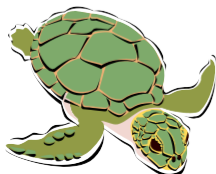
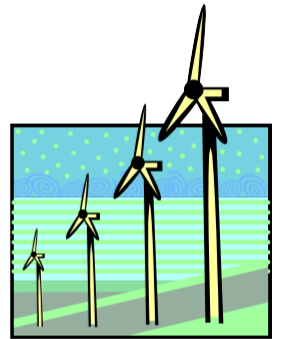
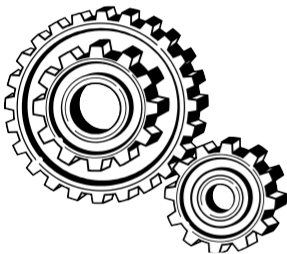
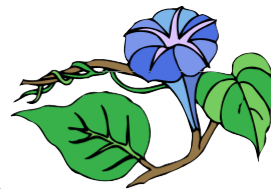
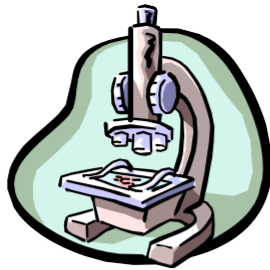


INVENTION PROJECT

6TH – 12TH GRADE



Student Information Packet





SECONDARY

SCIENCE & ENGINEERING FAIR

STUDENT INFORMATION PACKET

Revised 2009, 2011, 2017



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INVENTION PROJECT (DRAFT)

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SCIENCE & ENGINEERING FAIR

STUDENT INFORMATION PACKET

INTRODUCTION



You are surrounded by science. Everything uses some form of science to make it work. Even the chair you sit on was made by a person using tools to build it based on knowledge of science and technology. How did they know what shape to make the saw and how sharp the teeth needed to be to cut wood? How did they know to make one saw for wood and a different one for metal? Why does the wood-cutting saw have larger teeth than the metal-cutting saw?

Science is asking questions and finding answers. A science project, simply put, is the process of asking a question about something you are interested in, for which you don't already know the answer, and then hypothesizing (best-guessing) what the answer might be, researching for information on that topic, experimenting, inventing, surveying, etc., analyzing your results, and coming to a conclusion!

The purpose of a Science & Engineering Fair is to provide a focus for you, the student, to apply skills and concepts you have learned in science as well as in math, reading, writing, and technology. It gives you a place to use these skills creatively in your own way.

What your accomplishment will mean for you:

- ★ Developing self-reliance
- ★ Gaining self-confidence
- ★ Acquiring organizational skills
- ★ Knowing what the scientific method is and how it can help you.
- ★ Having your work viewed and recognized by your school and community

Everything you need to know about doing a great science project is inside this packet. You'll be discussing the contents in class. Approximately every two weeks between now and your school Science & Engineering Fair, your teacher will give you a **Student Timeline for Science & Engineering Fair Project** sheet to check your science project's progress. The timeline sheet is designed to keep you on target, and keep your teacher and parents informed so that they can help you if needed

You must keep this packet, timeline sheets, letters home to parents, and all other information in a separate folder. Your Science & Engineering Fair folder should be kept at home unless your teacher asks you to bring it to school.

You will find the Science & Engineering Fair to be an exciting and rewarding experience. Let's make this year's fair the best ever!

HELPFUL HINTS FOR STUDENTS



- ⊕ Start EARLY; don't wait until the last two weeks before it is due.
- ⊕ Plan it out. It will be much more fun if you spread the time out over several days per week or several weekends, and you won't have to race to get it done!

It might look like this:

Week 1 – Decide on your PROBLEM – what you want to solve.

Week 2 – Conduct your preliminary research by reading information about your topic, visiting libraries, universities, making contact with other sources, and checking out web sites.

Week 3 – Work the steps of your project.

Week 4 – Think about the results and make your charts or graphs.

Week 5 – Write your report.

Week 6 – Make your display.

- ⊕ The goal is that you learn to use “the engineering design process” through direct experience.
- ⊕ Check with your parent or teacher if you want to use a web site for research. Not all web sites give correct information. *Remember:*
 - 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”, “gov” or “edu” are generally trustworthy for accuracy of content.
- ⊕ What is an acceptable Science & Engineering Fair project?
 - Something that answers a question to which you do not know the answer
 - Something you can figure out yourself
 - Something you can change somehow, add another variable, and then predict the outcome. That's an experiment!
- ⊕ What is NOT an acceptable Science & Engineering Fair project?
 - Reproducing results found on the web is *not* an experiment; it's a reproduction.
 - A demonstration is not an experiment (i.e., volcano).

