The Pikes Peak Regional Science Fair Judging Handbook

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Judging: The Big Picture

Science Fair judging has many goals. The ultimate goal of Science Fair judging is to rank the projects into 1st, 2nd, 3rd, … places within a category and then to choose the overall Fair winners from the category winners. We accomplish this goal by using a huge number of judges to rate each project with scores that run from 0 to about 180 points.

A ''Project'' is an *investigation* for science folks and a *constructed project* for engineering students.

IMPORTANT POINTS

If you read nothing else in this document, please read the boxes like this one.

Other goals include: encouraging Fair participants to continue to pursue their interests in Science, rendering advice on how to leverage students' skills and desires, and sharing judges' knowledge with the participants. Of course, it's always a goal for everyone to enjoy their day at the Fair.

The students are competing for recognition, trophies, ribbons, cash prizes, special awards, and sponsored trips both to the Colorado State Science and Engineering Fair and the International Science and Engineering Fair.

OUR GOALS

Rank the top students (for prizes) and encourage all competitors to keep up the good work.

Some Details

To achieve a ranking, judges rate (give a score to) the student's work in planning and executing a science project, their oral presentation, their backboard, and (to an extent) the results of their experiment or project.

Each project is judged by several different judges, each of whom assigns a numerical score and assessment of effort. The aggregate of all (8 or more, generally) judges' scores is massaged statistically to find a rank for a given student (thus reducing reliance on or impact of any single judge). Committees then choose the category winners and overall Fair winners from the high-scorers.

About Timeliness

One of the most important results a judge provides is a reasonable, fair, timely score for each project he or she judges. Scores that arrive after a round finishes cannot be used to rank the competitors. Spending three hours judging a project would probably yield a 'better' or more precise result; unfortunately, we must conduct the Science Fair in a very limited timeframe and must do the best job we can *in that timeframe*. Thus, fear not being off by a point or two either way when judging a project: The other judges for that project will surely average out any slight differences.

JUDGING SCHEDULE

Judges **must** follow the judging schedule to the letter in order to ensure the success of the day-long event − do not skip projects, reorder projects, linger too long, or finish more than a minute or two early. Cards must be turned in immediately after each Judging Round.

Here is the tentative schedule for this year's Fair:

M1	9:20 am	Lunch	12:15 pm
M2	9:50 am	A1	1:05 pm
M3	10:20 am	A2	1:30 pm
Break	10:45 am	A3	1:55 pm
M4	10:55 am	A4	2:20 pm
M5	11:20 am	A5	2:45 pm
Break	11:45 am		

- At 9:00 or so, browse the projects suggested by the letters on your badge.
- Round 1 includes six sessions; the first two are 30 minutes while the rest are 25 minutes.
- Morning judging ends at 12:10 or so. Judges lunch is half an hour later (after the kids eat and the cafeteria cooks up some more food).
- Meet for the afternoon judging schedule around 1:10 and commence afternoon judging at 1:20. Four more 25 minute sessions just like the morning follow.
- At 3:00, Finalist and Platinum (overall Fair) judges meet in the cafeteria to determine the Fair's winners.

About Projects

Most PPRSF students create science projects which have a hypothesis and test that hypothesis by comparing some variant scheme's properties with 'standard' results from a 'control'. A few students fabricate Engineering projects, which feature development a device or method along with its evaluation using some absolute measurements (which are often compared to some similar device).

Science projects carry with them several potentially surprising properties:

- A valid science project isn't required to have practical *application*
- A valid science project might have a hypothesis that's been rejected
- Science projects might, by chance, reproduce some work already performed by others (from other students through top scientists) in the past. Good projects have a new twist or a different approach or idea.

Please don't reduce Science projects' scores because of impracticality of the project's final goals (e.g., to cure cancer quickly) or because of a hypothesis whose opposite turned out to be true (unless, of course, this wasn't recognized). Note that the practicality of the end-result is different from practicality of finding that result – the experiment itself **must** be able to be completed.

As a brief aside, exhibits that appear as if they were created by a professional might actually be created by a professional! Try to assess this carefully.

PROJECT TYPES

Projects judged as 'science' projects have a hypothesis, experimental observations, and results/analysis. Projects judged as 'engineering' projects create some new entity which is then evaluated according to contestant-specified criteria.

Group Projects

Some projects are created by two or three students instead of just one. The difference in scoring will be detailed in the 'Interview' section below.

Encouragement

Nothing turns a student to a non-science career faster than suffering through Simon Cowell-like criticism at a Science Fair. Please leave every student with a positive attitude about his/her project and the Fair [4].

ENCOURAGEMENT

Please praise and encourage the competitors; avoid all but the most constructive criticisms if at all possible.

PPRSF Judging Philosophy

Like football polls and beauty contests, ranking Fair contestants contains an element of personal subjectivity. The PPRSF mitigates this in two ways:

- By using forms with extremely detailed point allocations that enable judges from widely varying backgrounds to arrive at similar or identical scores for a project, even when judging at different times.
- By judging each project with several judges independently. These judges' scores are combined to form the project's score.
- 'Finalist' judging committees include judges who have seen almost every project to be considered for awards and thus enable 'baseline judging' where projects are ranked above or below each other only by those who have seen both projects.

These three points combine to form the backbone of the Fair's credibility, fairness, and ranking defensibility.

Of course, student presentations and familiarity with their project at 9:30 AM on Fair day are dramatically different than at 2:00 PM after they have spoken with the better part of a dozen judges. This is just the way Fairs work.

Judging takes place across two very similar rounds. The first and second round forms were combined into one comprehensive judging form starting in 2009.

Judges generally judge in their assigned category of expertise throughout the fair schedule. At the lunch break, scores are sorted so that the afternoon schedules ensure that Finalist Judges and Platinum Judges see the top-ranked projects in each category.

PPRSF believes in 'baseline' judging that requires judges to make a direct, personal comparison between sets projects before those projects are declared as Category or Fair winners.

