

Your Research Paper Guideline

Please follow the steps below to complete the research paper portion of your science fair project. The research paper of your science fair project must be typed. Each step must be explained thoroughly and clearly. Some of the steps require a rough draft that will be turned in to your teacher; others you will need to complete on your own.

Step 1: State the Problem/Research Question

What question are you trying to answer? Ask a question that you can answer through observation or experimentation.

Step 2: State the Purpose

What is your reason for asking this question? What are you trying to discover?

Step 3: Background Research

Discuss your background research for your project. This section should be used to help you make a hypothesis (remember, in order to make an “educated guess” you have to include the “education”). You will need to cite at least 3-5 sources.

Step 4: Write a Bibliography

Make a list of the sources you used to collect your background research. Your teacher can help guide you in using the proper format.

Step 5: Make a Hypothesis

A hypothesis is a statement that predicts the outcome of your experiment, based on what you already know, and proposes an explanation that can be tested. What do you think that the answer to your research question will be? Remember, hypotheses don't need to be correct— they just need to be informed guesses! Never go back and change your hypothesis once your experiment is complete. You will learn something important whether your hypothesis is proven or disproven! If you have researched the topic of your project, then your research should help you make a good hypothesis. Remember, your hypotheses must be written using an “If..., then...” format.

Step 6: List the Materials

Every item that you will use to do the experiment should be listed in the materials section. A common format is to list items in the order in which you will use them.

Step 7: Describe the Procedure

The procedure describes the experiment in a step-by-step sequence. It may help to think of the procedure as a recipe, in which every step is clearly explained. How will your materials be used, and how and when will they be measured? Another person should be able to follow the procedure of your experiment and get the same, or similar, results.

Step 8: Perform the Experiment

Following the procedures from Step 7, conduct your experiment. If you realize that new steps or materials are needed, you may go back and revise those sections. But remember not to revise your original hypothesis.

Step 9: Record the Results

Record detailed records of the results of your tests and observations. Results should always be explained in a written format first, followed by graphs, charts, and/or tables.

Step 10: Make a Conclusion

After getting the results in Step 8, make a conclusion. According to your results, was your hypothesis proven or disproven? (Remember, it is okay for your hypothesis to be disproven!) Was there anything in the experiment that you would change if the hypothesis were retested? How could you change or expand this experiment if you were going to do it again? What did you learn from the experiment? How could this information be used to help people or to make the world a better place?

Step 11: Write an Abstract

An abstract is a one-page summary of your project. It should state your research question, purpose, and hypothesis. It should include your procedures, but you do not need to be as precise as you were in the procedures section; describe your steps more generally. Your results and conclusion should also be included. The abstract is meant to give a quick explanation of your project to someone before they start to read your paper and examine your display.

Step 12: Acknowledgments (optional)

Thank the people who helped you with your project.

Step 13: Create a Title Page and Table of Contents

The title page should include a title for the project. (It is okay to restate the research question if you can't think of a good title.) Also include your full name, your grade, your teacher's name, your school's name, and the school year. After placing each section of your paper in order, number your pages, and then write a table of contents.

Step 14: Proofread Everything Carefully!



The Final Order Of Your Research Paper Should Be:

Title page
Table of Contents
Acknowledgments
Abstract
Research Question
Purpose
Background Research
Hypothesis
Materials
Procedures
Results
Conclusion
Bibliography



