MENDOCINO COUNTY STUDENT SCIENCE & ENGINEERING PROJECT HANDBOOK

36th Annual
Mendocino County
Science Fair

March 12, 2022

MENDOCINO COUNTY OFFICE OF EDUCATION

Updated October 2021

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Welcome to the 36th Annual Mendocino County Science and Engineering Fair!

As you may know, while we anticipate to have this year's fair in person, we understand that things can change in the blink of an eye.

MCOE will be continually monitoring local health orders/recommendations and will comply with such recommendations. We encourage everyone to continue practicing healthy behaviors that reduce spread and keep our community and students healthy.

Due to COVID-19 and the ever changing circumstances we face, we reserve the right to change this event to be entirely virtual on the zFairs platform. This handbook will outline guidelines for an in-person fair.

For more information on COVID-19 safety guidelines, please visit https://www.cdc.gov/coronavirus/2019-ncov/community/large-events/considerations-for-events-gatherings.html

CONTACT INFORMATION

Science Fair Team

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Mendocino County Science Fair Mission Statement

To encourage and celebrate scientific curiosity and innovative problem solving skills in Mendocino's next generation of leaders.

To facilitate collaborative partnerships with schools and communities, to reward the critical thinking, and to recognize scientific potential of the students of Mendocino County.

Dear Student and Parents/Guardians,

The main purpose of the science fair project is to give you and your child experience in applying proper scientific and engineering methodology, to explore areas of their interest and to learn to do research.

This handbook also goes over the scientific and engineering process that is outlined in the Next Generation Science Standards (NGSS).

While scientific methods and procedures are discussed in school, most of the work for individual projects will be done at home. Parents, your encouragement and help with logistics will be of great value. This handbook will explain all criteria and steps necessary to complete a science fair project or presentation.

Parents, please review this handbook with your child. We are excited to promote critical thinking in our next generation of science leaders. We believe you will enjoy and take great pride in the creative and unique science or engineering project developed by your child.

Science Fair Project Completion Checklist

- ◊ Select your project (see Appendix B for resources to select your topic or find digital resources available through zFairs at ca-mendocino.zfairs.com)
- ◊ Verify that both your parents and coordinators agree that this is a doable project. If you are using live organisms, complete the corresponding form from your coordinator
- ◊ Create and maintain a logbook (see page 5)
- ◊ Be sure to follow all steps of the scientific or engineering methods to properly complete your project
- ◊ Take pictures of your project for possible evidence!
- ◊ Build your display board (see specifications on page 9)
- ◊ Practice answering the sample interview questions to prepare for the day of the fair (see page 14)
- ◊ Show up to the Science and Engineering Fair prepared, on time, and excited!
- ◊ **Parents,** forms you can expect to receive from coordinators before the county fair:
    - ◊ Notice of County Fair participation permission slip
    - ◊ Registering for zFairs (all participants in the county science fair must register on zFairs whether it is in-person or virtual)
    - ◊ Publicity Authorization Release (photo release)
    - ◊ Schedule of events for the day of the science fair

What is a Science or Engineering Project?

What is a science project?

A scientific experimentation project is an attempt to answer a question or solve a problem by creating and conducting an experiment, analyzing and interpreting the data, and constructing a conclusion based on evidence from your experiment. See more explanation on page 6-7.

What is an engineering project?

An engineering project begins by defining a problem, doing background research to find out the criteria and constraints selecting a solution, developing a prototype, and testing if your design best meets the success requirements. See more explanation on page 8.

Selecting Your Project Topic

For many students, one of the most difficult parts of a science project is selecting a topic. A sample list of ideas is provided in this handbook in Appendix B. There are fantastic websites with many ideas for possible science fair projects available on the Mendocino zFairs page. You can find these links by going to the “Student” tab and clicking “Science Fair Project Ideas”. You are encouraged to research additional ideas, as well.

Before deciding on a specific topic or project title, keep in mind that your project should be one that:

- ✓ You are really interested in researching;
- ✓ You are motivated to do;
- ✓ You have information available;
- ✓ You can get the materials and equipment needed;
- ✓ You can actually perform the experiment;
- ✓ You have enough time to work on and complete;
- ✓ And you can do by yourself or with very little help from others except for possible teammates (maximum 3 per team).
- ✓ If you are using live organisms, please complete the corresponding forms from your coordinator.

How to Begin and Maintain a Logbook

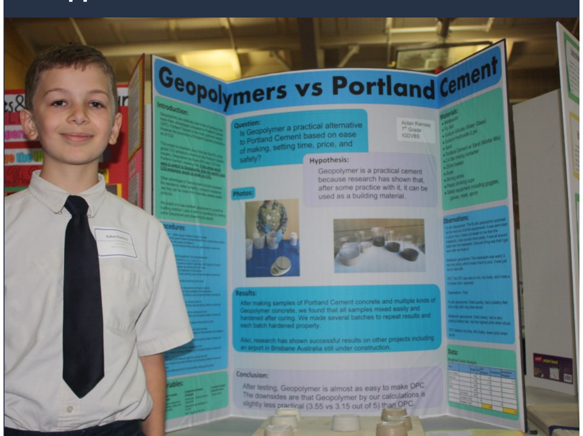
You should first determine if you are going to do a digital* or handwritten logbook. Begin the logbook by recording everything about your project including all of the different topics you considered before selecting your science or engineering project. All entries in your logbook should be dated and include each of the components listed on the right side of this page.

