I. BASIC INGREDIENTS FOR A SCIENCE FAIR PROJECT

TITLE

Choose a catchy title. Make it specific. (For more information see page 6.) It should describe one of the three types of projects:

1. An investigation (page 7)
2. A collection or model (page 7)
3. A demonstration of a scientific principle (page 8).

SCIENTIFIC METHOD

This is the method scientists follow to do their projects. (See pages 7 and 8) *

PURPOSE

HYPOTHESIS

PROCEDURE

A. Research

B. Experiments

RESULTS

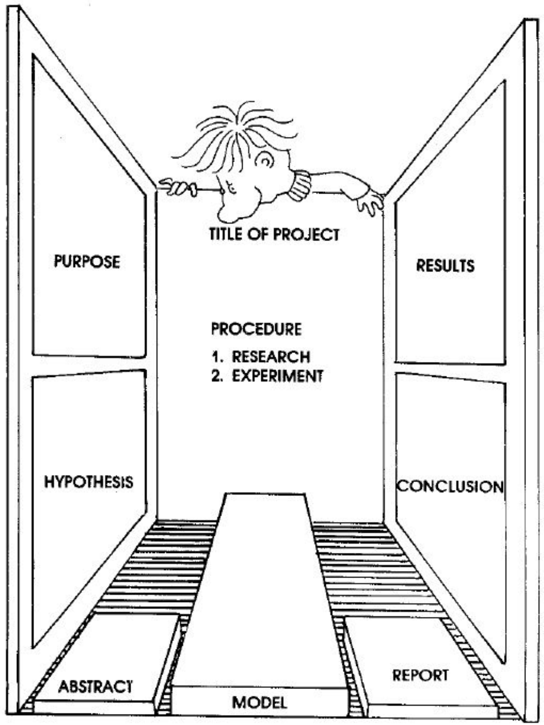
CONCLUSION

ABSTRACT

This is a brief summary of your project. (See page 10.)

EXHIBIT

This displays your project. (See page 9.)



* This book considers the scientific method to include purpose, hypothesis, procedure, results, conclusion—in that order. This is not the only order for the scientific method. For instance, your project may begin with an hypothesis (an untested idea which might solve a problem or answer a question), or some research into an interesting topic, or with an experiment. Sometimes the purpose of your project becomes clear after you test an hypothesis, conduct some research, or perform an experiment. See the sample abstract on page 22 for a different order to the scientific method.

II. FROM TOPIC TO TITLE

Student: How do I do a science fair project?

Guide: What are you curious about?

Student: Well, I am interested in:

- People
- Animals
- Plants
- Rocks
- Space
- Music
- Weather
- Diseases
- Television
- Electricity
- Pollution
- Clothing
- Movies
- Computers
- Etc., etc., etc. . .

Guide: Wait a minute! You could do a hundred projects on any of those. Decide what you're really curious about. Then focus on something in particular.

Student: Oh, you mean like:

- What makes a person an adult? (people)
- How can I best train my pet? (animals)
- How can plants best be protected against pests? (plants)
- What do the different colors in rocks mean? (rocks)
- What is in the night sky? (space)
- What's the difference between music and noise? (music)
- How weather changes. (weather)
- How does sickness affect people? (diseases)
- Which T.V. shows do people watch? (television)
- How does electricity do work? (electricity)
- How can pollution be controlled? (pollution)
- Which winter clothing is really best? (clothing)
- Do movies change people's attitudes? (movies)
- Simple computers. (computers)

Guide: That's a much better list. It is the same set of ideas, but more specific. But, well, you need to be very specific so you can really figure things out. You should try for the most exact information you can discover. It's like the difference between estimating and measuring, kind of like telling people you fell off a tall ladder. Just think how they'd react if you told them you fell off an eighteen foot ladder! Be specific if you want people to really understand you. In science information has to be exact if it's really going to matter.

Student: Let's see if I can make my list specific:

- How Eighth Graders Compare With Adults (people).
- Does the Length of an Animal Training Session Make a Difference? (animals)
- Can Companion Planting Protect Beans from Beetles? (plants)
- Simple Tests for Mineral Detection (rocks).
- Measuring the Night—A Personal Sky Chart (space).
- What Makes a Pleasing Sound? (music).
- Instruments That Measure Weather (weather).
- Influences on the Rate of Recovery from the Common Cold (disease).
- Using a Survey to Design Television Programs (television).
- Can a Worn-Out Battery Do Work? (electricity)
- Can Smoke Be Captured From the Air? (pollution)
- Can Mice Decide the Best Insulation? (clothing)
- Do Movies Affect People's Hopes and Fears? (movies)
- A Simple Computer Model (computers).