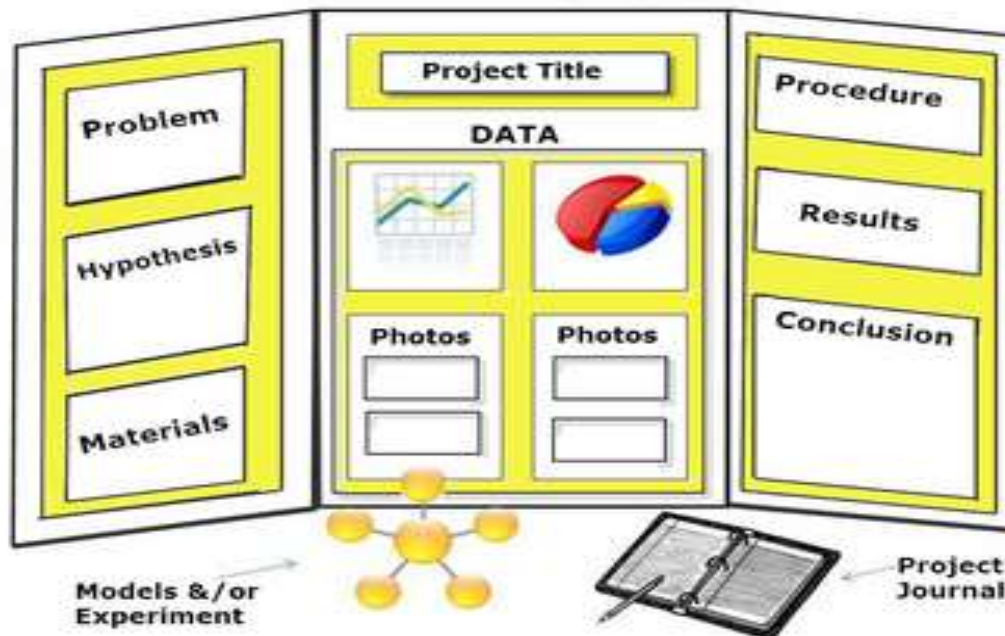
Sample: Scientific Method Display Board

- ✚ Display boards should be easy to read and appealing to look at.
- ✚ For privacy reasons, and to make sure that the judges are fair, do not allow your name or any faces to be displayed on the front of your board or anywhere else in your displayed materials.
- ✚ Text size should be large enough to easily read
- ✚ Standard display boards
- ✚ Before you glue everything onto your board, place each section where you think it would look best.
- ✚ If you use border, you should not use staples or tape- use glue.
- ✚ Information on your display board should be typed or hand written neat and carefully proofread.
- ✚ Your board should include the following: Title, Research Question, Hypothesis, Materials, Procedure, Results (including any graphs, tables, charts, and pictures), and Conclusion.

Below is a common way to set up your display board:

How do I display my experiment?

Your experiment should be placed on a display board that stands by itself, such as on a three sided display, as shown below



Scientific Method Research Planning Sheet:

Research Question/Purpose

Name _____ DueDate _____

Parent/Guardian Signature _____ On Time? Yes/No

Results

What question are you trying to answer? Ask a question that you can answer through observation or experimentation.

State the Purpose

What is your reason for asking this question? What are you trying to discover?

Teacher Comments/Suggestions:

Scientific Method Rough Draft: Background Research/Bibliography

Name _____ Due Date _____

Parent/Guardian Signature _____ On Time? Yes/No

Background Research

Write a background research section. This section will be used to help you make a hypothesis. To start, collect facts that are related to your research question. Remember to put the facts in your own words! On the back of each fact card or under each fact in the list, write down all of the information about where you got the fact. This information will be used to write your bibliography. Once you have gathered your facts, organize them in an order that makes sense and write a background research section about your topic. Remember to break your writing into paragraphs, and include topic and closing sentences for each group of new ideas.

Bibliography (3 to 5 sources)

Teacher Comments/Suggestions:

Scientific Method Research Paper Rough Draft:

Hypothesis

Name _____ Due Date _____

Parent/Guardian Signature _____ On Time? Yes/No

Make a Hypothesis

A hypothesis is a statement that predicts how an experiment will turn out, and why it will happen that way, based on what you already know. What do you think that the answer to your research question will be? Remember, hypotheses don't need to be correct—they just need to be informed guesses. If you have researched the topic of your project, then your research should help you make a good hypothesis. Hypotheses are often written using an “If..., then..., because...” format.

Teacher Comments/Suggestions:

Recommended Resources

- www.societyforscience.org
- www.sciencebuddies.org
- www.sciencenewsforstudents.org/blog/eureka-lab
- www.sciencenewsforstudents.org
- www.successwithscience.org
- www.madsci.org

Scientific Method Research Paper Rough Draft:

Materials/Procedure

Name _____ Due Date _____

Parent/Guardian Signature _____ On Time? Yes/No

List the Materials

Every item that you will use to do the experiment should be listed in this section.

Describe the Procedure

The procedure describes the experiment in a step-by-step sequence. It may help to think of the procedure as a recipe, in which every step is clearly explained. How will your materials be used, and how and when will they be measured? If each step is carefully explained, another person should be able to follow the procedure of the experiment and get the same, or similar, results. Use the back of the paper or separate sheets if you need more space.

Teacher Comments/Suggestions:

Scientific Method Research Paper Rough Draft:

Results

Name_____ DueDate_____

Parent/Guardian Signature_____ On Time? Yes/No

Results

Write down the results of the experiment. These should be detailed records of the results of your tests and observations. Attach notes, charts, tables, and graphs to this paper. Do not analyze the results here; just record what happened.

Teacher Comments/Suggestions:

Scientific Method Research Paper Rough Draft:

Conclusion

Name _____ Due Date _____

Parent/Guardian Signature _____ On Time? Yes/No

Make a Conclusion

According to your results, was your hypothesis proven or disproven? (Remember, it is okay for your hypothesis to be disproven!) Was there anything in the experiment that you would change if the hypothesis were retested? How could you change or expand this experiment if you were going to do it again? What did you learn from the experiment? How could this information be used to help people or to make the world a better place? Write your conclusion below.