The purpose of the logbook is to make your thinking visible. Judges during the science fair are interested in the quality of your thinking throughout the process. Therefore, the interview questions will be based on information included in your logbook. You can use your logbook during the interview to show the judges evidence. Please see sample student interview questions on page 14 to help guide you to know what to write about.

You may acknowledge those who helped you but refer to them as “teacher,” “parent,” etc.

Do not include the names of people in your log book or on your project display.

***If you decide to do your logbook digitally, please make sure to complete the digital logbook agreement found in Appendix D**



The Logbook

The logbook contains detailed notes of every step of the project from beginning to end. You must complete an <u>original</u> logbook to make your thinking throughout the project visible. This is a necessary requirement not only to verify the authenticity of your work, but also to celebrate the quality of your thinking.

Necessary Logbook Components:

- ✓ **Reading notes, articles, and background research**
  - ✓ “I’ve researched my topic in..”
- ✓ **Planning decisions**
  - ✓ “I’ve decided to experiment with plants” or state the reason why you decided to experiment on your subject.
- ✓ **Actions**
  - ✓ “I’ve gone to the library to find books on my topic. I found a lot of books on… I set up my planters and grow lights, and took pictures of them to show my progress.”
- ✓ **Scientific Experiment or Engineering Design Observations**
  - ✓ “I’ve noticed that the plants are starting to wilt, so I need to water them more. The crystals are very fragile, so I can’t put them on my display. I will need to take lots of pictures.”
- ✓ **Thoughts and reflections**
  - ✓ “I’ve noticed that many of the seedlings are dying. I wish I had used more seeds. I’m worried that all my plants will be dead before the experiment is finished. I wonder why they are dying?”
- ✓ **Research extension ideas**
  - ✓ “The next experiment I would conduct to further my research would be…”

Science Fair Scientific Method Steps to Include

Steps of the Scientific Method	Detailed Help for Each Step
Ask a Question: The scientific method starts when you ask a question about something that you observe: How, What, When, Who, Which, Why, or Where? For a science fair project some teachers require that the question be something	Your Question
Do Background Research: Rather than starting from scratch in putting together a plan for answering your question, you want to be a savvy scientist using library and Internet research to help you find the best way to do things and insure that you don't repeat mistakes from the past.	Background Research Plan Finding Information
Construct a Hypothesis: A hypothesis is an educated guess about how things work. It is an attempt to answer your question with an explanation that can be tested. A good hypothesis allows you to then make a prediction: "If ____*[I do this]* ____, then ____*[this]*____ will happen." State both your hypothesis and the resulting prediction you will be testing.	Variables Variables for Beginners Hypothesis
Test Your Hypothesis by Doing an Experiment: Your experiment tests whether your prediction is accurate and thus your hypothesis is supported or not. It is important that you select only one variable you will test (independent/ manipulated variable). You should also include in your logbook, and on your display board, your controlled variables, independent/manipulated variable, and responding/dependent variable along with a precise description of your procedure. You should either have several test groups or multiple rounds of testing to verify your answer was not caused by an uncontrolled variable (accident).	Experimental Procedure Materials List Conducting an Experiment
Analyze Your Data and Draw a Conclusion: Once your experiment is complete, you collect your measurements (quantitative and qualitative data) and analyze them to see if they support your hypothesis or not. Your conclusion should include: 1) If your hypothesis was supported or not. 2) What evidence from the data proves your conclusion. 3) Your reasoning to	Data Analysis & Graphs Conclusions
Communicate Your Results: To complete your science fair project you will communicate your results to others in a final report and a display board. Professional scientists do almost exactly the same thing by publishing their final report in a scientific journal or by presenting their results on a poster during a conference. *In the science fair, judges are interested in your findings regardless of whether or not they support your original hypothesis.* Regardless of whether your hypothesis was supported, you should include ideas	Final Report Abstract Display Board Science Fair Judging

Comparing Scientific Method & Engineering Method

WHAT IS THE SCIENTIFIC METHOD?

The scientific method is a process for experimentation that is used to explore observations and answer questions. Does this mean all scientists follow exactly this process? No. Some areas of science can be more easily tested than others. For example, scientists studying how stars change as they age or how dinosaurs digested their food cannot fast-forward a star's life by a million years or run medical exams on feeding dinosaurs to test their hypotheses. When direct experimentation is not possible, scientists modify the scientific method. In fact, there are probably as many versions of the scientific method as there are scientists! But even when modified, the goal remains the same: to discover cause and effect relationships by asking questions, carefully gathering and examining the evidence, and seeing if all the available information can be combined in to a logical answer.

