

# 2018-2019

## Centennial Hills

### Science Fair Project Guide

#### Grades 5th - 7th



Math, Science, and Technology play an important role in CASLV's mission. For this reason, all students will complete a science fair project this year. Your task is to research, design, and conduct your own science fair project. In February, the best projects from each class will be evaluated by a group of judges to select the winning projects in each grade. Those projects will go on to UNLV to represent Coral Academy in the Southern Nevada Regional Science Fair!

**3 Required Items Are Due at the End of This Project:** 1) Science fair Logbook/Journal, 2) the final draft of your Science Fair Report, 3) and your Display Board.

**Name:** \_\_\_\_\_

**Grade:** \_\_\_\_\_

**Teacher:** \_\_\_\_\_

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# 2018-2019 CASLV

## Topic Guidelines

1. **NO VERTEBRATE PROJECTS WILL BE ALLOWED.** A vertebrate is an animal that contains a backbone. PEOPLE are VERTEBRATES. Therefore, no projects involving people will be accepted. This includes memory tests and gender surveys. Other vertebrates include fish, birds, reptiles, amphibians, and all other mammals.
2. Invertebrates are acceptable such as worms, insects and mollusks **where no injury to the animals are involved.**
3. **NO MODELS** will be accepted such as solar systems or volcanoes.
4. **NO INVENTIONS** will be accepted. Although there is a category for this as part of the UNLV sponsored event, for CASLV, students are to focus on experiments and the scientific method.
5. **Use of Petri Dishes** - Per UNLV College of Science, our regional Science Fair host. "Using Petri dishes or cell culture dishes can be dangerous and harmful to participants and those around the if not handled in the correct manner or supervised by a qualified individual. Projects that involve the use of Petri dishes will NOT be allowed at the Beal Bank USA Southern Nevada Regional Science & Engineering Fair unless a medical doctor or another adult with a Ph.D. in the sciences supervises the student and his or her project." Reference: <https://www.unlv.edu/sciences/schools>
6. **For Grades 6th and 7th only. Science Fair topics should be related to either Life or Physical science.** These are the main topics that will be judged in the final UNLV science fair. See the following ELEMENTARY AND MIDDLE SCHOOL DIVISIONS AND AWARDS chart below.

## 2018-2019 CASLV Science Fair Project Planner

This planner is to inform you with the due date of each section. Teachers may grade sections per their discretion.

✓	<i>Due Dates</i>	<i>TASKS</i>
	<b>Friday, October 19, 2018</b> Refer to pages: 7-9	STEP 1 - SCIENCE FAIR LOGBOOK Set up your composition notebook with Table of Contents, page numbers, deadline schedule, personal info. and labels.
	<b>Friday, October 26, 2018</b> Refer to pages: 10-11	STEP 2 - PROBLEM STATEMENT & TESTABLE QUESTION Identify a problem and write a project or testable question.
	<b>Friday, November 9, 2018</b> Refer to pages: 12-13	STEP 3 - BACKGROUND RESEARCH Write facts about your topic and cite your sources.
	<b>Friday, November 16, 2018</b> Refer to pages: 14	STEP 4 - HYPOTHESIS Form an If/Then/Because statement for hypothesis.
	<b>Friday, November 30, 2018</b> Refer to pages: 15-16	STEP 5 - EXPERIMENTAL METHOD (MATERIALS & PROCEDURES) Design experiment and write procedure. List and gather materials.
	<b>Friday, November 30, 2018</b> Refer to pages: 17	STEP 6 - VARIABLES Identify your Independent, dependent, and control variables.
	<b>Friday, December 14, 2018</b> Refer to pages: 18-19	STEP 7 - DATA COLLECTION (CONDUCT EXPERIMENT) Conduct & observe experiment at least 5 times. Create data table.
	<b>Friday, December 21, 2018</b> Refer to pages: 20-21	STEP 8 - RESULTS (GRAPH, IDENTIFY RELATIONSHIPS IN DATA) Create chart, or graph from data. Identify data relationship. Determine significance of data.
	<b>Friday, January 18, 2019</b> Refer to pages: 22	STEP 9 - ANALYSIS/CONCLUSION Summary of results, important findings & how related to hypothesis.
	<b>Friday, January 25, 2019,</b> Refer to pages: 23	STEP 10 - REFLECTIONS Reflect on lessons learned & how to use or improve in future.
	<b>Friday, January 25, 2019</b> Refer to pages: 24	STEP 11 - ABSTRACT Overall purpose for experiment/study & brief summary of results.
	<b>Friday, February 1, 2019</b> Refer to pages: 25-26	STEP 12 - FINAL RESEARCH PAPER Combine research report with conclusion and abstract.
	<b>Friday, February 8, 2019</b> Refer to pages: 29-35	STEP 13 - FINAL PROJECT BOARD Make the project display.

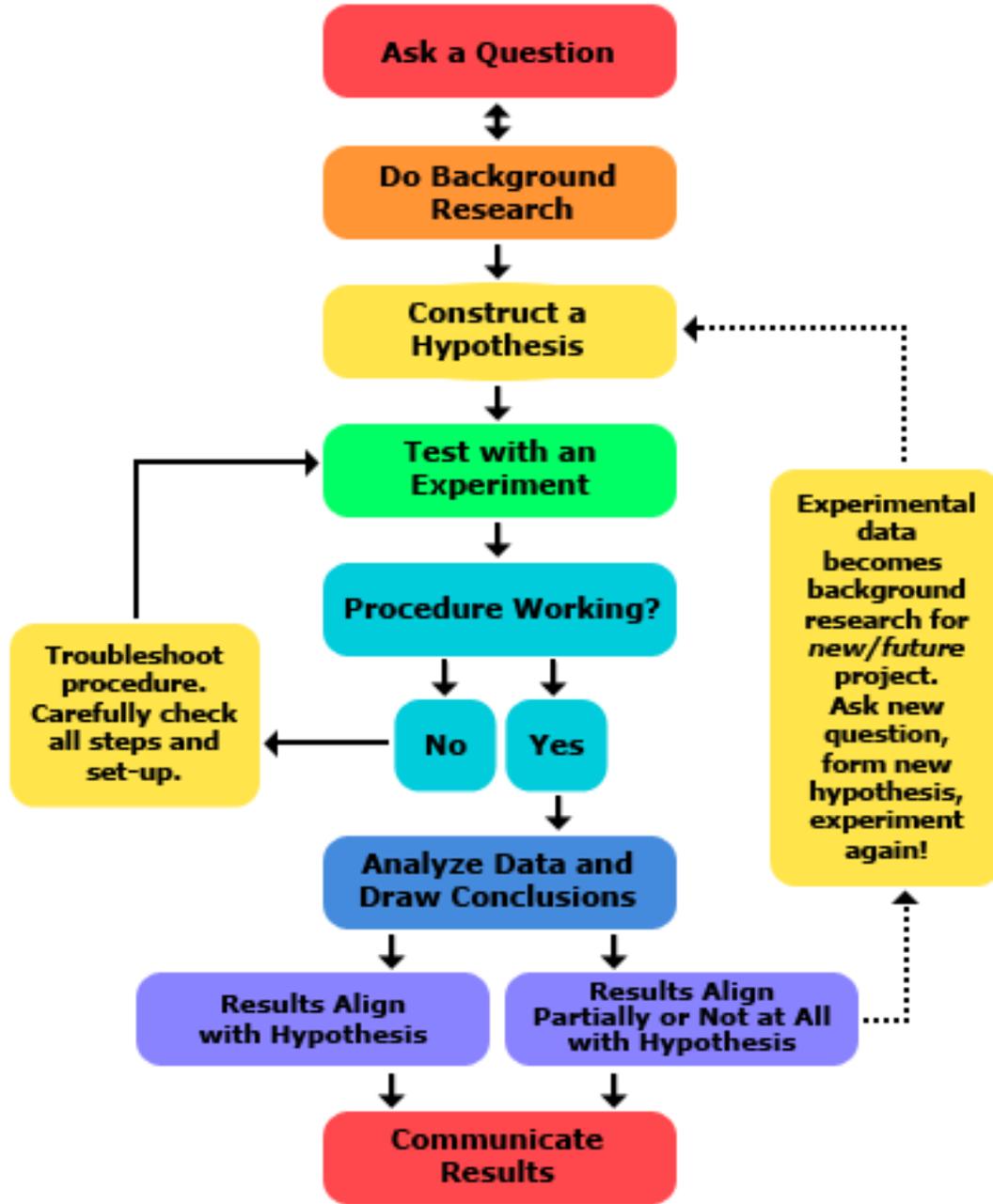
## 2018-2019 Science Fair Logbook Rubric