INVENTIONS: ENGINEERING INNOVATIONS



CREATING A SCIENCE & ENGINEERING FAIR INVENTION PROJECT USING THE ENGINEERING DESIGN PROCESS

For Grades 6 through 8

Nearly everything we use, work with, or wear is engineered. Someone had to think of how to design that object to solve a particular problem. Anyone can be an engineer! An engineer is someone who uses knowledge of science and math, and their own creativity to design objects or processes (inventions) to solve problems.

I. PROBLEM

Ask a question about an everyday problem you would like to solve with a practical solution. Inventions can be almost anything created to solve a problem or meet a need. Examples include pencils, cups, cell phones, processes to clean water or move heavy objects, etc.

II. RESEARCH

Research products and processes already available that meet a need or serve a similar function. To do your research, look online, visit stores, read books, and interview experts as well as potential invention users.

III. POSSIBLE SOLUTIONS

Brainstorm as many possible solutions as you can. Imagine different set-ups or designs. Compare and talk about the positive and negative points of each idea. Do not just try your first idea, but choose the *best* one. Reach consensus on which idea is the best possible solution.

Create a plan. Draw a diagram and label the parts of your diagram. Use symbols to label the parts. Make a list of the materials you would like to use for your invention and the amounts you will need.

IV. PLAN & CREATE

A. Diagram: Make a plan. Draw a diagram and label it so that other people can understand your design.

B. Materials: List the materials, including amounts, you will need for your invention. As you collect the materials, consider how you might borrow, make, or use inexpensive materials.

C. Build: Build your invention according to your "plan."

D. Obstacles: Keep a log of difficulties you run into and how you address them.

V. TEST & IMPROVE

A. Test: See if it works! Keep a data log of when and how you tested. Evaluate the results.

B. Improve: Gather information from the "test" of your first design to help find problems that need improvement. Improve your first design to make it better!

C. Re-Test: See if it works better! Add the new data to your data log to show the change.

VI. CONCLUSION & APPLICATIONS

Review how well your invention worked and how it might be useful to others.

VII. SCIENCE CONCEPTS

Explain how your invention uses principles of science to help solve a problem.

SECONDARY INVENTION

WRITTEN REPORT CONTENT

6th - 8th Grade



Scientists always report their research and experiments so that others may benefit from this new knowledge. Some research is reported through published papers while other work is presented at conventions, on TV, or through the Internet. *Your* research will be presented through your written report, a project display, and an oral presentation.

* **TITLE PAGE**

The title page belongs *after* the abstract. The project title must be centered on the page. See the **Written Report Format** sheet for information that needs to be in lower right corner.

* **PURPOSE**

In one short paragraph, tell why you did your project on the topic you chose.

* **ACKNOWLEDGEMENTS**

On one page, say “thank you” to all the people who helped you with your project. Include any family members, teachers, or experts who assisted you with information, materials, or equipment, or participated in some way in your experiment.

* **TABLE OF CONTENTS**

Divide your Table of Contents into sections as indicated on the **Written Report Format** sheet. Put the actual page numbers at the bottom of each page *after* you have finished the final copy of your report.

* **PROBLEM**

State the problem you set out to solve in the form of a one-sentence question. Be specific. Your page numbering begins here.

* **RESEARCH**

This section is a summary in essay form of the information you collected about products and processes already available to meet the need or serve a similar function. Make connections to your own invention. Use notes from books, journals, the Internet, magazines, visits to stores, and interviews with experts as well as potential invention users. If you are required to cite sources within this section, see **Written Report Format for Citing Scientific Research Sources**.

* **POSSIBLE SOLUTIONS**

Describe and/or diagram possible solutions you imagined during your brainstorming. Include a data table that shows positive and negative points (strengths and weaknesses) for each. Identify the solution you chose to try, explaining why you chose it. See **Examples of Data and Graphs**.

* **PLAN & CREATE**

A. DRAFT PLAN

Describe and explain the details of **how your invention will work**. Show your diagram (drawing) with the parts labeled, using symbols.

B. MATERIALS

List and describe the materials you used and briefly tell how and where you obtained them

C. BUILD

Explain how you put your invention together according to your plan.

D. OBSTACLES

Make a log of the troubles you run into with materials or the building process. Discuss how you make changes or discover ways to make it work.

WRITTEN REPORT CONTENT continued:

* **TEST & IMPROVE**

A. TEST

Use your data log, diagram with labels, and any charts you created to explain the ways you tested your invention. Use two or three sentences to evaluate how well your invention worked.

B. IMPROVE

Based on your data, describe changes you made to your invention so that it would work even better.