Even though we show the scientific method as a series of steps, keep in mind that new information or thinking might cause a scientist to back up and repeat steps at any point during the process. A process like the scientific method that involves such backing up and repeating is called an iterative process.

Whether you are doing a science fair project, a classroom science activity, independent research, or any other hands-on science inquiry understanding the steps of the scientific method will help you focus your scientific question and work through your observations and data to answer the question as well as possible.

Science Buddies (2018). Comparing the Engineering Design Process and the Scientific Method. Retrieved from: https://www.sciencebuddies.org/science-fair-projects/engineering-design-process/engineering-design-compare-scientific-method

Comparing Scientific Method & Engineering Method

What is the Engineering Process?

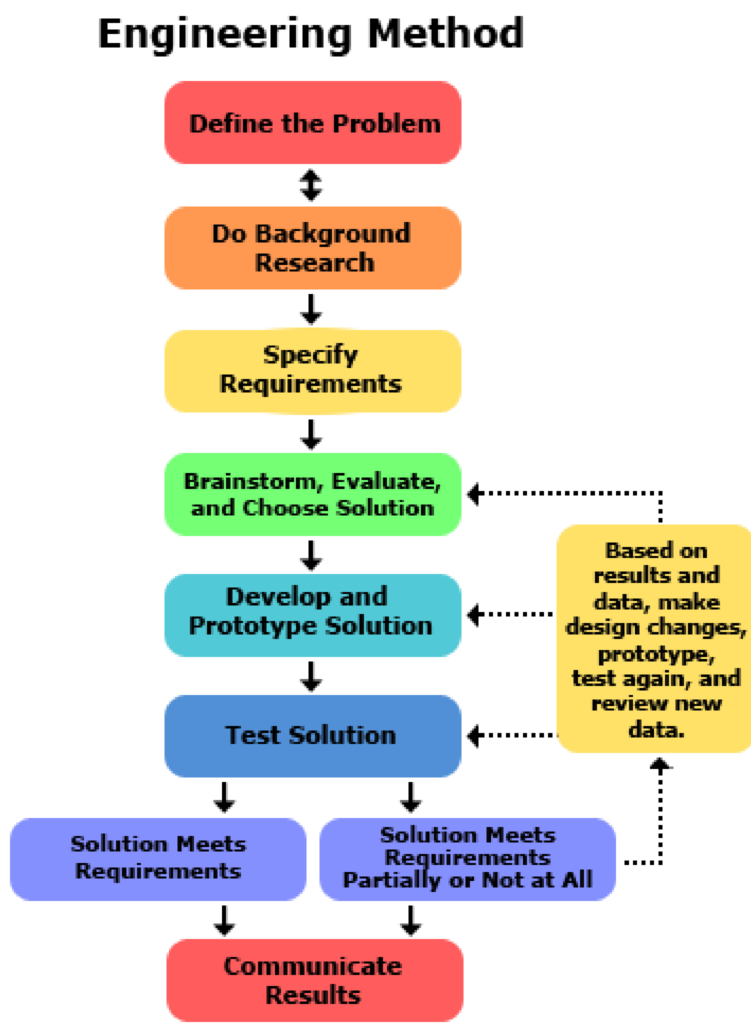
The engineering design process is a series of steps that engineers follow to come up with a solution to a problem. Many times the solution involves designing a product (like a machine or computer code) that meets certain criteria and accommodates certain constraints.

This process is different from the Steps of the Scientific Method, which you may be more familiar with. If your project involves making observations and doing experiments, you should probably follow the Scientific Method. If your project involves designing, building, and testing something, you should probably follow the Engineering Design Process. If you still are not sure which process to follow, ask your Science Fair coordinator.

THE STEPS OF THE ENGINEERING DESIGN PROCESS ARE TO:

- Define the Problem
- Do Background Research
- Specify Requirements (criteria and constraints)
- Brainstorm Solutions
- Choose the Best Solution
- Do Development Work
- Build a Prototype
- Test and Redesign

Engineers do not always follow the engineering design process steps in order, one after another. It is very common to design something, test it, find a problem, and then go back to an earlier step to make a modification or change to your design. This way of working is called iteration, and it is likely that your process will do the same!



Science Buddies (2018). Comparing the Engineering Design Process and the Scientific Method. Retrieved from: https://www.sciencebuddies.org/science-fair-projects/engineering-design-process/engineering-design-compare-scientific-method

Judging Criteria

The Mendocino Science Fair will make every effort to mitigate biased judging by relying on a judges orientation, common rubrics, scoring calibration, and judges may not evaluate a project completed by a student with whom they have a prior relationship.

Judging will be based solely on student work. All projects must clearly distinguish between the work of the student participant and the work of others. Although students may participate in a research opportunity in industry, a university, hospital, or institution other than their school, they must display only their research. No additional content can be added by parents or industry professionals.

