

***SECONDARY
SCIENCE FAIR
TEACHER
APPENDICES***





Science Fair

Preparation for Judging Site Fairs

Using the Rubric

The rubrics are divided into major criteria.
 For each criterion, there are usually 2 to 5 "critical attributes".
 For example:

<u>CRITERION</u>	<u>CRITICAL ATTRIBUTES</u>
Visual Quality of Display	1) appealing and neat 2) readable at appx. 2 feet 3) organized and clear 4) understandable visuals/models 5) few language/spelling errors

Each attribute is defined for the three levels of proficiency

1 (Partially Proficient) ≡ major, "show stopper" flaw or omission in one or more of the critical attributes
 Rubric wording is "... or ... or ... is missing ..."

3 (Proficient) ≡ minor flaw or omission in one or more of the critical attributes
 Rubric wording is "... and ... and ... are good."

5 (Advanced Proficient) ≡ no flaws in the critical attributes which are thoroughly completed with excellence and creativity
 Rubric wording is "... and ... and ... are excellent."

When judging projects, assign only scores of 1, 3, or 5. Resist the temptation to give "4" or "3.5".

After judging each criterion, make sure to double the points for the indicated **(x2)** criteria. Add the points. The total will be between 10 and 50. All judges scores for the students will be averaged. In the event of a tie, all of the judges involved will decide the winner by discussion and vote.

Problem <i>(Double Points)</i> (x2)
Preliminary Research
Hypothesis <i>(Double Points)</i> (x2)
Procedure & Materials
Results <i>(Double Points)</i> (x2)
Conclusions
Visual Quality of Display

Interviewing Students

Some Things to Look for When Interviewing Students:

- 1) connection of the project to the student's experiences and/or interests
- 2) that the project was a genuine learning opportunity for the student
- 3) how the research helped to form the hypothesis
- 4) how well the student connects their data to their conclusions

Some Things to Do to Help Students Do Their Best:

- * Get at eye level to the student. (Chairs should be available.)
- * Shake hands (and introduce yourself if they don't know you well).
- * Give a quick compliment to help break the ice. **"Oh, what a great board!"**
- * Nervous students may try to start reading their project board. To prevent this, start with something like, **"Tell me how you came up with this great idea."**
- * SMILE! Don't let your nervousness stop you from smiling. Relaxed students will do a better job of expressing their passion, interest, and understanding.

Logistical Arrangements

- ☑ Each teacher needs to list their projects by Name, Title, Grade Level (or Course), and Rubric Type.
- ☑ With this information, your coordinator will be able to make sure each student receives the proper rubrics.
- ☑ At the school site fair, make sure each project has a copy of the appropriate rubric and several appropriate scoring sheets.



School Science Fair

Judge's Score/Comment Sheet

for
Name: _____ Grade: _____

Title: _____

6th – 8th Grade **Career Shadow**

Circle the appropriate score and copy the points on the right.

	Partially Proficient	Proficient	Advanced Proficient	POINTS
Letter to Mentor	1	3	5	
Research (x2)	2	6	10	
Log (x2)	2	6	10	
Interview (x2)	2	6	10	
Reflection	1	3	5	
Photo Journal	1	3	5	
Visual Quality of Display / Scrapbook	1	3	5	

Score: ____ / 50

Comments: _____

Judged by: _____

NOTES TO TEACHER: For grading purposes, 5-10 pts = Not Proficient (1), 11-24 pts = Partially Proficient (2), 25-39 pts = Proficient (3), 40-50 pts = Advanced Proficient (4).
Complete grading should also include other details not included here as Judging Criteria: for instance, written report details, completion of deadline tasks, display guidelines, model quality, etc.



School Science Fair

Judge's Score/Comment Sheet

for
Name: _____ Grade: _____

Title: _____

6th – 8th Grade **Career Shadow**

Circle the appropriate score and copy the points on the right.

	Partially Proficient	Proficient	Advanced Proficient	POINTS
Letter to Mentor	1	3	5	
Research (x2)	2	6	10	
Log (x2)	2	6	10	
Interview (x2)	2	6	10	
Reflection	1	3	5	
Photo Journal	1	3	5	
Visual Quality of Display / Scrapbook	1	3	5	

Score: ____ / 50

Comments: _____

Judged by: _____

NOTES TO TEACHER: For grading purposes, 5-10 pts = Not Proficient (1), 11-24 pts = Partially Proficient (2), 25-39 pts = Proficient (3), 40-50 pts = Advanced Proficient (4).
Complete grading should also include other details not included here as Judging Criteria: for instance, written report details, completion of deadline tasks, display guidelines, model quality, etc.



School Science Fair

Judge's Score/Comment Sheet

for
Name: _____ Grade: _____

Title: _____

6th – 8th Grade *Experimental Project*

Circle the appropriate score and copy the points on the right.

	Partially Proficient	Proficient	Advanced Proficient	POINTS
Problem (x2)	2	6	10	
Preliminary Research	1	3	5	
Hypothesis (x2)	2	6	10	
Procedure & Materials	1	3	5	
Results (x2)	2	6	10	
Conclusions	1	3	5	
Visual Quality of Display	1	3	5	

Score: ____ / 50

Comments: _____

Judged by: _____

NOTES TO TEACHER: For grading purposes, 5-10 pts = Not Proficient (1), 11-24 pts = Partially Proficient (2), 25-39 pts = Proficient (3), 40-50 pts = Advanced Proficient (4). Complete grading should also include other details not included here as Judging Criteria: for instance, written report details, completion of deadline tasks, display guidelines, model quality, etc.



School Science Fair

Judge's Score/Comment Sheet

for
Name: _____ Grade: _____

Title: _____

6th – 8th Grade *Experimental Project*

Circle the appropriate score and copy the points on the right.

	Partially Proficient	Proficient	Advanced Proficient	POINTS
Problem (x2)	2	6	10	
Preliminary Research	1	3	5	
Hypothesis (x2)	2	6	10	
Procedure & Materials	1	3	5	
Results (x2)	2	6	10	
Conclusions	1	3	5	
Visual Quality of Display	1	3	5	

Score: ____ / 50

Comments: _____

Judged by: _____

NOTES TO TEACHER: For grading purposes, 5-10 pts = Not Proficient (1), 11-24 pts = Partially Proficient (2), 25-39 pts = Proficient (3), 40-50 pts = Advanced Proficient (4). Complete grading should also include other details not included here as Judging Criteria: for instance, written report details, completion of deadline tasks, display guidelines, model quality, etc.



School Science Fair

Judge's Score/Comment Sheet

for
Name: _____ Grade: _____

Title: _____

6th – 8th Grade *Invention*

Circle the appropriate score and copy the points on the right.