The 2006 Fair marked a departure from traditional science fair judging categories like: ''Science and engineering thought,'' ''Clarity and drama of the display,'' ''Skill,'' ''Concept originality,'' and ''Thoroughness.'' Why? Because the abstraction level of those concepts is so high that without concrete guidance, one might award almost any project a wide range of perfectly justifiable scores. Furthermore, each of those abstract categories requires evaluating the entire project before a score can be ascertained. This is at odds with the normal flow of project judging in which a student gives a brief oral presentation followed by a discussion with the judges.

The new judging forms contain sections that mirror the flow of a project's presentation: project selection, procedure, and execution. They also have sections for the student's communication, results, and interview.

METHODOLOGY

Each project is judged by many judges − don't worry about making a small mistake. Two similar judging rounds of five projects each in the morning and afternoon.

Vocabulary

Some quick definitions:

- The *participant*, *contestant*, or *student* is the person whose Science Fair project is being judged. They are 6th through 12th graders (generally 11-18 years of age). When more than one person created the project, it is found in the *group project* category.
- *Group project*s are created by two or three people working together. They are all lumped into the Group Project category and might cover any subject matter. They are judged just as regular projects, though any of the participating students might answer a question.

- This document uses *project* to refer the experiment, constructed entity, or whatever entity is the focus of any given student's entry.
- The *backboard* is generically all the presentation materials that a student uses to display his/her project.

Measurement

Measurements make up an important piece of almost every Science Fair project. The terms *accuracy*, *precision*, and *resolution* are handy to discuss measurements.

- *Accuracy* pertains to the absolute error of a measured or calculated value. Better accuracy means a smaller deviation from the variable's exact value (and better accuracy is often highly regarded).
- *Precision*, for our Fair, refers to the number of digits a measurement produces. More precision is not always better! Consider the idea of stating that a book weights 1.91359213985721385 kilograms. If the book weighs 2.0 kilograms, the measurement was very precise but very inaccurate. Many students confuse precision with accuracy and claim very high precision measurements whose accuracy falls off after two or even fewer significant digits.
- *Resolution* refers to the ability of a measuring device to separate two very close measurements. For example, if a time interval counter has a resolution of 10 ns, it could produce a reading of 3340 ns or 3350 ns but not a reading of 3345 ns. Instruments are almost never more accurate than their resolution.

Judging

Part of the judging is designed to determine whether the student followed the basic precepts of a science (or engineering) project. Do they have a backboard? Did they cite the hypothesis? Did they collect and analyze data? Did they draw a valid conclusion?

APPROPRIATE TO AGE GROUP

Many questions are marked "appropriate to age group". Judge competitors as members of their peer group, not against Newton and Einstein (or yourself).

Our goal in judging is to get a spread of scores (ratings) so that we can sort their aggregate into rankings. Do not fear giving someone a great score (165+), an average score (130-165), or a below-average score (<100). These forms are shared by both junior and senior students and must distinguish among the very best of the competitors in addition to working for less talented contestants. Some lower level students will receive fairly low scores – and that's fine. They are competing with peers not the higher-scoring senior group.

The PPRSF does not judge students based on their grooming, dress, race, gender, relatives, piercings, haircut, tattoos, age, creed, religion, or school attended. We are judging the students and their Science Fair project using a variety of criteria:

- Project Selection
- Solution & Procedure
- Execution and Data
- Communication and Exposition
- Results
- Interview

The point values for these categories (as implemented by the multiple line items in each of them) map nicely to the traditional criteria and have the added advantage of removing redundancy from the scoring.

Steps for Judging a Project

Following a simple checklist will all but eliminate simple errors and engender a pleasant judging experience for all concerned:

JUDGING CHECKLIST

Read this checklist!

- Find the judging sticker for the current round to learn the ID number of the next project to be judged. Affix it to a scoring form.
- Find that project (use the signs on the ends of the tables)
- Introduce yourself and confirm that that the name on the sticker is the name of the contestant. ''Hi, I'm Dr. Albert Einstein, and I'll be judging your project today. You're Nils Bohr?'' Wrong person? Find the proper project!
  Exceptions:
  - *The project is not present.* Check the ''Absent'' box on the score sheet. Browse other projects and have pleasant conversations with students or staff. Do not vary your judging schedule; wait until the appropriate time to judge others on your list.
  - *The project is present but no student(s).* Ascertain what's going on (perhaps there's a note? perhaps their neighbor knows?). If it appears no student will be present, check the ''Absent'' box on the score sheet. Browse other projects and have pleasant conversations with students or staff. Do not vary your judging schedule; wait until the appropriate time to judge others on your list.
  - *A group project is missing one or more of its members.* Explain that the project can not earn points unless all members are present. Conduct a normal interview, but **report a score of 0** (no matter how great the project is). Really: report a score of 0.
- The student probably has a short presentation; let them talk for no more than ten minutes.
- Work your way through the items on the judging score sheet, marking points as you assess the project's strengths. Of course you can always change the points as you learn more about the project.
- Three to four minutes before the end of the round (an announcer will remind you), finish up with the student and complete marking and calculation of the student's score.
- Additionally mark your score in the obvious space on the lower-right card of your assignment sheet.
- Write a few positive remarks and **no more than one constructive criticism** (e.g., ''Next year, you might consider taking multiple observations in order to confirm the effect of the stimulus.''). Of course, you can omit the criticism if you wish.
- Find a *runner* (they wear distinctive hats) and give your score sheet to them for transport to scoring headquarters.
- Commence judging the next project at the beginning of this list.

Demonstration Projects

A ''Demonstration Project'' is one in which a student merely reproduces some result or project, e.g., the construction of an electromagnet without adding any innovation at all. Some demonstration projects are quite elaborate. The 2005 Fair featured a demonstration project that isolated genes responsible for dyslexia. While a fabulous work with meticulous effort, it was nevertheless a very weak project vis a vis science since nothing remotely new was envisioned, created, tested, or hypothesized. The judging forms are designed to preclude demonstration projects from placing highly at the Fair. If you see one, please mark ''Check this project (demonstration)'' on your scoring card so our backup judges can make sure all is well.