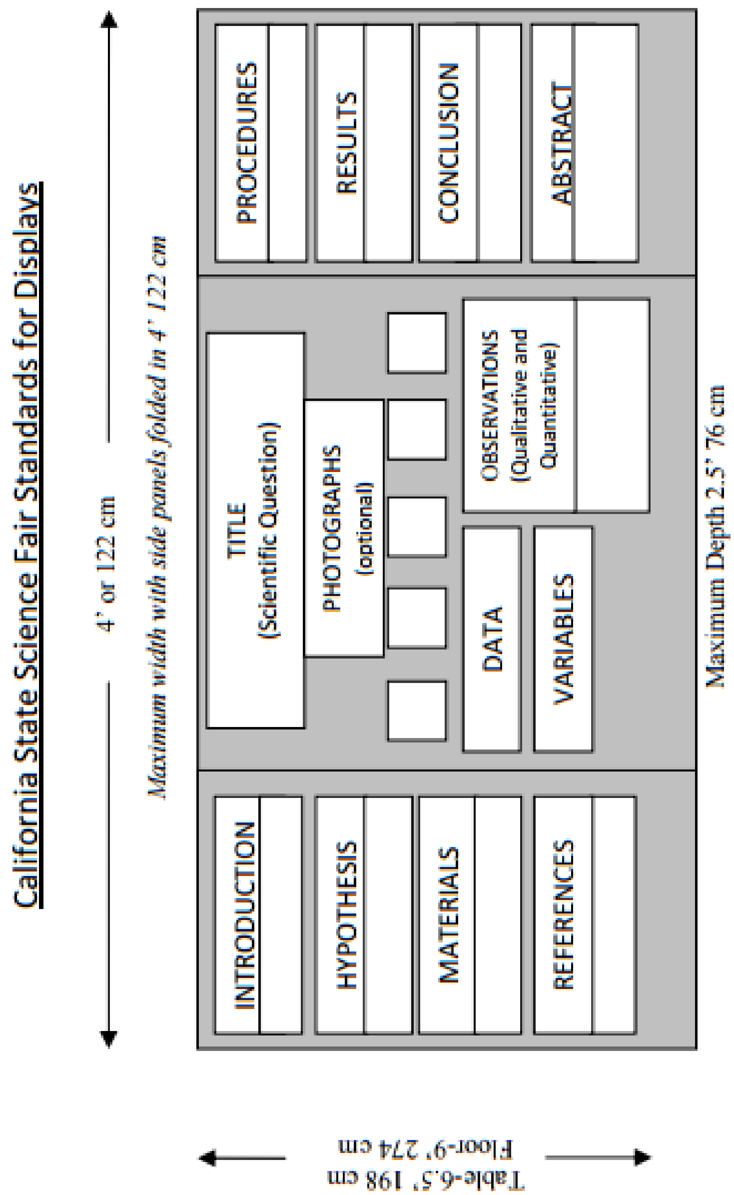
Please see the judging rubrics on pages 10-13.

Display Board Specifications

All projects must be free standing and must have a self-supporting display board. The student's name, school, and grade level should be displayed on the front of the board. Any indication of prizes or awards the project may have won at a local school science fair must be removed for display in the county fair. Listed below is a sample display board format.

Exhibit size:

- Maximum Width: 4 feet or 122 cm
- Maximum Depth: 2.5 feet or 76 cm
- Maximum Height: 6.5 feet or 198 cm on table OR 9 feet or 274 cm on floor.



Judging Rubric (Science)

Design and Methodology (15 pts)

Well designed plan and data collection methods

1	2	3	4	5

Variables and controls defined, appropriate and complete

1	2	3	4	5

Execution: Data Collection, Analysis and Interpretation(20 pts)

Sufficient data collected to support interpretation and conclusions

1	2	3	4	5

Systematic data collection and analysis

1	2	3	4	5

Reproducibility of results

1	2	3	4	5

Appropriate application of mathematical and statistical methods

1	2	3	4	5

Creativity (20 pts)

Project demonstrates significant creativity in one or more of the above criteria

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20

Research Question (10 pts)

Clear and focused purpose

1	2	3	4	5

Identifies contribution to field of study

1	2	3	4	5

Testable using scientific methods

1	2	3	4	5

Judging Rubric (Science cont.)

