiian eruptions
Build your own seismograph and test the Earth's activity
An analysis of nitrogen oxides, carbon monoxide and hydrocarbons in our air
Constructing and testing fuel-tracking instruments for rocket flights
Investigating the homing instincts of pigeons using celestial navigation
Investigating the effects of gravitational forces on plant growth

Ecology
Do "bug lights" differentiate between "good" and "bad" insects?
Which decomposers are most beneficial in creating compost?
How does increased UV light affect the growth of microalgae over time?
Which is the most effective bio-control for white-fly infestations?
Does integrated pest management really work to control pests in an urban vegetable garden?
Do insect populations dramatically change in diversity and numbers when their habitat is altered?
What are the effects of an El Nino event on Palos Verdes kelpbed concentrations?
What is the effect on a tidepool ecosystem when keystone predators are removed?
What is the pattern of secondary succession in an abandoned parking lot?
How does increase levels of heavy metals in seawater affect the sex ratio of invertebrate offspring?

Engineering Applications
Constructing and testing a working model of a home space heating unit
Design a mechanical method of separating solid waste for recycling
Optimum energy conservation in houses- Survey and analysis of home energy conservation techniques
Design and construction of a battery-operated automobile
Constructing and testing for a model solar desalination system
Which wind turbine design creates the most energy at all low, medium and high speeds?
What mattress best holds the body in correct alignment?

Which boat design creates the fastest velocity while maintaining the greatest stability and cost-efficiency?
(Comparisons of existing products belong in Products Science)

Engineering Research
Testing the wind resistance of automobile models in a wind tunnel
An analysis of exhaust emissions of cars as related to the size of cars and tune-up conditions
Experiments to determine the efficiency of commercially available insulation
Is chemical energy storage the answer to our future local transportation needs?
Which barrier (screen, paint, plastic) effectively blocks ELF radiation?
How does primary, secondary and tertiary treatment affect bacteria in waste water?
Which is the most effective method of restoring an acidified lake to natural pH concentrations?
Compare the safety of skateboard park designs
Which brand of golfball flies the farthest and most accurately?
Which kitchen floor covering has the least friction with the greatest possible shine?

Environmental Management
Can water hyacinths remove nitrates from waste water?
Can variations in the growth rings of tree rings be correlated with specific environmental effects?
Which is the most efficient and cost-effective method for cleaning up small oil spills?
What is the effect of microwaves on the growth of grass?
Does low electromagnetic radiation affect bacterial growth?
How long does it take to restore normal coliform counts to beach waters after heavy rains?
A study of green mussel invasion and control in Southern California waterways

Materials Science
Water Absorption in Eight Selected Hardwoods With and Without Sealants
Best Plywood for Homemade Skateboards
Fire Resistance of Roofing

Microbiology
What level of bacterial growth is found in various sources of Los Angeles County drinking water
Do x-rays affect viruses?
Is the tobacco mosaic virus inhibited by modified purine and pyridines?
What populations of microscopic organisms are found in rain puddles?
What is the diversity of phytoplankton in local pond water?
What type of filtration material catches the most bacteria in waste water?
What is the optimum method for ensuring plasmid transfer in E. coli bacteria?
Which water fountain at school contains the greatest diversity and number of bacteria?

Pharmacology
Do increased levels of calcium intake by adolescent females decrease the symptoms of PMS?
Does increased intake of Gingko biloba increase short-term memory retention in humans?
Can large doses of vitamin C prevent getting sick as often during the flu season compared to a placebo?

Which insect repellent works better on mosquitoes?
Which water-repellent sunscreen gives the greatest protection in sea water?
Do fat-blockers really work?
Which antacid absorbs the greatest amount of excess acid per gram?
Which lipstick stays on the longest and looks the freshest after eating?

Physics
How does stress affect the strength of a given plastic?
How would adding a foliage barrier affect sound transmission?
How does varying densities of water affect wave lengths of light?
What is the optimum amount of sunlight/day to run a solar panel to power a hot water heater and store energy for night-time use?
What are the average g-forces experienced during a drop from the highest loop of the Cyclone rollercoaster?
Which tint of sunglasses gives the greatest UV protection?
How will global warming affect the type of light waves that enter our atmosphere?

Plant Biology
Comparison of stored seed and seed germination
Comparison of cotton growth in sandy loam and alkali soils
Analysis of lawn seed germination at winter, spring, summer and fall temperatures
What is the best soil type for leaf propagation in African Violets?
How do plants signal for help when they are being preyed upon?
What is the pressure needed to trigger a capture response in the Venus Fly-trap?
What is the optimum planting density for the greatest yield in cherry tomatoes?
Which wind-dispersed seed type is designed to travel the greatest distance?
Which garden plant attracts the greatest diversity of pollinators?