The Assignment Sheet

Assignment Sheet

This section tells how the assignment sheet and score sheet work − don't miss the important bits!

Below is a typical morning assignment sheet.

Atkins, Robert G. 0479 MORNING 2009

M1 9:20 am SCI J0479 2009
Karan Dhindsa
Temperature vs. viscosity

M2 9:50 am SCI J0479 2009
Nicholas Clement
Good vibrations

7C27

7D25

M3 10:20 am SCI J0479 2009
Ethan Bouwens
Surfing the waves

M4 10:55 am SCI J0479 2009
Elizabeth Collins
Why so loud?

7E13

7D13

M5 11:20 am SCI J0479 2009
Cellene Feathers
Recharge and save

M6 11:45 am SCI J0479 2009
Lucas Singer
I scream for ice cream

7D20

7E9

0479 MORNING 2009
Atkins, Robert G.

JUDGE 0479 [2009]

7C27____ **7D20**____
7D25____ **7E9**____
7E13____
7D13____

At 3:00, remove this form from your packet and return both to judging reps

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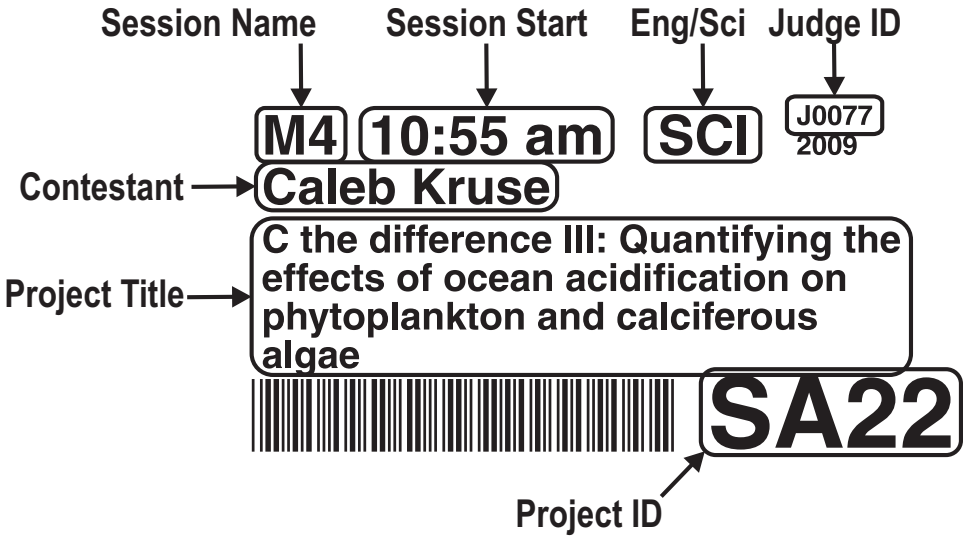
Just before each round of judging, you will pick up a sheet with several sticky labels for score reporting. These labels describe each project to be judged and the time to judge it.

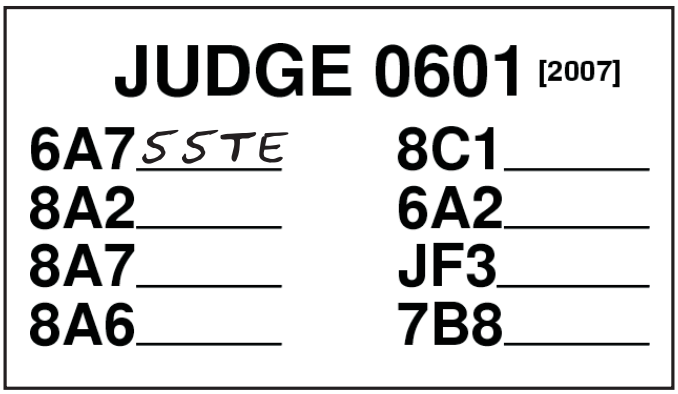
Here's a typical sticky label for the fourth judging session at 10:55 am:



The various fields are easy to understand:

- **Session Name** is our code for when the session runs (M for morning; A for afternoon).
- **Session Start** tells the time yo should be at the described project to start judging.
- **Eng/Sci** tells the student's idea of whether this is an engineering or science project.
- **Judge ID** enables us to find cards that you have judged.
- **Contestant** enables you to double-check that you (and the student) are at the proper project.
- **Project Title** tells the name of the project you should be judging at the Session Start Time.
- **Project ID** is the most important item: It tells you the category and ID number within that category so you can find the project.

In addition to completing the score sheet (which you will hand to a runner for delivery to the judges scoring headquarters), you should also complete the scoring summary in the lower right corner of your assignment sheet. Why? Because if something happens to the scorecard (e.g., the runner has a heart-attack and is carted away to the hospital), we can query you about the score and avert that emergency in just seconds. Here's a sample showing the first project with its score filled in:



Summary

The assignment sheet of sticky labels tells you where to be and when. Double-check the participant's name and project ID. Be sure to record the score **twice** before handing the card to a runner. Don't forget the letters for challenge and effort.

The Score Sheets

THE JUDGING FORM

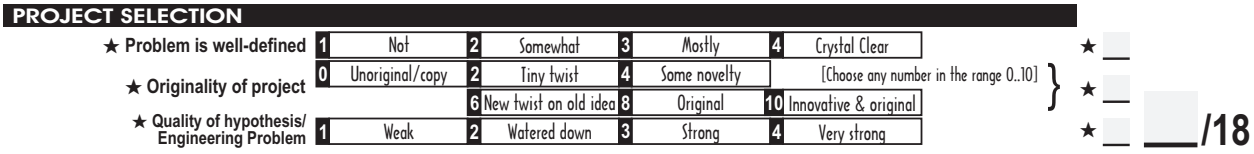
The next pages tell how to fill out the form. It's worth reading what each of the scoring lines means!