The following rubric is being graded by section as you complete each task in your logbook. Once the project is completed there will be 2 separate rubrics for the completed Science Fair projects: Research Report, and Display Board. **Teachers may grade sections per their discretion.**

	4	3	2	1	Score
<b>1 - Science Fair Logbook - Setup, Maintenance &amp; Format.</b>	Plain, College Ruled Composition Book. Labeled correctly on back inside cover, Table of Contents, Deadline Schedule, numbered with pen & section Tabs/Post-Its. No torn out pages, pencil or white-out used	Plain, College Ruled Composition Book. Labeled correctly on back inside cover, Table of Contents & numbered with pen.	Plain, Wide Ruled Composition notebook. Labeled correctly. No or partial, initial setup completed.	Plain, Wide Ruled Composition notebook, label in wrong location. No initial setup completed.	
<b>2 - Problem Statement &amp; Testable Question</b>	Independently identified a question which must be: original, can be investigated by a science experiment, is measurable & specific, is related to <b>Life or Physical (6-7 only)</b> Science.	Independently identified a question that could be investigated by an experiment, & is related to <b>Life or Physical (6-7 only)</b> Science.	The student identified a problem but did not write it in question form. Is related to <b>Life or Physical (6-7 only)</b> Science.	Identified a question that could not be tested/investigated or one that did not merit investigation. Is not clear what area of science related to.	
<b>3 - Background Research</b>	Five or more facts were recorded in the student's own words. Five or more sources were cited correctly. ALL notes & info gathered through process & documented in black/blue ink.	All notes taken & information gathered throughout the process. Note ALL sources used. 4 or fewer sources & facts.	All notes taken & information gathered throughout the process. Note ALL sources used. 3 or fewer sources & facts.	All notes taken & information gathered throughout the process. Note ALL sources used. 2 or fewer sources & facts.	
<b>4 - Hypothesis</b>	The hypothesis is original and must contain the following: <b>If/then/because</b> statement supporting dependent/independent variables & relates back to your original problem.	The hypothesis must contain the following: <b>if/then/because</b> statement supporting dependent/independent variables & relates back to your original problem.	The hypothesis is missing one component listed.	Hypothesis is written but incorrectly.	
<b>5 - Experimental Method - Materials &amp; Procedures</b>	<b>Materials</b> - DETAILED LIST of ALL materials w/ exact measurements used. <b>Procedures</b> - NUMBERED & DETAILED step-by-step list of everything done in experiment. Must be <b>exactly</b> the same as Report & Board.	Materials and procedures are listed but formatted incorrectly.	Either materials or procedures are missing.	No materials or procedures are listed.	
<b>6 - Variables</b>	Identify all variables that apply: independent, dependent, all constants/controls. Explain how each of these is found/important/relevant to the experiment.	Variables are identified and explanation is attempted.	Variables are identified but no explanation is provided.	No variables are identified.	

<p><b>7 - Data Collection (Conduct Experiment)</b></p>	<p><b>Everything dated.</b> Detailed observations made throughout the experiment. Includes very specific Quantitative (Quantity-Numerical) &amp; Qualitative (Quality-5 Senses) data about <b>EVERYTHING</b> going on. Test hypothesis &amp; must have: At least 5 trials/samples, accurate, easy-to-follow table(s) w/ labels to illustrate the results, pictures, etc.</p>	<p>Experiment tests the hypothesis and must have: at least three trials or samples. Provided an accurate, table with labels to illustrate the results of the experiment.</p>	<p>Experiment tests the hypothesis and must have: at least three trials or samples. Did NOT provided an accurate, table with labels to illustrate the results of the experiment.</p>	<p>Did not provide a table OR the table was incomplete. Data was collected several times. It was summarized, independently, in a way that clearly describes what was discovered.</p>	
<p><b>8 - Results (Graph, Identify Relationships in Data)</b></p>	<p>Turn data from table into complete graph/chart with the following: Title, X-axis (Independent) &amp; Y-axis (Dependent) labels, reasonable &amp; consistent scale. Identify relationship between Independent &amp; Dependent Variables. Determine significance of data.</p>	<p>Provided an accurate chart or graph with labels to illustrate the procedure or the results of the experiment.</p>	<p>Provided a chart or graph, but was unclear and difficult to follow.</p>	<p>Did not provide a chart or graph OR the chart or graph was incomplete.</p>	
<p><b>9 - Analysis/Conclusion</b></p>	<p>Clear summary of results &amp; important findings. How results relate to hypothesis. Identify sources of errors. Suggest future study &amp;/or actions. Did data support/not support the hypothesis? How do you know?</p>	<p>Summary of results was provided and explained. No future study was suggested.</p>	<p>Summary of results was provided but did not relate to the hypothesis.</p>	<p>No analysis of conclusion provided</p>	
<p><b>10 - Reflections</b></p>	<p>Answer questions: What to do differently next time? What part/how change experiment? How to extend research?</p>	<p>Two out of the three questions were answered.</p>	<p>One of the questions was answered.</p>	<p>No reflection was done.</p>	
<p><b>11 - Abstract</b></p>	<p>80-300 words. Overall purpose of study/experiment. Problem (testable Question). Basic design of experiment or methods used. Major findings, trends, or analysis. Brief summary of your personal conclusion based on results.</p>	<p>Three out of four of the guidelines were met.</p>	<p>Two out of four guidelines were met.</p>	<p>No abstract was written.</p>	
<p><b>12 - Final Report</b></p>	<p>Please see separate Research Report Rubric</p>				
<p><b>13 - Final Project Board</b></p>	<p>Please see separate Project Board Score Sheet</p>				

# Steps of the Scientific Method



From Science Buddies: [https://www.sciencebuddies.org/science-fair-projects/science-fair/steps-of-the-scientific-method?gclid=EAIaIQobChMIyvf90M\\_A3QIVFoTICH3\\_MQukEAAYASAAEgJUrFD\\_BwE](https://www.sciencebuddies.org/science-fair-projects/science-fair/steps-of-the-scientific-method?gclid=EAIaIQobChMIyvf90M_A3QIVFoTICH3_MQukEAAYASAAEgJUrFD_BwE)



## Step 1: Science Fair Logbook

Whether you are a research student or a first-time science fair student, a logbook is a crucial part of any research project. It is a detailed account of every phase of your project, from the initial brainstorming to the final research report. The logbook is proof that certain activities occurred at specific times. Here is how you will set up and organize your work throughout this entire process.