	Partially Proficient	Proficient	Advanced Proficient	POINTS
Problem (x2)	2	6	10	
Research	1	3	5	
Possible Solutions	1	3	5	
How Solution Works	1	3	5	
Evaluation Chart	1	3	5	
Obstacles	1	3	5	
Revised Solutions	1	3	5	
Science Concepts	1	3	5	
Display Presentation	1	3	5	

Score: ____ / 50

Comments: _____

Judged by: _____

NOTES TO TEACHER: For grading purposes, 5-10 pts = Not Proficient (1), 11-24 pts = Partially Proficient (2), 25-39 pts = Proficient (3), 40-50 pts = Advanced Proficient (4).

Complete grading should also include other details not included here as Judging Criteria: for instance, written report details, completion of deadline tasks, display guidelines, model quality, etc.



School Science Fair

Judge's Score/Comment Sheet

for
Name: _____ Grade: _____

Title: _____

6th – 8th Grade *Invention*

Circle the appropriate score and copy the points on the right.

	Partially Proficient	Proficient	Advanced Proficient	POINTS
Problem (x2)	2	6	10	
Research	1	3	5	
Possible Solutions	1	3	5	
How Solution Works	1	3	5	
Evaluation Chart	1	3	5	
Obstacles	1	3	5	
Revised Solutions	1	3	5	
Science Concepts	1	3	5	
Display Presentation	1	3	5	

Score: ____ / 50

Comments: _____

Judged by: _____

NOTES TO TEACHER: For grading purposes, 5-10 pts = Not Proficient (1), 11-24 pts = Partially Proficient (2), 25-39 pts = Proficient (3), 40-50 pts = Advanced Proficient (4).

Complete grading should also include other details not included here as Judging Criteria: for instance, written report details, completion of deadline tasks, display guidelines, model quality, etc.



School Science Fair

Judge's Score/Comment Sheet

for
Name: _____ Grade: _____

Title: _____

6th – 8th Grade *Rube Goldberg Device*

Circle the appropriate score and copy the points on the right.

Task	Partially Proficient	Proficient	Advanced Proficient	POINTS
Research	1	3	5	
Preliminary Design	2	6	10	
Obstacles (x2)	1	3	5	
Final Design with Key (x2)	2	6	10	
Reflection	1	3	5	
Device Operation (x2)	2	6	10	

Score: ____ / 50

Comments: _____

Judged by: _____

NOTES TO TEACHER: For grading purposes, 5-10 pts = Not Proficient (1), 11-24 pts = Partially Proficient (2), 25-39 pts = Proficient (3), 40-50 pts = Advanced Proficient (4). Complete grading should also include other details not included here as Judging Criteria: for instance, written report details, completion of deadline tasks, display guidelines, model quality, etc.



School Science Fair

Judge's Score/Comment Sheet

for
Name: _____ Grade: _____

Title: _____

6th – 8th Grade *Rube Goldberg Device*

Circle the appropriate score and copy the points on the right.

Task	Partially Proficient	Proficient	Advanced Proficient	POINTS
Research	1	3	5	
Preliminary Design	2	6	10	
Obstacles (x2)	1	3	5	
Final Design with Key (x2)	2	6	10	
Reflection	1	3	5	
Device Operation (x2)	2	6	10	

Score: ____ / 50

Comments: _____

Judged by: _____

NOTES TO TEACHER: For grading purposes, 5-10 pts = Not Proficient (1), 11-24 pts = Partially Proficient (2), 25-39 pts = Proficient (3), 40-50 pts = Advanced Proficient (4). Complete grading should also include other details not included here as Judging Criteria: for instance, written report details, completion of deadline tasks, display guidelines, model quality, etc.



School Science Fair

Judge's Score/Comment Sheet

for
Name: _____ Grade: _____

Title: _____

7th Grade **Scientific Survey Projects**

Circle the appropriate score and copy the points on the right.

	Partially Proficient	Proficient	Advanced Proficient	POINTS
Problem (x2)	2	6	10	
Preliminary Research	1	3	5	
Hypothesis	1	3	5	
Procedure (x2)	2	6	10	
Results (x2)	2	6	10	
Conclusions	1	3	5	
Visual Quality of Display	1	3	5	

Score: ____ / 50

Comments: _____

Judged by: _____

NOTES TO TEACHER: For grading purposes, 5-10 pts = Not Proficient (1), 11-24 pts = Partially Proficient (2), 25-39 pts = Proficient (3), 40-50 pts = Advanced Proficient (4). Complete grading should also include other details not included here as Judging Criteria: for instance, written report details, completion of deadline tasks, display guidelines, model quality, etc.



School Science Fair

Judge's Score/Comment Sheet

for
Name: _____ Grade: _____

Title: _____

7th Grade **Scientific Survey Projects**

Circle the appropriate score and copy the points on the right.

	Partially Proficient	Proficient	Advanced Proficient	POINTS
Problem (x2)	2	6	10	
Preliminary Research	1	3	5	
Hypothesis	1	3	5	
Procedure (x2)	2	6	10	
Results (x2)	2	6	10	
Conclusions	1	3	5	
Visual Quality of Display	1	3	5	

Score: ____ / 50

Comments: _____

Judged by: _____

NOTES TO TEACHER: For grading purposes, 5-10 pts = Not Proficient (1), 11-24 pts = Partially Proficient (2), 25-39 pts = Proficient (3), 40-50 pts = Advanced Proficient (4). Complete grading should also include other details not included here as Judging Criteria: for instance, written report details, completion of deadline tasks, display guidelines, model quality, etc.



School Science Fair

Judge's Score/Comment Sheet

Teacher: _____

for
Name: _____ Period: _____

Title: _____

9th – 12th Grade *Experimental Project*

Circle the appropriate score and copy the points on the right.

	Partially Proficient	Proficient	Advanced Proficient	POINTS
Problem (x2)	2	6	10	
Preliminary Research	1	3	5	
Hypothesis (x2)	2	6	10	
Procedure & Materials	1	3	5	
Results (x2)	2	6	10	
Conclusions	1	3	5	
Visual Quality of Display	1	3	5	

Score: ____ / 50

Comments: _____

Judged by: _____

NOTES TO TEACHER: For grading purposes, 5-10 pts = Not Proficient (1), 11-24 pts = Partially Proficient (2), 25-39 pts = Proficient (3), 40-50 pts = Advanced Proficient (4).
Complete grading should also include other details not included here as Judging Criteria: for instance, written report details, completion of deadline tasks, display guidelines, model quality, etc.



