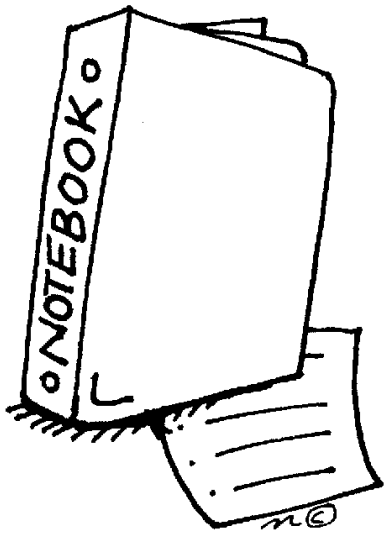
Elementary Science Fair Notebook Engineering Projects



Name: _____

Project Due Date: _____

Project Overview

What is a science fair project?

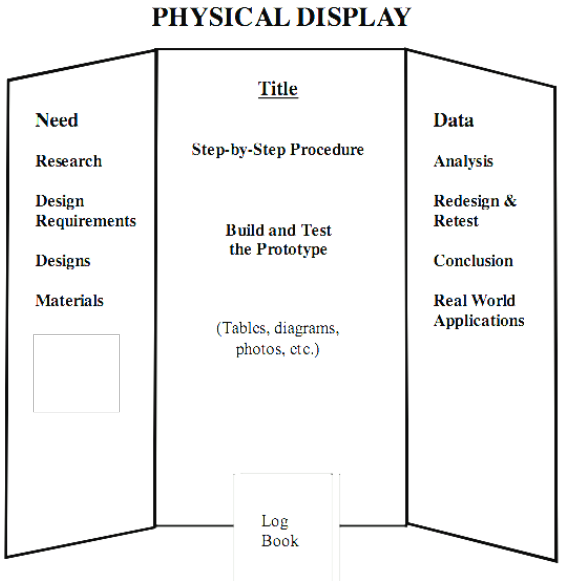
The science fair project is a long-term project where you will plan, build, and share results from your engineering design solution. The project includes defining a problem or need, research, designing and testing a prototype, recording your designs and data from testing in a science notebook, analyzing your data to improve your design, and creating a tri-fold poster to share your project. You can use this notebook to help you with the project process.

What makes a good project?

The first step to completing a good science fair project is to choose a topic that interests you. Students that have excellent projects do research before they begin. They really understand the need for their project, the science behind their topic and use their knowledge to design an interesting solution. Another thing that makes a great project is originality. Try to come up with your own idea. There are a lot of examples of projects on the Internet. If you are stuck, use these as jumping off points, but try to make the project your own. When you test your prototype, do multiple trials. The more data you collect, the better. Also, if something doesn't go as planned and you have an idea to test why or a way to redesign your prototype, keep going, this is what engineers do. Finally, you want your poster to be informative, clear, and attractive. You have put a lot of work into planning and conducting your experiment. A well-planned poster will help others see this.

What goes on an engineering project poster?

Posters for engineering projects should explain the problem you addressed, show your design process of building, testing, and redesigning, and include a conclusion that describes the importance of your project . Also be sure to have a science notebook that includes your research, sources, and design process.



Science Fair Timeline – Engineering Projects

Dates	Steps
	Select a Topic Read magazines, make observations, ask people about challenges or problems that they have to gather ideas for an engineering project.
	Purpose Define the need or the problem that you want to address in the project.
	Research After you have chosen a problem or a need research more about your topic. Come up with some questions related to your topic and search for the answers. Then write a paragraph about what you learned.
	Design Goal Use what you learned from research to develop a possible solution to your need or problem. Describe your design idea in detail, including materials you will need and costs.
	Teacher Approval Form Before you can begin to build a prototype your teacher must sign an approval form. The form is on the last page of this notebook.
	Build, Test, Revise Start by following your design goal, then make adjustments to your prototype after you have tested it. You will probably have to go through several cycles of building, testing, and redesigning. Be sure to record all of this process.
	Design Solution Once you have a prototype that addresses your need or problem, you need to develop a materials list and procedures for creating the final prototype.
	Conclusion Share what you learned from your experiment in your conclusion. Be sure to explain how your design effectively solves the problem, or meets the need. Your conclusion will be 1 – 3 paragraphs long.
	Poster Your poster should include all the sections of your project in a clear display. The goal of the poster is to teach others about your design solution and what you learned through the process.