Guide: Much better. Your list sounds like science project titles! But you could go on forever. Time to choose . . .

III. PROJECT TYPES
(THE THREE BASIC CHOICES)

TYPE 1 • An investigation

- Can a machine really teach?
- How long does it take the heart to return to normal after exercise?
- What is the most electricity you can make using a magnet and a coil?
- How rapidly does a plant make starch?

Any of these questions could become a science project. Just follow the scientific method:

PURPOSE

What exactly are you trying to figure out with your project? Make a statement, for example: To find out if a machine can really be used to teach.

HYPOTHESIS

Based on what you know, try to make an answer for your question. This is your best guess, your hypothesis. As you do your project, you will try to find out if your hypothesis is true. A hypothesis is a statement. It might sound like this: A simple machine can teach children basic science facts.

PROCEDURE

A. **Research**—Collect information to help you answer your question. Use books, magazines, interviews, and TV. Try contacting businesses, utilities, government offices, etc.

B. **Experiment**—Test your hypothesis. Try it out. For example, can your machine teach science facts better than another method? How can you find out? An hypothesis must be proved or disproved.

RESULTS

List your results. Use a notebook, charts, graphs, pictures, or tapes. Be clear! Give facts, not opinions.

CONCLUSION

What did your project teach you? Even if your experiment proved your hypothesis wasn't true, you've learned something.

TYPE 2 • Construction of a Kit or Model, or Putting Together a Collection

- A model of a solar home
- A telegraph system
- An ecology terrarium
- Types of flowers
- A model of recycling plant
- Styles of handwriting
- Insulation materials and their uses

You could use any of these as a project title. It would be better if you could form a question, for instance: How can a model of a solar home show storage of solar energy? How does a telegraph system work? Follow the scientific method. Make it part of your project.

PURPOSE

If your title is a question, the purpose of your project is to provide an answer, for instance: to find out if solar energy can be stored as heat energy within a home.

HYPOTHESIS

This is an idea to try out. When tested, it will help you to accomplish your purpose, for instance: A model of a solar home will show that certain materials will store solar energy for use in home heating. An hypothesis is a possible answer to a question or solution to a problem.

PROCEDURE

A. **Research**—Gather information to aid your purpose.

B. **Experiment**—Test your hypothesis. How can you prove that solar energy can be stored as heat energy?

RESULTS

Give measurements, not statements like "more or less."

CONCLUSION

What might your project lead to? What is its importance?

III. PROJECT TYPE CONTINUED

TYPE 3 • Demonstration of a Scientific Principle

- Measuring lung capacity
- Farday's famous ice pail experiment
- An oil-drop model of a splitting atom
- An electrical smoke trap

Any of these demonstrations could be turned into a science fair project. Think in terms of a question to help you get at the important ideas, for instance: Why should lung capacity be measured? To have a guideline for the project, follow the scientific method:

PURPOSE

What is your goal? It might sound like this: To find out if a large lung capacity is an advantage during exercise.

HYPOTHESIS

Tell how you think your project can demonstrate whether or not you reached your goal. A hypothesis might sound like this: Students with the largest lung capacities can do the most exercise. An hypothesis must be tested.

PROCEDURE

A. **Research**—Search for information about your project.
B. **Experiment**—Test your hypothesis! How exactly can you prove it?

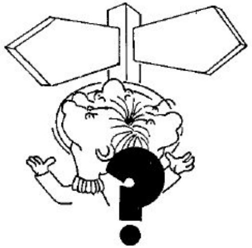
RESULTS

List the main points of what you've learned. What did your research and experiments prove?

CONCLUSION

What does it all add up to? What is the value of your project?

IV. WANT TO GIVE UP OR GO ON?



Student: It seems complicated. I think I am getting a little confused.

Guide: **That's because you don't have much experience. It's like learning a new game, hobby, sport, or job. Nobody knows everything the first time. Talk to people who have done a project once or twice before. They will tell you that you'll pick it up as you go along.**

Student: I'm still not too sure I remember it all.