School Science Fair

Judge's Score/Comment Sheet

Teacher: _____

for
Name: _____ Period: _____

Title: _____

9th – 12th Grade *Experimental Project*

Circle the appropriate score and copy the points on the right.

	Partially Proficient	Proficient	Advanced Proficient	POINTS
Problem (x2)	2	6	10	
Preliminary Research	1	3	5	
Hypothesis (x2)	2	6	10	
Procedure & Materials	1	3	5	
Results (x2)	2	6	10	
Conclusions	1	3	5	
Visual Quality of Display	1	3	5	

Score: ____ / 50

Comments: _____

Judged by: _____

NOTES TO TEACHER: For grading purposes, 5-10 pts = Not Proficient (1), 11-24 pts = Partially Proficient (2), 25-39 pts = Proficient (3), 40-50 pts = Advanced Proficient (4).
Complete grading should also include other details not included here as Judging Criteria: for instance, written report details, completion of deadline tasks, display guidelines, model quality, etc.

School Science Fair

Judge's Score/Comment Sheet

for
Name: _____ Grade: _____

Title: _____

9th – 12th Grade *Invention*

Circle the appropriate score and copy the points on the right.

	Partially Proficient	Proficient	Advanced Proficient	POINTS
Problem (x2)	2	6	10	
Research	1	3	5	
Possible Solutions	1	3	5	
How Solution Works	1	3	5	
Evaluation Chart	1	3	5	
Obstacles	1	3	5	
Revised Solutions	1	3	5	
Science Concepts	1	3	5	
Display Presentation	1	3	5	

Score: ____ / 50

Comments: _____

Judged by: _____

NOTES TO TEACHER: For grading purposes, 5-10 pts = Not Proficient (1), 11-24 pts = Partially Proficient (2), 25-39 pts = Proficient (3), 40-50 pts = Advanced Proficient (4).

Complete grading should also include other details not included here as Judging Criteria: for instance, written report details, completion of deadline tasks, display guidelines, model quality, etc.

School Science Fair

Judge's Score/Comment Sheet

for
Name: _____ Grade: _____

Title: _____

9th – 12th Grade *Invention*

Circle the appropriate score and copy the points on the right.

	Partially Proficient	Proficient	Advanced Proficient	POINTS
Problem (x2)	2	6	10	
Research	1	3	5	
Possible Solutions	1	3	5	
How Solution Works	1	3	5	
Evaluation Chart	1	3	5	
Obstacles	1	3	5	
Revised Solutions	1	3	5	
Science Concepts	1	3	5	
Display Presentation	1	3	5	

Score: ____ / 50

Comments: _____

Judged by: _____

NOTES TO TEACHER: For grading purposes, 5-10 pts = Not Proficient (1), 11-24 pts = Partially Proficient (2), 25-39 pts = Proficient (3), 40-50 pts = Advanced Proficient (4).

Complete grading should also include other details not included here as Judging Criteria: for instance, written report details, completion of deadline tasks, display guidelines, model quality, etc.

Science Fair RUBRICS GUIDE

TYPES OF PROJECTS ALLOWABLE FOR GRADE LEVELS							
Grade	Collection	Experiment	Research	Invention	Career Shadow	Rube Goldberg Device	Scientific Survey
K	Yes	Yes	Yes				
1 st	Yes	Yes	Yes				
2 nd		Yes	Yes				
3 rd		Yes	Yes	Yes			
4 th		Yes	Yes	Yes			
5 th		Yes	Yes	Yes			
6 th		Yes		Yes	Yes	Yes	
7 th		Yes		Yes	Yes	Yes	Yes
8 th		Yes		Yes	Yes	Yes	
9 th		Yes		Yes			
10 th		Yes		Yes			
11 th		Yes		Yes			
12 th		Yes		Yes			

Updated October 2009



Science Fair *Career Shadow* (6th - 8th Grade)

Rubric for School Site Science Fair

	Attempted 1	Proficient 3	Advanced Proficient 5
Letter to Mentor	Introduction letter thanks the mentor for allowing student to shadow them, but does not provide details about relevant skills or interest that the student brings to the shadow. Or, provides little or no information about the purpose of the shadow.	Introduction letter thanks the mentor and introduces the student to mentor mentioning some relevant skills or interests that the student brings to the shadow. Provides some information about the purpose of the shadow.	Introduction letter thanks the mentor and introduces the student to mentor clearly explaining relevant skills and interests that the student brings to the shadow. Provides a clear presentation of the purpose of the shadow.
Research <i>(double points)</i> x2	Cites only one or two sources of information about the occupation observed, or uses only one type of information resource. Makes little or no connection to the reason for selecting the planned shadow.	Cites three or more sources of information about the occupation observed, using at least two types of information resources. Makes a general connection to the reason for selecting the planned shadow in the student's own words.	Cites four or more sources of information about the occupation observed, using at least three types of information resources. Makes clear and well-elaborated connections to the reason for selecting the planned shadow in the student's own words.
Log <i>(double points)</i> x2	Notes from the job shadow are incomplete or lack detail, or do not reflect completion of the required eight hours or lack mentor's signature to validate the hours.	Notes chronicling each hour of the job shadow provide adequate detail to describe the experience. The log records eight to ten hours of shadowing, verified by the mentor's signature.	Detailed notes chronicling each hour of the job shadow give details that clearly describe the experience. The log records more than ten hours of shadowing, verified by the mentor's signature.
Interview <i>(double points)</i> x2	Student transcribes responses to questions, or records only a few responses. Or, there are less than three student-developed questions. Or, the summary of responses fails to give a clear picture of the occupation and the mentor's experience in it.	Student summarizes responses to several questions, including at least three student-developed questions, that give a general picture of the occupation and the mentor's experience in it.	Student summarizes responses to at least 10 questions, four of which are student-developed, to give a clear picture of many aspects of the occupation and the mentor's experience in it.
Reflection	Reflection on the experience merely retells events of the job shadow and makes vague or no reference to the student's life.	Reflection on the experience relates the shadow in a general way to the student's own life.	Reflection on the experience relates the shadow and the mentor's occupation to the student's temperament, talents, and future aspirations.
Photo Journal	Few photos record parts of the job shadow.	Several photos of the job shadow, including one of the mentor with the student, reflect significant aspects of the experience.	Thorough photographic record of the job shadow, including one of the mentor with the student, provides an organized visual overview of the experience.
Visual Quality of Scrapbook / Display Board	Various parts of the assignment are collected into a scrapbook or onto a display board, but little organization or effort to convey a complete story of job shadow experience is evident.	All parts of the assignment are assembled into a scrapbook or onto a display board showing some organization to convey the job shadow experience.	All parts of the assignment are neatly organized into a scrapbook or onto a display board that creatively draws the reader into the student's job shadow experience.