Presentation - Interview (25 pts)

Clear, concise, thoughtful responses to questions

1	2	3	4	5

Understanding of basic science relevant to project

1	2	3	4	5

Understanding interpretation and limitations of results and conclusions

1	2	3	4	5

Degree of independence in conducting project

1	2	3	4	5

Recognition of potential impact in science, society and/or economics

1	2	3	4	5

Quality of ideas for further research

1	2	3	4	5

For team projects, contributions to and understanding of project by all members

1	2	3	4	5

Presentation - Poster (10 pts)

Logical organization of material

1	2	3	4	5

Clarity of graphics and legends

1	2	3	4	5

Supporting documentation displayed

1	2	3	4	5

Judging Rubric (Engineering)

15% - Design and Methodology (15 pts)	
Exploration of alternatives to answer need or problem	Range: 1 - 5
Identification of a solution	Range: 1 - 5
Development of a prototype/model	Range: 1 - 5

20% - Execution: Construction and Testing(20 pts)	
Prototype demonstrates intended design	Range: 1 - 5
Prototype has been tested in multiple conditions/trials	Range: 1 - 5
Prototype demonstrates engineering skill and completeness	Range: 1 - 5

20% - Creativity (20 pts)	
Project demonstrates significant creativity in one or more of the above criteria	Range: 1 - 20

10% - Research Problem (10 pts)	
Description of a practical need or problem to be solved	Range: 1 - 5
Definition of criteria for proposed solution	Range: 1 - 5
Explanation of constraints	Range: 1 - 5

Judging Rubric (Engineering cont.)

25% - Presentation - Interview (25 pts)	
Clear, concise, thoughtful responses to questions	Range: 1 - 5
Understanding of basic science relevant to project	Range: 1 - 5
Understanding interpretation and limitations of results and conclusions	Range: 1 - 5
Degree of independence in conducting project	Range: 1 - 5
Recognition of potential impact in science, society and/or economics	Range: 1 - 5
Quality of ideas for further research	Range: 1 - 5
For team projects, contributions to and understanding of project by all members	Range: 1 - 5

10% - Presentation - Poster (10 pts)	
Logical organization of material	Range: 1 - 5
Clarity of graphics and legends	Range: 1 - 5
Supporting documentation displayed	Range: 1 - 5

Sample Interview Questions for Students

You should be prepared to answer the following questions.

1. How/where did you get the idea for your project?
2. How did you go about investigating the problem?
3. How accurate is the data? How did you determine the accuracy?
4. Do you think you could/should have done more testing?
5. Does the data support your hypothesis?
6. What are some limitations of the data?
7. What were your greatest challenges or successes during the project?
8. Can you explain more about your methods? (What were your major decisions?)
9. We know you might have needed some help. What help did you receive? Who helped you? And what did they do?
10. What did you learn from your observations/data analysis?
11. How do you know your data is reliable? (Could you replicate this experiment?)
12. What would you do differently next time? What errors did you make?
13. What would you do if you had more time and resources to work on this?
14. What new information (insight) did you gain?
15. What else did you learn that isn't part of your presentation?
16. Can you suggest what experiment should come next?
17. How do you see your research/ project informing this field of science?
18. What are some practical applications or extensions for this kind of investigation?

Safety Rules for Public Display

Anything which could be hazardous for public display is prohibited.

This includes:

- Live insects, or live disease-causing organisms which are pathogenic to vertebrates.
- Microbial cultures of fungi, alive or dead including unknown specimens.
- Chemicals or substances included on the federal list restricted to experimentation at college level or above.
- Flames, open or concealed, or flammable display materials.
- Caustics, acids, or dangerous chemicals.
- Combustible solids, fluids or gases (inert substitutes may be used for display).
- Tanks which have contained combustible gases, including butane and propane.
- Syringes, pipettes, or similar devices.
- Batteries with open top cells.
- No glass or liquids with display —we suggest drawings or photos.

Electrical

1. Bare wires and exposed knife switches may be used only on circuits of 12 volts or less; otherwise standard enclosed switches are required.
2. Electrical connections in 110 volt circuits must be soldered or fixed under approved connectors and connecting wires insulated.
3. Safety precautions for substances in the American Chemical Society booklet, *Safety in academic Chemistry Laboratories,* must be followed.
4. Circuits with 110 volts must have a main disconnect switch of a type approved by the National Board of Underwriters. Where high voltage is used (110 or above) must be plainly labeled with a conspicuous sign stating high voltage.
5. Electric heating elements must be mounted on non-combustible supports in such a manner that a fire cannot possibly start in the exhibit, and enclosures must be thoroughly ventilated.
6. Exhibits producing temperatures exceeding 100°C (212° F) must be adequately insulated.

Suggested List of Invertebrates / Plants for Scientific Investigation

ANIMALS Most of these specimens may be obtained at a pet store, in your own backyard, or may be ordered from a science materials catalog.		**PLANTS/SEEDS** Most of these seeds/plants are fast growing and may be obtained at a nursery, seed store or a health food store.	
Daphnia (transparent water flea)	Fruit Flies	Corn	Radishes
Brine Shrimp	Mealworms	Beans	Peas
Snails	Crickets	Lima Beans	Tomatoes
Protozoan	Sow bugs	Soy Beans	Duck Weed (aquarium plant)
Earthworms	Lady Bird (bugs), etc.	Alfalfa	Other young plants from a nursery, etc.