Topic Brainstorm

In this section you will record ideas about your interests. This will help you to pick a topic and develop a plan for your science fair project. Fill in each text box.

1. What do you like to do outside of school? (examples: art, theater, sports, build things, cook, etc.)

2. What is your favorite thing you have done related to science? (examples: experiments, tv shows, museums, etc.)

3. Take the science interest survey on the next pages. List the disciplines that you are interested in.

4. Free Write: In the space below write about the topics you think you might be interested in for the science fair. What ideas do you have right now?

Science Interest Survey

Directions: Answer each question with "yes", "no" or "kinda"

1. Do you like building or repairing machines?
2. Do you enjoy gardening and working with plants?
3. Are you curious to understand things like gravity and magnetism?
4. Does observing the behavior of different people fascinate you?
5. Do you enjoy working on computers or learning about how computers work?
6. Do you like to go hiking or snorkeling so that you see different animals in their natural environment?
7. Do you enjoy learning about the forces of nature like weather and earthquakes?
8. Do you enjoy learning about memory and how our brain works?
9. Are you curious about the way different animals grow, develop, and live?
10. Are you interested in science fiction stories involving faster than light travel and "beams" that do amazing things?
11. Do you want to understand more about how people are affecting the environment?
12. Do you enjoy learning about outer space and astronauts?
13. Do you enjoy learning about lakes, rivers, the ocean, and beaches?
14. Have you built inventions or other things for fun and not a school project?
15. Do you enjoy learning about chemicals and things that bubble, fizz, or explode?
16. Do you enjoy discovering new ways to recycle, restore, or re-use old stuff?
17. Do you like to go on drives or hikes specifically so that you can see interesting mountains, rock, or caves?
18. Do you enjoy watching or participating in sports?
19. Do you like learning about what makes us healthy and what makes us sick?
20. Are you interested in how to build roads, bridges, and buildings?

What kinds of science are you interested in?

Directions: Circle the numbers that you answered "Yes" to on the other side. These are the kinds of science that you are interested in!

1. Engineering: Learning about how to build and design things, how things work
2. Plant biology: Learning about how plants grow and change
3. Physics: Learning about energy and forces, how things move and change
4. Psychology: Learning about how people and animals think and behave
5. Computer science: Learning about how computers and computer software works
6. Zoology: Learning about different kinds of animals
7. Meteorology: Learning about weather and how it changes
8. Psychology: Learning about how people and animals think and behave
9. Zoology: Learning about different kinds of animals
10. Optics (physics): Learning about how light behaves and interacts
11. Environmental science: Learning about ecosystems, living and nonliving things
12. Astronomy: Learning about outer space and our solar system
13. Oceanography: Learning about the oceans and other bodies of water
14. Engineering: Learning about how to build and design things, how things work
15. Chemistry: Learning about what matter is made of and how they change
16. Environmental science: Learning about ecosystems, living and nonliving things
17. Geology: Learning about the earth and what it is made of
18. Sports science: Learning about the physics of games and the biology of athletes
19. Biology: Learning about living things and how they grow and change
20. Engineering: Learning about how to build and design things, how things work

Now list the types of science you are interested in box #3 of the Topic Brainstorm page.

Purpose

The goal of an engineering project is to design and construct a prototype that addressed a need or solves a problem. Begin by thinking about a need or a problem. Could you design something to address that problem?

Excellent engineering projects are creative and meaningful. If you found your idea on the Internet, ask yourself if there is a way to make the project your own. As you think about your project make sure your idea is meaningful. What is the purpose of your project? Who might it help?

1. Write your question or describe the purpose of your engineering project in the space below:

2. A great way to get ideas for your science fair project is to share your initial ideas with others. In the space below record ideas or questions that others have shared with you about your project.

Research

Before you begin to design your prototype it is important that you do some research. For engineering projects, first you need to make sure that your idea or invention does not already exist. Then you should do some research on the need for your product. You may want to interview people for this. It is also a good idea to understand some of the scientific principles that are related to your problem or your idea for a design. For example, if you want to design a better hot chocolate cup, you should research cup designs that already exist, ask people what they want in a hot chocolate cup, and finally research information about thermal energy and heat transfer. The more you know, the better your project will be.