### You Will Need to Have:

1. A **PLAIN**, hard-bound, **College Ruled** Composition Book like the one you see above. Preferably black, but any solid plain color will do (i.e. blue, red, green, yellow, purple, etc.).
2. Blue or Black ink pen. You will **NEVER** use pencil in your notebook.
3. Tabs or Post-Its to label each section.

### Initial Logbook Set-Up:

1. **Label the Inside Back Cover** of your composition book with an either a typed or Sharpie written label containing the following information:
  - a. Your first and last name
  - b. Coral Academy of Science - Centennial Hills
  - c. Teacher Name (Fallon or Waits)
2. **Table of Contents** - Leave the first page blank for your Table of Contents. **This page will be the last thing you complete for your logbook** after all entries have been made.
3. **Number Pages** - After the table of contents, number the remaining pages of the logbook.
4. **Section Tabs** - Use tabs to separate the sections of your logbook. This can be Post-its and/or Post-it labels.

### What is the Purpose of the Logbook: (<https://www.unlv.edu/sites/default/files/24/science-display.pdf>)

- Before you begin your project, you should start your Science Project Log Book, which will be a very important part of your project.
- Students should keep the logbook nearby to record all ideas, thoughts, experiments and activities.
- The notebook serves many purposes:
  - the place to keep notes while they plan their project
  - the place to keep notes while they perform their experiments
  - illustrates the quality of work they perform and shows the amount of time and effort that went into their project.
- Students should handwrite everything into this book that pertains to the project, no matter how insignificant it might seem. You never know when that piece of information will come in handy.
- Students must always write in ink, **never erase, or tear out pages** just because they made a mistake. When students enter notes in their logbook, they should try to:

- be as complete and clear as possible
- write neatly enough that other people can read it
- use correct grammar and spelling
- enter the date and time of day **every time** they have ideas, at the time they think of them, or when they are working on their project
- have their entries witnessed at least once a week, either by the you or a parent, depending on where they are performing the experiment.
- The quality of your logbook will be part of the judging criteria.
- **A science logbook must accompany project Display Boards in order to compete in the fair.**

### **Logbook Sections:**

1. **Table of Contents:** Despite this being the first page, this will be completed or filled in last, to make sure you can easily identify the correct page numbers.
2. **Deadline Schedule:** Write the schedule on page 2 of your logbook. It will help keep you on track with due dates.
3. **Problem Statement & Testable Question:** After Investigating the world around you, think of a problem, related to physical and life science, you want to investigate further. The problem statement is the entire purpose of doing your research and completing your experiment. Now take your previously determined problem, and create your testable question.
4. **Background Research:** Include all notes taken while researching in the media center or online. This information will be used to write your research report. You should also record the source of information for your works cited page. Do this for EVERY website, book, encyclopedia, magazine, or interview that you use for information. A minimum of 5 sources is required for this project. You must follow the proper citation format (see sample section for guidelines).
5. **Hypothesis:** Now it is time to use your background research and write your formal testable question in the form of an 'If...then...because...' statement or a hypothesis, for what you think the answer to the Testable Question is going to be. It is an "educated" guess in the form of a statement.
6. **Experimental Method:** Include in this section:
  - a. **Materials:** Make a DETAILED list of all materials you will be using in the experiment. Be specific! For example, if you will be watering plants, you should list the EXACT amount of water you will use.
  - b. **Procedures:** Make a NUMBERED step-by-step list of everything you will do in the experiment. Your procedures and materials should be so complete that someone could take your logbook and do the same exact experiment.
7. **Variables:** This section should include the **independent variable**, the **dependent variable**, and all **constants/control variables** that apply. See your science fair packet for a description of each of the terms.

8. **Data Collection:** Remember to date every entry!!! Your detailed observations made throughout the experiment should be recorded in this section. This includes data collected, what you are doing, AND what you see/smell/hear/feel. Be VERY specific about everything going on in the experiment. See the sample page to get an idea of how it should look.
9. **Results:** Include pictures you have taken throughout the experiment, data tables created to organize your data, charts, and graphs, and a summary of the data.
10. **Analysis/Conclusion:** **Using your data**, discuss the outcome of the experiment. Did your data support your hypothesis? Did it not support your hypothesis? How do you know?
11. **Reflections:** What would you do differently next time? What part of the experiment could be changed to improve the procedures? How could you extend your research?

### **Things to Keep in Mind:**

- NEVER use a pencil! Use a blue or black ink pen only.
- NEVER erase or use white-out! If mistakes occur, mark it out with ONE neat line.
- NEVER tear a page out of your logbook!
- NEVER redo something to make it neater. Neatness isn't important. Getting your thoughts and data recorded is the important part of the project.
- NEVER place loose papers in the logbook. They are easily lost.
- ALWAYS date every entry every time you make research notes or an entry in your logbook.
- ALWAYS use the metric system when measuring or recording amounts. Example: Use centimeters, meters, milliliters, liters NOT inches, feet, cups, or gallons.

**\*\*\*REMEMBER\*\*\***

**\*\*You Must Enter Info for ALL Topics in Your Logbook As You  
Go\*\***

## Step 2: Problem Statement and Testable Question

Obviously you want a great project and to learn new things about science. These goals are possible, but to reach them you will have to spend a lot of time working on your project, so choose a topic that interests you. The objective of a science project is to learn more about something in science that YOU are interested in.

An observation is something you notice, measure or detect. Making an observation involves using the five senses and using tools to measure or describe things in the natural world. Scientific observations are objective. This means they are based on facts and NOT opinions or personal beliefs. They are not judgments or evaluations. For example, "I think this tree is beautiful," is not a scientific observation. "The tree has red, orange and yellow leaves," is a scientific observation.

### **Choose a Topic in Either Life or Physical Science Only (Grades 6th - 7th only)**

While observing your environment, keep in mind what are some topics that interest you? (Some examples include: Space, Weather, Plants, Electricity, Rocks). What do you want to know or learn more about? Ask yourself, "I wonder what would happen if...?" Problems are always written in the form of a question, and are specific, measurable, and testable.

#### **Make Your Topic Specific**

A specific topic only alters one thing. Examples:

- Space: How does the phase of the moon affect the tides?
- Weather: Does weather affect test scores?
- Plants: What is the best soil for plant growth?
- Electricity: Which type of battery generates the most electricity?
- Rocks: What happens when rocks freeze and thaw?

#### **Make Your Topic Measurable**

Can your topic be measured with a tool or observed using your senses? You must be able to relate some sort of numerical value to your question, i.e. time, distance, speed, height, weight, volume, etc.

