**Science Fair Project**

**Guide**

**Grace Christian Academy**

**Kankakee, Illinois**

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**Doing What Scientists Do**

**Being Curious:**

Keep your eyes wide open and watch for the unusual things. Wonder about everything! Constantly ask questions:

 “What will happen if I do this?”

 “Why did this happen?”

 “What did I learn from this?”

**Being Organized:**

Get all your materials together before you start your investigation. Read, write, and Follow directions carefully. Keep good Records! Write down everything that you see and learn in your observation notebook.

**Being Wise:**

Follow all the rules for sage science and take good care of your science equipment and supplies

**Being Inventive:**

Don’t be afraid to try different things, to ask more questions, and to make guesses about what might happen. Try different ways to come up with checking out your question. If something didn’t work out or something is still puzzling you, try to find out why it didn’t work.

**Being Patient:**

Allow for plenty of time to perform your experiment or investigation. If it doesn’t work right at first, then be willing to try again. Try to find out why your investigation did not work out. This is really doing science.

**Having Fun:**

The fun of science is not in getting the answer but in DOING SCIENCE and LOOKING FOR THE ANSWER! The most brilliant scientists don’t understand everything. Life is full of mysteries. Have fun searching for more questions and answers!

**What is a Science Project?**

 A science project is your attempt to answer a question using a step by step process called the scientific method. Science projects primarily involve experimental tests to arrive at a specific conclusion

A SCIENCE PROJECT HAS THE FOLLOWING COMPONENTS:

1. **Purpose:** Explain why you are doing this investigation
2. **Problem:** This should be stated in the form of a question that cannot be answered yes or no. An experiment must be conducted to find the answer
3. **Research:** A 250-500 word report is written giving background information about your topic. Information is gathered from books, encyclopedias, magazine articles, and online about the subject. This information should be written in your own words. Any information you find and use must be cited in a citation page.
4. **Hypothesis:** After researching information about your topic, write an educated guess to answer your problem question using the If… Then…Because… format.
5. **Procedure of Investigation:** Give a detailed description of the process used to test your hypothesis. List variables, materials used, and a description of how your experiment was performed. To be a “fair test,” the experiment must be performed three times.
6. **Results:** Date and observations are collected from your experiments is recorded on a data chart/ graphed.
7. **Interpretation of Data:** The meaning of the data recorded on your chart is graphed and explained in words.
8. **Conclusion:** The hypothesis is restated. Summarize what happened by explaining what the results showed. State whether or not the hypotheses was supported. If your hypothesis was not supported, then use the information that you have gathered to make a new hypothesis.
9. **Future study:** Explain what you would do next if you continued with this investigation
10. **Display:** Show and tell what your project is all about.

**Steps to a Great Science Project**

**Choosing a Topic**

A science project is an investigation you do to find the answer to a Question that you may have.

**Selecting a Topic**

It is a challenge to decide a topic that is original and interesting. An experiment can be done on many things. Choose a topic in which you are interested and one in which you are somewhat familiar. Your topic should be one for which you can find adequate information.

**Science Fair Categories**

Your Science Fair Project should fit into one of the following categories.

**1. Biological Sciences:**

• includes projects that involve living things or once living things

• Examples of projects in this category are studies of plant growth, cell structure, molds, preservatives, growth and development

**2. Environmental Sciences/Ecology:**

• includes projects that involve the environment and the relationships of living things to each other and/or to the environment

• Examples of projects in this category are studies of organisms in their habitat, relationships between various organisms, and studies on how people’s actions affect the environment

**3. Physical Sciences:**

• includes projects involving non-living things

• Math, computer, and engineering projects are included in this category

• Other topics in this category are aerodynamics, probability, crystal growth, evaporation, solar power, electrical circuits

**4. Earth Sciences:**

•includes projects involving the earth and physical phenomena

•examples for projects in this category are weather, astronomy, rocks/minerals, and water

**Where to Look**

Conduct some research to try and find a topic that excites you. Check these resources:

* Science Books
* Science Lab Manuals
* Science Fair Idea Books
* Encyclopedias
* Professional People
* Engineers, Medical People
* Science Centers
* The Internet (Listed websites to help start your research)
* <http://www.sciencefair-projects.org>
* <http://www.sciencefairadventure.com/>
* <http://www.all-science-fair-projects.com/>
* <http://www.education.com/science-fair/>

<http://www.sciencebuddies.org/science-fair-projects/project_ideas.shtml>

**My Topic is:**

Parent’s approval: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Teacher’s approval: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Observation Notebook**

Scientific thinking is based on observation. An observation is information that a person has gained by using one or more of their five senses. Good scientific observations are repeatable, so try your experiment several times to see if your observations are consistent.