Judges will mark the same type of form for each kind of project (Science and Engineering) and for both the morning and afternoon judging rounds.

Each section below shows an excerpt of the judging form along with explanation on how to complete it. When interviewing the student(s), write the score digit(s) for each line item in the gray box to the item's right. It is then easy to create the subtotals for each section.

Project Selection

The Project Selection section assesses how well the project's problem is defined, how original the project is, and the quality of the hypothesis or engineering goal.



Appropriate to Age Group

The bold star that precedes some questions is intended to be a reminder that the particular question should be evaluated in the context of the student's level. Senior high school students, for instance, are probably geared up for dramatically greater challenge than sixth-graders. Over half the evaluation criteria are marked this way!

Note that adults' expectations of Science Fair projects generally run toward the very high side. Try to evaluate projects relative to the levels displayed at this Fair.

Judging Non-adults

Many judging criteria are "starred" to indicate "judge appropriate to age group." Bear in mind that none of the participants is a college gradate − they are fascinated and learning; they are **not**, generally, subject matter experts. Please have appropriately low expectations.

Problem is Well-Defined

Typical ways to evaluate 'well-defined' include: Could a layman understand what challenge is being tackled? How about a 10th grader?

Originality of Project

This question has a different weighting scale because it's the one that really gets judges' attention at subsequent Fairs. Unoriginality is easy to see… ''completely original'' is not. Use the scale as best you can to give your subjective viewpoint on just how original this project appears to be. Note that some extremely complex laboratory or engineering projects might actually get a 0 here since they have nothing ''new'' to report as a result or as an approach. Combining well-known processes in a new way counts as ''original'' because the combination is original even if the components are not. Likewise, ''twists'' or new insights contribute to originality.

Quality of Hypothesis/Problem All-in-all, is this a good hypothesis or a good engineering problem? Examine the hypothesis (or engineering problem statement) and determine (again, mostly subjectively) its strength. ''Water appears to flow at room temperature'' is a fairly weak hypothesis compared to ''Transparent aluminum exhibits superior strength with temperature insensitivity''.

Project Design & Variables

This section assesses the clarity and practicality (as far as completing the project goes) of the project's design. It also assesses the relevance and evaluation techniques for the identified variables.

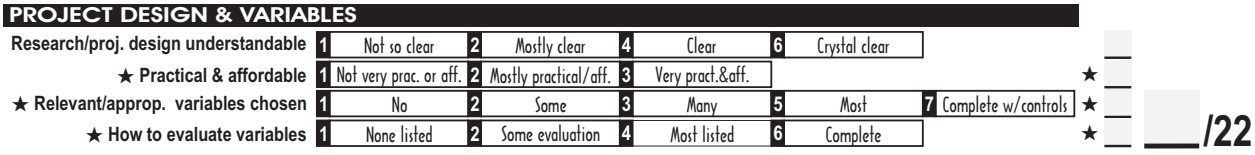
A project's 'variables' include all those environmental and other influences on the outcome of a project. If plants are being grown with outdoor light, is the variability of seasonal sunshine taken into account? If one is measuring the speed of sound, are the variables of temperature, pressure, and humidity understood? Of course, this is always in the context of age group: one would not expect a sixth grader to know the subtleties of the relationship between humidity and the speed of sound in air.

Once measured, variables are used in a few ways:

- Evaluation on an **absolute scale** (''this car can climb a 45 degree slope'')
- **Comparison to similar measurements** (''this plant was third tallest in its group''; ''this paper towel picked up more water than any other paper towel tested'')
- **Comparison to a control value** (''on average, rats taking the new drug lived 45 days longer than their counterparts who were administered a placebo'')

Appropriate to age group, students need to explain how all variables are/were measured, controlled, or constructively ignored (i.e., acknowledged but explicitly disclaimed to be outside the project's purview).

Science experiments compare two (or more) sources of data (e.g., a control plant grown outdoors and an experimental plant grown under a special light); engineering projects create a new device or process from scratch. Thus, engineering projects evaluate their results against absolute evaluation criteria (or specifications) rather than by comparing with some other instance of their project. This is reflected in the science vs. engineering versions of this section.



Understandable As presented by the display and the verbal discussion, is the project's design easy to understand?

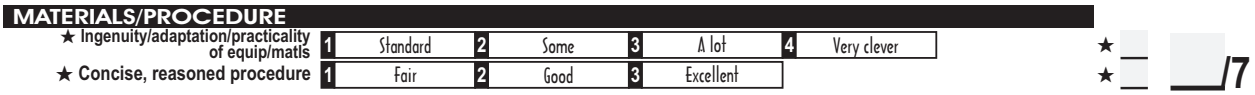
Practical & affordable This question examines the project's procedures (not its results). Does this project require the resources of IBM's national research laboratory to complete? If so, it's not affordable. Can the student, potentially working with a mentor, come to a reasonable conclusion? If so, then award full marks.

Variables Chosen Are the variables in the experiment properly defined and laid out? Are controls included?

Evaluate Variables Is the procedure for evaluating the observation values for the variables well-explained?

Materials/Procedure

This section assesses the cleverness of materials/equipment use and quality of the procedure.



Ingenuity How clever was the use of materials and equipment? Does the project display elegance in its use of materials and equipment?

Concise, Reasoned Procedure Is the procedure well-done and professional?