**\*\*Write Your Topic in Your Logbook\*\***

#### **Now Make Your Topic Testable** (by Stephanie Elkowitz)

##### **What is a Testable Question:**

- A testable question is a special type of science question. A testable question can (and is) answered through a scientific experiment.
- A testable question almost always involves investigating what happens when you change something. In other words, a testable question involves changing one thing to see what the effect is on something else.

##### **Characteristics of a Testable Question:**

- A testable question is specific. It is focused and about changing or altering one thing.
- A testable question is observable. It can be observed using your senses or measured using tools.

- A testable question is scientific. It asks questions about living things and/or nonliving things or substances in the natural world.

**Examples of Testable Questions:**

- Does the sun heat freshwater and saltwater at the same rate?
- Does fertilizer help plants grow bigger flowers?
- Does coating a surface with water or oil reduce friction more?

**Non-Testable Questions:**

- Questions that are not testable questions are answered through research or research reports.
- Non-testable questions are scientific and observable, but tend to be more general.
- Examples: How do plants grow?, How do rockets work?

**Look for ways to turn your original question into a testable question:**

- ORIGINAL QUESTION: "Why does bubble gum lose its flavor?" (Not testable.)
- REVISED: "Which brand of bubble gum has flavor that lasts longest?" (Testable!)

**Refining Your Question - Dichotomous Key**

Use the information below as a reference tool to fill out the arrow diagram on the next page.

## Investigative Questions

## Dichotomous Key

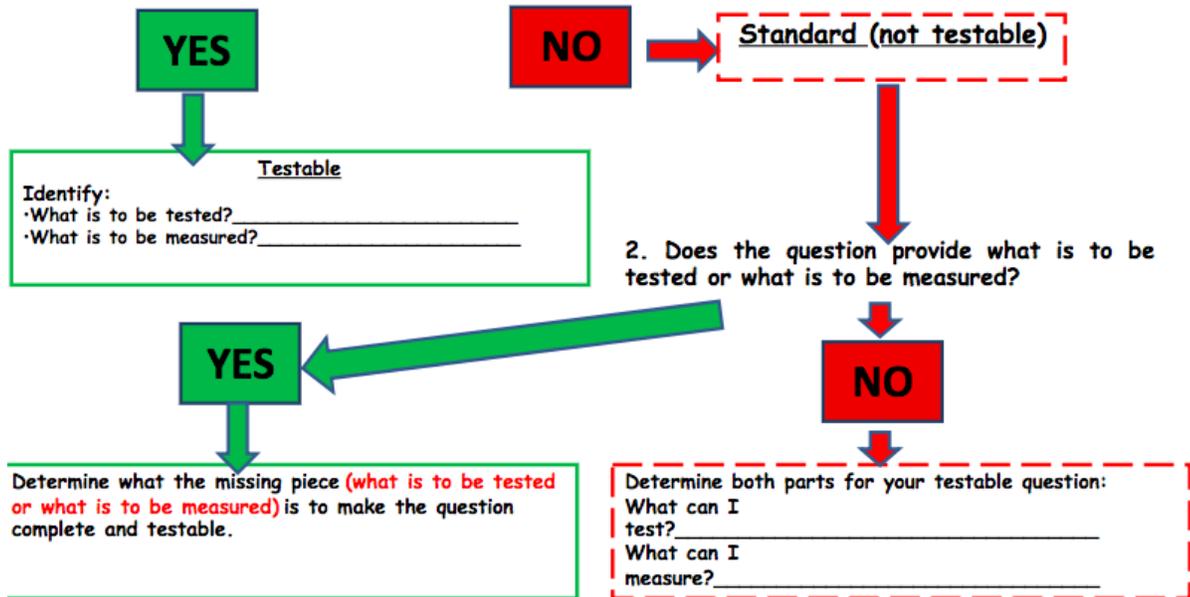
Testable questions are always about changing one thing to see what the effect is on another thing. "If I change \_\_\_\_\_, what will happen to \_\_\_\_\_, compared to our control?"

**TESTABLE QUESTION FORMATS**

- Does changing \_\_\_\_\_ affect \_\_\_\_\_?
- How does changing \_\_\_\_\_ affect \_\_\_\_\_?
- If I change \_\_\_\_\_, will it affect \_\_\_\_\_?

Look at the question given:

•Is the question testable or investigative? Does the question give both what to test and what to measure?



By Tamara Heffer, 2012 Sequoia Science Exploration - <https://slideplayer.com/slide/9218695/>

**\*\*Write Your Testable Question in Your Logbook\*\***

## Step 3: Background Research

So you've picked your chosen a topic, and written your problem or testable question... Now it is time to research your problem as much as possible so you can make your inference. Becoming an expert at your topic is what real scientists do in real labs.

### Here are some tips for conducting research:

- Look for general information about your topic/question.
- Find others who have already experimented about a similar problem (prior research).
- Try to find information that applies directly to your question.

**\*\*You need at least 5 sources! - See below expectations based on grade level.\*\***

### Research Notes

You will need to find four facts about your topic. These facts will be used to write your final paper. Learn what has been discovered or done before. It is recommended that you write the research portion of your paper while conducting this research. (Amount of paragraphs, detail of facts, and conventions required will increase according to grade level.)

Grades 5	One paragraph per fact
Middle School	Two paragraphs per fact

Prior knowledge of the topic. (What did you already know?)

Fact 1 (Written in your own words)

**\*\*Write Your Fact 1 in Your Logbook\*\***

Fact 2 (Written in your own words)

**\*\*Write Your Fact 2 in Your Logbook\*\***

Fact 3 (Written in your own words)

**\*\*Write Your Fact 3 in Your Logbook\*\***

Fact 4 (Written in your own words)

**\*\*Write Your Fact 4 in Your Logbook\*\***

Fact 5 (Written in your own words)

**\*\*Write Your Fact 5 in Your Logbook\*\***

**Citing Evidence (MLA Formatting)**

As you locate the information about your science fair project document your sources (books, magazines, internet websites, encyclopedias, scientific documents/studies, interviewing an expert, etc.) Never plagiarize; always give credit when using another’s work. Feel free to add more if needed.

**Sample Formatting:**

\_\_\_\_\_. (\_\_\_\_). \_\_\_\_\_  
Author (Last, First) or Company Name      Date      Title of book or website (Italics)

\_\_\_\_\_  
Book publisher or web address

**\*\*Write Your Source 1 in Your Logbook\*\***

**\*\*Write Your Source 2 in Your Logbook\*\***

**\*\*Write Your Source 3 in Your Logbook\*\***

**\*\*Write Your Source 4 in Your Logbook\*\***

**\*\*Write Your Source 5 in Your Logbook\*\***

## Step 4: Hypothesis

### What is a hypothesis? (by Stephanie Elkowitz)

- A hypothesis is an educated guess or prediction. It is a thoughtful answer to a testable question.
- A hypothesis is not a random prediction. It is based on observations, facts, evidence and findings from previous experiments.
- A hypothesis is tested with an experiment and proved to be true or false.

### How to write a hypothesis:

- A hypothesis is written in a specific way: "If [I change this], then [this will happen] because....".
- There are three parts to the format of a hypothesis:
  1. If: "If" refers to the change (**Independent Variable**) you in make in the testable question.
  2. Then: "Then" refers to your prediction (predicted **Dependent Variable**). It is the effect that you believe the change with make.
  3. Because: "Because" is the reason or explanation for why you made the prediction.