Plant Physiology
Periodicity in onion roots- Do onion root cells divide at certain times during a 24-hour period?
Bean plant growth in various nutrient-deficient soils
Auxins and geotropism- Do pea seed roots grow down because of plant growth hormones?
How does blanching effect enzyme activity in vegetables?
What is the relationship between fertilizer concentration and the growth of plants?
Are natural fertilizers better and cheaper than chemical fertilizers?
Which shape of leaf shows the least transpiration rate in windy conditions?
Which is the best hydroponics medium to grow the largest and fastest-growing lettuce?

Product Science
Cotton, Linen, Wool: Which One Lasts Longer?
Which Laundry Detergent Works the Best?
Antilock vs. Lock Brakes
Shock Attenuation in Baseball Helmets
Effective Sound Barrier Materials.

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Internet web sites:

- Los Angeles County Science Fair: www.lacoe.edu/science
- California State Science Fair: www.usc.edu/CSSF/
- National Science Teachers Association: www.nsta.org
- International Science and Engineering Fair: www.sciserv.org/isef/
- Science Fair Resources: www.scifair.org

APPENDIX

Regulations for Projects

The following regulations will help keep the projects uniform and within the laws of the State of California. Fair sponsors want all students to have the best opportunity to compete for the annual awards. During the time that the Fair is open to the general public, the perception of the projects must be positive and precautions must be taken for the security of each project. All projects at the Los Angeles County Science Fair must abide by the following:

1. **Present an experimentally based research design exemplifying a scientific methodology.** Non-experimental projects which may be overlooked at registration and entered will be judged using the criteria for experimental projects and will be at a great disadvantage.

2. **Be carefully prescreened by the school's Science Fair sponsor and the teacher whose student is submitting the project.** The Los Angeles County Science Fair *Judges Worksheet* lists the criteria used to evaluate the projects.

3. **Clearly distinguished between the work of the student entrant and the work of others.** Students who have prepared a project in conjunction with research participation opportunity in industry, a university, hospital or institution other then their school must show only the student's research in their project display. Students may mention the relationship to the research of others in notebooks only if they clearly specify the assistance received and the role and contributions of others in research related to the project. It is highly recommended that projects of this kind be accompanied by a letter from the principal research director indicating the relationship of the student project.

4. **Be original and distinct.**
   Identical project/data may not be submitted by a school under separate judging divisions. Likewise, the same unmodified project can not be submitted multiple years.

5. **Be within the total quota for each school.** Quotas will be announced in advance of the Fair. If additional applications are submitted, schools will be contacted and each school will determine which projects are the official entries. If excess entries are initially overlooked, only a number corresponding to the quota will be judged. Those to be judged will then be selected at the discretion of the Science Fair Committee.

6. **Be entered in the Fair after an application is sent.** Schools should avoid sending applications for projects until it is certain that the projects will be completed in time and will physically arrive at the Fair. Projects, for which we receive a registration, but are not actually entered, create errors in the program, a waste of time for judges and leave unsightly open spaces in the exhibit area. The Fair Committee will reduce the project quota for any school that fails to produce the project for which we have received a registration.

7. **Be submitted by students only in grades 6-12 or with an age equivalent to those in grades 6-12.** Younger students may submit only if they are in an accelerated program with certified enrollment in grade 6 or higher level subjects.

8. **Be entered at the Fair and picked up only within the designated hours.** Early entries will not be accepted. Entries will be accepted and project pick up will be permitted only when a member of the Los Angeles County Science Fair Committee is present. Facility staff members are not authorized to receive or permitted to pick up projects.

9. **Use illustrations of micro-organisms, animals and plants.** The display of bacterial cultures and live or preserved animals and plants will not be permitted.

10. **Remain at the Fair during the days scheduled for public viewing.** The only exception to this rule is for students who must take projects to the International Fair, if their departure day/time overlaps the time that the Los Angeles County Science Fair is open. To ensure security during project removal, the authorized time for pick up will be strictly followed. The Fair is not responsible for projects left after the designated time.

11. **Use a title which provides the viewer with a clear concept of the subject and procedure of the research.** Present the steps of the scientific methodology used, organized from left to right and top to bottom. Use metric units for all measurements. Have all values on charts and graphs correctly labeled. Present all narrative writing in a legible manner with correct grammar, punctuation and spelling. Carefully review the category descriptions and select the proper one for the project.

12. **Fit within the prescribed space limitations** – no larger than 76 cm (30 inches deep (front to back), 122 cm (48 inches) wide (side to side) and 284 cm (108 inches) high (floor to top *including* height of table). Oversized projects will be screened at the door and refused entry.

13. **Be able to support their weight and not collapse due to inadequate construction.** Any project which does not meet minimum standards for construction will be removed from the display area and not judged.

14. **Display photographs which do not show procedures detrimental to the health and well-being of vertebrate animals.** For instance, the performance or results of surgical procedures will not be shown. Those not in compliance will be removed from the display areas and not judged.