C. RE-TEST

Tell about the results of your improved design. Did the redesign help or not?

* **CONCLUSION & APPLICATIONS**

Evaluate how well your invention has addressed the problem you posed at the beginning. Explain how your project findings apply to society and/or you personally. Reflect on and write about the benefits of doing this project.

* **SCIENCE CONCEPTS**

Describe how your invention applies scientific concepts. These can be related to things you have learned in class or from other sources. You should cite where you learned the science concept.

* **SOURCES / BIBLIOGRAPHY**

List all books, articles, pamphlets, and other communications or sources that you used for writing your research section. You must have at least three sources, only one of which may be an encyclopedia. College libraries, as well as city libraries, should be used. Interviews with experts in your field of study are encouraged. See Written Report Format for Sources/Bibliography.

BOXED topics are part of the rubric criteria for judging.

The other parts are used only for grading the written report by the teacher.

Review your paper several times to correct errors.
Have someone you trust proofread your report before you make the final copy.

SECONDARY INVENTION

WRITTEN REPORT FORMAT

Each line with a box () in front of it begins a new page in the report.

Title page

Title
in middle of page

In lower right-hand corner.
Last Name, First Name
Grade ____
Teacher Name
School Name
Date (include year)

- Purpose
- Acknowledgements
- Table of Contents (with page numbers)
- Problem (page numbering starts here)
- Research
- Possible Solutions
- Plan & Create
 - Draft Plan
 - Materials
 - Build
 - Obstacles
- Test & Improve
 - Test
 - Improve
 - Re-Test
- Conclusion & Applications
- Science Concepts
- Sources / Bibliography

OTHER POINTS TO REMEMBER:

- ✓ Type or write on one side of paper.
- ✓ Do not put pages in plastic.
- ✓ Make two copies of your original report: Original to teacher, one copy you keep, second copy to use on display board (if you wish).
- ✓ Put report in a store-bought folder with three brads or rings.
- ✓ Put name, subject, period, date, and teacher's name on front of the folder in *upper right-hand corner*.

WRITTEN REPORT FORMAT FOR CITING SCIENTIFIC RESEARCH SOURCES



(When used within the report)

Citations are similar to footnotes in English or history papers but are much easier to include. Citations are included only in the Preliminary Research. Scientific citations are placed *within* the paper itself, not at the bottom of the page. Citations are placed *at the end* of a sentence or paragraph that contains the information you gathered from another source.

- Rule 1:** Cite all sources that refer to information on your species, experiment, or study site.
- Rule 2:** Cite all sources that back up your conclusions.
- Rule 3:** Cite anything that brings in a fact not directly taken from your own personal observations or experiment.
- Rule 4:** When in doubt, cite!

EXAMPLES OF PROPER CITING

(author, date)

White sharks are known to be manateers (Halstead, 1954). They are the only shark that regularly preys on marine mammals for food. Some scientists believe that great whites attack humans by mistake: the silhouette of a surfer paddling on a surfboard may be mistaken for a seal sunning on the surface (Ellis, ed., 1987).

(editor, date)

VARIATIONS IN SCIENTIFIC CITATIONS

One Author	Example	<i>(last name only, date)</i> (Bronowski, 1973)
Two Authors	Example	<i>(both last names only, date)</i> (Walker and Maben, 1980)
Three or More Authors	Example:	<i>(all last names only, date)</i> (Cochran, Wiles, and Kephart, 1975)
No Authors	Example:	<i>(abbreviated title, date)</i> (Insects of Guam, 1942)
Only an Editor	Example:	<i>(last name only, abbreviation for editor, date)</i> (Ellis, ed., 1987)
Citing an Expert You Have Spoken to or Corresponded with	Example:	<i>(last name, "personal communications")</i> (Collins, pers. commun.)



WRITTEN REPORT FORMAT FOR



SOURCES / BIBLIOGRAPHY

Entries in a Sources / Bibliography section of a report are alphabetized by the last name of the author and the date is placed directly afterwards. An entry for which the author is unknown, such as a newspaper article or an unsigned review, is alphabetized by the first word of the title, excluding the articles *A*, *An*, and *The*. Always double-space and *indent the second and succeeding lines of each reference*. Do not number your references and if you have two or more references by the same author, alphabetize them starting with the most recently written paper.

Books

One Author *(last name) (initial) (date) (title) (city) (publisher)*
Bronowski, J. 1973. The Ascent of Man. Boston: Little & Brown, Inc. 376 pp.
(total # of pages only)

By Editor *(editor)*
Ellis, R. (ed.) 1987. Sharks. New York: Wiley, 256 pp.