### Example of a hypothesis:

- Testable question: Does fertilizer improve plant growth?
- Hypothesis: If I add fertilizer to soil, then the plant will grow taller because fertilizer provides nutrients and minerals that help the plant increase in size.

### What happens if a hypothesis is wrong?

- If an experiment proves your hypothesis wrong, it's OK! Your hypothesis and experiment are not good or bad based on whether your hypothesis is correct.
- A "good" hypothesis is thoughtful and reasoned. A "bad" hypothesis is random and thoughtless. As long as your prediction is rationalized by facts and observations, your hypothesis - whether right or wrong - is good.

**\*\*Write Your Hypothesis in Your Logbook\*\***

## Step 5: Experimental Method (Materials & Procedures)

### Procedure and Materials:

- This is where you design your experiment.
  - Write out all of the steps in a clear, specific and detailed way so that someone else could easily replicate the experiment.
- Create a Materials List.
  - Make a numbered list of everything you use to conduct your experiment.

### What is an experimental method? (by Stephanie Elkowitz)

- An experimental method or procedure is the process or way the experiment is carried out.
- The experimental method describes the materials used in an investigation and how they are prepared and used in the experiment.

### How is an experimental method written?

- An experimental method is written in a step-by-step fashion. The steps of an experimental method are written in chronological order.
- The steps are clear, specific and detailed so that someone else could easily replicate the experiment.

### What are features of a good experimental method?

- The method is written in a stepwise fashion.
- The number of test subjects used and trials is stated.
- The specific amount of substances or materials used are stated.
- The tools needed and specific measurements that need to be taken are stated.
- The time needed to complete certain parts of the experiment are clearly defined.

### Why is the experimental method important?

- A good experiment is easily replicated. Therefore, a good experiment has a good experimental method. In order for the experiment to be duplicated, the steps must be written in a straightforward but thorough way.
- The experimental method is also important because scientists need to understand how an investigation was conducted in order to judge the reliability of the experiment. Scientists want to know if an experiment was performed in a thoughtful way and the experimental method will reflect if it was carried out this way.

**\*\*Write Your Materials in Your Logbook\*\***

**\*\*Write Your Procedures in Your Logbook\*\***

## Table to Help Plan Your Experimental Method

	How to plan a good experiment	EXPLAIN
VARIABLES	Only change one variable.	You should change only one factor and keep all other factors the same or constant.
EXPERIMENTAL GROUPS	Always compare your experimental group(s) to a control group.	You should have multiple experimental group and a control, which doesn't receive the variable being changes.
SAMPLE SIZE	Use many test subjects (large sample size).	You should use may test subjects to help reduce errors.
TRIALS	Have at least three trials.	You should have multiple trial to reduce errors and produce more accurate results.
RECORDING DATA	Record observations and data in a notebook or table.	You should organize observations and measurements in an organized manner in a notebook or table.

## Step 6: Variables

### What are variables?

- Variables are factors in an experiment that you change, measure or keep constant.
- There are three types of variables in a controlled experiment.

### Types of Variables

#### 1. Independent Variable

- The independent variable is the factor you change or manipulate in the experiment.
- There is only one independent variable.
- A change in the independent variable has different effects in the experimental groups

#### 2. Dependent Variable

- The dependent variable is the factor you measure in the experiment.
- The dependent variable must be observable or measurable.
- The dependent variable depends on the independent variable. It changes because of the independent variable
- In most experiments, there is only one dependent variable.

#### 3. Controlled Variables

- The controlled variables are all other factors in the experiment.
- There are multiple controlled variables in a controlled experiment.
- Controlled variables are kept the same or constant for different groups. Keeping controlled variables constant is very important in a controlled experiment. You want to make sure only the independent variable changes so that you know it's that specific factor that is affecting your experiment.
- For example - let's say you are testing the effects of sunlight on plant growth. You alter the amount of sunlight for different experimental groups. You should keep the amount of water, the type of plant, the kind of soil and temperature the same for ALL the experimental groups to make sure that you are testing ONLY the effects of sunlight on plant growth.

### Identifying Variables:

- Example: A student wants to determine the effects of fertilizer on plant growth.
- Independent variable: the fertilizer
- Dependent variable: plant growth (how tall the plant grows)
- Controlled variables: type of plant, soil, amount of sunlight the plants receive, amount of water the plants receive, temperature.

**\*\*Write Your Variables in Your Logbook\*\***

## Step 7: Data Collection (Conduct Experiment)

### The Experiment

- The experiment is the testing of your hypothesis.
  - **Observations** – Record everything you do and see including what happens in the experiment. Your recordings must be precise enough for a separate third party to reenact your experiment without any direction from you AND get the same results.
    - **Experiment must be able to be observed at least 3 times.**

### What is an observation? (by Stephanie Elkowitz)

- An observation is something you notice, measure or detect.
- Making an observation involves using the five senses (vision, smell, hearing, taste and/or touch) and using tools to measure or describe things in the natural world.
- Scientific observations are objective. This means they are based on facts and NOT opinions or personal beliefs. They are not judgments or evaluations. For example, “I think this tree is beautiful,” is not a scientific observation. “The tree has red, orange and yellow leaves,” is a scientific observation.

### Types of Observations - There are two types of observations:

1. **Qualitative observations:** (Quality) Qualitative observations are things noticed or observed using your senses. These are things you see, smell, hear, touch or taste. Qualitative observations describe the color, texture, appearance, odor and other physical characteristics of something.
2. **Quantitative observations:** (Quantity) Quantitative observations are measurable observations. They are numerical measurements or observations. Measurements are made with tools like a ruler, scale, thermometer or graduated cylinder.

### Data and Data Tables: (by Stephanie Elkowitz)

- Data is information collected during an investigation. Data includes observations you make with your senses (what you see, hear, smell, feel, etc) and measurements you make with tools such as thermometers, rulers and scales.
- Data should be collected in a logical and orderly way. The best way to collect data in with data tables.
- Data tables are tables that organize observations and measurements collected during an experiment.
- Data tables display information in an organized way, which makes it easier to understand the data at the end of the investigation.

### Data Table Format:

- Data tables have a specific format.
- Data tables have a title to describe the recorded information
- Data tables have columns and rows. The top of each column and/or start of each row is labeled with a title. If recording a measurement, list the unit of measurement under the title in parentheses.
- Very often, the independent variable is listed in the first (far left) column. The experimental groups are listed in the subsequent columns. Data collected from the groups is placed in boxes down the columns.

- When measuring change over time, time is listed in the first column and the experimental groups are listed in the subsequent columns. Data collected from the groups is placed in boxes down the columns.

### Why are data tables useful and important?

- Recording data in a data table helps prevent mixing up measurements and observations for different things.
- Recording data in a data table helps prevent missing data that you need to collect at different points in the investigation.
- Data tables help you better analyze and interpret information collected during an investigation.