APPENDIX A:

Reference list of science and engineering project vocabulary

Reference List of Science & Engineering Project Vocabulary

Accuracy - The quality of being near to the true or desired value

Analysis - Breaking an object or process into smaller parts to examine or evaluate systematically

Argument - A persuasive defense for an explanation or solution based on evidence and reasoning

Assessment - An evaluation of the cost, quality and/or ability of someone or something

Causation - The relationship between cause and effect

Claim - A response made to a question and in the process of answering that question

Communicate - To share information orally, in written form and/or graphically through various forms of media

Constraints - A limitation or condition that must be satisfied by a design, including materials, cost, size, labor, etc.

Control - A variable that is kept the same across all tests for use as the comparison standard

Correlation - A predictive dependent relationship between variables that may be positive or negative. Changing a variable creates a corresponding change in another but does not imply causation.

Criteria - Attributes of a design that can be measured; a set of standards upon which a decision is based

Design (v.) - To generate or to propose a possible solution; to create, fashion, execute, or construct

Diagram (n.) - A visual representation of data or information

Effectiveness - A determination of how well a solution meets the criteria

Efficiency - The measurable relationship between a solution and the amount of resources it requires

Error - The difference between a measured value and its true or accepted value; important types include:

Random Error - An unpredictable result from a consistent measurement process

Systematic Error - A predictable and consistent deviation from a value (true or accepted) or a process

Evaluate - To determine significance

Evidence - Data used to support a claim

Failure - The inability of a device, process, or system to perform a required function

Function - A specific task that a system or part of a system performs or is intended to perform

Hypothesis - A possible explanation that can be tested with an experiment

Impact (n.) - A strong effect or influence on someone or something

Implication - A suggestion about or connection to a future outcome that is not stated directly

Inference - Forming an opinion based on known facts or evidence

Investigate - The process of gathering or examining information systematically; generating data to provide evidence to support a claim based on a stated goal, predicted outcome, and planned course of action

Limit - The minimum or maximum permissible value

Model - A diagram, replica, mathematical representation, analogy, or computer simulation used to analyze a system for condition flaws, test a solution, visualize or refine a design, and/or communicate design features

Reference List of Science & Engineering Project Vocabulary

Observation - To become aware of an occurrence using the senses

Parallax - A perceived line of sight displacement while viewing an object

Patterns - Significant predictive features identified through analysis

Performance - The required action of a device, process or system

Plan (n.) - A systematic approach to solving a problem

Precision - The quality of being reproducible in amount or performance

Predict - To determine a future outcome

Problem - A situation to be changed; a question raised for inquiry, consideration, or solution

Process - A series of steps that form a pathway to a solution

Prototype - A model that tests design performance

Qualitative - Non-measurable and described through observation; subjective

Quantitative - Measurable and can be represented in numeric form; objective

Reasoning - A logical, objective thought process based on data, information, and evidence to form a conclusion or judgement

Refine - To improve through small changes

Reflect - Analyze a past course of action, process, or experience in order to generate a future improvement or modification

Relevance - The capability of someone or something to help solve a problem

Reliability - The ability of a device, process or system to perform an intended function without failure for a given time under specified operating conditions

Repeatability - Consistently repeating the same measurement procedure on a system or part of a system with the same tool used under the same conditions by the same person

Reproducibility - The consistent ability of a tool to reproduce the same measurement on a system under the same conditions no matter who operates the tool

Requirements - What the design must do; may be used in place of criteria

Scale - The relationship between the size of an accurate representation of an object and the actual object itself

Simulation - The use of a model to learn how a device, process or system will behave

Specifications (Specs) - A detailed written record specific to the criteria needed to solve the problem; the technical information about “what” is needed to solve the problem but not “how” to solve it

Test (v.) - To determine whether or not a design, model, process, system or theory meets the criteria as a possible solution

Theory - An idea or set of ideas used to explain a fact or event

Trade-Off - An exchange of one idea for another that may involve losing a quality or aspect of a design

Trueness - The closeness between the average value of a large series of measurements results and the true or reference value; quantitative

Uncertainty - Quantifiable doubt about a measurement result

Variability - The extent to which data points differ from each other; how far apart or how close together

APPENDIX B:

Categories / Ideas for Science Fair Projects

Categories / Ideas for Science Fair Projects (on zFairs ‘student’ tab)

Students discuss various aspects of a science fair project.

http://www.archimedesinitiative.org/themes.html

Student interviews on an array of insightful projects providing excellent advice from conquering fears to working through unforeseen results

Agricultural Ideas for Science Projects

www.ars.usda.gov/is/kids/fair/ideasframe.htm

This website offers suggestions for a wide variety of science fair projects with an agricultural theme.

- Botany
- Chemistry
- Environmental Science
- Medicine and Health
- Microbiology
- Zoology

Virtual Library—Science Fairs

http://physics.usc.edu/%7Egould/ScienceFairs/

A comprehensive list of every science fair accessible through the Web.