Once you have found a topic that you will enjoy, you are ready to get started. It is important to organize yourself by getting a notebook, or compile printed pages into a three ring binder, to create an observation notebook of everything that you will be learning and doing on your project. An observation notebook often proves to be the most efficient way of organizing your research and it will serve as an excellent outline for your report. **This will be where you will record everything as you conduct your experiment!**

Things to write in your observation notebook:

1. **Title Page:**
	* Include the title of your project or the question; your name; your school; your grade; the names of your classroom teacher & science teacher; the date.
2. **Table of Contents:**
	* List all sections of your notebook with page numbers.
3. **Purpose:**
	* Write a paragraph about your project. Explain how you became interested in your topic
4. **Problem:**
	* State the scientific question you are investigating.
5. **Background Research:**
	* Include background information, definitions and research you did during the course of your project.
6. **Hypothesis:**
	* State your hypothesis about the proposed relationship between the independent and dependent variables. State your reasons for choosing your hypothesis.
7. **Materials:**
	* List all your materials and the amount used of each.
8. **Procedures:**
	* Write a complete, numbered, step-by-step description of how you conducted your investigation.
9. **Data, Observations:**
	* Try your experiment at least 5 times. Keep a complete record of all data and observations. Organize the numerical data into table(s).Include variables and units of measurement. If you have copied any data, place your original laboratory data in the back of the project notebook. Include notes, photos, drawings, changes in the variables, and/or unexpected responses.
10. **Results:**
	* Find averages of all measured data and final observations. (Not a conclusion.)
11. **Graph of Results:**
	* Display your results on a graph. Graphs must be student generated and appropriate for the type of data collected. Computer graphs are acceptable. Include variables and units of measurement on graphs.
12. **Conclusion:**
	* Write the conclusion to your investigation. Restate the investigative question. Was your hypothesis correct? Use results to prove the conclusion. Include error analysis and what was learned.
13. **Applications and Future Research:**
	* Explain how the information you learned could be used in the real world. Describe how you would change your investigation or extend your experiment in the future.
14. **Works cited:**
	* List all sources of information using the proper format: e.g. Internet websites, encyclopedias, books, people interviewed, magazines, etc.
15. **Acknowledgments:**
	* Give credit to anyone who gave you any special advice or help, such as typing the report, helping you find information, assisting with building, or setting up or conducting your experiment.

**Purpose**

Every project must have a purpose. Why are you doing this project? After you have chosen a topic; explain why you are conducting this experiment. Begin by writing an introduction to your purpose statement, which says something about your topic. Then explain the purpose of your project. A good purpose will make things easier as you get into your experiment.

**Example of an excellent purpose statement:**

|  |
| --- |
| *The purpose of this experiment was to find out how the density of plant cover affects soil erosion. I became interested in this experiment when the hillside next to our yard began to erode. The information from this experiment will help people to determine how many plants they should plant on their yards hillside.* |

**Use this outline to guide you as you write your own purpose statement**

-The purpose of this experiment was to…

-I became interested in this experiment when…

-The information gained from this experiment will help others by…

**Write your Problem Question and Identify Variables**

The problem is written as one question which cannot be answered with “yes” or “no”. When your problem question is written clearly, the project is much easier to do.

 In order to conduct a fair test, you must control all the variables in your experiment except the one being changed, which is the independent variable. Be sure there is a control. The control is the part of the experiment that has all of the variables regulated so the conditions are kept the same or constant in each test. Having a control lets you compare what happens in your tests to what could usually be expected to happen. The change that happens is measured and is called the dependent variable.

**Example**

|  |  |  |  |
| --- | --- | --- | --- |
| Question  | Independent Variable(What I change)  | Dependent Variables (What I observe)  | Controlled Variables (What I keep the same) |
| How much water flows through a faucet at different openings?  | Water faucet opening (closed, half open, fully open) | Amount of water flowing measured in liters per minute  | * The Faucet
* Water pressure, or how much the water is "pushing"

"Different water pressure might also cause different amounts of water to flow and different faucets may behave differently, so to insure a fair test I want to keep the water pressure and the faucet the same for each faucet opening that I test."  |
| Does heating a cup of water allow it to dissolve more sugar?  | Temperature of the water measured in degrees Centigrade  | Amount of sugar that dissolves completely measured in grams  | * Stirring
* Type of sugar

"More stirring might also increase the amount of sugar that dissolves and different sugars might dissolve in different amounts, so to insure a fair test I want to keep these variables the same for each cup of water." |

Things to include in your problem question

* 1. What is your control?
	2. What is your independent variable?
	3. What is your dependent variable?
	4. What is your time limit?

