

# Science Fair Booklet

Contributed by Deb Dommel

## Science Fair Manual for Students and Parents

### Research, Experiment and Presentation by Deb Dommel

This booklet has been prepared to help you through the steps of a science fair project. By working sequentially through the project you should be able to produce an award winning project for your school or local science fair.

Begin by exploring all the steps of the project from Exploring and Choosing a Topic, to Creating Your Display and Preparing an Oral Presentation. Following the step by step instructions will help you keep focused on each step, and assure that you complete all necessary items for a successful project.

{mospagebreak title=Step 1 Choosing A Topic}

### Preparing for Experimentation

#### Step 1 - Exploring & Choosing A Topic

- Start by listing topics you are interested in.
- For each topic area, list questions that you think might be interesting to answer.
- Try to make the question as specific as possible.
- The best science fair projects require an experiment. Projects that show how something works do not make good projects. Showing how an electromagnet works is not as good as seeing how changing the number of coils wrapped around the core affects the strength of an electromagnet.
- Models (of the solar system, a volcano, etc.) are not experiments, and therefore do not make good projects.
- If you need ideas here are some websites to check for some ideas. Be sure to make the topic your own, not just what someone else has done.
  1. <http://www.cdli.ca/sciencefairs/> click on "intermediate projects"
  2. <http://www.all-science-fair-projects.com/> click on "Browse"

- Research questions may take one of the following forms:

- What is the effect of \_\_\_\_\_ on \_\_\_\_\_? (Ex: What is the effect of detergent on germination of seeds?)
- How (or to what extent) does \_\_\_\_\_ affect \_\_\_\_\_? (Ex: How does the color of material affect the absorption of heat?)
- Which (what) \_\_\_\_\_ (verb) \_\_\_\_\_? (Ex: Which detergent makes the most bubbles?)
- Research what is known and what has been done on these topics.
- In light of your research revise your list of questions. If a question has been researched before try to come up with a new and different approach, alter what you test or under what conditions you will test it.
- Finally choose a question that can be answered by doing an experiment. Consider these questions before selecting the question:
  - a. Will it be interesting and safe?
  - b. Can I get the necessary equipment or materials to do it?
  - c. Will I have enough time to complete it?

{mospagebreak title=Step 2 Background Research}

Step 2 - Background Research You must understand your topic to design your experiment, and to be able to present it to the judges. Your science fair paper will include a section titled background research.

When searching the internet - be sure to get information from reliable sources. Personal blogs are not as reliable as scientific or educational websites. Please verify Wikipedia info from another source.

- Begin with the articles and information you have already researched and take notes.
- Notes should be brief and to the point
- Do not use complete sentences on note cards
- Use the author's ideas, not his words
- Make bibliography cards for each resource.
- Include notes on:
  - i. Background information on the topic
  - ii. Experiments that have been done in the past
  - iii. Results of past experiments

- iv. Scientific or consumer significance of this topic (Judges look for this.)
  
- Arrange notes in order. They should be sequenced so that they make sense to the reader. Use the order listed above.
- Write the first draft of your background research.
  
- Use interesting and vivid vocabulary
- Vary sentence beginnings and length
- Use complete sentences with capital letters and punctuation
- Revise your paper. Read revised draft aloud to find mistakes. Check spelling.

### Step 3 - Designing Your Experiment

- Your experimental design should include the following items:
  
- Introduction - Why did you select this topic or experiment?
- Question - What is the purpose of your experiment? Use the types of questions listed above in Step 1
- Hypothesis - What do you think will happen?
- Variables
  
- Manipulated - What are you going to change
- Responding - What are you going to measure
- Controls - List all the things that will stay the same throughout the experiment.
- Submit your experimental design for approval.

### Step 4 - Preparing Your Science Fair Proposal

- Write out your exact procedures for conducting your experiment.
  
- Step by Step, Numbered
- Procedure should be written as commands. Do Not Use any Pronouns.
- Create a list of materials and supplies that you will need to conduct your experiment.
- Have a parent or other adult read your procedure and materials list to see if it makes sense.
  
- Create a rough draft following the sample that includes: Introduction, Problem or question, Hypothesis, Materials, Procedures, and Bibliography.

{mospagebreak title=Step 5 Conducting the Experiment}

## Experimentation

If you plan to enter the METRO Area Fair, you cannot begin experimentation until all the proper forms are completed, including signatures!