(Projects will receive between 10 and 50 points when all rubric criteria have been addressed.)

Suggested Questions for *Career Shadow* Interview:

1. How long have you been doing this job?
2. What originally attracted you to this job?
3. What type(s) of schooling or other training did you have to do to be qualified for this job?
4. How do you stay on top of the most current research in this job?
5. Are there particular skills that are needed or come in handy in this occupation?
6. What do you find to be the most rewarding part of this job?
7. In this occupation, what types of situations or circumstances create stress?
8. What types of things have come as a surprise to you in this job?
9. How do subjects taught in middle and high school prepare me for a future in this field?
10. Is the way you practice this profession the only way this job is done? What other ways can it be done? What are the benefits of each?
11. What are the controversial issues involved in this profession? What are the different sides of each issue?



Science Fair *Experimental Projects* (6th – 8th Grade)

Rubric for School Site Science Fair

	Attempted 1	Proficient 3	Advanced Proficient 5
Problem <i>(Double Points)</i> (x2)	States the problem as a question that is vague, or as a statement, or addresses an issue to which the student already knows the answer. Shows limited or no connection to a valid scientific or mathematical concept.	States problem as a question, and represents a genuine learning opportunity for the student. Generally addresses a valid scientific or mathematical concept.	States problem as a question, provides evidence that it comes from the student's personal interests or experiences, and represents a genuine learning opportunity for the student. Specifically addresses a valid scientific or mathematical concept, or has a beneficial application to some aspect of society.
Preliminary Research	Uses limited sources from only one type of information resource (e.g., text, encyclopedia, businesses, magazines, catalogs, internet, or interviews), or uses some resources that are not reputable sources. Fails to connect the research to the problem, or material is copied rather than written in the student's own words.	Uses three or more reputable sources, cited correctly. Cites more than one type of information resource. Makes a general connection between the research and the problem in the student's own words.	Uses five or more reputable sources, cited correctly. Cites at least four types of information resources. Makes a clear connection between each source and the problem in the student's own words.
Hypothesis <i>(Double Points)</i> (x2)	Hypothesis is either not testable or does not connect to the stated problem, or shows no connection to the preliminary research.	Hypothesis is complete (in one sentence), testable, addresses the stated problem, and shows some connection to the preliminary research.	Hypothesis is complete (in one sentence), testable, and clearly addresses the stated problem. Shows a direct connection to their preliminary research.
Procedure & Materials	Experiment is not relevant to the hypothesis or is only performed once. The procedures outlined are seriously incomplete or not sequential, or materials list is missing or incomplete.	Experiment is adequate to test the hypothesis, but may leave some unanswered questions. Performs experiment one or more times. Procedures are outlined in a step-by-step fashion, but there may be 1 or 2 gaps that require explanation. Major materials are listed.	Experiment is a well-constructed test of the hypothesis and is performed several times. Procedures are outlined in a step-by-step fashion that could be followed by anyone without additional explanations. All relevant materials are listed.
Results <i>(Double Points)</i> (x2)	Does not summarize data clearly. The relationship between the variables is unclear or not discussed. Makes no predictions about what might happen if part of the experiment were changed to better test the hypothesis or answer a further question.	Summarizes the data in a way that clearly describes what was discovered using graphs or charts. Mentions at least one relationship between the variables and gives some analysis of trends/patterns. May attempt predictions about what might happen to the results if part of the experiment were changed to better test the hypothesis or answer a further question.	Summarizes the data in a way that clearly describes what was discovered using graphs or charts. Discusses relationships between the variables and thoroughly analyzes trends/patterns. Makes well-reasoned predictions about what might happen if part of the experiment were changed to better test the hypothesis or answer a further question.
Conclusions	Conclusion does not answer the problem, or does not refer back to the hypothesis, or contradicts the evidence collected.	Conclusion addresses the problem, states if the hypothesis was supported or rejected, and gives some explanation why.	Conclusion completely answers all aspects of the problem, states if the hypothesis was supported or rejected, and clearly cites evidence to explain why.
Visual Quality of Display	Project has limited eye appeal or is not easily readable at approximately two feet distance. The project has limited organization, or contains confusing visuals, or contains major language or spelling errors.	Project is appealing and readable at approximately 2 feet distance. It is organized and clear, uses understandable visuals and/or models, and contains few language and spelling errors.	Project is appealing and neat, and is readable at approximately 2 feet distance. It is well organized and clear, makes striking use of inventive or amusing visuals and/or models, and uses language and spelling flawlessly.

(Projects will receive between 10 and 50 points when all rubric criteria have been addressed.)

Science Fair
Experimental Projects
 (6th – 8th Grade)
 Judge's Score Sheet for
 School Site Science Fairs

Problem <i>(Double Points)</i> (x2)																			
Preliminary Research																			
Hypothesis <i>(Double Points)</i> (x2)																			
Procedure & Materials																			
Results <i>(Double Points)</i> (x2)																			
Conclusions																			
Visual Quality of Display																			
Total Score																			

<i>Teacher:</i>	<i>Period:</i>
Student(s):	
Project:	
Student(s):	
Project:	
Student(s):	
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Project:	
Student(s):	
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Project:	

NOTES TO TEACHER: For grading purposes, 5-10 pts = Not Proficient (1), 11-24 pts = Partially Proficient (2), 25-39 pts = Proficient (3), 40-50 pts = Advanced Proficient (4). Complete grading should also include other details not included here as Judging Criteria: for instance, written report details, completion of deadline tasks, display guidelines, model quality, etc.