To help you with this process think of questions that you need to answer before you start to develop your solution. Record your questions in the boxes below, then research the answers. Do not forget to write down your source (Internet, book, expert) in the works cited section.

Question 1: **Answer:** **Works Cited:**
Question 2: **Answer:** **Works Cited:**
Question 3: **Answer:** **Works Cited:**

Background Research Paragraph

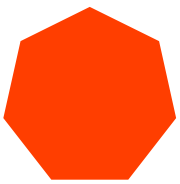
Synthesize the information that you learned while researching your topic to write a background research paragraph. The paragraph should include information about the need that your project will address. You should also explain the science concepts that are related to your engineering project.

In the space below write your background information paragraph.

Design Goal

The next step in your project is to create a design goal. Describe your initial ideas about what you will design to address the need. Be specific when you describe your prototype. Include information about the size of your prototype, the materials you will use to build the prototype, and an estimate of the costs. Also describe how you plan to test your prototype.

1. Write your design goal in the space below:



STOP: Before you start to build your prototype be sure that your teacher has signed and collected your science fair approval plan (the last page of this packet).

Build, Test, Redesign

In this section you need to build and refine your prototype. In your design goal you proposed a plan for your prototype. Start by following that plan, however chances are you will make adjustments as you go along. Be sure to record the materials that you used to build the prototypes, schematics and plans that you followed while building the prototypes, tests you used to evaluate your prototypes, data you collected while testing, and pictures or written descriptions of how you redesigned your protoypes based on tests. Remember, you need to keep going through the build, test, redesign process until you have developed a prototype or solution to the problem you identified. The next few pages of the notebook are blank so that you can record this process.

Build, Test, Redesign cont'd

Build, Test, Redesign cont'd

Build, Test, Redesign cont'd

Build, Test, Redesign cont'd

Design Solution

When you feel that the prototype has reached its greatest efficiency according to the need or problem, you are ready to develop a detailed description of your design solution. For this description you should include a picture and/or schematic of your design, materials used to build the prototype, and step-by-step procedures for building the prototype. Use the boxes below to record this information.

1. Draw or paste a picture or schematic of the design solution in the space below.

2. List your materials, include quantities.

3. Write step by step procedures for your prototype.

Conclusion

The conclusion is a place for you to share what you learned through the design process. Your conclusion should be one to three paragraphs long. In your conclusion you should answer the following questions:

- How does the prototype or design solution address the need or problem?
- What did you learn during the design process (testing and evaluating) that informed your final design solution?
- Why is your design solution important? How can it be applied to real life?
- How could your design solution be improved?

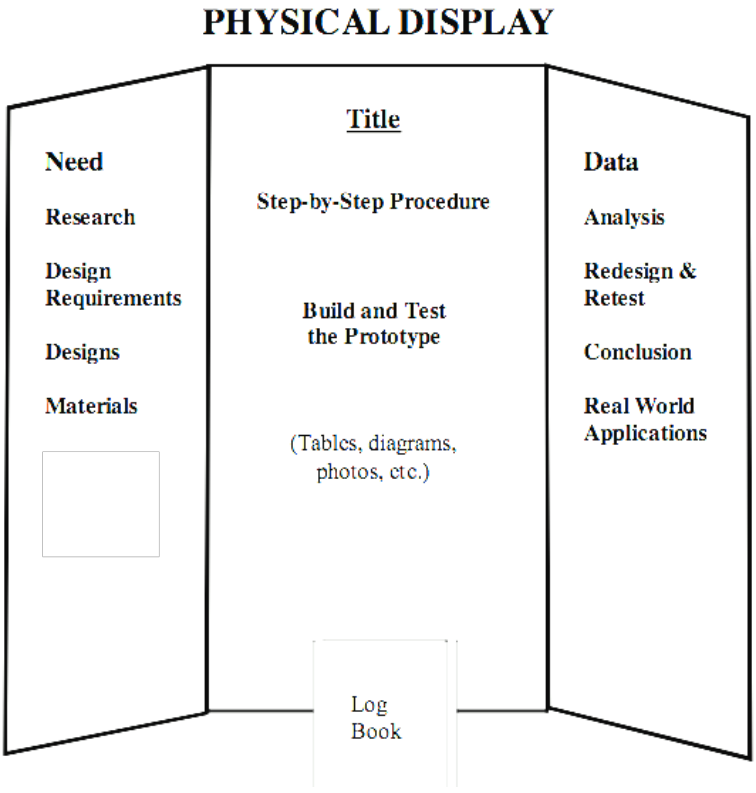
Write a rough draft of your conclusion in the space below.

