# The Be-All, End-All Step By Step Guide for Science Fair:

Just follow these easy steps and you will create a wonderful, award winning science fair project, thought up and finished entirely by you.

## Part 1 – Selecting a Project

### A - Types of Science Fair Projects:

There are two types of science fair projects: Models and Experiments. Here is the difference between the two:

Not a good idea for science fair!!!!


- **A Model, Display or Collection:**

  Shows how something works in the real world, but doesn't really test anything.
  Examples of display or collection projects can be: The Solar System, Types of Dinosaurs, Types of Rocks, or My Gum Collection. Examples of models might be: The Solar System, How an Electric Motor Works, or Tornado in a Bottle.

- **An Experiment:**

  Lots of information is given, but it also has a project that shows testing being done and data being collected.

Examples of experiments can be "The Effects of Detergent on the Growth of Plants," "How Does Color Affect the Absorbency of Paper Towels," or "What Structure can Withstand the Most Amount of Weight."

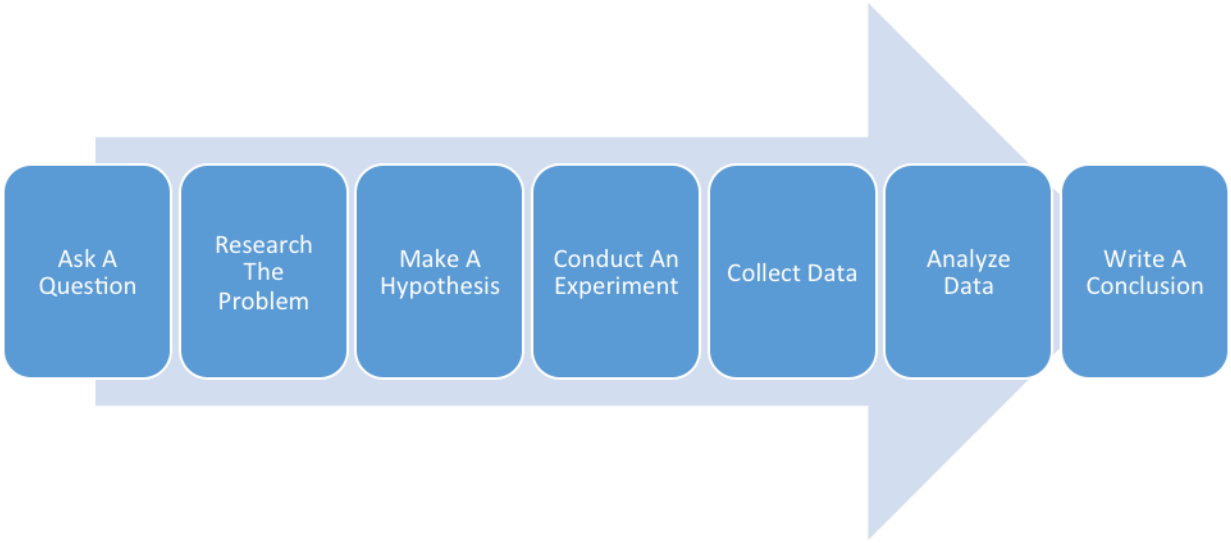
You can tell you have an experiment if you are testing something several times and changing a single variable to see what happens. We'll discuss variables later…….

**B - So, What Type of Project Should You Do……?**

Even though you can learn a lot from building a model, or a display, **we want you to do an EXPERIMENT!!!!!!** Why, you ask? Well, they are fun, they are more interesting and most of all, they require that you think like a scientist, and go through the science processes. Besides, using the science processes is one of the key elements that the judges will be looking for when they judge your project.

**C - Thinking Like A Scientist (and any other person that is curious)……**

**How Do You Think Like A Scientist (or any other person that is curious)??**

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When you are finished you will check your hypothesis against the results, was your hypothesis supported by your data, or not supported by your data? You will also write about what you learned and how it applies to the real world, and quite possibly come up with another problem.

**D - Choosing a topic that interests you…..**

All great projects start with great questions but before you can get started on a great question you need to pick a topic that interests you.

- **Life Science:** This category deals with all animal, plant, and human body questions that you might have and want to do an experiment about. Remember that **it is against science fair rules** to complete any type of vertebrate studies (dogs, cats, frogs, humans, birds, snakes, hamsters, rats, fish, etc.) **WITHOUT** prior approval from the science fair committee, and a doctor that will monitor your project. Yes, even you collecting data on how long you can play XBox 1 without going cross-eyed is considered a human study and requires paperwork!