Science Fair ~~Inventions~~: ~~Engineering~~ Innovations (6th-8th Grade)

Rubric for School Site Science Fair



	Attempted 1	Proficient 3	Advanced Proficient 5
Problem (x2) <i>(Double Points)</i>	Addresses a practical need to which there is already a common solution, or addresses an issue of little practical value.	Addresses a somewhat practical need some people have, which may have an expensive or uncommon solution.	Creatively addresses a practical need some people have, which may have an expensive or uncommon solution.
Research	Cites one or no information resource (e.g., text, encyclopedia, businesses, magazines, catalogs, internet, or interviews). Fails to mention a known similar idea in common use, or material is copied rather than written in the student's own words.	Cites few information resources. Mentions known similar ideas with some elaboration. Makes a general connection to a similar idea in the student's own words.	Cites at least four types of resources Makes a clear and well-elaborated connection with a known similar idea in the student's own words.
Possible Solutions	Proposes three or fewer solutions, some of which may be fanciful. Solution description is limited.	Proposes at least three practical solutions with limited description.	Proposes three or more practical solutions. One or more are very creative. Provides sufficient description for reader to understand.
How Invention Works	Provides few details, leaving the reader unclear about how the invention works.	Provides adequate details, giving the reader a general understanding of how the invention works.	Explains the invention, addressing all details, giving the reader a clear understanding of how the invention works.
Chart for Evaluating Invention	Student-developed criteria may be generic and do not apply specifically to the problem. Or, criteria may not be student-developed.	Criteria are student-developed. Some criteria apply to how the invention addresses the problem.	Criteria are student-developed specifically for the project and apply directly to how the invention addresses the problem.
Obstacles	Fails to analyze obstacles related to the practical design and function of the invention (i.e., may list obstacles that refer only to shopping for materials or cosmetic issues).	Provides adequate analysis of the obstacles related to the practical design and function of the invention (i.e., may discuss durability, strength, ease of use, cost/benefit for potential customers, etc.).	Demonstrates in-depth analysis of the obstacles related to the practical design and function of the invention.
Revised Solutions	Revised solutions do not address the obstacles mentioned, or are not practical.	Revised solutions practically address the obstacles mentioned.	Revised solutions practically address the obstacles mentioned and consider durability or other future issues.
Science Concepts	Provides limited or no explanation of science concepts. Explanation may not apply to the project.	Provides an adequate explanation of at least one science concept, which has some application to the project.	Provides in-depth explanation of at least one science concept directly applying to the project.
Display Presentation	Project has limited eye appeal or is not easily readable at approximately two feet distance. The project has limited organization, or contains confusing visuals, or contains major language or spelling errors.	Project is appealing and readable at approximately 2 feet distance. It is organized and clear, uses understandable visuals and/or models, and contains few language and spelling errors.	Project is appealing and neat, and is readable at approximately 2 feet distance. It is well organized and clear, makes striking use of inventive or amusing visuals and/or models, and uses language and spelling flawlessly.

(Projects will receive between 10 and 50 points when all rubric criteria have been addressed.)



Science Fair Rube Goldberg Device (6th - 8th Grade)

Rubric for School Site Science Fair

	Attempted 1	Proficient 3	Advanced Proficient 5
Task	The device performs a simple task that has no practical value.	The device performs a simple task some people would find practical.	The device performs a task that is moderately complicated, or that many people would find practical.
Research	Cites two or fewer sources of information about energy, or uses the wrong format, or uses only one type of information resource. Makes little or no connection to the actual energy transformations of the device.	Cites three or more sources of information about energy in the correct format, using at least two types of information resources. Makes a general connection to the types of energy transformations of the device in the student's own words.	Cites four or more sources of information about energy, in the correct format, using at least three types of information resources. Makes clear and well-elaborated connections to each energy transformations of the device in the student's own words.
Preliminary Design	Diagram and notes show limited progress toward making a working device, or have fewer than eight energy transfers, or use only two or three types of energy.	Diagram and notes show a proposed device with at least eight energy transfers using four types of energy.	Diagram and notes show a proposed device with at least ten energy transfers using five or more types of energy.
Obstacles <i>(double points)</i> x2	Fails to analyze obstacles related to the practical design, construction, and stable function of the invention (i.e., may list obstacles that refer only to shopping for materials or cosmetic issues).	Provides adequate analysis of the obstacles related to the practical design, construction, and stable function of the device.	Demonstrates in-depth analysis of the obstacles related to the practical design, construction, and stable function of the device.
Final Design with Key <i>(double points)</i> x2	Drawing is not rendered in ink, or is unclear or incomplete in showing the operating pieces and structural supports. Or, the labels and explanations for the energy transfers are significantly flawed.	Drawing is made in ink. It reasonably represents the operating pieces and the necessary structural supports. Energy transfers are labeled and explained with minor omissions or mistakes.	Drawing is made in ink. It clearly shows each operating piece and the necessary structural supports. All energy transfers are well labeled and explained.
Reflection	Student fails to describe both challenges and rewards of the project, or omits or makes unclear applications to personal strengths and possible career goals.	Student describes some challenges and rewards of the project, making applications to personal strengths and possible career goals.	Student clearly describes challenges and rewards of the project, making numerous applications to personal strengths and possible career goals.
Device Operation <i>(double points)</i> x2	Live device (or video recording) does not demonstrate complete operation without a break and without assistance after starting the device. Student narrates, from start to finish, the transfers of energy from object to object, but has significant omissions or inaccuracies.	Live device (or video recording) shows complete operation without a break and without assistance after starting the device. Student narrates, from start to finish, the transfers of energy from object to object with minor omissions or inaccuracies.	Live device (or video recording) proves complete and reproducible operation without a break and without assistance after starting the device. Student narrates, from start to finish, the transfers of energy from object to object without omissions or inaccuracies.

(Projects will receive between 10 and 50 points when all rubric criteria have been addressed.)

Energy Forms to Use in Rube Goldberg Device Projects:

Potential Energy (Stored) Forms

- Gravitational in height
- Chemical in the bonds of fuels/foods
- Elastic in stretched or compressed objects
- Electrostatic in charged objects
- Magnetic in magnetized objects
- Nuclear in the nucleus of atoms

Active Energy Forms

- Mechanical (Kinetic) moving objects
- Electrical moving charges
- Thermal moving atoms/molecules
- Electromagnetic moving photons



Science Fair Scientific Survey Projects (7th Grade)