Using this information, write your problem question here:

**Review of Literature**

**Why the Need for Background Research?**

So that you can design an experiment, you need to research what techniques and equipment might be best for investigating your topic. Rather than starting from scratch, savvy investigators want to use their library and Internet research to help them find the best way to do things. You want to learn from the experience of others rather than blunder around and repeat their mistakes. A scientist named Mike Kalish put it humorously like this: "A year in the lab can save you a day in the library."

Background research is also important to help you understand the theory behind your experiment. In other words, science fair judges like to see that you understand why your experiment turns out the way it does. You do library and Internet research so that you can make a prediction of what will occur in your experiment, and then whether that prediction is right or wrong, you will have the knowledge to understand what caused the behavior you observed.

**Making a Background Research Plan: How to Know What to Look For**

When you are driving a car there are two ways to find your destination: drive around randomly until you finally stumble upon what you're looking for OR look at a map before you start. (Which way do your parents drive?)

Finding information for your background research is very similar. But, since libraries and the Internet both contain millions of pages of information and facts, you might never find what you're looking for unless you start with a map! To avoid getting lost, you need a background research plan.

**Writing a Research Report**

After establishing your purpose statement and problem question, research is done to collect background information on your topic. Using your purpose statement and problem question will help guide your research. This research will help you understand how to set up an experiment, help you recognize what you need to control, and get the most out of your variables. **Information you have gathered is organized and a 250-500 word report is written**. All sources that you use to write your report must be cited correctly in your works cited.

You need to use reliable resources. Not all web sites have accurate information. Make sure the information obtained can be verified in more than one source. You need to check the relevancy of the information, how qualified the author is, and whether or not the information could be biased. Recommended websites end with .gov .edu .org and other reliable sources. **You need a minimum of 5 sources.**

|  |
| --- |
| **EXAMPLE WORKS CITED PAGE** "Battery." *Encyclopedia Britannica*. 1990."Best Batteries." *Consumer Reports Magazine* 32 Dec. 1994: 71-72.Booth, Steven A. "High-Drain Alkaline AA-Batteries." *Popular Electronics* 62 Jan. 1999: 58.Brain, Marshall. "How Batteries Work." *howstuffworks*. 1 Aug. 2006       <http://home.howstuffworks.com/battery.htm>."Cells and Batteries." *The DK Science Encyclopedia*. 1993.Dell, R. M., and D. A. J. Rand. *Understanding Batteries*. Cambridge, UK: The Royal Society       of Chemistry, 2001. "Learning Center." *Energizer*. Eveready Battery Company, Inc. 1 Aug. 2006       <http://www.energizer.com/learning/default.asp>."Learning Centre." *Duracell*. The Gillette Company. 31 July 2006       <http://www.duracell.com/au/main/pages/learning-centre-what-is-a-battery.asp>. |

**Write your Hypothesis**

A Hypothesis is what scientists call an educated guess to your problem question. It is a guess that is made after your subject has been thoroughly researched and you have learned all you can from various sources. It must answer your problem question.

**Examples to the same questions in the problem question:**

|  |
| --- |
| *“****If*** *I open the faucet [faucet opening size is the independent variable],* ***then*** *it will increase the flow of water [flow of water is the dependent variable].*  *“Raising the temperature of a cup of water [temperature is the independent variable] will increase the amount of sugar that dissolves [the amount of sugar is the dependent variable]."* |

Using the information from your problem question will help you in writing your hypothesis. Let’s break the hypothesis into three stages. To start off, tell me what you are going to change (independent variable). The next stage explains what will happen (dependent variable) because of the independent variable. The last stage of the hypothesis is the educated guess. This is where you will explain why you think the dependent variable will act the way it does when you change the independent variable.

If… (Independent variable), Then… (Dependent variable), Because… (Explanation of why the dependent variable is going to react)

Try writing your hypothesis:

If:

Then:

Because:

**Procedure**

Your **experimental procedure** is like a step-by-step recipe for your science experiment. A good procedure is so detailed and complete that it lets someone else duplicate your experiment exactly!