Super Science Fair Projects

www.super-science-fair-projects.com/

Complete Guide to Science Fair Projects, Topics and Experiments

- Steps for Doing a Science Fair Project
- Science Fair Idea: Winning Strategies
- Science Fair: How Judges Think
- School Science Fair Projects: How to keep a Timeline
- Science Project Ideas: Science Category Outline
- Science Fair Project Ideas: Science Topic Outline
- High School Science Fair Projects: How to do Project Research
- Kids Science Fair Projects: How to Write a Project Report
- Middle School Science Fair Projects: How to Do a Presentation
- Cool Science Fair Projects: Day of the Science Fair
- Best Science Fair Projects

The DuPont Challenge Science Essay Competition

http://thechallenge.dupont.com/

Google Science Fair

http://www.google.com/events/sciencefair/

- Science Project Resources
- Partner Resources- especially Scientific American

Science Fair Resource Center

http://homeworkspot.com/sciencefair/

Project ideas, information, books and kits

- General Science Fair Project Ideas
- Ideas by Subject
- Help
- Middle School Science Resources
- High School Science Resources

Junior Science & Humanities Symposia (JSHS) Program

http://www.jshs.org/

JSHS is sponsored by the research arm of the Department of Defense and administered in cooperation with nationwide colleges and universities. JSHS aims to prepare and support students to contribute as future scientists and engineers -- conducting STEM research on behalf of or directly for the Department of Defense, the Federal research laboratories, or for the greater good in advancing the nation’s scientific and technological progress.

Contains a variety of excellent resources including preparation and presentation tips. A list of awards and scholarships is also included.

Maryland BioGENEius Challenge

http://www.biotechinstitute.org/go.cfm?do=Page.View&pid=71

The premier competition for high school students that recognizes outstanding research in biotechnology.

Toshiba ExploraVision

http://www.exploravision.org/

ExploraVision is a science competition that goes beyond the typical student science competition and into what it takes to bring ideas to reality. A teacher will sponsor and lead his/her students as they work in groups of 2 – 4 to simulate real research and development. A teacher will guide his or her students as they pick a current technology, research it, envision what it might look like in 20 years, and describe the development steps, pros & cons, and obstacles.

Categories / Ideas for Science Fair Projects (on zFairs 'student' tab)

Science Buddies

www.sciencebuddies.org (choose the Project Ideas tab) Science Buddies offers detailed guidance and examples for serious students who want to do the best possible project.

- "How-to" information
- Ask an expert online mentoring
- Teacher resources

Science Buddies Advanced Project Guide

http://www.sciencebuddies.org/
(choose the Advanced Project Guide tab)

Preparing for Advanced High School Science Competitions

- Overview of the Top Science Competitions
- Nine Reasons to Do a High School Science Project
- How to Be Successful at a Top Science Competition
- Roadmap: How to Get Started On an Advanced Science Project
- How to Find a Mentor
- Mentoring & Coaching Advanced High School Student Research
- Roundtable on Finding an Idea for an Advanced Project
- Sample Projects from Advanced Competitions
- How to Read a Scientific Paper

What Makes A Good Science Fair Project

www.usc.edu/CSSF/Resources/Good_Project.html

A website from USC that gives a lot of good tips and ideas to think about regarding what makes a good science fair project. Advice for students as well as teachers and parents is included.

Science Project Ideas

www.scienceproject.com

World's largest web site for Science Project ideas, information and support.

- Middle School project ideas (Intermediate projects)
- High School project ideas (Senior projects)

Science Fair Adventure

http://www.sciencefairadventure.com/

Science Fair projects ideas by topic.

Parent Resources to Science Fair Projects

http://school.discoveryeducation.com/sciencefaircentral/Parent- Resources.html

- What is the parent's role?
- How do I help my student come up with a project idea?
- How much time will we need?
- How do I help with the project?
- What are the main sticking points for students?
- What should the final project look like?
- What else can I do to help?
- Where do I get supplies?

Math Ideas for Science Fair Projects

http://mathforum.org/teachers/mathproject.html

http://mathforum.org/library/drmath/sets/high_projects.html

- Includes tips on finding interesting ideas
- Topics arranged by math subjects

Science Fair Resource Guide

www.ipl.org/div/projectguide

Resources for science fair projects. Includes tips, explanation of the scientific method, and help choosing a topic.

Successful Science Fair Projects

http://faculty.washington.edu/chudler/fair.html Includes an overview of how to do a science fair project and additional science fair websites.

Science Fairs

https://www.apa.org/education/k12/science-fair.aspx Information about research methods and statistics that is particularly useful for high school students.

The above information was gathered from the Anne Arundel County Public Schools Science Fair Resource Guide, 2014.

ANNE ARUNDEL
COUNTY PUBLIC SCHOOLS

Categories / Ideas for Science Fair Projects (on zFairs 'student' tab)

Behavior/Health/Social Sciences (Life Science B: Medicine, Health, Behavior and Social Sciences)

- Does color have an effect on a person's food choice? How?
- How do sound waves affect your mood?
- Do TV commercials control buying habits?
- Which orange drinks have the highest concentration of Vitamin C?