Teacher Comments/Suggestions:

Scientific Method Research Paper Rough Draft:

Abstract

Name _____ DueDate _____

Parent/Guardian Signature _____ On Time? Yes/No

Write an Abstract (recommended for grades 4-5)

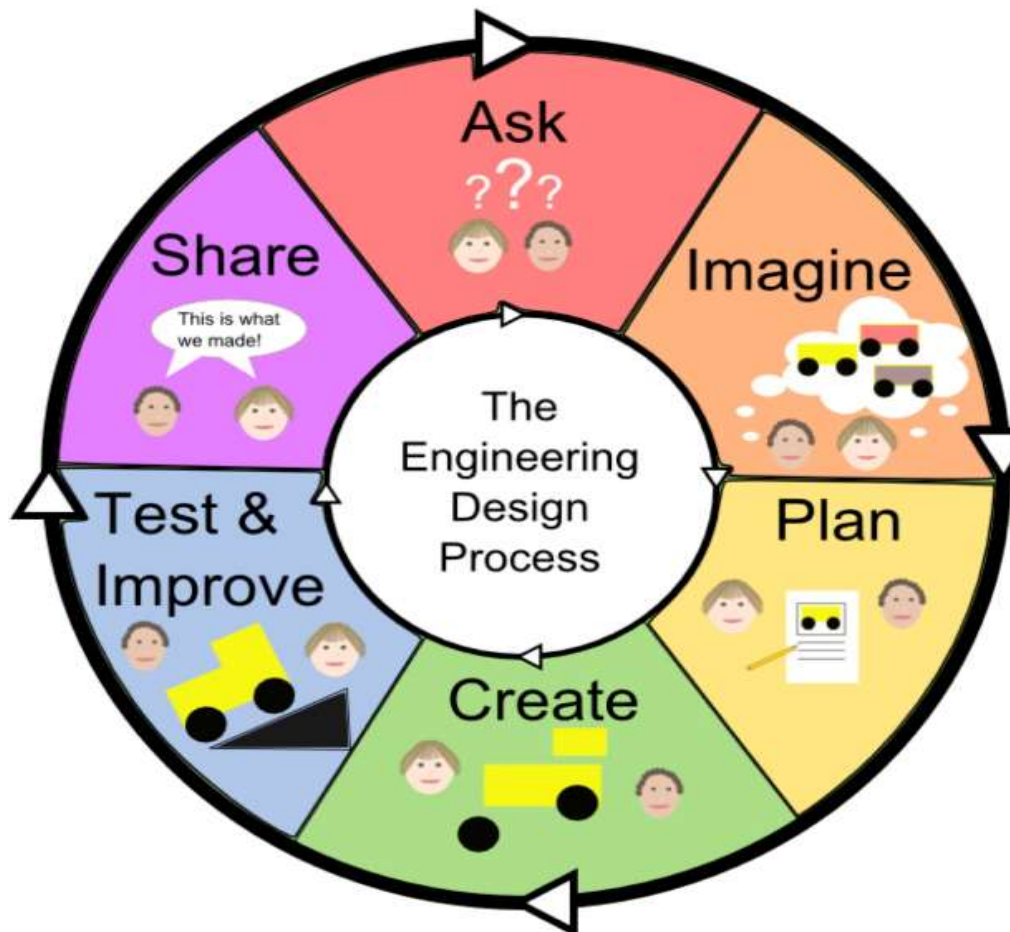
An abstract is a one-page summary of your project. It should state your research question, purpose, and hypothesis. It should include your procedures, but you do not need to be as precise as you were in the procedures section; describe your steps more generally. Your results and conclusion should also be included. The abstract is meant to give a quick explanation of your project to someone before they start to read your paper and examine your display.

Teacher Comments/Suggestions:

Part Two: Engineering Design-Choosing a Category that interests you...

Engineering Design Engineering is the designing, building, and testing of a made-at-home product. It is the invention category of the science fair. A prototype is built according to the requirements set up by the student. After the prototype is built, it needs to be tested to see if it works. The data is analyzed. It is to be compared to the design requirements. If it doesn't perform according to the design requirements, the student needs to go back and redesign the prototype on paper. Adjustments are made on the prototype and retested. This process of redesigning and making adjustments continues until it works according to the design requirements.

- 🌈 The engineering design results have to be useful and apply to real world situations, issues, or ideas.
- 🌈 The prototype cannot be made from a kit. It has to be created by the student.



Engineering Design Journal

All Engineering design projects must have a journal (log). The journal is the literacy that connects the writing, thinking, research, planning, building, testing, and conclusion to engineering design project. The interviewer can question everything that is written in the journal.

The journal consists of four main parts:

- Title page
- Table of Contents page
- The Engineering Design pages
- The Bibliography page

1. Title Page

The title page consists of the project title, student name, school, and date.

