Los Angeles County
Science & Engineering Fair
JUDGE'S HANDBOOK

Thank you for being an integral part of the LA County Science Fair.
We are honored that you are able to join us today and make a positive impact in the many lives of our student scientists!

Please take time to review this document prior to the day of judging.

Contents

The Purpose of the Science Fair:

- To give students the opportunity to
  - Do *real* science, math and engineering.
  - Learn about a new subject *or more about an old one*.
  - Learn the scientific methodology.
  - *Have fun!*
- Provide motivation for students to apply creativity and critical thinking to solving problems they see around them.
- Encourage students, educators, scientists and engineers to exchange ideas and discuss career opportunities.
- Recognize the achievements of talented science and engineering students in LA County.
- Foster school-community cooperation in developing the scientific potential and communication skills of tomorrow's leaders in science and engineering.

The Judge's Job is to:

- Question skillfully and thoroughly
- Leave the students feeling positive about their accomplishments
- Help the students learn something from the experience
- Determine winners
- Make sure every entrant is interviewed

What Should I Expect From Students?

- Pride in their projects and accomplishments.
- Ability to clearly and concisely explain their projects.
  - These students have been working with this content for months. They may be a bit nervous, but with a little encouragement they would love to share with you that big idea.
- To be able answer judge's questions at levels appropriate to their grade and age.
  - There will be teachers spread throughout the different judge groups, if you are unsure what an 8th grader should be able to do, ask a teacher.
- A wide variety of project quality and sophistication.
  - Often you will see the same topic several different times. What makes this one unique? How did the student modify their found experiment?

Be an Educator

- Treat students with respect.
- Project should be considered a significant, serious enterprise.
- Evaluate but also *praise efforts* and accomplishments.
- Ask questions which will cause the student to *think, learn, and explore further*.

Judging Mindset

- Consider *how well* the resources were used.
    - Not all students have access to a lab and lab materials. How well did they use the resources that were available?
- Not all projects are hypothesis driven or lend themselves to the use of controls; this is especially true of engineering projects.
- Hypothesis should be based on theory and data, NOT guessing.
    - What research was done prior to experimentation?
- All things being equal, ORIGINALITY is superior.
    - This is more of an issue in the Junior division. If you see the same topic multiple times, did any of the projects take it a step further? Did the student complete a unique experiment?
- Error analysis IS important: *appropriate to grade level.*
    - Look at the graphs that have been completed. Can the student explain what the graphs show? (Keep in mind also the age of the student.)
- Draw on team expertise for any subject/content that is unclear.
    - If you are not sure, please ask another expert as part of your judging team.
- **Not** a *"Backboard Beauty Contest" .*
    - Students do spend a great deal of time on their display board, however check to make sure that the student understand the science of their project.
- Don't *automatically assume* that a complicated project is not student generated. *If unsure, re-interview*.
    - *Ask the student again. Often these top students have done a great deal of research and experimentation. Ask them to show you things in their log book or to go into more depth on a certain aspect of the experimentation/research.*
- Project should show evidence of literature review in report.
    - Most students complete some form of a literature review or report prior their experimentation. You can always ask to see it or at least their bibliography. Note that some of these students are doing research with new concepts and have had difficulty acquiring a depth of research.

Screening Team Projects

Aspects to Consider

- Why is this a team project?
    - How does this project necessitate the need of two or three members?
- Do all Team Members understand objectives & outcomes?
    - Are all members able to answer questions?
- What are the unique contributions of *each team member?*
    - *What was the role for each team member?*
    - *How did they work together?*

Screening Multi-Year Projects

Aspects to Consider

- Is it " at least 2/3rd's different" from the previous year?
    - Students are able to use their experiment from the previous year as a starting point for this current year.
    - Students completing a multiyear experiment need to have completed proper forms as part of the pre-approval process.

Confidentiality

- Information regarding your findings or conclusions must not be revealed to anyone *except other panel members and Science Fair officials*.
- *Please do not let anyone know who won in your category prior to the awards ceremony.*

Conflicts of Interest

- Recuse yourself and ask to be reassigned if a real *or perceived* conflict of interest occurs.
- A conflict of interest is when you find in your judging category a student that goes to your school or one that you have worked with/mentored.

What Should You be Able to Find as Part of the Overall Project?

Display

Although terminology and organization may differ, a good display usually includes:

1. Abstract (may or may not be on the board)
2. Introduction
3. Materials & Methods
4. Results *(Data)*
5. Discussion
6. Conclusions *(can be within Discussion)*
7. References/Bibliography *(Literature Cited)*

Video Presentation

- Presentation where student explains the hypothesis, procedure, results, and conclusion of their project.

Log/Notebook

- What was done & when was it done.
    - Look for daily entries of what the student did or what happened.
- Should be *original recorded data*.
    - A well done notebook is handwritten in ink.
- We would like to see a Log/Notebook for all students, however we know that not all students are given the guidance to start/use one; this is especially evident with many of the Junior division projects. Senior division projects should have a logbook.