**2 Authors,
Local Agency** Walker, R. G., and A. Maben. 1980. The Feeding Ecology of Bats.
Guam Div. Aquatic & Wildlife Resources. Mangilao, Guam. 44 pp.
(agency) (city) (country) (total # of pages)

Magazines and Scientific Journal Articles

**3 Authors,
Journal Article** *(last name, first initial, then first initial, last names) (date) (title)*
Cochran, J. A., Wiles, G. and D. Kephart 1975. "Money, Banking, and
the Economy". Fortune 34 (4): 47-55.
(vol.) (no.) (exact pages)

**No Author,
Scientific Bulletin** "Insects of Guam". 1942. Bernice P. Bishop Museum, Honolulu Bull. 17.
(title) (date) (publisher) (bulletin # only)

Newspapers

Basic Entry *(author) (exact day) (title)*
Kristof, Nicholas D. 3 Jan. 1985: "Oil Futures Plunge on OPEC Doubt."
New York Times, D13.
(publisher) (section #)

Encyclopedia, Dictionary, Atlas

Article Within Encyclopedia	<i>(author)</i> Halstead, B.	<i>(date)</i> 1954.	<i>(title)</i> "Poisonous & Dangerous Marine Animals".	<i>(specific pages within)</i> Pp. 105-115 in <u>Encyclopedia Britannica</u> Vol. 93 (C. Brown, ed.), New York: Academic Press.
	<i>(encyclopedia)</i>	<i>(volume)</i>	<i>(editor)</i>	<i>(city)</i> <i>(publisher)</i>
Dictionary Entry	"Advertisement." <u>Webster's Third International Dictionary</u> . (Because the number of the edition appears in the title, the date is not necessary.)			
Atlas Entry	"Hidden Face of the Moon." <u>Times Atlas of the World</u> . 1981 ed.			

Nonprint Sources

Video / Film	<i>(director)</i> Shatner, William, dir.	<i>(date)</i> 1989.	<i>(title)</i> <u>Star Trek V: The Final Frontier</u> .	<i>(actors)</i> With William Shatner, Leonard Nimoy, and DeForest Kelley. Paramount Studios, Hollywood.
				<i>(studio)</i> <i>(city)</i>

Computer Materials

Computer Software	<i>(title)</i> <u>SimEarth</u> .	<i>(date)</i> 1990.	<i>(version)</i> Version 2.0.	<i>(publisher)</i> Sunburst Software,	<i>(city)</i> Green Valley, CA.	<i>(format)</i> CD or DVD
Web Sites	<i>(title)</i> "How to Produce Award-winning Science Projects".	<i>(date)</i> 2005.	<i>(source)</i> Nat. Assoc. of Biology Teachers Bulletin Board, NABT.edu.	<i>(Internet address)</i>		

Citing "personal communications" with an Expert

(in person, on the phone, in letters or on the Internet)

<i>(full name and title)</i> Collins, Dr. Charles	<i>(date interviewed)</i> 2009.	Prof. of Biology, Calif. State Univ., Long Beach, CA	
		<i>(address of work or home)</i>	



EXAMPLES OF DATA TABLES AND GRAPHS

DATA TABLES

Experimentation that produced data in the form of numbers (quantitative data) must be placed in data tables. Data tables are needed in reports so that you can display your observations (data) in a clear, organized form. Several data tables may be included on one page, as long as the format is clear and easy to read.

Data tables should be created on computers. Each table's columns need headings above them (titles). Any units needed (centimeters, seconds, grams, etc.) should appear in the labels, not within the table itself. Rows may also need labels to identify a variable.

Titles for data tables should go *at the top* of each table and include a specific description of the kind of data the table contains. In formal reports, each title should also include the date and location where the data was collected. High school reports working with specific animals or plants should include the scientific as well as the common name. Always remember to underline or put into italics all scientific names.

Table 1. Earth's human population since 1 A.D.

YEAR	POPULATION (in billions)
1	0.25
1600	0.45
1700	0.59
1800	0.90
1900	1.55
2000	6.10

Table 2. The number of brine shrimp found in sections of tubing after the shrimp were exposed to differences in light, pH, or temperature, on October 2, 2009 at Poly High.

VARIABLES	SECTION 1	SECTION 2	SECTION 3	SECTION 4
LIGHT	5 (brightest)	15	68	50 (darkest)
pH	13 (pH 5.5)	37 (pH 6.7)	76 (pH 7.8)	65 (pH 8.6)
TEMPERATURE (°C)	68 (coldest)	64	32	44 (warmest)
CONTROL	23	34	21	37

GRAPHS

Graphs are a perfect way to visually present your data. A data table will show your results in numbers, but is often uninteresting or difficult to interpret. A graph can take the same data, make it eye-catching and easily show large differences in your results. Graphs show comparisons between two or more groups or differences between variables.