15. **Have notebooks and small equipment items removed no later than the viewing period following the end of the awards ceremony.** The Fair will not be responsible if these items are missing from projects. Do not display items you cannot afford to lose.

16. **Do not have computers with projects for the preliminary judging.** A computer may be brought by the student for the judging interview on the second day if the student assumes full responsibility for the computer. Judges are instructed to have students return for interviews if the computer demonstration is essential.

17. **Give attention to all considerations of safety.** Projects which use 120 volt electrical current must have all wires and connections well shielded. Those not in compliance will be screened at the door and refused entry.

18. **Adhere to all of the rules and regulations of the Fair and all relevant federal, state and local laws.** Those not in compliance will be screened at the door and refused entry.

19. **Be submitted with the understanding that the decisions of the Los Angeles County Science Fair Committee is final.**

Los Angeles County Science & Engineering Fair

Judges Worksheet

PROJECT NUMBER	DIVISION (CHECK ONE)	CATEGORY
	☐ Junior ☐ Senior	

A. Creativity (30 points total)

1. The problem is original or is a unique approach to an old problem (considering the student's grade level)
2. Equipment and materials are used ingeniously
3. Interpretation of data is appropriate for student's grade level
4. Applications of project information shows student's creative involvement
5. Student shows evidence of understanding that unanswered questions remain
6. Creativity is evident

Creativity Total ▶	

B. Scientific Thought or Engineering Goals

Scientific Thought (30 points total)

1. The hypothesis is clearly stated and the project is clearly designed
2. The project shows depth of study and effort
3. Project exhibits orderly recording and analysis of data
4. Sampling techniques and data collection are appropriate for the problem
5. Scientific procedures are appropriate and organized
6. Conclusions formulated are logical, based on the data collected, and are relevant to the hypothesis

Scientific Thought Total ▶	

OR

Engineering Goals (30 points total)

1. The project has clear objective relevant to needs of potential user
2. Product or process has been tested
3. Product or process is both workable and feasible economically and ecologically
4. Project exhibits orderly recording and analysis of data
5. Testing procedures are appropriate and organized
6. Conclusions are logical and based on the data collected

Engineering Goals Total ▶	

C. Thoroughness (15 points total)

1. The study is complete within the scope of the problem
2. Scientific literature has been searched
3. Experiments have been repeated and careful records have been kept

Thoroughness Total ▶	

D. Skill (15 points total)

1. Special skills needed for construction or use of equipment is evident
2. Special mathematical, computational or observational skills are evident
3. Project is skillfully designed so that it yields valid, reliable, and accurate data

Skill Total ▶	

E. Clarity (10 points total)

1. The project notebook is well organized, neat and accurate
2. The purpose, procedures and conclusions are clearly outlined and the title accurately reflects the problem

Clarity Total ▶	
Total Points for Project ▶	

SPECIAL COMMENTS OR CLARIFYING STATEMENTS (USE REVERSE SIDE IF NECESSARY)

SIGNATURE OF JUDGE	DATE SIGNED

Los Angeles County Science & Engineering Fair

Judges Worksheet
Mathematics and Computers

PROJECT NUMBER	DIVISION (CHECK ONE)	CATEGORY
	☐ Junior ☐ Senior	

A. Mathematics and Computers Creativity (25 points total)

1. The mathematics or computer usage for this project is extended beyond that commonly taught at this grade level.
2. The project represents a new point of view or a more in-depth study of a standard topic.
3. The mathematical concepts or methods of computer programming are used ingeniously.
4. Interpretation of results shows student's creative involvement.
5. Student shows understanding of the mathematical or computer science context related to the project.

Mathematics and Computers Creativity Total ▶	

B. Analytical Methods (30 points total)

1. The purpose is clearly and succinctly stated.
2. The background theory to support the project is explained.
3. All initial conditions are given.
4. The conclusions follow logically from the hypothesis or initial conditions.
5. The measure of development found in references and the amount of original work is well-defined.
6. The project shows depth of study and effort.

Analytical Methods Total ▶	

C. Presentation (20 points total)

1. The visuals are clear, clean, neat, and easily understood.
2. The written descriptions show correct grammar and spelling.
3. Mathematical symbols or computer program readouts are standard or carefully explained.
4. Computational or programming methods are completely shown or outlined in detail.

Presentation Total ▶	

D. Background (25 points total)

1. The study is complete within the scope of the problem.
2. The appropriate literature has been searched.
3. All original calculations or computer programs are available.
4. Special mathematical, computational, or programming skills are evident.
5. A well-organized and neat notebook clearly demonstrates the student's involvement in all aspects of the project.

Background Total ▶	

Total Points for Project ▶	

SPECIAL COMMENTS OR CLARIFYING STATEMENTS (USE REVERSE SIDE IF NECESSARY)

SIGNATURE OF JUDGE	DATE SIGNED

Form No. 601-077 Rev. 10-18-2000