Guide: **Look. You are finding out about something, and making a display. Making a science fair project is like building a model, doing a puzzle, playing a sport or giving a musical performance. You become better at it as you stick with it. Remember, your project idea can take you places. Take a look at page 11 to find out just where your idea can take you.**

Student: OK. I've got an idea for a project. I'll follow the scientific method, but what do I need for the science fair.

Guide: **You need your exhibit and an abstract.**

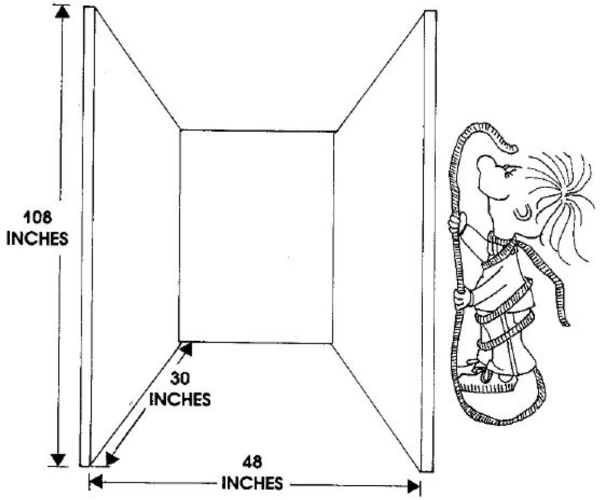
Student: That's it?

Guide: **You bet!**

Student: What kind of an exhibit should I make, and what is an abstract?

Guide: **Well, an abstract is a written summary of your project, but the easiest way to find out is to visit a science fair or to look at pictures or exhibits. I'll try to make it sound uncomplicated.**

V. EXHIBIT

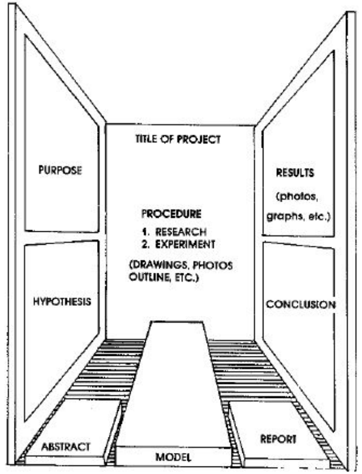


SIZE—It must not be larger than 48 inches wide, 30 inches deep (front to back), and 9 feet tall. Keep your exhibit neat, uncluttered, and to the point.

MATERIAL—The materials must be strong, light weight and self-supporting. You should be able to assemble it yourself. Be sure to make everyting sturdy so it can be safely transported. Make sure you can fit it into your car. Fasten everything well. Use hardware not tape.

SAFETY—Anything which might be hazardous is prohibited. Do not use open flames, dangerous chemicals (even household cleansers can be very dangerous when mixed), unshielded light bulbs, etc. You will need to supply your own electrical cord if needed. Be sure it's in good shape and uses a three-prong (grounded) plug. Check with your teacher for complete rules. Also, if you are working with live vertebrate animals, you will need to check with your teacher for special permission.

DISPLAY—Use attractive lettering. You might like to make up your own cut-outs because small stencil letters can be hard to read. Use one-color printing to avoid confusion. Spell correctly. Main points should be large and simple. Details must be clear 3-5 feet away. You may include any of the following:



POSTERS—These "advertise" the main features of your project. You might use drawings, pictures, outlines, etc.

GRAPHS—There are many types. Line graphs, bar graphs, and picture graphs all serve to illustrate some kinds of results. Check your math textbook for more information. Consult with parents and teachers.

MODELS—Be able to explain them!

PHOTOGRAPHS, SLIDES—These can display information you couldn't bring to the fair. They can also show different stages of your project's development.

VI. ABSTRACT (See Samples)

All Projects should have this

Length It should be no longer than 250 words (use only one side of a page). If it is typed, be sure to double space; if it is handwritten, skip lines.

Quality Be sure your thoughts are clear. Have someone check your spelling and grammar. If your paper is handwritten, be extra neat.

Content Your abstract is a summary, an overview, of your project, it should include:

PURPOSE
Why did you do your project? What was the question you wanted to answer? What was the problem you tried to solve?