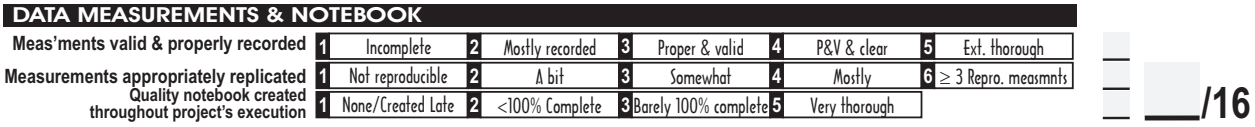
Data Measurements & Notebook

This section assesses the effectiveness of the data collection procedure and the project's (usually hand-written) notebook. Key points include:

- Data must be observed and properly recorded
- Data should be observed multiple times to ensure reproducibility and mitigate observational errors.
- **Notebooks must be created during experimentation, not afterward.**

Judge Larry Mott feels notebooks are extremely important; some of his comments are paraphrased here:

> Better notebooks extend for some months prior to the fair and include musings, data, mistakes, and show the flow of the project. I use the notebook during judging to gauge the quality of the projects. It is a direct indicator of the amount of work that went into the project and a dead giveaway if the student did not do the majority of the work. Those who render inappropriate assistance do not think of doing a notebook if they are behind the curtains directing a project. I like to open the notebook at random and ask a specific question about an entry, an experimental result, an apparatus sketch, a data table, etc. The answers are very revealing indeed. Having the experimental data is just as essential as having the results.
>
> Typed or neatly hand-written notebooks are likely to have been created after the project (a no-no). RBK adds that, of late, some students keep computer-generated notebooks as they go along. Finally, there are generally no erasures in proper notebooks, only lines through incorrect observations.



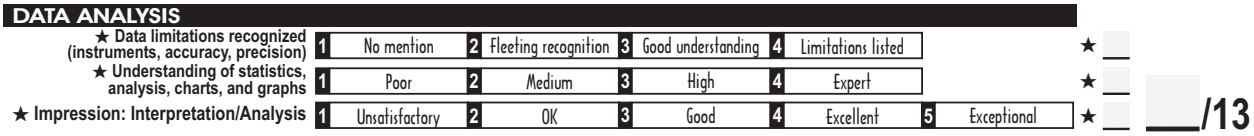
Data Valid & Properly Recorded This item assesses whether the data measurements were well-done in a professional manner. Check the data's representation, the notebook, and the oral presentation to deduce if the data has been properly observed and recorded.

Measurements Replicated Measurements (or samples, in some cases) need to be reproducible and replicated during experimentation to ensure that any given data reading is not a fluke. Use good judgment here, e.g.: measuring three successive gas-consumption runs of a new vehicle is just as good as measure the height of three different plants grown under red light.

Quality notebook created throughout project's execution Check the notebook to make sure it was created during the full duration of the project. A notebook that is beautifully typeset and obviously re-done after the project gets no credit here (which is usually very counterintuitive to the student). No notebook means 0 points here. Typically, one asks the student to show the notebook.

Data Analysis

This section includes far more judgment than some of the previous ones. It assesses the analysis and statistics shown in the project.



Data Limitations Recognized The student needs to demonstrate an understanding of the limits of measurements (especially regarding precision and instruments' limitations).

Understanding Statistics and Graphics Too often, students get ''help'' from a well-meaning mentor who chooses statistics or tabular/graphical presentation techniques that are beyond the student's abilities. This question asks for your judgment about that understanding. Query the student with relevant questions like, ''Just what is a standard deviation?''

Impression: Interpretation/Analysis Exercise your best judgment here to share your overall impression of the project's interpretation and analysis of the collected data.

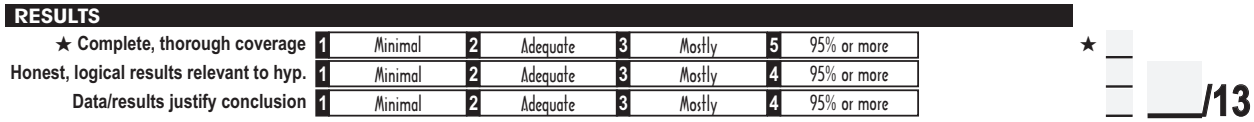
First Page Totals

After recording each line items' score in the provided shaded box, calculate the subtotals and then the totals for the front page.

Front Form Total ____/76

Results

This section awards points for how well the project achieved the goals it set out to achieve.



Complete, Thorough Coverage Does the experiment as executed meet the promise of the procedures and materials section?

Honest, Logical Results Relevant to Hypothesis Examine the results to determine if they are honest, logical, and relate properly to the initial hypothesis. ''Results'' are very similar to ''data'', though a certain amount of aggregation, summarizing, and/or statistics is implied.

Data/results justify conclusion Does the totality of the data enable the experimenter(s) to reach the conclusion that is presented?

Display and Exposition

The display is usually a backboard but can also be a more novel presentation. This section assesses the completeness and neatness of the display in addition to the overall verbal presentation of the project itself.

BACKBOARD and EXPOSITION												
Purpose, hypoth., procedures, data/results, mat'l/equ. (notebook), anal., & conclusion	0	4 or more missing	10	3 missing	15	2 missing	20	1 missing	25	All present		
★ Neatness	1	Messy	2	OK	3	Good	4	Great	6	Stellar	★	
★ Progression of verbal exposition	1	Haphazard	2	Confused	3	Clear	4	Clear & logical	5	Clr, logical, succinct	★	/36

Purpose, hypothesis, procedures, material/equipment, data/results, analysis, & conclusion A complete backboard has all these items: purpose, hypothesis (or goal in the case of engineering projects), procedure(s), material/equipment listing (though this might appear in a notebook), data/results (potentially in summary form), analysis, and conclusion. Count them up (ignoring quality) and deduct points if some items are not present.

Note, however, ''that no particular credit should be given (or deducted) for purchased or borrowed equipment that is not part of the work of the student and serves only as a tool in the investigation'' [8].

Neatness Neatness is slightly distinguished from ''professional''. A backboard can be extraordinarily well done with hand-lettering or very sloppy/messy with fancy computer-generated elements (though computer-generated elements do not generically incur much of a penalty). How does it look to you?