Rubric for School Site Science Fair

	Attempted 1	Proficient 3	Advanced Proficient 5
Problem <i>(Double Points)</i> (x2)	States the problem as a question that is vague, or as a statement, or addresses an issue to which the student already knows the answer. Shows limited or no connection to a valid scientific or mathematical concept	States problem as a question, and represents a genuine learning opportunity for the student. Generally addresses a valid scientific or mathematical concept.	States problem as a question, provides evidence that it comes from the student's personal interests or experiences, and represents a genuine learning opportunity for the student. Specifically addresses a valid scientific or mathematical concept, or has a beneficial application to some aspect of society.
Preliminary Research	Uses limited sources from only one type of information resource (e.g., text, encyclopedia, businesses, magazines, catalogs, internet, or interviews), or uses some resources that are not reputable sources. Fails to mention what is already known about the problem, or material is copied rather than written in the student's own words.	Uses three or more reputable sources, cited correctly. Cites more than one type of information resource. Makes a general connection between the research and the problem in the student's own words.	Uses five or more reputable sources, cited correctly. Student cites at least four types of sources. Makes a clear connection between each source and the problem in their own words.
Hypothesis	Hypothesis is either not testable or does not connect to the stated problem, or shows no connection to the research.	Hypothesis is complete (in one sentence), testable, addresses the stated problem, and shows some connection to the research.	Hypothesis is complete (in one sentence) and is testable, and clearly addresses the stated problem. Student clearly shows a direct connection to their research.
Procedure <i>(Double Points)</i> (x2)	Survey questions are not relevant to the hypothesis, or ambiguous, or are biased (leading) questions. Or, the survey only samples a small number of people and makes no attempt to randomize the respondents. There is no intention to determine anything beyond the direct answers to the questions.	Survey questions are relevant to the hypothesis and unbiased. The procedure shows efforts to sample the largest number of people possible and seeks to randomize the respondents. There is no intention to determine anything beyond the direct answers to the questions.	Survey questions are relevant to the hypothesis and unbiased. The student clearly surveys the largest number of people possible and seeks to randomize the respondents. The survey is designed to determine something more than just answers to the individual questions.
Results <i>(Double Points)</i> (x2)	Fails to clearly summarize data from the survey or is displays it in only one way. Or, relationships, trends, and patterns are either not related to the problem or not evident at all. Does not make note of flaws or unexpected results, and does not make predictions about what might happen if part of the survey or the conditions of the survey were changed.	Summarizes data from the survey and visually displays it using at least two types of graphs and charts. Highlights trends or patterns relevant to the problem. May note flaws or unexpected results, but does not make reasonable predictions about what might happen if part of the survey or the conditions of the survey were changed.	Summarizes data from the survey and visually displays it using at least two well-chosen types of graphs and charts. Highlights trends or patterns relevant to the problem. Notes flaws or unexpected results (if any) and makes reasonable predictions about what might happen if part of the survey or the conditions of the survey were changed.
Conclusions	Conclusion does not answer the problem, or does not refer back to the hypothesis, or contradicts the evidence collected.	Conclusion answers the problem and states if the hypothesis was supported or rejected.	Conclusion completely answers all aspects of the problem. It also states if the hypothesis was supported or rejected, and explains why.
Visual Quality of Display	Project has limited eye appeal or is not easily readable at approximately two feet distance. The project has limited organization, or contains confusing visuals, or contains major language or spelling errors.	Project is appealing and readable at approximately 2 feet distance. It is organized and clear, uses understandable visuals and/or models, and contains few language and spelling errors.	Project is appealing and neat, and is readable at approximately 2 feet distance. It is well organized and clear, makes striking use of inventive or amusing visuals and/or models, and uses language and spelling flawlessly.

(Projects will receive between 10 and 50 points when all rubric criteria have been addressed.)



Science Fair **Engineering Projects** (9th-12th Grade)

Rubric for School Site Science Fair

	Attempted 1	Proficient 3	Advanced Proficient 5
Problem (x2) <i>(Double Points)</i>	Addresses a practical need to which there is already a common solution, or addresses an issue of little practical value.	Addresses a somewhat practical need some people have, which may have an expensive or uncommon solution.	Creatively addresses a practical need some people have, which may have an expensive or uncommon solution.
Research	Cites one or no information resource (e.g., text, encyclopedia, businesses, magazines, catalogs, internet, or interviews). Fails to mention a known similar idea in common use, or material is copied rather than written in the student's own words.	Cites few information resources. Mentions known similar ideas with some elaboration. Makes a general connection to a similar idea in the student's own words.	Cites at least four types of resources. Makes a clear and well-elaborated connection with a known similar idea in the student's own words.
Possible Solutions	Proposes three or fewer solutions, some of which may be fanciful. Solution description is limited.	Proposes at least three practical solutions with limited description.	Proposes three or more practical solutions. One or more are very creative. Provides sufficient description for reader to understand.
How Invention Works	Provides few details, leaving the reader unclear about how the invention works.	Provides adequate details, giving the reader a general understanding of how the invention works.	Explains the invention, addressing all details, giving the reader a clear understanding of how the invention works.
Chart for Evaluating Invention	Student-developed criteria may be generic and do not apply specifically to the problem. Or, criteria may not be student-developed.	Criteria are student-developed. Some criteria apply to how the invention addresses the problem.	Criteria are student-developed specifically for the project and apply directly to how the invention addresses the problem.
Obstacles	Fails to analyze obstacles related to the practical design and function of the invention (i.e., may list obstacles that refer only to shopping for materials or cosmetic issues).	Provides adequate analysis of the obstacles related to the practical design and function of the invention (i.e., may discuss durability, strength, ease of use, cost/benefit for potential customers, etc.).	Demonstrates in-depth analysis of the obstacles related to the practical design and function of the invention.
Revised Solutions	Revised solutions do not address the obstacles mentioned, or are not practical.	Revised solutions practically address the obstacles mentioned.	Revised solutions practically address the obstacles mentioned and consider durability or other future issues.
Science Concepts	Provides limited or no explanation of science concepts. Explanation may not apply to the project.	Provides an adequate explanation of at least one science concept, which has some application to the project.	Provides in-depth explanation of at least one science concept directly applying to the project.
Display Presentation	Project has limited eye appeal or is not easily readable at approximately two feet distance. The project has limited organization, or contains confusing visuals, or contains major language or spelling errors.	Project is appealing and readable at approximately 2 feet distance. It is organized and clear, uses understandable visuals and/or models, and contains few language and spelling errors.	Project is appealing and neat, and is readable at approximately 2 feet distance. It is well organized and clear, makes striking use of inventive or amusing visuals and/or models, and uses language and spelling flawlessly.

(Projects will receive between 10 and 50 points when all rubric criteria have been addressed.)