Display Board

Your display board should demonstrate all of the hard work that you have put into your science fair project. Don't wait until the last minute! Use the information that you have recorded in this science fair notebook to help you decide what to write on each section of your board.

The picture shows one example of how to set up your board. Your board may look different, depending on the need your design addressed and the process you followed. Be sure that your poster includes adequate information about:

- The problem or need the project addresses
- Your building, testing, and redesigning process
- A clear description of the final design solution
- An explanation of why your project is important



You also need to display your science fair notebook or log book. You can use this packet as your science fair notebook or use a spiral notebook. In the notebook be sure to have the research you did in the beginning of the project, a list of your sources for research, and all of your notes, observations, diagrams, and data that you collected while designing, testing, and redesigning your prototype.

2016 Granite STEM Fair-Pre Approval Form

Elementary and Junior Divisions

All students completing a STEM Fair project in grades 5-8 in Granite must complete this form

Student Name: Grade: Phone:
Team: Student Name: Grade: Phone:
Team: Student Name: Grade: Phone:

SCHOOL Name:

During my experiment I plan to test: (if yes, signatures must be before starting to do the testing-provide the expert with your research plan so they have enough detail to determine if your project can be approved)

Yes: No: Human Test Subjects (ex: survey, taste test, play a game, or interact with in any way)

During review, if it is determined that there is more than minimal psychological or physical risk to the human subjects involved in the project, the student must receive written consent from each of the participants and written parental consent for students under 18 years old, MUST be included with registration form. If it is determined that there are unacceptable risks involved the student must revise his or her project. Please attach a copy of the surveys or tests you intend to use with your research plan.

If yes, _____ ***&*** _____
(Science Teacher Signature & Date) (Psychologist, Medical doctor, or Registered nurse Signature & Date)

Yes: No: Vertebrate Animals (ex: fish, rabbits, dogs, etc.)

Behavior observation studies or supplemental nutritional studies involving pets may be done at home. Any other experiments involving laboratory animals (rats, mice, hamsters, gerbils, rabbits, etc) cannot be conducted in a student's home. Proper animal care must be provided daily, including weekends, holidays and vacations. Experimental procedures that cause unnecessary pain or discomfort are prohibited. Experiments designed to kill vertebrate animals are not permitted. Experiments with a death rate of 30 percent or higher are not permitted.

If yes, _____ ***&*** _____
(Science Teacher Signature & Date) (Veterinarian or other Biomedical/Biological Scientist & Date)

Yes: No: Prescription or Over the Counter Drugs, Alcohol, Tobacco

Students must adhere to all federal, state and local laws when acquiring and handling controlled substances. Only under the direction of a qualified scientist or designated supervisor may a student use federally controlled or experimental substances for therapy or experimentation.

If yes, _____ ***&*** _____
(Science Teacher Signature & Date) (Biomedical/Biological Scientist & Date)

Yes: No: Potentially Hazardous Chemicals, Weapons/Firearms, Lasers, Radiation, etc.

Students must adhere to federal and state regulations governing hazardous substances or devices. **An adult must directly supervise the experiments.** Students working with hazardous substances or devices must follow proper safety procedures for each chemical or device used in the research.

If yes, _____ ***&*** _____
(Science Teacher Signature & Date) (School Fair Coordinator & Date)

Yes: No: Bacteria, Mold, Fungi, Viruses or Parasites, Human or Animal Fresh Tissues, blood or body fluids, etc. (Potentially Hazardous Biological Agents)

Determine the level of biological containment available to the student researcher. **Biosafety Level 1 projects can be performed in a school BSL-1 laboratory but are prohibited in the home environment. Bacteria, mold, fungi or any other potentially hazardous biological agent CANNOT be cultured at home or elementary school.** Standard microbiological practices must be used and all hazardous agents must be properly disposed of at the end of experimentation. The experiment must be supervised by a qualified scientist or a trained designated supervisor. For lab space or questions, please visit https://slvsef.org/resource-center/find-a-lab.