Progression of Verbal Exposition Students can choose any ordering and organization they wish for their presentation. What is your opinion of their speech?

Research

This section assesses whether the student performed background research about the project. The timing of the research is not discussed.

RESEARCH										
★ Cited authoritative approp. literat.	0	No	1	1-2 Citations	2	3-4 Citations	4	5 or more	★	
★ Other approaches/theories	1	Slight mention	2	Some knowledge	3	Good listing	5	Excellent references	★	
★ Further research or development	1	Little listed	2	Adequate	3	Excellent	4		★	/13

Cited authoritative appropriate literature Most literature citations these days will be web-based. It is still relatively easy to count the reasonable citations (e.g., *Readers Digest* is rarely a good source of scientific information; neither are websites promoting a given agenda). If you are not familiar with some website, ask the student about it. ''Is this from a company? a school? a library? How did you find this website?'' Sometimes students don't understand that a reference to http://www.google.com is not as complete as it needs to be; they get less credit here.

Other approaches/ theories Is the contestant aware of how other people approached the problem they are solving?

Further research Students are told to indicate further research for their project. This means that further research appears printed on their backboard or in their notes/notebooks – not solely presented verbally. Relevance to the current project is a plus.

Presentation/Interview

This section continues assessment of the verbal presentation and student's general interactive responses to judges' questions. While the interview is not strictly part of the project, it nevertheless has tremendous influence on the final results. This section is almost entirely subjective and enables a judge to award points for interview quality.

PRESENTATION/INTERVIEW										
★ Proper focus on important ideas	1	Unfocused	3	Good focus	5	Great focus	7	Outstanding focus	★	
Engagement level	1	Participating	3	Somewhat involved	5	Fully engaged	7	Enthusiastic		/14

Proper Focus Does the student exhibit enough knowledge and skill to focus responses on the request information? Too often students will carry on at length in hopes of hitting a gold nugget somewhere in their information; this should not be rewarded.

Engagement Level This question rewards those students whose attitude is one of strong participation or even enthusiastic passion.

Impressions

The newest section here is 'Extemporaneous thinking ability' which is really 'Ability to think on one's feet.' This section was added in order to identify those students who have memorized their entire presentation along with answers to popular questions. Pick some random question about the project or its notebook to test this ability.

For group projects, deduct points in each category where each member is not represented relatively equally, e.g., if one person does all the talking. Group projects are intended to be projects with equal contributors! The current guideline for two students is that the each student's participation level needs to be between 1/3 and 2/3 of the total time. For three students, think more like 1/4 to 1/2 the time for each student (imbalance is a fact of life; we're concerned with gross imbalances).

IMPRESSIONS

★ Extemporaneous thinking ability	1	Poor	2	OK	3	Good	4	Very good	5	Excellent
★ General impression of responses	1	Poor	2	OK	3	Good	4	Very good	5	Excellent
★ General impression of knowledge	1	Poor/BS/bluffing	2	OK	3	Good	4	Very good	5	Expert

★ ___
★ ___ ___/15
★ ___

Extemporaneous Thinking Ability Students talking from a script often cannot answer questions outside its strict bounds. This category (which judges both verbal communication skills and thinking on one's feet) rewards those who have deep subject knowledge and can answer questions from that depth. Of course, these students simply might not have a complete knowledge of their subject matter (since none of them has a Ph.D.), so the answer ''I don't know'' is perfectly reasonable (and expected!) for challenging questions. This is a subjective category; please share your assessment.

General Impression of Responses This is your opinion of the 'big picture' of the interview: did you have confidence in the student? Was the student informative, intelligent, polite, able to respond to questions, and forthcoming. This category depends entirely on your judgment. This is a subjective category; please share your assessment.

General Impression of Knowledge Does the student have a clue what they are talking about? **Any bluffing is an instant 0** in this category. This one is also subjective.

Project as a whole

This section contains subjective questions about the big picture of the project's quality and organization in addition to oral and written description.

PROJECT AS A WHOLE

★ Project quality and depth	1	Average	3	Good	5	Excellent	7	Superior
★ Organization	1	Average	3	Good	5	Very organized	7	Super methodical

★ ___
★ ___ ___/14

Project Quality and Depth Is quality evident throughout the project? High marks for meticulous, in-depth work. As you examine the display and listen to the oral presentation, assess the project's quality. Determine how far the student has really gone (e.g., measure paper towel liquid absorption has less depth than creating a new substance harder than diamond).

Organization High marks here for a methodical approach from the beginning to the end of the project. A slapdash project assembled the day before the Fair generally will earn low marks here.

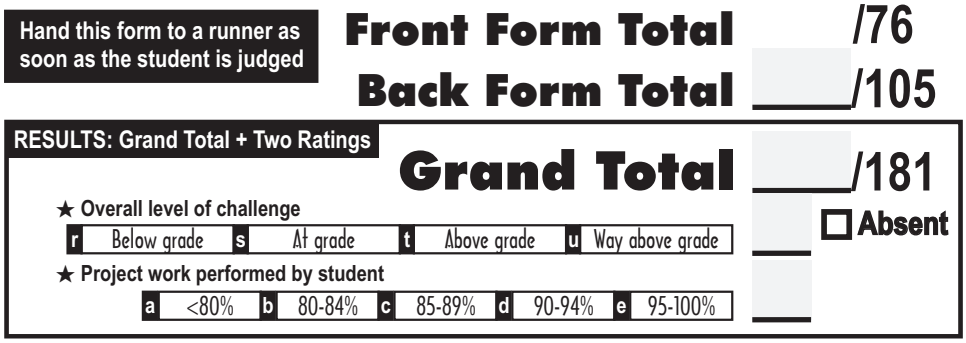
Back Form Total

As before, record the line item point values in the shaded boxes and sum them to create sub totals. Sum the subtotals to calculate the ''Back Form Total''. Add carefully; in 2009, 10% of the forms had addition errors.