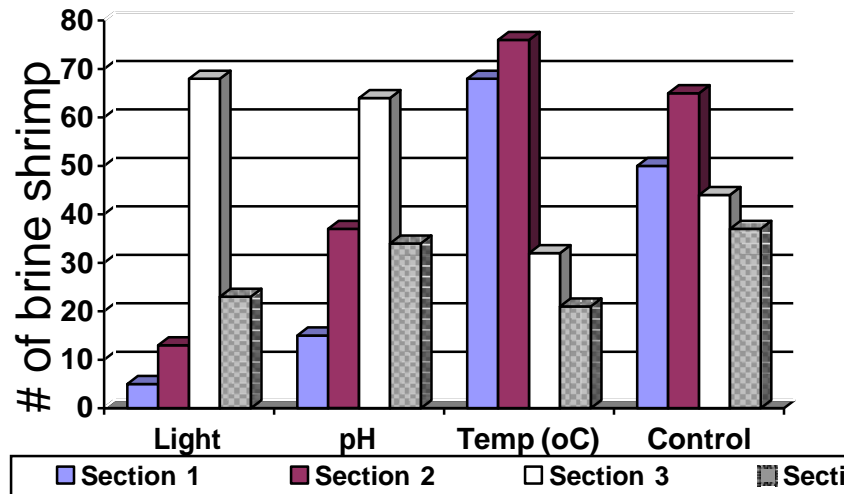
A graph cannot stand alone - it must be preceded by a data table. The data table contains exact details from an experiment that a graph often cannot show. They complement each other: one gives the details, one displays the trends.

Label both the X and Y axes and include any units necessary (grams, centimeters, etc.). Data from **dependent variables** (data that vary as the experiment continues) are placed on the Y axis. Data from

independent variables (data that do not vary during the experiment, such as the days of the week, experimental group numbers, and time periods) are placed on the X axis.

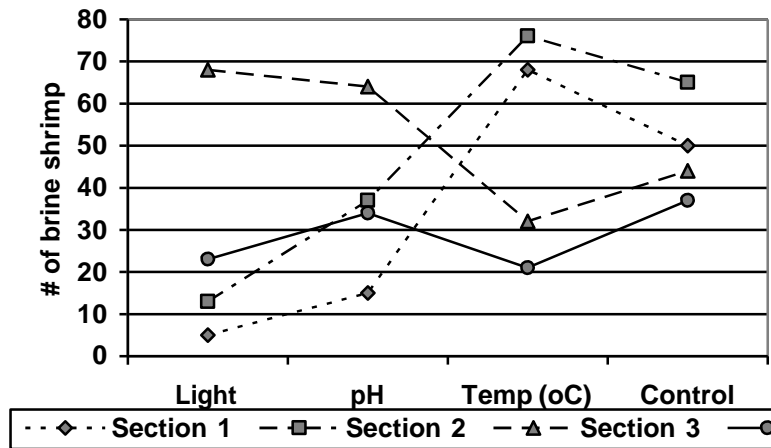
Graphs must be properly titled. The **formal title** for a graph goes **at the bottom** of the graph and like a data table, includes a description of the kind of data the table contains. In formal reports, each title should also include the date and location where the data was collected.

An Example of a BAR GRAPH
(Three variables and the control are graphed)



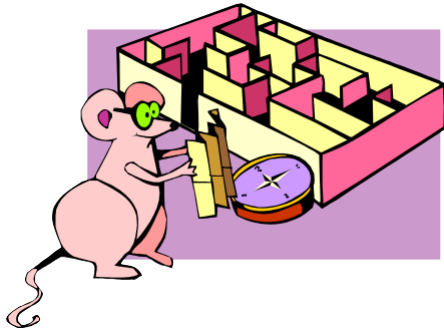
The number of brine shrimp preferring various levels of light, pH, and temperature.
 (See Table 1 for details.)

An Example of a LINE GRAPH
(Three variables and the control are graphed)



The number of brine shrimp preferring various levels of light, pH, and temperature.
 (See Table 1 for details.)

NOTE: The preceding examples show three variables graphed. It is suggested that you use only one variable in your experiment unless you have teacher permission. Also, the preceding examples are of a bar and line graph. As you know, there are other types of graphs that you have seen or made in science and other classes. You may select the type of graph(s) you would like to use in your written report.