Science Fair *Experimental Projects* (9th – 12th Grade)

Rubric for School Site Science Fair

	Attempted 1	Proficient 3	Advanced Proficient 5
Problem <i>(Double Points)</i> (x2)	States the problem as a question that is vague, or as a statement, or addresses an issue to which the student already knows the answer. Shows limited or no connection to a valid scientific or mathematical concept.	States problem as a question, and represents a genuine learning opportunity for the student. Generally addresses a valid scientific or mathematical concept.	States problem as a question, provides evidence that it comes from the student's personal interests or experiences, and represents a genuine learning opportunity for the student. Specifically addresses a valid scientific or mathematical concept, or has a beneficial application to some aspect of society.
Preliminary Research	Uses limited sources from only one type of information resource (e.g., text, encyclopedia, businesses, magazines, catalogs, internet, or interviews), or uses some resources that are not reputable sources. Fails to connect the research to the problem, or material is copied rather than written in the student's own words.	Uses three or more reputable sources, cited correctly. Cites more than one type of information resource. Makes a general connection between the research and the problem in the student's own words.	Uses five or more reputable sources, cited correctly. Cites at least four types of information resources. Makes a clear connection between each source and the problem in the student's own words.
Hypothesis <i>(Double Points)</i> (x2)	Hypothesis is either not testable or does not connect to the stated problem, or shows no connection to the preliminary research.	Hypothesis is complete (in one sentence), testable, addresses the stated problem, and shows some connection to the preliminary research.	Hypothesis is complete (in one sentence), testable, and clearly addresses the stated problem. Shows a direct connection to their preliminary research.
Procedure & Materials	Experiment is not relevant to the hypothesis or is only performed once. The procedures outlined are seriously incomplete or not sequential, or materials list is missing or incomplete.	Experiment is adequate to test the hypothesis, but may leave some unanswered questions. Performs experiment one or more times. Procedures are outlined in a step-by-step fashion, but there may be 1 or 2 gaps that require explanation. Major materials are listed.	Experiment is a well-constructed test of the hypothesis and is performed several times. Procedures are outlined in a step-by-step fashion that could be followed by anyone without additional explanations. All relevant materials are listed.
Results <i>(Double Points)</i> (x2)	Does not summarize data clearly. The relationship between the variables is unclear or not discussed. Makes no predictions about what might happen if part of the experiment were changed to better test the hypothesis or answer a further question.	Summarizes the data in a way that clearly describes what was discovered using graphs or charts. Mentions at least one relationship between the variables and gives some analysis of trends/patterns. May attempt predictions about what might happen to the results if part of the experiment were changed to better test the hypothesis or answer a further question.	Summarizes the data in a way that clearly describes what was discovered using graphs or charts. Discusses relationships between the variables and thoroughly analyzes trends/patterns. Makes well-reasoned predictions about what might happen if part of the experiment were changed to better test the hypothesis or answer a further question.
Conclusions	Conclusion does not answer the problem, or does not refer back to the hypothesis, or contradicts the evidence collected.	Conclusion addresses the problem, states if the hypothesis was supported or rejected, and gives some explanation why.	Conclusion completely answers all aspects of the problem, states if the hypothesis was supported or rejected, and clearly cites evidence to explain why.
Visual Quality of Display	Project has limited eye appeal or is not easily readable at approximately two feet distance. The project has limited organization, or contains confusing visuals, or contains major language or spelling errors.	Project is appealing and readable at approximately 2 feet distance. It is organized and clear, uses understandable visuals and/or models, and contains few language and spelling errors.	Project is appealing and neat, and is readable at approximately 2 feet distance. It is well organized and clear, makes striking use of inventive or amusing visuals and/or models, and uses language and spelling flawlessly.

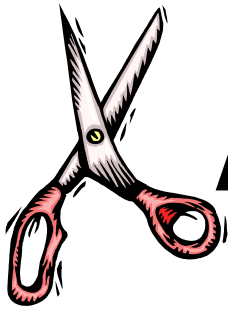
(Projects will receive between 10 and 50 points when all rubric criteria have been addressed.)



SCIENCE TOPICS FOR GRADES 6-12

Try to choose a science project that lines up with a science topic covered during your current school year. Or, you might choose to do a science project from next year's topics. Use the list of topics below to help you think of project ideas if you are not sure how to start.

	Earth Sciences	Life Sciences	Physical Sciences
6th	<ul style="list-style-type: none"> ▪ Earth's Layers ▪ Plate Tectonics ▪ Mountain Building ▪ Earthquakes, Faults, and Epicenters ▪ California Geology ▪ Mechanical & Chemical Weathering ▪ Minerals ▪ Rock Cycle (Igneous, Metamorphic, and Sedimentary) ▪ Sun's Effect on Weather ▪ Convections ▪ Solar Energy ▪ Atmospheric Conditions ▪ Natural Resources ▪ Stratigraphy: Fossil Locations Rock ▪ Geologic Timeline of Earth's History ▪ Formation of Fossils ▪ Methods of Dating Earth's History 	<ul style="list-style-type: none"> ▪ Food Chains / Food Webs ▪ Ecosystems ▪ Human Impacts on Ecosystems 	<ul style="list-style-type: none"> ▪ Density (Qualitative) ▪ Energy ▪ Temperature vs. Heat ▪ Heat Transfer
7th		<ul style="list-style-type: none"> ▪ Cell Similarities & Differentiation ▪ Function of Cell Structures ▪ Energy at the Cellular Level ▪ Photosynthesis / Respiration ▪ Mitosis ▪ Genetics ▪ DNA – RNA – Protein ▪ Sexual / Asexual Reproduction ▪ Meiosis ▪ DNA, Genes, & Alleles ▪ Dominant & Recessive Traits ▪ Theory of Evolution ▪ Natural Selection ▪ Body Systems ▪ Taxonomic Keys ▪ Kingdoms & Major Phyla 	
8th	<ul style="list-style-type: none"> ▪ Galaxies and Stars ▪ Life Cycles of Stars (Nebular Theory, Novas, etc.) ▪ Distances in Astronomy ▪ Light Sources and Reflectors in the Universe ▪ Cosmology (Universe Origin) ▪ Solar System 	<ul style="list-style-type: none"> ▪ Simple Machines and the Human Body ▪ Blood Pressure and Heart Valves ▪ Organic Chem. / Biochem. 	<ul style="list-style-type: none"> ▪ Observing and Defining Motion ▪ Forces and their Effects ▪ Gravity's Large Scale Effects ▪ Basic Atomic Theory ▪ Metals, Non-metals, Inert Gases ▪ Electrons beyond the Bohr Model ▪ Ions and Isotopes ▪ Physical & Chemical Properties ▪ Element vs. Compound Properties ▪ Chemical Bonding ▪ Atoms and Ions Forming Solids ▪ Chemical Equations & Conservation of Matter ▪ Exothermic vs. Endothermic ▪ Acids, Bases, and pH ▪ Density & Buoyancy ▪ Sound and Light Energy
9th through 12th	<ul style="list-style-type: none"> ▪ Earth's Place in the Universe ▪ Dynamic Earth Processes ▪ Energy in the Earth System ▪ Biogeochemical Cycles ▪ Structure and Composition of the Atmosphere ▪ California Geology 	<ul style="list-style-type: none"> ▪ Cell Biology ▪ Genetics ▪ Ecology ▪ Evolution ▪ Physiology 	<ul style="list-style-type: none"> ▪ Motion and Forces ▪ Conservation of Energy ▪ Heat and Thermodynamics ▪ Waves ▪ Electromagnetic and Magnetic Phenomena ▪ Atomic and Molecular Structure ▪ Chemical Bonds ▪ Gases ▪ Acids and Bases ▪ Chemical Thermodynamics ▪ Organic and Biochemistry