If yes, _____ ***&*** _____
(Science Teacher Signature & Date) (Biomedical/Biological Scientist & Date)

Project Categories

Elementary Division Categories (check one):

- ☐ Behavioral & Social Sciences (BE)
- ☐ Biology & Biochemistry (BI)
- ☐ Chemistry (CH)
- ☐ Earth & Environmental Sciences (ES)
- ☐ Energy: Chemical & Physical (EN)
- ☐ Engineering: Civil & Environmental (CE)
- ☐ Engineering: Electrical & Computer Science (EE)
- ☐ Engineering: Materials & Biomedical (MB)
- ☐ Engineering: Mechanical (ME)
- ☐ Medicine & Health Sciences (MH)
- ☐ Physics, Astronomy, & Math (PA)
- ☐ Plant Sciences (PS)

Science Fair Project Research Plan

My Question is:_____

When I researched my question/topic I found: ("No research available" is NOT a valid response, investigate keywords about your question, or discuss what you read/saw that lead you to your question)

My Hypothesis is: (Remember, a strong hypothesis includes what you expect to happen AND a supporting reason.)

Where will your experiment be conducted? Please list all locations you might conduct your experiment.
(Bacteria/fungi/mold projects or any other project involving potentially hazardous biological agents **CANNOT** be cultured or grown at home. See previous page.)

_____

Adult Supervisor's Name & Phone Number (this is the person who will be supervising the safety of your experiment. It might be a classroom teacher or possibly a parent, but if you are doing work in a lab it may be a scientist, physician or vet).

Procedure/Project Summary
(*Please write a detailed explanation about what you plan to do for your experiment.* ***Include all safety precautions*** *that will be in place for you and your test subjects, use the back of this page if needed*):

NOTE: If you are part of a team, this page must be completed by each student and their parent/guardian.

Display and Safety Rules – The Following Items Cannot be Displayed at the Science Fair

1. Living Organisms
2. Plant materials (living, dead or preserved)
3. Taxidermy specimens or parts
4. Preserved animals – includes embryos
5. Food (empty containers may be displayed)
6. Human or animal parts or body fluids
7. Soil, sand or waste samples
8. Laboratory/household chemicals – including water
9. Poisons, drugs, hazardous substances or devices
10. Sharp items – pipettes, glass, syringes, needles
11. Dry ice or other sublimating solids
12. Flames or highly flammable display materials
13. Empty tanks that previously contained combustible liquids or gases
14. Batteries with open top cells
15. Photographs of people other than yourself or your family without their written permission.
16. Photographs or other visual presentations depicting vertebrate animals in surgical techniques, dissection, necropsies, other lab techniques, improper handling methods, improper housing conditions etc.

The Salt Lake Valley Science and Engineering Fair, and the participating school districts reserve the right to remove anything else displayed with your science fair project that may be deemed hazardous or inappropriate for public display.

Project board size limit: 30" deep, 48" wide (side to side), and 108" tall

Student & Parent/Guardian Signatures

I certify that my science project complies with all of the experimental rules of the Salt Lake Valley Science and Engineering Fair. I understand that if I have not complied with these rules that my project could fail to qualify for competition. I have also read and I understand the display and safety rules. If I display any of the objects listed above, I am aware that they will be removed and returned at the conclusion of the science fair. If I am selected to participate, **I agree to set up my project on the appointed day prior to my competition and I will leave my project on display until the designated time for project tear down. I understand that I must be present for judging during the designated competition date and time.**

Signature of Student_____ Signature of Parent/Guardian_____ Date_____

Signature of Student_____ Signature of Parent/Guardian_____ Date_____

Signature of Parent/Guardian_____ Date_____

Signature of Student_____

Teacher Signature

I have reviewed and approved this student's research plan prior to experimentation and certify that they will comply with all of the experimental rules of SLVSEF.

_____

Teacher Signature Date

SLVSEF Approval for Competition

_____

Regional SRC Approval

_____

Date

Every effort will be made to protect exhibits from loss or damage. However, since the exhibition of projects is open to the public, the SLVSEF Committee and University of Utah cannot and will not accept any liability or responsibility of any nature for any theft, loss or damage to any exhibit or any other property of any SLVSEF participant. Accordingly, it is recommended that each participant should secure and guard his/her project and take all prudent precautions to prevent any theft, loss or damage to their project.

For more information please visit our website https://slvsef.org

The Salt Lake Valley Science and Engineering Fair is presented by the Center for Science and Mathematics Education and the University of Utah.