SECONDARY INVENTION DISPLAY INFORMATION

BACKBOARD MATERIALS

The backboard must be sturdy and stand by itself on a table. Foam core-board and cardboard are the best materials. If you need to cut through the sides of your core-board to make “wings”, do not cut all the way through.

COLORS

If you need to paint your backboard, enamel paint works best. Do not use water-based paint. Contact paper may also be used. Use a minimum of three contrasting colors on your board.

LETTERING

Your title and subtitles may be computer-generated or cut from construction paper. Do not freehand the letters. The title letters should be 3-4 inches high. The subtitle letters should be 1-2 inches high. The subtitles, which are mandatory on the display board, are: **Purpose**, **Problem**, **Research**, **Possible Solutions**, **Plan & Create**, **Test and Improve**, **Conclusion & Applications**, and **Science Concepts**. All items on the display must be glued to the board. Do not use pins, tacks, staples, or tape.

DRAWINGS, DIAGRAMS, PHOTOS AND GRAPHS

Drawings, diagrams and photos are most useful on the display. Drawings and diagrams should be drawn in pencil first and then retraced. They should be in color and outlined in thin black felt tip pen. Diagrams must have all parts labeled, using symbols to label the parts. Graphs and charts must have explanatory titles. Graph axes must be labeled.

If you have a camera, you should photograph your **invention in** progress. A photo of you with your **invention** is encouraged. All photos must be titled.

DISPLAY DIMENSIONS

1. When backboard (display portion) is flat, it should be 48 inches wide.
2. Side panels (“wings”) should be 12 to 18 inches.*
3. Height should be no more than 48 inches.

REPORT POCKET

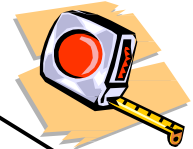
There must be a “pocket” on the display to hold your report.

When you have decided what you are going to put on the backboard (display), lay the unglued display on the floor and look at it carefully. Have family and friends look at it and ask their opinions. Then, you should glue everything into place. Examples of displays will be shown and discussed in class.