Back Form Total ____/105

Final Overall Assessments

Turn the form back to the front side and record the Back Form Total in the obvious spot. Sum with the Front Form Total to determine the Grand total. Now it's time to mark two more subjective assessments.



THESE NEXT TWO QUESTIONS ARE UNIQUE
You record a letter instead of a number.

Overall Level of Challenge Relative to the student's current academic level, determine whether the work in the project was below, at, above, or even way above the student's grade level. Mark the letter in the shaded box.

Work Performed By Student It is expected and encouraged that students solicit and receive help on their project. The key thing to evaluate is ''what parts of the project that would have been appropriate for a student to perform were, in fact, implemented by the student?'' Of course, if the majority of the project was something that a student could not implement (but was nevertheless implemented), then points should be deducted here. This item actually **multiplies** the total score by a number less than 1.0; be sure you mark it as best you can.

Often it's easiest just to ask the exhibitor how much of the work he/she did and/or who helped them and how much. A quick follow-up, ''Did you really build this electron microscope from scratch?'' usually reveals the truth of the matter fairly quickly. Note that research supervision does not count against the "100% of the work" evaluation.

Completed Forms

Once you've completed marking the form (shortly after you finish interviewing the student), please turn the form to a runner (identified by a unique hat) who will convey it to scoring table. Please don't forget to record the score on your assignment sheet.

The Judging Forms

The next two pages show the judging forms.

PIKES PEAK REGIONAL SCIENCE FAIR 2009

★ = Appropriate to Age Group

PROJECT SELECTION

★ Problem is well-defined	1 Not	2 Somewhat	3 Mostly	4 Crystal Clear				★	___
★ Originality of project	0 Unoriginal/copy	2 Tiny twist	4 Some novelty	[Choose any number in the range 0..10]				★	___
		6 New twist on old idea	8 Original	10 Innovative & original					
★ Quality of hypothesis/ Engineering Problem	1 Weak	2 Watered down	3 Strong	4 Very strong				★	___ /18

PROJECT DESIGN & VARIABLES

Research/proj. design understandable	1 Not so clear	2 Mostly clear	4 Clear	6 Crystal clear					___
★ Practical & affordable	1 Not very prac. or aff.	2 Mostly practical/aff.	3 Very pract.&aff.					★	___
★ Relevant/approp. variables chosen	1 No	2 Some	3 Many	5 Most	7 Complete w/controls			★	___
★ How to evaluate variables	1 None listed	2 Some evaluation	4 Most listed	6 Complete				★	___ /22

MATERIALS/PROCEDURE

★ Ingenuity/adaptation/practicality of equip/matls	1 Standard	2 Some	3 A lot	4 Very clever				★	___
★ Concise, reasoned procedure	1 Fair	2 Good	3 Excellent					★	___ /7

DATA MEASUREMENTS & NOTEBOOK

Meas'ments valid & properly recorded	1 Incomplete	2 Mostly recorded	3 Proper & valid	4 P&V & clear	5 Ext. thorough				___
Measurements appropriately replicated	1 Not reproducible	2 A bit	3 Somewhat	4 Mostly	6 ≥ 3 Repro. measmnts				___
Quality notebook created throughout project's execution	1 None/Created Late	2 <100% Complete	3 Barely 100% complete	5 Very thorough					___ /16

DATA ANALYSIS

★ Data limitations recognized (instruments, accuracy, precision)	1 No mention	2 Fleeting recognition	3 Good understanding	4 Limitations listed				★	___
★ Understanding of statistics, analysis, charts, and graphs	1 Poor	2 Medium	3 High	4 Expert				★	___
★ Impression: Interpretation/Analysis	1 Unsatisfactory	2 OK	3 Good	4 Excellent	5 Exceptional			★	___ /13

★ = Appropriate to Age Group

Scheduletime Engin./Science JudgeID

Student Name

Proj Name

Bar code Proj ID

Hand this form to a runner as soon as the student is judged

Front Form Total ____/76

Back Form Total ____/105

RESULTS: Grand Total + Two Ratings

Grand Total ____/181

☐ Absent

★ Overall level of challenge

r Below grade s At grade t Above grade u Way above grade ___

★ Project work performed by student

a <80% b 80-84% c 85-89% d 90-94% e 95-100% ___

PIKES PEAK REGIONAL SCIENCE FAIR 2009

★ Appropriate to Age Group

RESULTS

★ Complete, thorough coverage	1	Minimal	2	Adequate	3	Mostly	5	95% or more	★ ___
Honest, logical results relevant to hyp.	1	Minimal	2	Adequate	3	Mostly	4	95% or more	___
Data/results justify conclusion	1	Minimal	2	Adequate	3	Mostly	4	95% or more	___ ___/13

BACKBOARD and EXPOSITION

Purpose, hypoth., procedures, data/results, mat'l/equ. (notebook), anal., & conclusion	0	4 or more missing	10	3 missing	15	2 missing	20	1 missing	25	All present
★ Neatness	1	Messy	2	OK	3	Good	4	Great	6	Stellar
★ Progression of verbal exposition	1	Haphazard	2	Confused	3	Clear	4	Clear & logical	5	Clr, logical, succinct

★ ___ ___/36

RESEARCH

★ Cited authoritative approp. literat.	0	No	1	1-2 Citations	2	3-4 Citations	4	5 or more
★ Other approaches/theories	1	Slight mention	2	Some knowledge	3	Good listing	5	Excellent references
★ Further research or development	1	Little listed	2	Adequate	3	Excellent	4	

★ ___
★ ___
★ ___ ___/13

PRESENTATION/INTERVIEW

★ Proper focus on important ideas	1	Unfocused	3	Good focus	5	Great focus	7	Outstanding focus
Engagement level	1	Participating	3	Somewhat involved	5	Fully engaged	7	Enthusiastic