2. Table of Contents

Make a table of contents that shows where the pages of the Engineering Design process steps are found with page numbers so these steps are easily found.

- Define a need
- Research
- Design Requirements
- Project Prototype Designs
 - Beginning Prototype Designs
 - Final Prototype Designs
 - List of Materials
 - Step-by-Step Procedure
- Building, Testing and Recording, and Analyzing the Prototype
- Redesigning, Retesting and Recording, and Analyzing the Prototype
- Conclusion

3. The Engineering Design

In this section you will write what you did or discovered by following each part of the Engineering Design process.

- | | |
|---|--|
| *Define a Need page | *Building the Prototype page |
| *Research page | *Testing and Recording page |
| *Design Requirement page | *Analysis page |
| *Project Designs | *Redesigning, Retesting and Recording, Analyzing the Prototype |
| Beginning Designs page | *Redesigning page |
| Final Designs page | *Retesting and Recording page |
| List of Materials page | *Analysis page |
| Step-by-Step Procedure page | *Conclusion page |
| *Building, Testing and Recording, and Analyzing the Prototype | |

4. Bibliography

Write a list of the three or more sources you used for research by telling the type of source, title, and page numbers (if applicable).

Engineering Design Outline:

Engineers use the Engineering Design Process to create solutions to problems. An engineer identifies a specific need: Who need(s) what because why? And then, creates a solution that meets the need.

When using the Engineering Design process while doing a science fair project, all of these steps listed below are required in the order shown. During the process of completing each step, needs to be written in your journal and later put on your display board. A judge will ask you about the Engineering Design process in your interview.

- Define a Need
- Research
- Design Requirements
- Preliminary and Final Designs
- Materials Needed
- Step-by-step Procedure
- Build and Test the Prototype
 - Build the Prototype
 - Test the Prototype
 - Record the Data
 - Analyze the Data
 - If it doesn't work according to the "Design Requirements" then...
- Redesign and Retest as Necessary
- Conclusion



The Engineering Design process outline. The major objective is to understand the process of designing something and building a prototype (model of the product). The engineering project should be one that is a novice idea. It cannot be a purchased kit. The materials are to be raw materials found around the house and/or purchased at a store.

Students who want to build a prototype for the science fair are required to follow The Engineering Design process described below. As students follow the Engineering Design Process, they must write about each of the following steps in a journal. **The interviewer can question anything that is in the journal.**

Begin by writing a need for something you want to construct and to explain its purpose. It could be for a problem that needs to be solved or a situation that needs improvement. Write it so the need is clearly understood. The goal of this engineering project is to design and construct a prototype for someone to use to perform a useful function. Example: "The goal of this project is to design, build, and test a way to minimize waiting time at stop lights in the city."

2. Research:

You need to research your topic using library materials, Internet sites, magazines, textbooks, encyclopedias, experts, and other available and reliable sources. **At least three sources must be used for the research.** A fairly lengthy paragraph should be written telling what you learned from your three research sources. Be sure the paragraph goes deep into the content learned and you are not just telling knowledge that is already known. Copying a page from a book or Internet and placing it in the journal is not research. **The research needs to be hand or type written. The interviewer can question anything that is written in the journal.**

3. Design Requirements:

Next, you need to establish the requirements needed for the development of the prototype to decide how it will be built. Typical requirements relate to shape, size, weight, appearance, physical features, performance, use, cost, time and money. Another part of the design requirements is to tell the prototype expectations and how it will be tested to meet the desired expectations.

4. Preliminary and Final Designs:

Beginning designs

Here you need to draw the beginning designs of the prototype with labeled parts. They can be brainstorming designs showing two or three ideas.

Final designs

As you focus into one type of design, you need to show the changes needed as the designs get closer to the requirements and expectation of the prototype. The changed designs need to show progress from design to design.

List of materials

Make a list of all the materials and equipment you will use for building the prototype. Using descriptive words to describe the materials and equipment are important. Any materials that are measured should have the measurements listed. (Ex. wooden board 2" x 4" x 8")

Step-by-step procedure

Write a step-by-step procedure you will follow to build the prototype. Write it in the order you want to follow. Be very descriptive in your writing.

5. Build, Test and Record, and Analyze the Results of the Prototype

Building the prototype

Build a prototype according to the design requirements, drawn designs, list of supplies and equipment, and the step-by-step procedure. You need to write about the experience building the prototype.

Testing and data recording

After it is built you need to test the prototype to see if it works according to the testing procedure stated in the design requirements. You need to write down what is actually happening during the testing. You should be as descriptive as possible. Testing the prototype two or three times is important to make sure the test data is accurate.

Data is analyzed if redesigning is necessary

Analyze the data. See if the results match the design requirements. If not, redesigning is necessary.