DISPLAY SIZE & SET-UP

FOR SCHOOL SITE AND LBUSD SCIENCE &

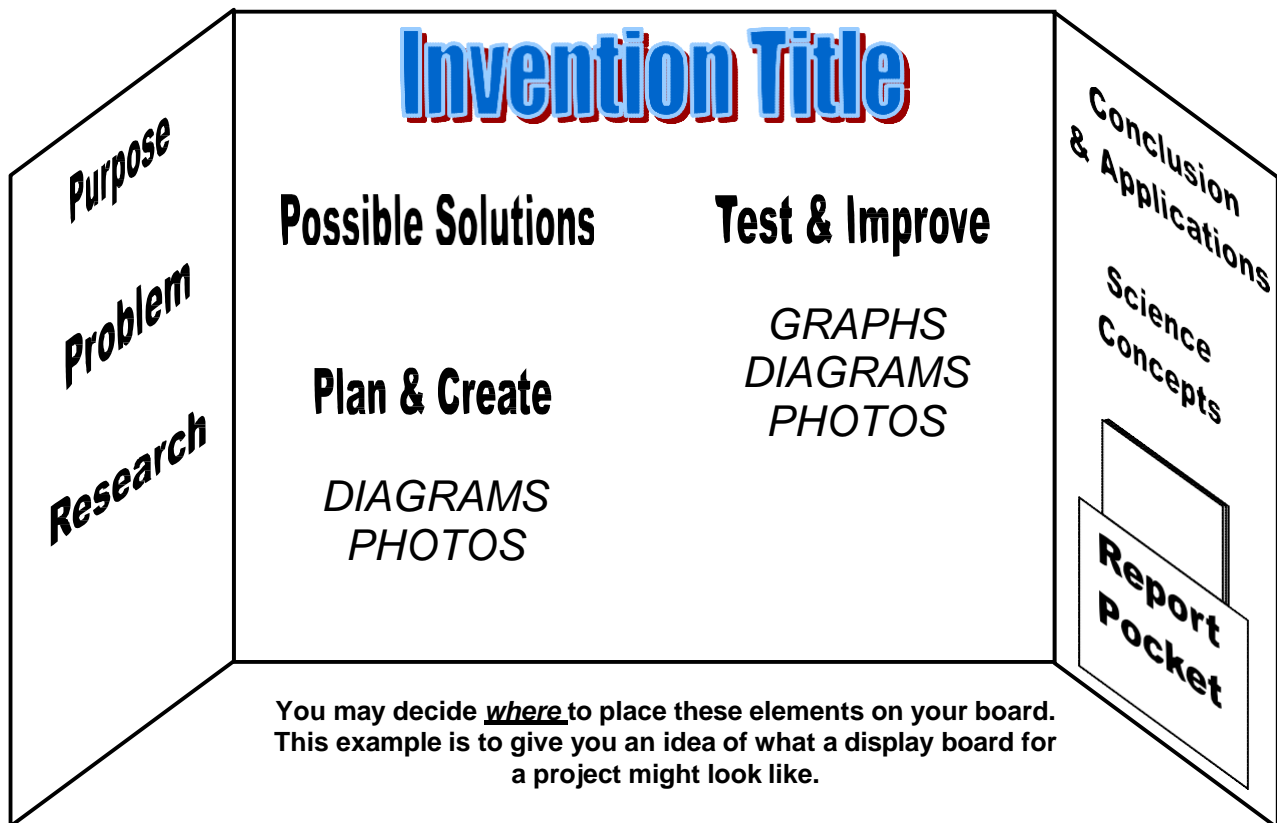
18" max
12" min



48" max
32" min

Minimum sizes are suggested, not required.

48" max
36" min





PURPOSE

PROBLEM

RESEARCH

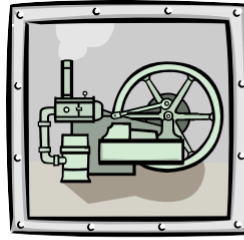
POSSIBLE

SOLUTIONS

PLAN & CREATE

**TEST & IMPROVE
CONCLUSION &
APPLICATIONS
SCIENCE
CONCEPTS**

DISPLAY ITEMS



Part of your display should include something that represents the project and should be placed in front of or on the display board. Depending on the type of project you do, the display items may or may not be the focus of the display.

If you cannot decide what to use to represent your project, brainstorm with family, friends, and classmates. Keep in mind that the items you choose will set the tone for your display and must be approved.

No part of your display may pose a safety hazard. Do not include harmful chemicals, bacterial cultures, sharp objects, or any source of heat or flames. No live or preserved animals are allowed at the LBUSD district-level Science & Engineering Fair, at the Los Angeles County Fair, or at the California State Fair.

Some examples of display items are listed below:

- ◆ **Equipment or materials** you have built or used as part of your project (i.e., an incubator, variously shaped kites, a solar oven, a microscope with slides, etc.)
- ◆ **Models**
- ◆ **Artistic representations** of your topic (i.e., a large paper maché nose for an odor project, toothpick bridges for a physics project, or a collage of leaves for a plant project)
- ◆ **Samples or specimens**
- ◆ **Simulated items** such as photos, video, and audio taken while working on your project or during your experiment. (Keep in mind that use of an extension cords requires special permission.)

There are endless possibilities. Be creative! Put on your thinking cap!

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

Rubric for School Site Science & Engineering Fair



	Attempted 1	Proficient 3	Advanced Proficient 5
Purpose & Problem	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	Fails to mention a known similar idea in common use, or material is copied rather than written in the student's own words.	Mentions known similar ideas with some elaboration. Makes a general connection to a similar idea in the student's own words. May or may not address the needs of potential users.	Makes a clear and well-elaborated connection with a known similar idea and with the needs of potential invention users in the student's own words.
Possible Solutions	Proposes three or fewer solutions, some of which may be fanciful. Solution description is unclear or incomplete.	Proposes three or more practical solutions with limited description.	Proposes three or more practical solutions. One or more are very creative. Provides sufficient description for reader to easily understand.
Plan & Create <i>(Double Points)</i> (x2)	Provides few details, leaving the reader unclear about how the invention works. Or, obstacles encountered in the building process are not mentioned.	Provides adequate diagram and explanation of the invention, giving the reader a general understanding of how the invention works. Obstacles encountered in the building process and their solutions are mentioned briefly.	Diagrams and explains the invention, providing all labels and details needed to give the reader a clear understanding of how the invention works. Obstacles encountered in the building process are described well and solutions to the obstacles are explained.
Test & Improve <i>(Double Points)</i> (x2)	Student-developed criteria may be generic and do not apply specifically to the problem. Or, criteria may not be student-developed. Or, there is no evidence of redesign and retesting.	Criteria are student-developed. Some criteria apply to how the invention addresses the problem. There is evidence of a design change, but connection to data may be unclear. Improved design is tested.	Criteria are student-developed specifically to test how well the invention addresses the problem. The student uses data from the test to improve the design. The improved design is tested using the same criteria as before.
Conclusion & Applications	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). Or, fails to mention applications.	Provides some analysis of the obstacles related to the practical design and function of the invention (i.e., durability, strength, ease of use, etc.). Mentions potential applications.	Demonstrates in-depth analysis of the obstacles related to the practical design and function of the invention (i.e., durability, strength, ease of use, etc.). Invention is clearly connected to real world applications.
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.