**Repeating a science experiment is an important step** to verify that your results are consistent and not just an accident.

* For a typical experiment, you should plan to repeat it at least three times (more is better).
* If you are doing something like growing plants, then you should do the experiment on at least three plants in separate pots (that's the same as doing the experiment three times).

**This is what needs to be included in your Procedure:**

* Materials
	+ Be extremely detailed with your list of materials that you used in your experiment
	+ The goal is to allow people to repeat your experiment
* Variables
	+ Independent variables
	+ Dependent variables
	+ Constant
* Control Group
	+ In many experiments it is important to perform a trial with the independent variable at a special setting for comparison with the other trials. This trial is referred to as a **control group**. The control group consists of all those trials where you leave the independent variable in its natural state.
* Experimental Group
	+ The **experimental group** consists of the trials where you change the independent variable.
* A step-by-step list of everything you must do to perform your experiment.
	+ Think about all the steps that you will need to go through to complete your experiment, and record exactly what will need to be done in each step.
	+ The experimental procedure must tell how you will change your one and only independent variable and how you will measure that change
	+ The experimental procedure must explain how you will measure the resulting change in the dependent variable or variables
	+ If applicable, the experimental procedure should explain how the controlled variables will be maintained at a constant value
	+ The experimental procedure should specify how many times you intend to repeat your experiment, so that you can verify that your results are reproducible.
	+ A good experimental procedure enables someone else to duplicate your experiment exactly!

Example:

|  |
| --- |
| Materials List* CD player & a CD (low drain device)
* Three identical flashlights (medium drain device)
* Camera flash (high drain device)
* AA size Duracell and Energizer batteries
* AA size of a "heavy-duty" (non-alkaline) battery (I used Panasonic)
* Voltmeter & a AA battery holder
* Kitchen timer

Experimental Procedure1. Number each battery so you can tell them apart.
2. Measure each battery's voltage by using the voltmeter.
3. Put the same battery into one of the devices and turn it on.
4. Let the device run for thirty minutes before measuring its voltage again. (Record the voltage in a table every time it is measured.)
5. Repeat #4 until the battery is at 0.9 volts or until the device stops.
6. Do steps 1–5 again, three trials for each brand of battery in each experimental group.
7. For the camera flash push the flash button every 30 seconds and measure the voltage every 5 minutes.
8. For the flashlights rotate each battery brand so each one has a turn in each flashlight.
9. For the CD player repeat the same song at the same volume throughout the tests.
 |

**Procedure of Investigation**

(Use this outline as a rough draft)

Materials:

Variables:

 Controlled:

 Independent:

 Variable:

Procedure:

1.

2.

3.

4.

5.

6.

7.

8.

9.

10.

**Design a Data Chart**

While you are carrying out the procedure of your investigation, you need a way to collect and organize your data (measurements) from your experiment. Create a chart for the types of data you will gather.

 The data chart should have a title which indicates the independent variable (variable you changed) and the dependent variable (variable you measured). It should include the number of tests you performed. Three trials are the minimum for accurate results. Average the results of each trial.