### Examples of Data Collected and placed into Tables:

1. A student measures the height of two plants for 5 weeks. One plant is grown in sunlight and the other is grown in the dark. The plant grown in the sunlight measures 5 cm the 1st week, 6.5 cm the 2nd week, 8 cm the 3rd week, 10 cm the 4th week and 12.5 cm the 5th week. The plant grown in the dark measures 5 cm the 1st week, 5.2 cm the 2nd week, 5.5 cm the 3rd week, 5.8 cm the 4th week and 6.1 cm the 5th week.

Week	Plant grown in sunlight (cm)	Plant grown in the dark (cm)
Week #1	5 cm	5 cm
Week #2	6.5 cm	5.2 cm
Week #3	8 cm	5.5 cm
Week #4	10 cm	5.8 cm
Week #5	12.5 cm	6.1 cm

2. A student measured the amount of dissolved oxygen in freshwater and saltwater at different temperatures. At 1°C, the concentration is 14.0 ppm in freshwater and 11.0 ppm in saltwater. At 10°C, the concentration is 11.5 ppm in freshwater and 9.0 ppm in saltwater. At 15°C, the concentration is 10.0 ppm in freshwater and 8.0 ppm in saltwater. At 20°C, the concentration is 9.0 ppm in freshwater and 7.5 ppm in saltwater. At 25°C, the concentration is 8.0 ppm in freshwater and 7.0 ppm in saltwater.

Temperature (°C)	Freshwater (ppm)	Saltwater (ppm)
1 °C	14.0 ppm	11.0 ppm
10 °C	11.5 ppm	9.0 ppm
15 °C	10.0 ppm	8.0 ppm
20 °C	9.0 ppm	7.5 ppm
25 °C	8.0 ppm	7.0 ppm

**\*\*Put Your Data & Tables in Your Logbook\*\***

## Step 8: Results (Graph, Identify Relationships In Data)

### Analyzing and Interpreting Data:

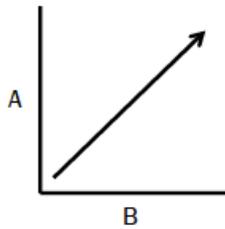
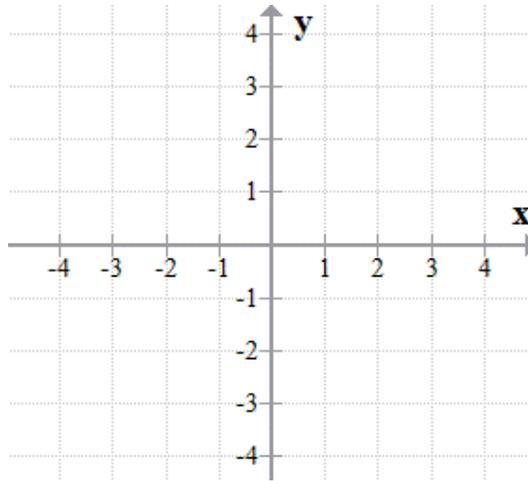
- Analyzing is looking at data carefully and looking for relationships, patterns and solutions.
- Interpreting is making statement about what the data means.
- Very often, we graph information in data tables. Graphs are visual representations of data. Graphs make it easier to “see” data and thus, easier to analyze and interpret the data.

### Why do we analyze and interpret data?

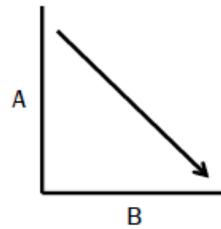
- We analyze and interpret data to determine whether there is a relationship between things tested in an experiment. We look to see if something is related to something else. Specifically, we look to see if changes in the independent variable cause changes in the dependent variable.
- We also analyze data to see if the data is reliable. We analyze the sample size, number of trials and controlled variables. If an experiment is not controlled, the sample size is small and/or the experimenter did not conduct multiple trials, the data and results may be flawed and unreliable.

### How do we analyze data?

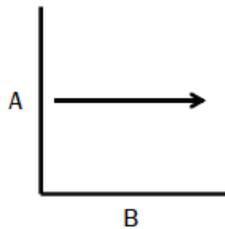
- **Quantitative data** (Quantity - identified by numbers) is recorded on charts, tables and graphs.
- **Qualitative data** (Quality - observed with senses) includes illustrations and photographs. Sources must be included with photographs. **REMEMBER: NO FACES ALLOWED IN PHOTOS.**
- When analyzing data, we look for patterns and describe the relationship between the independent and dependent variable. We often use the statement: “If [independent variable] increases/decreases, **then** [dependent variable] increases/decreases/stays the same/etc, **because...**”
  - When measuring a variable against time, we use the statement: “As time passes/increases, the [dependent variable] increases/decreases/stays the same/etc”
  - We can describe the rate at which a variable changes by using terms such as quickly, slowly, exponentially (faster and faster), more and more slowly, etc.
- There are some relationships that we define when the dependent variable changes in a specific way compared to the independent variable:
  - **Direct relationship:** A change in the **independent variable (x-axis)** causes the same change (direction and rate) in the **dependent variable (y-axis)**.
  - **Indirect relationship:** A change in the **independent variable (x-axis)** causes the opposite change in the **dependent variable (y-axis)**.
  - **Constant relationship:** A change in the **independent variable (x-axis)** causes NO change in the **dependent variable (y-axis)**.
  - **Exponential relationship:** A change in the **independent variable (x-axis)** causes the **dependent variable (y-axis)** to change in the same direction but at a faster rate.
  - **Cyclic relationship:** A change in the **independent variable (x-axis)** causes the **dependent variable (y-axis)** to increase and decrease in a regular pattern.



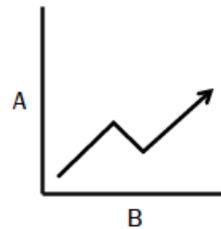
As A increases,  
B increases.  
**DIRECT RELATIONSHIP**



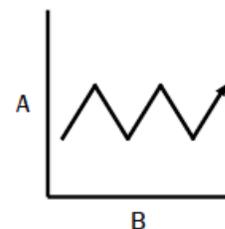
As A increases,  
B decreases.  
**INDIRECT RELATIONSHIP**



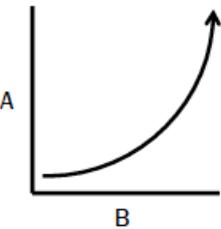
As A increases,  
B stays the same.  
**CONSTANT RELATIONSHIP**



As A increases,  
B increases, decreases  
then increases.



As A increases,  
B increases and decreases  
in a regular pattern.  
**CYCLIC RELATIONSHIP**



As A increases,  
B increases exponentially.  
**EXPONENTIAL RELATIONSHIP**

**\*\*Put Graph(s) & Relationships in Your Logbook\*\***

## Step 9: Analysis/Conclusion

### How do we interpret data?

- When we interpret data, we determine what the data implies. We assign meaning to the information.
- Interpreting data is important to making conclusions and determining the significance of the finding in an experiment. It is also important to explaining how or why data is reliable or unreliable. It is an explanation for why data should be “trusted” or why data may be flawed.
- In the graph, the plant height increases over time (the analysis). The interpretation of this analysis is that the plant is growing. Plants that grow get taller. Since this plant is getting taller, it must be growing.

### What is a conclusion?

- The conclusion is the end or close of the investigation. It wraps-up and summarizes all the findings of the investigation.
- In most investigations, the conclusion is a written piece. The conclusion addresses important things that sum up the findings, how the experiment proceeded and how future experiments could (or should) be conducted to confirm or further develop the findings of the experiment.