- **Physical Science:** If you like trying to figure out how things work, then this is the category for you! It includes topics about matter and structure, as well as electricity, magnetism, sound, light or anything else that you might ask the following question, "How does it work, and what if I do this to it, will it still work?"

  Physical Science also includes the composition of matter and how it reacts to each other. These are the science experiments that may have bubbling and oozing going on, like figuring out what which candy is an acid, and which is a base. It is the category to try and mix things together to see what will happen as a result of the mixing.

- **Earth and Space Sciences:** This category is really awesome because it covers all sorts of topics that deal with the Earth or objects in space. This includes studying weather, Geology (which is the study of everything that makes up the Earth, like rocks, fossils, volcanoes, etc.), and the study of all that is in space, including the stars, our sun, and our planets. Unfortunately this topic is also where most kids mess up and do a collection or model project instead of an EXPERIMENT, so be very careful.

**Finally, you get to do some work!!!!:**

Write down your favorite Science Fair Category and what it is you want to learn more about:

My favorite category was _____.

I want to do an experiment involving _____

_____.

## Part 2: Coming up with a Good Question

Now that you have picked out a topic that you like and that you are interested in, it's time to write a **testable question** and identify the problem within the topic. To give you an idea of what we mean you can start off by filling in the question blanks with the following words (these are only example questions, yours will be different based on your interests):

### A - The Effect Question:

What is the effect of _____ on _____?

| | |
|---|---|
| sunlight | on the growth of plants |
| eye color | pupil dilation |
| temperature | the size of a balloon |

### B - The How Does Affect Question:

How does the _____ affect _____?

| | |
|---|---|
| color of light | the growth of plants |
| humidity | the effectiveness of starch on a cotton shirt |
| color of a material | its absorption of heat |

### C - The Which/What and Verb Question

Which/What _____ (verb) _____?

| | | |
|---|---|---|
| does paper towel color | do | to absorbency |
| types of foods | do | meal worms prefer |

### Now, you write your testable question……

Create a testable question using either the "Effect Question," the "How Does Affect Question," or the "Which/What and Verb Question."

## Part 3: Doing (GULP!!!!) the Research


So you've picked your category and/or topic, and you've written your testable question. Now it is time to research your problem as much as possible. Becoming an expert at your topic is what scientists do in the real world.

Hum, how do you become an expert?

## A - You READ!!!!!!!

READ about your topic. READ trade books. READ articles and books from the library. READ articles on the internet. Take note of any new science words (that means write them down in your journal….more about the journal in a bit) you learned and use them in your paper. It makes you sound like a scientist. **Keep track of all the books and articles you read. YOU WILL NEED THAT LIST LATER.**

## B - You DISCUSS!!!!!!

Talk with your family, with your teachers, with experts. Experts are those people that might be currently working in the field of study, or category/topic you selected. Sometimes websites will even give you e-mail addresses for experts that can answer your questions! **E-mail ONLY WITH PERMISSION OF YOUR PARNETS/GUARDIANS, and include me on your cc line (so I get a copy of the e-mail as well).**

If you are interviewing people for your research, TAKE pictures of yourself interviewing people.

Just when you think you're finished and have learned all you could possible learn it is time to write your research paper.

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**Part 4 - Write a Hypothesis (another way of saying "predict what is going to happen)**

Now is the time to PREDICT what you think will happen when you test your problem. This type of guess or prediction is what we, in science, refer to as a hypothesis.

- **And, just how do you write this fabulous hypothesis?????????**

  What do you think will happen during the experiment, (even before your start experiment)?

  **Example Problem:** How does a varying octane level affect the mileage a car gets on a tank of gas?

Now use the IF, THEN, BECAUSE format …….

**Example Hypothesis:** **If** I increase the amount of octane in the gas, **then** I will increase the amount of mileage per gallon, **because** the octane cleans the gas causing it to burn more efficiently in the engine.

Notice the **IF, THEN, BECAUSE** format. This format requires that you write your independent and dependent variable in your hypothesis, and giving a possible reason for the results (which would mean you thought about the research you completed and used what you learned to help write the because statement).

HA! You are actually beginning to think about what the results you expect to "see" during your experiment.

**Your turn, write your hypothesis in the following format:**

**IF** _____, **THEN** _____

**BECAUSE** _____.

**Part 5 - Testing your Hypothesis by Doing an Experiment…….**

Finally, the good part. The part that all scientists can't wait for, you guessed it, THE EXPERIMENT.

Designing your experiment is really cool because you get to use your imagination to come up with an experiment to test your question. More importantly, you get to prove/support (or disprove/not support) your hypothesis (YES, it is absolutely o.k. to disprove/not support your hypothesis).