**Example** of a data chart testing the voltage of a battery while being used by a flashlight:

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *AA Batteries Tested in a Flashlight* |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
| *Energizer Brand AA Batteries* |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
| Battery # | #3 | #4 |   | #19 | #20 |   | #31 | #32 |   |   |
|   |   |   |   |   |   |   |   |   |   |   |
| Time (hour) | Voltage | Voltage | Flashlight dead? | Voltage | Voltage | Flashlight dead? | Voltage | Voltage | Flashlight dead? | Average Voltage |
| 0.0 | 1.605 | 1.610 |   | 1.607 | 1.609 |   | 1.604 | 1.605 |   | 1.607 |
| 0.5 |   |   |   | 1.396 | 1.402 |   | 1.400 | 1.412 |   | 1.403 |
| 1.0 | 1.356 | 1.363 |   | 1.343 | 1.351 |   | 1.354 | 1.360 |   | 1.355 |
| 1.5 |   |   |   | 1.307 | 1.314 |   | 1.318 | 1.327 |   | 1.317 |
| 2.0 | 1.295 | 1.295 |   | 1.280 | 1.288 |   | 1.304 | 1.311 |   | 1.296 |
| 2.5 | 1.273 | 1.280 |   | 1.267 | 1.284 |   | 1.268 | 1.278 |   | 1.275 |
| 3.0 | 1.260 | 1.265 |   | 1.255 | 1.262 |   | 1.261 | 1.267 |   | 1.262 |
| 3.5 | 1.249 | 1.256 |   | 1.245 | 1.247 |   | 1.247 | 1.252 |   | 1.249 |
| 4.0 |   |   |   | 1.226 | 1.232 |   | 1.230 | 1.238 |   | 1.232 |
| 4.5 | 1.221 | 1.226 |   | 1.206 | 1.216 |   | 1.212 | 1.224 |   | 1.218 |
| 5.0 |   |   |   | 1.197 | 1.204 |   | 1.196 | 1.210 |   | 1.202 |
| 5.5 | 1.160 | 1.186 |   | 1.170 | 1.178 |   | 1.177 | 1.190 |   | 1.177 |
| 6.0 |   |   |   | 1.128 | 1.150 |   | 1.174 | 1.184 |   | 1.159 |
| 6.5 | 1.108 | 1.135 |   | 1.085 | 1.117 |   | 1.132 | 1.144 |   | 1.120 |
| 7.0 | 0.630 | 1.120 | Yes | 1.012 | 1.063 |   | 1.125 | 1.137 |   | 1.015 |
| 7.5 |   |   |   | 0.515 | 0.586 | Yes | 1.063 | 1.095 |   | 0.815 |
| 8.0 |   |   |   |   |   |   | 0.609 | 0.900 | Yes | 0.755 |

 |

* Notice that the voltages of each battery are recorded every half hour.
* From this sample, there were plenty of trials recorded for us to get accurate data
* The results from every trial were averaged

**Review** your data. Try to look at the results of your experiment with a critical eye. Ask yourself these questions:

* Is it complete, or did you forget something?
* Do you need to collect more data?
* Did you make any mistakes?

**Choose the Appropriate Graph to Interpret the Data Results**

* Calculate **an average** for the different trials of your experiment, if appropriate.
* Make **sure to clearly label** all tables and graphs. And, include the **units of measurement** (volts, inches, grams, etc.).
* Place your **independent variable on the x-axis** of your graph and the **dependent variable on the y-axis**.

**Example of graph from the data chart on page 13**

|  |
| --- |
| Time (the independent variable) is on the x-axis of the graph.  |
| Voltage (the dependent variable) is on the y-axis of the graph. |

A **bar graph** might be appropriate for comparing different trials or different experimental groups. It also may be a good choice if your independent variable is not numerical. (In Microsoft Excel, generate bar graphs by choosing chart types "Column" or "Bar.")

A **time-series** plot can be used if your dependent variable is numerical and your independent variable is time. (In Microsoft Excel, the "line graph" chart type generates a time series. By default, Excel simply puts a count on the x-axis. To generate a time series plot with your choice of x-axis units, make a separate data column that contains those units next to your dependent variable. Then choose the "XY (scatter)" chart type, with a sub-type that draws a line.)

A **xy-line graph** shows the relationship between your dependent and independent variables when both are numerical and the dependent variable is a function of the independent variable. (In Microsoft Excel, choose the "XY (scatter)" chart type, and then choose a sub-type that does draw a line.)

A **scatter plot** might be the proper graph if you're trying to show how two variables may be related to one another. (In Microsoft Excel, choose the "XY (scatter)" chart type, and then choose a sub-type that does not draw a line.)

**Conclusion**

The conclusion part of your investigation gives you a place to tell what happened during the experiment. Re-state your hypothesis. Explain whether or not your hypothesis was supported and tell why the data appears to agree with your conclusion. Reading your research will help explain why.

The future study tells the reader what you would do next if you continued with this investigation. It can also state that more tests need to be conducted in order to get more accurate results. You can suggest changing variables and retesting. On the acknowledgements page, thank everyone who helped you during your project.

When an investigation is completed, the results are sometimes different that those that were predicted. Many scientific investigations do not always support the hypothesis. This just indicates that many experiments need additional testing. Your investigation is still valid.

Your **conclusions** summarize how your results support or contradict your original hypothesis:

* Summarize your science fair project results in a few sentences and use this summary to support your conclusion. Include key facts from your background research to help explain your results as needed.
* State whether your results support or contradict your hypothesis. (Engineering & programming projects should state whether they met their design criteria.)
* If appropriate, state the relationship between the independent and dependent variable.
* Summarize and evaluate your experimental procedure, making comments about its success and effectiveness.
* Suggest changes in the experimental procedure (or design) and/or possibilities for further study.