### What are important things to address in a conclusion? There are four important features of a conclusion:

1. **A summary of the results.** You should summarize the results and major findings of the experiment in the conclusion. You should discuss your interpretation of the results (which you carefully analyzed) and how the findings are significant or important. You should also relate the findings back to the question of the experiment.
2. **How the results relate to the hypothesis.** You should discuss if the findings support or refute the hypothesis. Remember - an experiment is not considered “good” or “bad” based on whether your hypothesis is right or wrong. You should also discuss how the results relate to previous studies and/or known facts, theories or laws.
3. **Sources of error.** You should discuss the effectiveness and success of the experimental design. You should also point out any mistakes or errors made in the experiment and how the mistakes or errors might have affected the results. A good scientist will honestly evaluate how their experiment was conducted. It is OK to have mistakes, but it is NOT OK to try and cover up or intentionally disregard them. Acknowledging errors means you have respect for the scientific process and the ability to truly analyze and evaluate your investigation.
4. **Suggestions for future studies and how the investigation could be improved.** You should give recommendations for future studies that could (or should) be performed to further develop the findings of your experiment. You should also discuss how someone else could improve your experiment. Give suggestions on how to do things better or things to “look out for” while replicating your experiment.

**\*\*Write Analysis/Conclusion in Your Logbook\*\***

## Step 10: Reflections

### What is error? (by Stephanie Elkowitz)

- Mistakes that happen during an investigation are called errors.
- Errors occur for different reasons. Some errors occur because of poor experimental design. Other errors occur because of uncontrolled variables or malfunctioning tools used in the experiment.
- Errors can affect (and flaw) the results of an experiment.
- Some errors can be completely prevented. However, there is some error that cannot be entirely avoided. We call this random error. Random errors are beyond the control of the experimenter. Although we cannot prevent all random error, there are things we can do to reduce it and its effect on the results of an experiment.

### Sources of Errors - There are 4 major sources of error in an experiment:

1. Small sample size and reduced number of trials. A good experiment has a large sample size and multiple (at least 3) trials. These design features reduce random error. If you have a small sample size, and there is something wrong with a test subject (ex. a test subject is sick) the results could be flawed. If a mistake occurs during a trial, and you don't have multiple trials, the results could be flawed as well.
2. Variables are not controlled. Controlling variables reduces the chance that something other than the independent variable causes a change. If factors outside of the independent variables are not kept the same, you cannot be entirely sure that it is only the independent variable that is causing changes.
3. The experimental method is not followed. Errors can occur when the method is not followed. These errors are obvious blunders and can be easily avoided by meticulously following the procedure and making truthful observations in an organized way. Record observations in a table or notebook to help prevent misreporting of data.
4. Tools malfunction or are uncalibrated. Measurements and observations are often made with tools that must be calibrated or standardized before using. If lab tools are not calibrated, the measurements are not accurate. Scales, thermometers and computer equipment should be checked before using them in an investigation. Make sure they are calibrated and working properly before using and relying on them to collect data.

### Recognizing and Reducing Errors

- In order to reduce errors, reduce the sources of errors. Use a large sample size, perform multiple trials of your experiment, control variables, follow the procedure and check to make sure lab tools are calibrating and functioning properly.
- When studying someone else's investigation, analyze the procedure and the collected data to find sources of error. Also read through the conclusion to learn about admitted mistakes made during the experiment. An honest experimenter will report mistakes made during the experiment.

**\*\*Write Your Reflection in Logbook\*\***

## Step 11: Abstract

**What is an Abstract?** - <http://writing2.richmond.edu/training/project/biology/abslit.html>

- The abstract, **although it comes first logistically, always should be written last**. It needs to be written last because it is the essence of your report, drawing information from all of the other sections of the report.
- An abstract summarizes, usually in one concise paragraph of 80-300 words. The major aspects of the entire paper in a prescribed sequence that includes:
  1. The overall purpose of the study and the research problem(s) you investigated, why the experiment was conducted.
  2. The problem (testable question) being addressed.
  3. The basic design of the study, or what methods were used to solve the problem.
  4. Major findings or trends found as a result of your analysis, the major results obtained.
  5. A brief summary of your interpretations and conclusions; the overall conclusions from the experiment as a whole.
- **The abstract allows you to elaborate upon each major aspect of the paper and helps readers decide whether they want to read the rest of the paper.**
- Therefore, enough key information [e.g., summary results, observations, trends, etc.] must be included to make the abstract useful to someone who may want to examine your work.

**How to I go about writing my Abstract?**

- The best way to attempt to go about writing an abstract is to divide it into the sections mentioned above.
- The first two sections are very similar and can be grouped together, but do not have to be. If you decide to address them separately, make sure that you do not repeat anything.
- Often a section can be mentioned in only one sentence.
- The most important thing to remember when writing the abstract is to be brief and state only what is pertinent. No extraneous information should be included. A successful abstract is compact, accurate and self-contained.
- It also must be clear enough so someone who is unfamiliar with your experiment could understand why you did what you did, and what the experiment indicated in the end.
- An additional note is that abstracts typically are written in the passive voice, but it is acceptable to use personal pronouns such as I or we.

**How do you know when you have enough information in your abstract?**

- A simple rule-of-thumb is to imagine that you are another researcher doing a similar study.
- Then ask yourself: if your abstract was the only part of the paper you could access, would you be happy with the amount of information presented there? Does it tell the whole story about your study? If the answer is "no" then the abstract likely needs to be revised.

**\*\*Write Your Abstract in Logbook\*\***

## Step 12: Final Research Report

### Final Science Research Report :

- The report should be written to inform the reader about your topic, project, and your results.
- This may be typed, or neatly handwritten on lined loose-leaf paper.
- You will use MLA Formatting, along with your BEST grammar, spelling, and organization skills.

### Your report will include the following:

1. **Cover** - An attractive and simple one/professional looking one
2. **Title Page** - Despite MLA formatting
  - Include your name and date
  - The title of your project - Think of something catchy but relevant
  - The topic
3. **Abstract**
  - See section on Abstract for detailed instruction.
  - This should be written last.
  - A one paragraph (or at the most one page) summary of your entire project, including the results of your experiment and your conclusions.
4. **Table of Contents**
  - Each section listed starting with "Introduction"
  - Page numbers next to the headings
  - Do not include the Title Page
5. **Introduction** to the topic.
  - Tell about your testable question and why you chose your topic.
  - Introduce your hypothesis.
6. **Question, variables, and hypothesis**
  - What was your hypothesis?
  - Why is your question/hypothesis important?
  - How do your variable relate to your hypothesis?
7. **Background research**
  - Teach the reader about your topic
  - Include your prior knowledge on the topic.
  - Give facts, details, definitions, examples about your topic
  - Where would I find this topic?
  - Why is the topic important?
8. **Experimental Method**
  - **Materials List**
    - What materials did you use? List ALL of them.
    - Include measurements of items if applicable.
  - **Experimental Procedure**
    - What was your procedure (what steps did you take)? List ALL of them!
    - Make sure they are in order and can be repeated without any assistance from you.
    - Students should begin the experiment by carefully following their Methods.
    - Student's Testing (experiment) should be age appropriate.
    - They should: record the dates and time of day of each step, and the acidity used.