HYPOTHESIS
This is a "best guess" explanation of what you think your experiment will prove.

PROCEDURE

A. **Research**—Briefly explain your research plan. How did you gain information about your project?

B. **Experiment**—Mention the goal and outcome of any experiments. Did they prove or disprove your hypothesis?

RESULTS
What were the most important facts learned from the project?

CONCLUSION
What do your results mean? Can you compare the results to anything else you know? Do your results give you any ideas for future research?

VII. FINAL PREPARATIONS

Student: I guess I might have to look over all that a few times, but it doesn't look too bad. Basically all I need to show is the exhibit itself, including the abstract?

Guide: That's it! You might want to include your bibliography. That's a list of all the materials you read during your research (see pages 15, 20, and 21). Your teacher can help you with the proper form. And you can do a research paper. It is something you can read over while you are waiting to be questioned. The judges might like to read it too!

Student: Questions? Judges?!!

Guide: You can also exhibit any notebooks you have kept during your project.

Student: What's this about judges?!

Guide: You might even practice giving a speech to your family, friends, or class. It will prepare you for talking to the . . .

Student: Judges! Wait a minute. What's all this about judging?

Guide: School science fairs use judges to select the best projects. If you win at your school fair, you might be eligible to go to the regional science fair. There you will be competing with hundreds of students from other schools.

Student: I don't know about this judging stuff!

Guide: It is not tough. Judges are people who enjoy talking to people about their exhibits.

SAMPLE ABSTRACTS

Narrative Style

ABSTRACT

Why Is There No Air In Light Bulbs?

The idea for this project came from an experiment called "Edison's Electric Light" described in Selected Experiments and Projects from the Edison Foundation.

Thomas Edison experimented with many types of filament wire in lamps, or bulbs, from which the air had been removed.

This project indicates the reason that air is removed from light bulbs.

For a fire to burn, air (the oxygen in air) must be present: no oxygen, no fire. Electricity can cause material (even filament wire) to burn. It seemed that for a light bulb filament to glow without burning up quickly, it would have to let electriciity pass through it without the oxygen in air being present.

A test was set up to determine whether or not a filament would glow longer and brighter without the oxygen in air being present.

A low resistance nichrome wire 2 cm. long was used to represent a light bulb filament. This length burned out after about two seconds of carrying electricity from a 6 Volt battery.

Electric current was applied to each of 20 filaments placed in a "bulb" that contained air. The burn out time for each trial was measured and the average time was calculated.

Electric current was then applied to each of 20 filaments placed in a "bulb" from which air had been removed. The burn-out time for each trial was measured and the average was compared to the first set of trials.

The filaments glowing without the oxygen in air being present lasted 30% longer, on the average, than the filaments glowing in the presence of the oxygen in air. These test results indicate that in order to make light bulb filaments last longer, air must be removed from light bulbs.

Outline Style

ABSTRACT

Why is There No Air In Light Bulbs?

Research When a light bulb breaks, it makes a "popping" noise as air rushes into the vacuum inside the bulb. Descriptions of Edison's inventions indicate that "he had to create a good vacuum to prevent the filament from burning up". These facts lead to the forming of an hypothesis.

Hypothesis A light bulb filament will glow longer and brighter if the oxygen in air is removed from the bulb.

Purpose By re-enacting one of Edison's experiments, this project will indicate the reason that air is removed from light bulbs.

Procedure The experiment was conducted as follows:

1. A low resistance nichrome wire was selected to represent a filament.
2. It was found that a 2 cm. length of this wire would burn out after about two seconds when current from a 6 Volt battery was applied.
3. Twenty times electric current was applied to 2 cm. lengths of filament placed in a "bulb" that contained air. The burn-out time for each trial was recorded and the average determined.
4. Electric current was then applied to each of twenty filaments placed in a "bulb" from which the oxygen in air had been removed by a burning candle. Trials were recorded and the average determined.
5. The results from each set of trials were put in graph form and the averages were compared.

Results Although there was no noticable difference in brightness, the filaments glowing without the oxygen in air being present lasted, on the average, 30% longer than filaments glowing in the presence of the oxygen in air.

Conclusion There is no air in light bulbs because the oxygen in air would cause filaments to burn out more quickly than if the oxygen were removed.

SAMPLE PROJECTS