SCIENCE FAIR

MATERIALS SOURCES



Alin Party Company

4139 Woodruff Ave., Lakewood
(562) 420-2489

CM School Supplies

5440 E. Del Amo, Long Beach
(562) 429-2425

Home Depot

2450 Cherry Ave., Signal Hill
(562) 595-9200
751 Spring St., Signal Hill
(562) 426-4667
5000 Hardwick St., Lakewood
(562) 529-3500
www.homedepot.com

Lowe's

7300 E. Carson St., Long Beach
(562) 421-9996
2840 Bellflower Blvd., Long Beach
(562) 496-8120
www.lowes.com

Lyon's Art Supply

420 E. 4th Street
Long Beach, CA
(562) 435-5383

Michael's Crafts

4000 Hardwick St., Lakewood
(562) 633-1913
7320 Carson St., Long Beach
(562) 377-0669

Office Depot

2301 E. Willow, Signal Hill
(562) 427-6333

Radio Shack

For a location near you, call
(800) 843-7422

Staples

3515 Atlantic Avenue, Long Beach
(562) 427-6477
4600 Pacific Coast Highway, LB
(562) 597-1922
7400 E. Carson St., Long Beach
(562) 377-0403
www.staples.com
1-800-378-3-2753



COMMUNITY RESOURCES

Airports

If your project deals with aeronautics, then an airport would be a good place to locate information. Airports often employ meteorologists who may help you with a project dealing with weather

Animal Hospitals and Wildlife Rescue Centers

Often veterinarians are willing to help students with science projects. If you need an appointment, call about a week in advance.

Botanical Gardens and Commercial Nurseries

Plant specialists can be found at local botanical gardens and nurseries. Sometimes they will donate materials if you explain your project to them.

Colleges and Universities

Local college and university libraries offer you a wider selection of references than your local library. Scientists on the faculty may help you and even allow you to use their laboratory facilities.

Government Agencies

Look in your telephone book for government agencies. Agencies are listed under Federal, State, and Municipal categories. The California Department of Fish and Game in Long Beach is a good source.

GPO

Send a letter to the address below indicating what topic area you are interested in and they will send you a catalog of available books and pamphlets.

U.S. Government Printing Office
Superintendent of Documents
Washington, D.C. 20402

Hospitals and Medical and Dental Offices

Many hospitals have an education department that you can contact. They also have libraries with up-to-date information. Perhaps your family physician or dentist can give you some assistance.

Industries

Major industries have specialists that may be willing to help. Locate them with your telephone book or magazine advertisements. When writing to corporations, include "Public Relations Department," in the address on the envelope and in the letter.

Nature Centers, Parks, and Marine Reserves

Naturalists work at nature centers. They will be able to give you information if your project involves natural environments and ecosystems.

Telephone Books

The Yellow Pages of your telephone book, especially a commercial telephone directory, will give you names, addresses, and general product information. When calling anyone, remember to be polite. Give your name and tell exactly why you are calling.

Zoos and Aquariums

The L.A. and San Diego zoos, Sea World, the Cabrillo Marine Aquarium in San Pedro, and the Long Beach Aquarium of the Pacific have education departments that are often willing to help. They may be able to arrange a meeting for you with an animal keeper or zoologist.



INTERNET REFERENCES

Internet use and web sites:

- You may get ideas and material from the internet.
- You are not allowed to copy a science project from the internet. You must modify it to contain both a control and a variable
- Parents must oversee the web sites that their child visits; many have pop-ups and links that are not for elementary school age students.
- Using information from the web is just like a book, word for word is plagiarism and you need to include it in your bibliography.
- To use copyright protected pictures and text from a web site; you must get permission from the author. This usually takes a long time.
- Include a print out of permission (email is OK) in the bibliography.
- Refer to the Web Site list in this handout.



WARNING!

- Anyone can create a Web site; this does not mean its information is correct!
- Make sure the web site is run by a large, recognized group such as a college or organization.
- DOT “org” or “edu” are generally trustworthy for accuracy of content.

Web site samples that can be used for research:

Description	URL
Internet Public Library	http://www.ipl.org
Within the library, Kid friendly	http://www.ipl.org/div/kidspace/projectguide/
National Oceanic & Atmosphere Administration	http://www.noaa.gov/
Weather and ocean related phenomena	http://www.education.noaa.gov/
US Government web site for kids	http://www.kids.gov/
US Geological Survey (USGS)	http://www.usgs.gov/
Earthquake section of USGS	http://earthquake.usgs.gov/4kids/
Geology section of USGS	http://geology.usgs.gov/index.shtml
Fish and Wildlife (Department of the Interior)	http://www.fws.gov/
Discovery Channel Science Fair	http://school.discovery.com/sciencefaircentral/
Jet Propulsion Laboratory	http://jpl.nasa.gov/kids/
How Stuff Works	http://www.howstuffworks.com
Science page of How Stuff Works	http://www.science.howstuffworks.com

LIBRARY REFERENCES

150 PSYCHOLOGY & SOCIAL SCIENCES

510 MATHEMATICS

Number System
Arithmetic
Geometry

520 ASTRONOMY

Universe
Solar System
Moon
Planets
Meteors
Black Hole
Comets
Sun
Constellations
Telescope
Map Making

530 PHYSICS

Mechanics
Matter
Gravity
Simple Machines
Energy and Force
Solar
Coal
Gas
Nuclear
Sound
Light
Optics
Color
Prisms
Heat
Electricity
Magnetism
Atomic Energy and Force

540 CHEMISTRY AND ALLIED SCIENCE

Crystallography
Mineralogy



550 SCIENCES OF EARTH AND OTHER WORLDS

Geology (Earth Science)
Structure of the Earth
Volcanoes
Geysers
Floods (Erosions)
Caves
Earthquakes
Oceanography
Meteorology
Climatology and Weather
Economic Geology
Metals and Iron
Water
Gems

560 PALEONTOLOGY (Prehistoric Life)

Fossils
Dinosaurs
Prehistoric Caves
Cave Men
Cave Art

570 LIFE SCIENCES

Human Races
Anthropology
Primitive Societies
Physical Anthropology
Primitive Man
Heredity
Prehistoric Man
Biology
Evolution
Microbes (Viruses)
Microscopes

580 BOTANY

Propagation
Seeds, Flowers, Bulbs
Types of Plants
Wild Flowers
Trees
Vegetables
Vines