Biological Sciences (Life Sciences A: Biology, Botany, Zoology, Microbiology, Biochemistry)

- What is the highest temperature at which milk may be stored and not spoil in a week?
- Does gravity affect the direction that a seed grows?
- Does magnetism affect plant growth? How?
- Which fruits contain a large quantity of acid?
- How much salt will a plant tolerate and still grow?

Earth Science (Geology, Astronomy, Ecology, Atmospheric Science, Environmental Science)

- What is the rate of absorption of water in different soil types?
- Pick a constellation. Track its movement each night and use that to prove the earth's orbit around the sun.
- At what time during the day does the sun give the most energy?
- Conduct cloud chamber investigations of particles and cloud formation.

Engineering

- Create an original machine that will perform a function. Make modifications and test each model.
- Test the wind resistance of automobile models in a wind tunnel.
- Conduct a data analysis of exhaust emissions of cars as related to the size of cars and tune-up conditions.
- Design, construct, and test a mechanical method of separating solid waste for recycling.
- Construct and test a model solar desalination system.

Physical Sciences (Physics, Chemistry, Aerodynamics, Hydrodynamics, Electronics & Electromagnets, Mathematics, Software, and Computer Science

- How does salinity affect the rusting rates of metal?
- Does the temperature of the air affect the air pressure?
- Do the different colors in the spectrum have different temperatures?
- What surfaces reflect light best?
- What stain remover will remove the largest percentage of the stain?
- How are Fibonacci numbers and ratios found in nature?
- Providing geometric theorems by using concrete objects.
- Programming computers to perform equations to test mathematical results (i.e., prime factorization, statistics).
- Using probability methods in predicting future weather patterns.
- Design a new mathematical system for analyzing solutions.

For additional ideas, refer to the "Student" tab on our zFairs website by clicking on "Science Fair Project Ideas"

APPENDIX C:

Examples of Citing References

Examples of Citing References (Website, article)

Citations Examples as Quoted from [Purdue Owl Online Writing Lab for MLA Online Citations]()

BASIC STYLE FOR CITATIONS OF ELECTRONIC SOURCES (INCLUDING ONLINE DATABASES)

Here are some common features you should try to find before citing electronic sources in MLA style. Not every web page will provide all of the following information. However, collect as much of the following information as possible:

- Author and/or editor names (if available); last names first.
- "Article name in quotation marks."
- *Title of the website, project, or book in italics.*
- Any version numbers available, including editions (ed.), revisions, posting dates, volumes (vol.), or issue numbers (no.).
- Publisher information, including the publisher name and publishing date.
- Take note of any page numbers (p. or pp.) or paragraph numbers (par. or pars.).
- DOI (if available), otherwise a URL (without the https://) or permalink.
- Date you accessed the material (Date Accessed). While not required, saving this information it is highly recommended, especially when dealing with pages that change frequently or do not have a visible copyright date.

Use the following format:
Author. "Title." *Title of container (self contained if book), Other contributors (translators or editors), Version (edition), Number (vol. and/or no.), Publisher, Publication Date, Location (pages, paragraphs and/or URL, DOI or permalink). 2nd container's title, Other contributors, Version, Number, Publisher, Publication date, Location, Date of Access (if applicable).*

CITING AN ENTIRE WEB SITE
When citing an entire website, follow the same format as listed above, but include a compiler name if no single author is available.

The Purdue OWL Family of Sites. The Writing Lab and OWL at Purdue and Purdue U, 2008, owl.english.purdue.edu/owl. Accessed 23 Apr. 2008.
Felluga, Dino. *Guide to Literary and Critical Theory. Purdue U, 28 Nov. 2003, www.cla.purdue.edu/english/theory/. Accessed 10 May 2006.*

A PAGE ON A WEB SITE
For an individual page on a Web site, list the author or alias if known, followed by an indication of the specific page or article being referenced. Usually, the title of the page or article appears in a header at the top of the page. Follow this with the information covered above for entire Web sites. If the publisher is the same as the website name, only list it once.

Lundman, Susan. "How to Make Vegetarian Chili." *eHow, www.ehow.com/how_10727_make-vegetarian-chili.html. Accessed 6 July 2015.*
"Athlete's Foot - Topic Overview." *WebMD, 25 Sept. 2014, www.webmd.com/skin-problems-and-treatments/tc/athletes-foot-topic-overview.*

APPENDIX D:

Digital Logbook Agreement

Mendocino County Science Fair

Technology Use for Log Book

This form must be completed if the student(s) is completing their log book digitally. This is to ensure that the work provided in the digital version of the log book was created by the student. This form needs to be submitted upon registration to the County Science Fair.

Current Date:

Date: ______________________

Student Name(s):

____

____

____

____

This is to certify that I, ____

(type or print name of advisor)

certify that, to my personal knowledge, that the log book created by the above-named student(s) was created by them and only them with little to no guidance from other students or adults.

Signature of Advisor:

____

Date:

____

Address:

____

____

Telephone:

____

SCIENCE FAIR TEAM

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