★ ___
___ ___/14

IMPRESSIONS

★ Extemporaneous thinking ability	1	Poor	2	OK	3	Good	4	Very good	5	Excellent
★ General impression of responses	1	Poor	2	OK	3	Good	4	Very good	5	Excellent
★ General impression of knowledge	1	Poor/BS/bluffing	2	OK	3	Good	4	Very good	5	Expert

★ ___
★ ___
★ ___ ___/15

PROJECT AS A WHOLE

★ Project quality and depth	1	Average	3	Good	5	Excellent	7	Superior
★ Organization	1	Average	3	Good	5	Very organized	7	Super methodical

★ ___
★ ___ ___/14

★ Appropriate to Age Group

JUDGING FLOW OVERVIEW

- Introductions
- Student generally has ten minute 'speech'
- Interview student to determine scores for this form; print the point values
- At four minute warning: complete score sheet and feedback sheet
- Feedback sheet to student
- This sheet with totals and two rankings (other side!) to runner

Back Form Total ___/105

Leaving early

If you as a judge must leave early (any time before 3:10), please turn in your schedule at the scoring table so that we can handle your absence.

Feedback Forms

Judges are the professional authority for the competitors. Please be sure you fill that role properly.

All rounds include written feedback to students given on very free-form full sheets of paper. In the top third, circle a few (one? two? three?) of the areas in which the student's project excelled.

In the next area, please try to pick two or three items to emphasize as positive feedback (even if science isn't in their future, they may well become a politician voting on science!):

- I liked _____ best about your project
- You did a great job on _____
- _____ was really well done
- You did really well on _____ and _____

Some judges put a header (e.g., ''Best parts of your project'') and list the parts they enjoyed below that.

It is often appropriate to offer a suggestion or idea for improvement; it is not a requirement. Don't hesitate to do so – but please confine negative feedback to one thought per judging session. Please avoid nasty words (i.e., don't be like the mean judge on *American Idol*). Suggestions could be couched like ''If you had more time, you might have _____'' or ''If you wished to expand on this, you might _____'' or even ''The best way to improve your score for next time would be _____''.

Try to leave them with something concrete. Avoid: ''Your analysis was just not up to par.'' in favor of ''Calculating the mean and variance for the distribution of your results would have strengthened your analysis.''

Feedback will in all likelihood be shared with both parents and teachers; please write feedback so that it is favorably received by all.

Chairs

If you prefer sitting while judging, don't hesitate to ask the student to share the chair.

Parallel Judging

Both ''special awards'' and ''backup'' judges are judging the contestants, potentially at the same time as we (the Fair Award judges) are. The backup judges will work with us on the Grand Award winners.

MULTIPLE JUDGES AT A PROJECT

Category judges (like you) have a certain "priority" in judging. You always get to judge a project (potentially with another category judge) on the provided schedule, even if other judges are there.

Avoid Arguing

Besides the obvious actions to avoid (like being patronizing), please avoid ''arguing'' with the competitor. If they are sticking by an erroneous assumption or argument, mark the scoresheet and proceed after potentially probing a tiny bit.

Why? Judges don't have enough time; everyone gets impatient; and a stubborn student will just walk away frustrated. None of these achieves our goals.

Safety

Before the judging starts, the PPRSF Safety Team checks all exhibits to make sure they conform to International Science Fair standards. If you as a judge find something questionable, please notify a runner to report this to the scoring table immediately (with the project ID, of course). Proceed to judge the project normally.

Discretion

Please ensure that any discussions you have are properly private. Students (competitors) are everywhere – even in bathrooms. Please be discreet. This again caused problems at a recent fair!

Sensitivity/Harassment

Please avoid harassment and discrimination/prejudice in its myriad forms: age, race, color, national origin, ancestry, religion, gender, gestures, physical contact, and disabilities (including blindness and deafness). Please avoid improper remarks, gestures, physical contact, anything that might be construed even remotely as offensive.

Judge This Year's Research

Note that only research conducted in the last 12 months is to be judged. Previous efforts can be discussed briefly but should not form a core of this year's project. Request a runner to fetch the head judge if you think a project does not contain enough current research.

Sample Questions

To get your brain thinking on the sorts of questions to stimulate discussion with the contestant, here are some queries you might consider.

Before we get to the questions, though, let's not ask: ''Why is this project important to you?'' I don't see how that helps.

- You can always ask for the definition of a (presumably technical) word the contest uses.
- In response to a question, contestant says, ''I don't know.'' No problem. Your reply: ''How would you figure it out?''
- When it's time to probe peripheral knowledge, please preface your evermore-challenging questions with: ''I've got some questions slightly peripheral to your presentation, don't be bothered if they are out of your area of expertise'' or some students will get extremely nervous. Remember: even a second grader can corner the smartest people just by repeatedly asking, ''Why is that?''
- Where did you get the idea for this project?
- What did you enjoy most?
- What problems arose during your investigation?
- How did you overcome them?
- Do your results indicate further study is needed?
- What is the purpose/objective of your study?
- What are some previous studies?
- What are the possible sources of error?
- How accurate are your measurements?
- What is/are your controls?
- Why did you do the statistical analysis the way you did? What does it mean?
- How many times did you repeat your measurements? [or over what time period…]
- On what did you base your conclusions?
- Are there are any other approaches you might have taken to your research?
- Over what time period did you conduct your study?

- What instruments did you use for your measurements?
- Tell me about the equipment you constructed yourself.
- What would you do differently if you were doing this again?
- Do you think you could continue development of this project?

Acknowledgments

Several folks dramatically improved the quality of this document. Thanks to Bruce Erickson, James Hardy, and Richard Painter. Any errors that remain, of course, are mine.

References

[1] Vancouver Island Regional Science Fair
[2] Minnesota Academy of Science
[3] U S Air Force
[4] Kern County Science Fair
[5] Louisiana Region VIII Science Fair
[6] Home School Learning Network
[7] Discovery Channel (discoveryschool.com)
[8] Access Excellence at the National Health Museum (http://www.accessexcellence.org)