### Step 5 - Conduct your Experiment, Record Data and Observations

- Follow your procedures to complete your experiment. If you decide to change anything while you are doing the experiment record it in your science fair log book.
- Make sure that everything stays the same (control variables) except the one thing you change (manipulated variable.)
- Make measurements and record your data (responding variable). Use metric units whenever possible. Record this data in a chart in your science fair log book.
- Be sure you have enough trials. Do your experiment many times. The more trials the better. Depending on cost and time 25-100 is great.
- Everyday write at least one entry in your log book describing what you did, thoughts or ideas and questions you have regarding your science fair project.
- Take pictures during your experimentation. Focus on what is happening in the experiment, not on you. Good pictures that show before and after are great ways to display your data. {mospagebreak title=Step 6 Analyze Your Data}

### Step 6 - Analyze your Data

- Examine the data you have recorded.
- Represent it in a table and/or on a spreadsheet
- Determine how it can best be represented in a graph (pie, line, bar, etc.)
- Create the graphs.
- If appropriate find the mean, median, and/or mode.
- Analyze your data - What does it mean? Do you see any patterns?
- Did you make any changes in your procedures? What? Why?
- Did you have any problems with the experiment? What? Why? {mospagebreak title=Step 7 State Conclusions}

### Step 7 - State your conclusion

- What are the results of your experiment? What happened? Write this part of your conclusion as if the reader cannot see your graphs.
- Based on the results of your experiment what is the answer to your original question.
- Was your hypothesis correct? (Judges will be looking for this.)

A correct hypothesis is not as important as understanding what happened in your experiment and why. More science learned by incorrect hypothesis than by correct ones.

- If your hypothesis was incorrect explain why, and state what you learned as a result of this experiment. {mospagebreak}

title=Step 8 Recommendations}

### Step 8 - Recommendations for Future Research

- This is a chance to reflect on what you (or another scientist) can do next.
  - Based on the results of your experiment, write a paragraph describing additional research that could be done as a result of what you discovered or learned.
- {mospagebreak title=Step 9 Scientific Paper}

### Publishing your Project Step 9 - Scientific Paper

- Using all the parts of your science fair project write the rough draft of your scientific paper.
  - Use interesting and vivid vocabulary
  - Vary sentence beginnings and length
  - Use complete sentences with capital letters and punctuation
  - Revise your paper. Read revised draft aloud to find mistakes. Check spelling.
  - Create a bibliography for your paper.
  - Create a Title page for your paper.
  - Have an adult check your rough draft for errors, then write the final copy of your paper.
  - Typed, double spaced, 1 inch margins.
  - Standard font - Times New Roman, Arial, Courier, Courier New, Tribune
- Size 12 or 14
- {mospagebreak title=Step 10 Writing the Abstract}
- ### Step 10 - Writing an Abstract
- Briefly summarize your Scientific paper - maximum of 250 words
  - Have a parent or other adult read your abstract to see if it makes sense and that it is free of errors. The adult who reads your paper should be one who has not helped you with the project.
  - Revise the abstract as necessary.
  - Final copy needs to be on the appropriate form for the science fair(s) you are entering. It should also be single spaced, size 12 standard font.

- Metro Area Science and Engineering Fair (Link: <http://www.msefomaha.com/> )  
{mospagebreak title=Step 11 Create Your Display}

### Step 11 - Create your Science Fair Display ( Also include list of additional things to display)

- Purchase a standard science fair display board available at most office supply stores, Wal-Mart, etc. 32' or 36' x 48'
- Create headings for the various sections of your display - can be typed or can be made of 2 inch bulletin board letters
- Type all sections for board using a font that is easy to read and a size that can be seen from a distance. Here is a place to use the creative fonts and large size type you like. Make sure it is easy to read.
- If needed, color or cover the board with an appropriate background.
- Before gluing anything to the board check your arrangement to see that everything fits, that it is well organized, eye-catching, free of spelling errors and neat.
- Assemble display board

{mospagebreak title=Step 12 Oral Presentation}

### Step 12 - Prepare Your Oral Presentation

- Review your scientific paper and note the highlights of each part
- Prepare your oral presentation. For the judges this should be no longer than 3-5 minutes. You may want to use note cards to help you prepare your presentation.
- Practice giving your presentation. You should be able to speak to the judges without looking at your note cards.
- Know your project well so that you are able to answer any question the judges may ask you.

If you do not know the answer to a question. Acknowledge that it is a good question and that you would have to further research, OR that it was a question that this experiment was not designed to cover, and further experimentation would be necessary.

{mospagebreak title=Appendices}

#### #1 Science Fair Proposal|INTRODUCTION

Should include one or two paragraphs describing why you selected this topic/experiment

#### QUESTION

Be specific. Your experiment should be able to answer this question. Use the format suggested in the Step 1, n  
(Maybe you could link to that section - or not I don't know what is best.)