**Abstract**

An **abstract** is an abbreviated version of your science fair project final report. For most science fairs it is limited to a maximum of 250 words (check the rules for your competition). The science fair project abstract appears at the beginning of the report as well as on your display board.

**Why Is an Abstract Important?**

Your science fair project abstract lets people quickly determine if they want to read the entire report. Consequently, at least ten times as many people will read your abstract as any other part of your work. It's like an advertisement for what you've done. If you want judges and the public to be excited about your science fair project, then write an exciting, engaging abstract!

Since an abstract is so short, each section is usually only one or two sentences long. Consequently, every word is important to conveying your message. If a word is boring or vague, refer to a thesaurus and find a better one! If a word is not adding something important, cut it! But, even with the abstracts brief length, don't be afraid to reinforce a key point by stating it in more than one way or referring to it in more than one section.

**Almost all scientists and engineers agree that an abstract should have the following five pieces:**

* **Introduction**. This is where you describe the purpose for doing your science fair project or invention. Why should anyone care about the work you did? You have to tell them why. Did you explain something that should cause people to change the way they go about their daily business? If you made an invention or developed a new procedure how is it better, faster, or cheaper than what is already out there? **Motivate** the reader to finish the abstract and read the entire paper or display board.
* **Problem Statement**. Identify the problem you solved or the hypothesis you investigated.
* **Procedures**. What was your approach for investigating the problem? Don't go into detail about materials unless they were critical to your success. Do describe the most important variables if you have room.
* **Results**. What answer did you obtain? Be specific and use numbers to describe your results. Do not use vague terms like "most" or "some."
* **Conclusions**. State what your science fair project or invention contributes to the area you worked in. Did you meet your objectives? For an engineering project state whether you met your design criteria.

**Final Report**

* Write the abstract section last, even though it will be one of the first sections of your final report.
* Your final report will be several pages long, but don't be overwhelmed! Most of the sections are made up of information that you have already written. Gather up the information for each section and type it in a word processor if you haven't already.
* Save your document often! You do not want to work hard getting something written the perfect way, only to have your computer crash and the information lost. Frequent file saving could save you a lot of trouble!
* Remember to do a spelling and grammar check in your word processor. Also, have a few people proof read your final report. They may have some helpful comments!
* Your final report will include these sections:
	+ Title page.
	+ Abstract. An abstract is an abbreviated version of your final report.
	+ Table of contents.
	+ Question, variables, and hypothesis.
	+ Background research. This is the Research paper you wrote before you started your experiment.
	+ Materials list.
	+ Experimental procedure.
	+ Data analysis and discussion. This section is a summary of what you found out in your experiment, focusing on your observations, data table, and graph(s), which should be included at this location in the report.
	+ Conclusions.
	+ Ideas for future research. Some science fairs want you to discuss what additional research you might want to do based on what you learned.
	+ Acknowledgements. This is your opportunity to thank anyone who helped you with your science fair project, from a single individual to a company or government agency.
	+ Bibliography.

**Construct Your Exhibit**

**THE DISPLAY**

The display should SHOW and TELL what your project was all about. The judges will look for neatness, organization, appearance, and correct writing mechanics. Your display should consist of a backboard, a report and tangible representation of your project. This can include the actual items used or studied, photographs or models.

Your exhibit should display all aspects of your project. All the information needs to be self-explanatory. A judge or reader should be able to see and understand your investigation just as if you were there telling them in person.

**The Backboard:**

 The backboard should include all the major parts of your project. The backboard is an upright, self-supporting board with organized highlights of you project. It is three sided and must meet the space standards of thee fair you are entering.



**Organize your information like a newspaper** so that your audience can quickly follow the thread of your experiment by reading from top to bottom, then left to right. Include each step of your science fair project: Abstract, question, hypothesis, variables, background research, and so on.

**Use a font size of at least 16 points** for the text on your display board, so that it is easy to read from a few feet away. It's OK to use slightly smaller fonts for captions on picture and tables

**The title should be big and easily read from across the room**. Choose one that accurately describes your work, but also grabs peoples' attention. This is the first thing people see when they look at your display!

**A picture speaks a thousand words!** Use photos or draw diagrams to present non-numerical data, to propose models that explain your results, or just to show your experimental setup. But, don't put text on top of photographs or images. It can be very difficult to read.

**Things that must be included in the display:**

* Backboard
* Final Report
* Observation Notebook
* Abstract