Analysis of Data

- Data should be in table **and** graphic form.
- Projects should include statistical analysis appropriate for the project and the student's grade level
    - Ask a teacher if you are unsure of what a student at this level should be able to do.
- When sampling is an integral part of the project, be sure the*sample size, repeat runs, and control of variables* are appropriately addressed.
    - Ask the students about the number of trials. Why did they choose to do that many?
    - Did they expect that they would get the same results again? Why or why not?

Communication Skills

- Ability of student(s) to communicate elements of their project CONCISELY
- Grammar and spelling/syntax should be considered.
- Please keep in mind that for many of these students this is the first time that they have had to defend/discuss their project with experts in the field of their project. Be sure to smile and be encouraging.
- It is encouraged that you start with easier questions and then move up in difficulty if the project and student warrant the additional questions.

Asking Questions

The best tool in judging is the ability to ask questions and listen carefully to the answers. Ask questions that the student can answer and continue the conversation based on their response. Sample questions might include:

- How did you come up with the idea for this project?
    - What is the significance of this project to your life?
- What did you learn from your background search?
- What were your variables? Controls?
- How long did it take you to build the apparatus?
- Did you have help in building this apparatus?
- How did you build the apparatus?
- How did you make sure to run a fair (controlled) experiment?
- What were your significant findings? (Results)
- What formulas did you use?
- Did your results match your research?
- How much time (days, weeks, months) did it take to run the experiments
    - (i.e., grow the plants, collect each data point, record observations, etc.?
- How many times did you run the experiment with each configuration?
- How many experiment runs are presented by each data point on the chart?
- Did you take all data (run the experiment) under the same conditions, e.g., at the same temperature, time of day, lighting conditions?
- How does your apparatus (equipment/instrument) work?
- What do you mean by : _____(terminology or jargon used by the student)?
- Do you think there is an application in industry for this knowledge (technique)?
- Were there any books that helped you do your analysis (build your apparatus)?
- When did you start this project? Or, how much of the work did you do this year?
- (Some students bring last year's winning project back, with only a few enhancements.)
- What new questions did your results suggest?
- What do you wish you had done differently?

- What is the next experiment to do in continuing this study?
- What further results/experiments might you now be interested in doing?
- Are there any areas that we have not covered which you feel are important?
- Do you have any questions for the judges?

Note: *These questions are only suggestions to keep the dialog going. You will find other questions to be more useful in specific interviews.*

WHAT TO DO DURING THE JUDGING/INTERVIEW PROCESS.

1. Prior to starting work with your team to come up with a plan to conduct each interview.
2. Please do not go as a big group of judges to one student - it makes them nervous. No more than 2 judges should be interviewing a student/team at the same time.
3. Some judging groups will be covering both Jr & Sr division projects.
4. Briefly, introduce yourself first to the student scientist(s), who are you and what your background is (less than 30 seconds per judge).
5. When you interview a student/team spend at least 6 minutes with the student scientist(s).
6. Be respectful of the student, remember our non-discrimination policy.
7. During breaks, discuss the projects that stood out to you.
    a. Finalists are students that you feel are at the top of your category: about 25% of the projects.
    b. Finalists should be interviewed by as many of the judges in the team as possible during the after-lunch session to help determine the winners.
8. Once all interviews are completed, caucus and determine the winners as discussed on page 9.
    a. All 1st & 2nd will go to the CA State Science Fair.
    b. You will let us know if your 3rd place project is a contender for State.
    c. Also determine if your 1st should be considered for ISEF (SR only) and/or Sweepstakes (JR & SR)
    d. Review and determine if any projects also meet the criteria of the Special awards listed.

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All judges will be using the following rubric to evaluate projects