Class grade should also include how well timelines were met and elements of the written report not found on the display board:

Title Page, Acknowledgements, Table of Contents, and Sources/Bibliography

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

Targets for an Excellent Science & Engineering Fair Project



	Advanced Proficient 5	“TRANSLATED”
Purpose & Problem	Creatively addresses a practical need some people have, which may have an expensive or uncommon solution.	Explain the problem you want to solve.
Research	Makes a clear and well-elaborated connection with a known similar idea and with the needs of potential invention users in the student's own words.	Research thoroughly. Connect the research to your question.
Possible Solutions	Proposes three or more practical solutions. One or more are very creative. Provides sufficient description for reader to easily understand.	Describe three ideas to solve the problem.
Plan & Create <i>(Double Points)</i> (x2)	Diagrams and explains the invention, providing all labels and details needed to give the reader a clear understanding of how the invention works. Obstacles encountered in the building process are described well and solutions to the obstacles are explained.	For your best idea, make a diagram and explain how it works. Describe difficulties you ran into and how you got past them.
Test & Improve <i>(Double Points)</i> (x2)	Criteria are student-developed specifically to test how well the invention addresses the problem. The student uses data from the test to improve the design. The improved design is tested using the same criteria as before.	Describe how you test your invention to make sure it works well. Explain how you use the results to improve your invention. Describe the results of re-testing after making improvements.
Conclusion & Applications	Demonstrates in-depth analysis of the obstacles related to the practical design and function of the invention (i.e., durability, strength, ease of use, etc.). Invention is clearly connected to real world applications.	Is your invention strong, easy to use? Will it last? Would people really buy it?
Science Concepts	Provides in-depth explanation of at least one science concept directly applying to the project.	Explain what science makes your invention work.
Display Presentation	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.	Make your project fun to look at with pictures and colors. Use large, clear lettering. Check grammar and spelling.

Science & Engineering Fair Inventions: Engineering Innovations (9th-12th Grade)



Rubric for School Site Science & Engineering Fair

	Attempted 1	Proficient 3	Advanced Proficient 5
Abstract	Abstract is missing one or more of the five key components. Or, the solutions, final product, and conclusions are not connected to the original problem.	Runs more than one page, or is incomplete in listing <u>the problem</u> as a question, or <u>relevant research highlights</u> . Or mentions fewer than <u>three possible solutions</u> , or <u>description of the final product</u> is incomplete. Or, explanation of <u>how well the final product addresses the original problem</u> is vague.	In less than one page, clearly <u>states the problem</u> as a question, lists <u>relevant research highlights</u> , mentions at least <u>three possible solutions</u> considered, with a complete <u>description of the final product</u> , and makes <u>summarizes how well the product addresses the original problem</u> .
Purpose & Problem	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.
Possible Solutions	Proposes three or fewer solutions, some of which may be fanciful. Solution description is unclear or incomplete.	Proposes three or more practical solutions with limited description.	Proposes three or more practical solutions. One or more are very creative. Provides sufficient description for reader to easily understand.
Plan & Create <i>(Double Points)</i> (x2)	Provides few details, leaving the reader unclear about how the invention works. Or, obstacles encountered in the building process are not mentioned.	Provides adequate diagram and explanation of the invention, giving the reader a general understanding of how the invention works. Obstacles encountered in the building process and their solutions are mentioned briefly.	Diagrams and explains the invention, providing all labels and details needed to give the reader a clear understanding of how the invention works. Obstacles encountered in the building process are described well and solutions to the obstacles are explained.
Test & Improve <i>(Double Points)</i> (x2)	Student-developed criteria may be generic and do not apply specifically to the problem. Or, criteria may not be student-developed. Or, there is no evidence of redesign and retesting.	Criteria are student-developed. Some criteria apply to how the invention addresses the problem. There is evidence of a design change, but connection to data may be unclear. Improved design is tested.	Criteria are student-developed specifically to test how well the invention addresses the problem. The student uses data from the test to improve the design. The improved design is tested using the same criteria as before.
Conclusion & Applications	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). Or, fails to mention applications.	Provides some analysis of the obstacles related to the practical design and function of the invention (i.e., durability, strength, ease of use, etc.). Mentions potential applications.	Demonstrates in-depth analysis of data related to the obstacles in the practical design and function of the invention (i.e., durability, strength, ease of use, etc.). Invention is clearly connected to real world applications.
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.

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Title Page, Acknowledgements, Table of Contents, Research Detail, and Sources/Bibliography