- **Gather your materials**

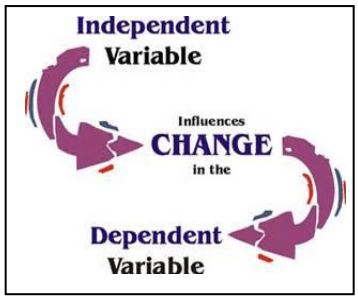
  What materials/supplies will you need to complete your experiment? The safest way to do this is to involve your parents/guardians. You will also need to know how much of each supply that will be required for EACH experiment, make sure to measure this in metric units (kilograms, liters, meters). Take pictures or draw pictures of your supplies so you will have the list handy.


- **Write a procedure**

  A procedure is a **STEP by STEP** list of what you will do to perform your experiment. This is like giving the hints for you to pass the next level on Candy Crush, or to get past the Creepers in Minecraft. If your friends want to be able to move on in Candy Crush or Minecraft they will have to follow your instructions step by step. In the real world, scientists do this so that others can repeat their experiments to validate their results. Again, take pictures of yourself doing your experiment.

- **Identify your variables**

  The variables are any factors that can change in an experiment. Remember that when you are testing your experiment you should only test one variable at a time in order to get accurate results. In other words, if you want to test the effect of water has on plant growth then all plants you test should be in the same conditions, these are called controlled variables: same type of dirt, same type of plant, same location, same amount of sunlight, etc.




The only variable you would change from plant to plant would be the amount of water it received. This is called the independent variable. The **independent variable** is the factor you are testing (it is the IF part your hypothesis). The results of the test that you do are called the dependent variables. The **dependent variable** is what happens as a result of your test (this is the THEN part of your hypothesis). Knowing your variables is CRITICAL because if you don't know them you will not be able to collect your data or read your results accurately.

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- **TEST, TEST, TEST.**

Remember that the science fair judges will expect your results to be consistent in order to consider this a good experiment. That means that you will be need to complete your experiment at least **FIVE times or more**. The more experimenting you do, the better the reliability of your results. Don't forget to take pictures of yourself completing your experiment.

- **Collect your DATA**.

This means to write down or record your results for each experiment. Be sure to organize your results in a way that is easy to read. In the real world, tables, charts, and other types of organizers are used to show results. Organizing makes the results easy to read, and much easier to recognize patterns in the results. Don't use a graph or table simply because we asked you to, use it only to benefit you. It serves no purpose to have a graph or table that doesn't have anything to do with answering your science fair question.


**ACK! What do I mean by collect data????**

**Keep a science journal:**

A science journal is a type of science diary that you can keep especially for your science fair project, from beginning to end. **We will require that you begin your science fair journal from day one, prior to selecting your topic**, and your science fair journal will be divided into specific sections to help with the organization of your information. Not only does the science journal give you a place to record your results, you will also include research information, draw and diagram pictures, and write down any additional questions you might have for later. YOU WILL WRITE EVERYTHING, EVERY THOUGHT, EVERY PURCHASE, EVERY RESEARCH ARTICLE, ABSOLUTELY EVERYTHING IN YOUR JOURNAL! It will become your BSCJFF (Best Science Fair Journal Friend Forever), at least until your science fair is complete.

Unidentified Minerals

| MINERAL | COLOR | LUSTER | STREAK |
|---|---|---|---|
| Sample A | black | glassy | white |
| Sample B | black | metallic | black |
| Sample C | green | glassy | white |
| Sample D | golden | metallic | greenish-black |
| Sample E | white | earthy | white |

Tables, charts, and diagrams are generally the best way to keep track of the data you collected during your various experiments. Remember that you will need to collect at **least FIVE sets of data**, more is preferable, that means completing your **ENTIRE experiment at least FIVE times**.
A table is an organized chart with columns and rows. The columns and rows are labeled so that anyone reading your table will know what the data is that you collected.

- **Be Accurate and Neat:**

  When you are writing your tables and charts make sure that you record your data in the correct column or row, that you write neatly, and that you record your data as soon as you collect it **SO YOU DON'T FORGET WHAT HAPPENED!** Sometimes you might even need to draw a picture or a diagram to explain what happened during an experiment. As they say a picture speaks 1000 words!