Topic	4	3	2	1
Introduction (I)/ Experimental Question (EQ) & Hypothesis (H) *(H may not be present in all projects)*	❑ It has an original, detailed EQ that clearly outlines the experiment. ❑ H (where appropriate) is clearly stated and based on research. ❑ The purpose of the investigation, answers a specific question.	❑ It has an EQ that outlines the experiment. ❑ H (where appropriate) is clearly stated.	❑ The EQ is the same as published by another source, lacks originality. ❑ H is based on assumptions, lacks a review of research.	❑ The EQ does not overview the experiment. ❑ H is not related to the EQ; student lacks understanding of experiment and expected results.
Background Research/ Exploration	❑ Research has been done on the scientific process that is being manipulated in the experiment. ❑ Correct number of cited references are present, written in proper format.	❑ Research has been done on the topic of the experiment. ❑ References are present but may not be cited	❑ Minimal research has been done. ❑ Student lacks understanding of the experimental topics. ❑ References maybe present.	❑ Lacks evidence of research related to the topic of the experiment. ❑ No references or citations are present.
Procedure/ Materials & Methods	❑ Detailed **ORIGINAL** procedure written to allow an outsider to understand all steps that were taken in the experiment. (This includes explanation of the variables, data collected, number of trials, disposal methods, if necessary, and all tools that were used.)	❑ The procedure is written to allow an outsider to understand steps that were taken in the experiment. (This includes explanation of the variables, data collected, and all tools that were used.)	❑ The procedure is the same as published by another source; lacks originality.	❑ The procedure is very brief and doesn't allow a reader to fully understand what was done during the experiment. ❑ The procedure is not repeatable
Data/ Results **Some projects do not use graphs with data.*	❑ Appropriate qualitative and/or quantitative data was collected. ❑ Data is clear and understandable. ❑ Sample size and number of trials are appropriate for the subject. ❑ Graphs/data/and tables are appropriately used. ❑ Data is appropriately labeled. ❑ Grade appropriate data presentation.	❑ Both qualitative and quantitative data has been collected. ❑ Multiple trials have been conducted. Graphs are present of trials and averages. These graphs include key parts of a graph and a caption.	❑ Only one kind of data has been collected. ❑ Limited trials have been conducted. ❑ Student has a graph of their data.	❑ Minimal data has been collected. ❑ Only one trial has been completed. ❑ Graphs are misleading; they do not have equal spans; lacking key information.
Conclusions/ Student Understanding	❑ The analysis is thorough and grade appropriate. ❑ Students have drawn conclusions based on their experiments and research. ❑ Student can discuss the results and cite the data that has been collected. ❑ The student can discuss if/when the research and data match or not. ❑ Students have further questions and research ideas. ❑ Great Depth of Understanding	❑ Student has drawn conclusions based on the experiments. ❑ They are able to discuss the results and cite the data that has been collected. ❑ Student has further questions and research ideas.	❑ Student has drawn conclusions based on the experiments. ❑ Student is able to discuss the results and cite the data that has been collected.	❑ Students have difficulty discussing the experiment and results. ❑ Student does not make connections between results and research.

Determining the Winners

After the interviews are completed, the judging team needs to work together to agree upon the winning project. Some points to consider are:

- The quality and quantity of the student's work are equally important.
- Team projects are judged the same as other projects. (An individual project of equal quality to that of a team project may be ranked higher because of the comparatively greater effort required by the individual).
- A less sophisticated project that the student understands, should get higher marks than a more sophisticated project that is not understood.
- Sometimes a hand-made graph is better than a computer generated one; it might indicate more understanding.
- Access to sophisticated lab equipment and supervision by professionals does not guarantee a high quality project. (Did the student really understand what was going on?)
- It is acceptable if the student ended up disproving the objective or hypothesis of the experiment.

High marks go to:

- A well-formulated hypothesis.
- A logical plan to solve the "problem".
- Genuine scientific breakthroughs.
- Discovering knowledge not readily available to the student.
- Correctly interpreting data.
- A clever experimental apparatus.
- Repetitions to verify experimental results.
- Predicting and/or reducing experimental results with analytical techniques.
- In engineering categories, experiments applicable to the "real world".
- Ability to clearly portray and explain the project and its results.
- Understand what constitutes a proof.

Low marks go to:

- Ignoring readily available information (i.e., not doing basic literary research).
- An apparatus (e.g. model) not useful for experimentation and data collection.
- Improperly using jargon, not understanding terminology, and/or not knowing how equipment or instrumentation works.

As judges, please do your utmost to ensure that all participants remember the Los Angeles County Science Fair as a positive experience in their lives.

How to Determine Winners

- Talk as a judging group during discussion and share both your impressions of the kids and projects and the scores that you attained for each project.
- Determine the top 3 projects; 1st, 2nd and 3rd.
    - This may require discussion and sometimes going back and reviewing the project/materials.
- Determine the Honorable Mention winners. There is often a clean break of the projects that fall into this group and those that do not.
    - Overall the goal is to recognize about 20-25% of the category, depending on category size.

There are Awards & Special Awards that need to be considered.

- ✓ 1st and 2nd place students automatically will move on the CA State Science Fair.
- ✓ Some 3rd place winners will be able to move on to state. *Due to space and other constraints at the CA Science Center, our project allotment is different each year.*
    - ⇨ **Look at your 3rd place project and give it an A, B or C grade.**
        - **A- This is a strong project and should move on to the State Fair.**
        - **B- This is a good project and could do a good job at the State Fair.**
        - **C- This project should not move on to the State Fair.**
- ✓ Designate any **Special Awards using the Special Awards Nomination document.**
    - ⇨ Use the Special awards nomination form to nominate students for Special Awards. Please pay attention to these and nominate students when appropriate.
- ✓ Nominate 1st Place recommendations for **Sweepstakes.**
    - ⇨ **Sweepstakes** is for the top award for all projects in the Division, Junior and Senior. Look at your top kid(s), your first place. Did they do an OUTSTANDING job? Maybe look at the top award in a related category and compare. If you feel that the project in your category is a top project, then nominate the project.
- ✓ Nominate 1st Place recommendations for **ISEF.**
    - ⇨ Senior division only.