#### HYPOTHESIS

What do you think will be the answer to your question. What do you think will be the results of your experiment.

The hypothesis has two parts:

- The condition (If)
- The prediction (Then)VARIABLES
  
- Manipulated Variable (also called the Independent variable) - The one thing in your experiment that you are changing
- Controlled variables (also called the constants) - All the things that you are going to keep the same
- Responding variable (also called the dependent variable) - What you are measuring

#### MATERIALS

A list of all things needed to complete the experiment. Use a bullet list.

#### PROCEDURES

Numbered steps to be followed to complete the experiment. Should be specific enough so that someone else could repeat exactly what you do.

#### BIBLIOGRAPHY

See sample entries listed below #3.

#### #2 Scientific Paper

Title page

Include title of experiment, name of event and date

Introduction

One or two paragraphs describing why you selected this topic/experiment

Question

Hypothesis

Background

A one to two page report that provides information about your science fair topic

Materials/Supplies

Written in paragraph form

Procedures

Written in paragraph form - NO PRONOUNS.

Analysis/Data/Graphs

In addition to graphs and charts one or two paragraphs describing what happened and what it means. The paragraphs should refer to the charts and graphs as well as state what they show in averages, medians, modes, etc.

Conclusions

What do your results mean, was your hypothesis correct or incorrect?

Plans for Future Research

Bibliography

On a separate sheet of paper, see below

#3 Bibliography

Canton, Bruce. The Army of the Potomac: Glory Road. Garden City: Doubleday, 1952.

(Book author. Title. City of publication: Publisher, copyright.)

Graham, D. K. "Battle of Gettysburg." Hobbies, Sept. 1974: 157-158

(Author of article. "Title." Magazine Title, date of publication: page numbers)

Scifair.org. National Science Teachers Association. 14 Sept. 1995 <<http://www.scifair.org/>

(Title of home page. Sponsor of site. Date of access web address)

"Wars." Encyclopedia Britannica. 1988 ed.

("Title of Article." Title of Encyclopedia. Copyright.)

Williams, T. Harry. "Civil War." World Book Encyclopedia. 1976 ed.

Author of article. "Title of article." Title of Encyclopedia. Copyright.)

Note: If entry goes to a second line - indent the line standard indent space.

Single space within entry.

Double space between entries.

#4 Science Fair Display Board  
Display Board Size 48" x 36." No Top Title Panel

Title

Catchy, Specific, Largest type or letters

Question (Problem)

Hypothesis

Materials & Procedures

List of all materials used, Directions for any equipment made, Step by step procedures in numbered form

Graphs/Tables

Display data gathered in appropriate graphs and tables that are labeled appropriately

Analyzed Results

Summary paragraph explaining results

Conclusions

Paragraph stating what results mean. Was the hypothesis correct?

Bible Verse

Verse that relates to the project, either directly or in principle Include a 1 or 2 sentence explanation of how the v relates to the project.

### Acknowledgements

the project

Document any written source that was instrumental to the project Acknowledge any person who gave help in com

### Additional Display Items

#### Logbook

Journal that was kept while working on the experiment

At the end include:

List of Variables that could not be controlled in the experiment

List of Mistakes done during the experiment with an explanation as to why the variable could not be controlled

List of Things that could be done differently if the research project were to be continued or redone

#### Scientific Paper

Placed on display table

#### Abstract

Placed on display table

#### Photographs

Can be placed on display board, in log book or on table, wherever is most appropriate

General Notes for your display:

- Neat and easy to read
- Well organized
- Error free
- Name should not be on anything in display

#### #5 Abstract

A brief summary of the entire project that gives an overview of the project without reading the complete research examining your visual aid in detail

Maximum 250 words

Purpose of the experiment (question)

Why did you choose this topic? What did you hope to accomplish?

Hypothesis

Procedure

Summary paragraph of procedures used

Analyzed Data

Summary of all data in paragraph form

Conclusions

Summary of what data means, was the hypothesis correct

May include:

Brief summary of background information

Possible research applications

Should not include:

Acknowledgements

Work done by mentor

#6 Oral Presentation Introduction

How you got interested in the topic, background information on topic, independent and dependent variables

Question

Hypothesis

Give your hypothesis and background information to support it

Procedure

What you did, when and how

## Results

Explain tables and recorded observations, explain what they mean and why you got the results you did

## Conclusions

Brief concise statement of conclusions, how you arrived at it and evidence to support it

Be prepared to discuss:

- Variables that could not be controlled
- Mistakes made during the experiment, and how they could have been corrected
- Things to do differently if the project were redone
- Ideas, problems or questions that could be developed for future research

Science Fair Basics