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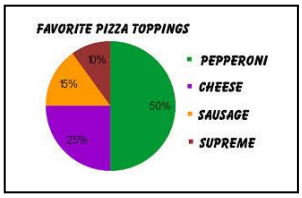
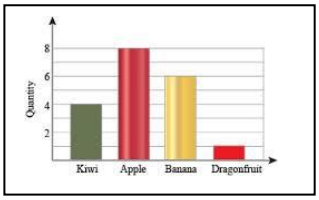
- **Use the Right Graph for the Experiment:**

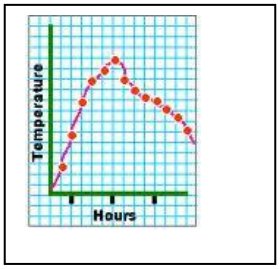
There is nothing more frustrating for a judge than to read a bad graph. There are all types of graph designs, but the ones listed below seem to be the easiest to use for science fair experiments (there are several on-line sites you can use to create your graph, or you can even use Microsoft Office or EXCEL, but be very careful to select the correct line graph as Microsoft reverses the independent and dependent variables).




**Pie graphs** – these are good for showing percentages of particular groups. Remember that you can't have more than 100% in a pie graph; therefore all parts must add up to 100%.




**Bar graphs** – these are good if you are comparing amounts of things because the bars show those amounts in an easy to read format. This way the judges will be able to tell the results in a quick glance. The X-axis (or horizontal axis) is where you label what is being tested (this is the IF part of your hypothesis), and the Y-axis is the collected information (this is the THEN part of your hypothesis).




**Line graphs** – these are good if you are showing how changes occurred in your experiments over time. In this particular case you would label the X-axis to show time increments (minutes, hours, days, weeks, months), and then you would use the Y-axis to show what you are measuring at that point in time. **Line graphs are ONLY used for showing change over time.**

**Part 6 - Write a Conclusion.**

Tell us what happened during your science fair project. Was your hypothesis supported or not supported? Were you successful, did everything turn out o.k.? Would you change anything about the experiment or are you curious about something else now that you've completed this experiment. And most of all, **TELL US WHAT YOU LEARNED FROM DOING THIS EXPERIMENT.**

- **Understand its application:**

  Write about how this experiment be used in a real life situation. Why was this experiment important? What is important for us to know about it?

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**Finally, your turn again……**

**Materials:** List, and take pictures (they are great for your project board)

List the materials that you will use in your science fair experiment (make sure to include metric units):

1 . _____ 6._____

2. _____ 7._____

3. _____ 8._____

4._____ 9._____

5. _____ 10._____

**Variables:**

List the variables that you will control, the variables that you will change and the variables that will be the results of your experiment:

- My controlled variables are (the stuff that will **ALWAYS stay the same**):
  _____

- My independent variable (this is the thing that changes from one experiment to the next, it is the thing you are testing, and **this is the IF part of your hypothesis)**: _____

- My dependent variable is (these are the results you will be collecting, **this is the THEN part of your hypothesis**): _____

**Procedure:** (the steps of your experiment, very detailed) List the steps that you will follow in order to complete your experiment:

1 - _____

2 - _____

3 - _____

4 - _____

5 - _____

And so on, and so on, and so on……until you have listed absolutely EVERYTHING you will do during your experiment in detail! **The more detailed the procedure, the better.**

**Data Collection**: Design a table or chart to collect your information: another reminder TAKE PICTURES (these are REALLY great for your project board).

**Conclusion:** Now tell us what you learned from this and if your hypothesis what supported or not supported? Did your experiment work? Why did your experiment work? Why didn't your experiment work? What did the results of your experiment tell you? Sometimes not being able to support your hypothesis is just as valid and important. What did you prove or disprove?

**Application:** (How does this apply to real world situations?)

It is important to know about this experiment because _____

_____

**Making a Interesting Display:**


This is an example of a neat looking Science Fair Display Board. It is just an example. Depending on your information and the amount of pictures, tables, and graphs, you may have a different layout. Just make sure that it is neat!!!

**Display Beauty Secrets:**

1. Write a fabulous title! Make sure it is big enough to be seen from across the room and grabs the reader!
2. Use a computer to print your information. Make sure to use a font size that is big enough for the judge to read your information from a distance.
3. Use spray adhesive, if you have it, it is less messy. Or you can use double stick tape (Scotch Double Stick is a great option).
4. Mount white paper, pictures, graphs, and tables on colored paper (make sure that the colored paper is slightly larger than the white paper so it creates a boarder around the white paper). You can also use scrapbooking paper if you like. And if you really want, you can add a border around the project board (you don't have to purchase board material, you can draw of stencil a boarder).
5. For empty space add things that will **enhance (not take away from)** your project board appearance. Too many extras can take away from the data and results and just make your board too busy, so be very careful!
6. Make sure to provide credit for any pictures that you include on your project board, including those that you took or pictures you may have copied and used from the internet (i.e., pictures by funny kitty or pictures copied from Google Images).

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