- Record any mistakes or unusual observations.
- Use more detail rather than less detail.
- Illustrate results — take photographs or make drawings of the methods and materials if desired and tape, glue or otherwise fix into the Science Logbook.
- They might want to also use these pictures on their Project Display Board. If so, they need two prints each.

**9. Data & Analysis** and discussion on findings (specify relationships), focusing on your observations, data table, graph(s).

- Include your tables.
- Convert your tables to graphs with properly labeled x and y-axis.
- Analyze your data. Do you notice any patterns? Did anything surprise you?
- Explain your results.

**10. Conclusion** including ideas for possible future research based on what was learned.

- What did you learn?
- Did your experiment work? Were you successful? Why or why not?
- What would you do differently next time?

**11. Acknowledgements** to anyone who helped with your science fair project from a single individual to a company or government agency.

**12. Bibliography** is a listing of all your sources you will cite throughout your project, and will be shown in MLA formatting.

## Step 12: Final Research Report Rubric

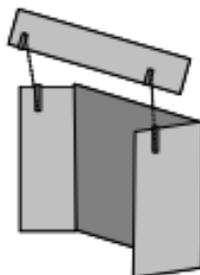
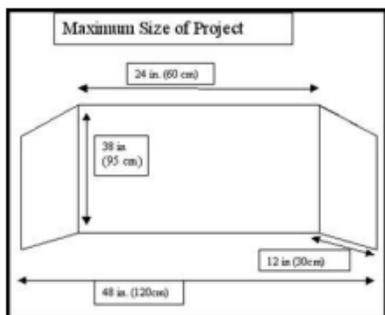
	4	3	2	1	Score
<b>Cover, Title Page, Table of Contents, Formatting (MLA)</b>	Attractive, simple, professional cover. Cover page with all required info. MLA formatting throughout. Accurate Table of Contents.	Includes the cover, MLA formatting, and Table of contents, but may be formatted incorrectly.	Includes 2/3 of the following: Cover, MLA formatting, and Table of Contents.	Includes little or no cover, Table of Contents, or MLA formatting.	
<b>Abstract</b>	The abstract includes a summary of the project, the results of the experiment, and a conclusion.	The abstract may be missing the summary, results, or conclusion.	The abstract only includes one of the following: summary, results, or conclusion.	No abstract is included.	
<b>Introduction</b>	Report clearly outlined a testable question and why they chose their topic. Includes an original, plausible hypothesis. Writing was easy to follow and organized.	Report outlined a testable question, why they chose their topic, and a hypothesis but student needed a little direction to expand upon their writing	Report introduction only outlined the question that was being tested. Did not offer hypothesis.	Introduction did not include any information about the topic, the question, or the hypothesis.	
<b>Question, Variables &amp; Hypothesis</b>	Answer: What is your hypothesis, taken from your testable question? Why your hypothesis is important? Your variables and how they relate in your hypothesis?	Hypothesis is explained and related to the variable, but no mention of why hypothesis is important.	Hypothesis is explained but not related to the variables.	No hypothesis is mentioned.	
<b>Background Research</b>	Includes several facts gathered from research about the project topic. Discusses several different points of prior knowledge and the reader is able to gain more information about the topic as a result of this paragraph	Explanation paragraph includes facts about the project topic, but doesn't offer any prior knowledge or other points that were discovered through research or the experiment.	Report only includes minimal facts that were evident of research.	Little or no research was conducted, therefore, no (or one) facts were included.	
<b>Experimental Method - Materials &amp; Procedures</b>	Includes listed materials and step-by-step procedures in sentence form. Procedures are explained in a way that someone would be able to replicate the experiment with ease.	Includes listed materials and step-by-step procedures in sentence form. Procedures are a little difficult to follow, which would make it difficult for someone to pick up and replicate.	Materials and procedures are listed, but they are not in sentence form.	Materials and procedures are scattered, difficult to follow or missing from the project report.	
<b>Data and Analysis</b>	Graphs and tables were included and properly labeled. Observations were explained in detail. Explanation of results were included.	Graphs and tables were included, however observations and explanations were lacking detail.	Limited graphs/tables and/or observations.	Missing graphs or analysis.	
<b>Conclusion</b>	Report includes a strong conclusion that describes the outcome of the experiment, answers the original questions, and compares the results to the initial hypothesis. Conclusion is easy to follow and understand.	Report includes a strong conclusion that describes the outcome of the experiment and answers the original question.	Report includes a conclusion that states the outcome of the experiment. The original question was not addressed in the conclusion and is a little difficult to follow and understand.	Report is missing the outcome of the experiment and the original question was not answered.	
<b>Conventions</b>	No errors in spelling, capitalization, punctuation, sentence structure, and word usage.	Almost no errors in punctuation, capitalization, spelling, sentence structure and word usage.	Many errors in punctuation, capitalization spelling, sentence structure and word usage.	Numerous and distracting errors in punctuation, capitalization spelling, sentence structure and word usage.	

## Step 13: Final Project Display Board

**Final Project Display Board** - <https://www.unlv.edu/sites/default/files/24/science-display.pdf>

- This is your chance to get the judges attention from all the other hundreds of boards they will be looking at.
- Your science fair display represents a summary of all the work that you have done, should be well organized and allow the views/judges to easy follow along through your discovery process.
- It should include all the following required, clearly labeled sections called:
  - **Question, Hypothesis, Methods, Experiment (materials and procedures), Results (data and analysis), Conclusion and Abstract.**
  - Your board should indicate you spent time thinking about, performing and learning something from their project, which we call “good science.”
  - Some will look like they were assembled in an hour, because in many cases they were.
  - Remember, judges are keen enough to recognize good, age-appropriate science, as long as it is presented reasonably well and it doesn’t look like your parents prepared the display for you.
  - You will not be there to talk with the judges, so your board will do your talking for you. It needs to communicate your work well.
- The **text** on the board should be **computer printed** or very carefully hand written.
- The **titles** could also be letters purchased from a craft store.
- The board should be **colorful, neat, and organized** so it attracts the attention of viewers but does not confuse them.
- The board should include **graphs or charts** of your data
- The board should include **pictures** of your experiment if possible, but **MUST** avoid student’s faces in the pictures.
- **IMPORTANT:** BEFORE YOU GLUE/PASTE/STENCIL/WRITE anything on your board, lay everything out and see if it fits well. Make any changes you need to before it’s too late!

**Board Specifications** - <https://www.unlv.edu/sites/default/files/24/science-display.pdf>



- The dimensions of the board shown above reflects the MAXIMUM size of the board.
  - Maximum size is a 48” by 36”, 3-Panel Folding Display Corrugated Board
  - Can be purchased from an office supply store, Walmart, Target, etc.
  - Boards do not need to be purchased; they can be made out of any material that is freestanding and that meets the size and shape requirements above.
- Smaller boards are acceptable. Project boards must be freestanding and stable.
- Detachable “Header” Title Boards, as shown above, are encouraged (but not required), since they stabilize the board.
- With the exception of the Science Log Book, all items displayed must be attached to the project board and may not touch the table top or destabilize the project board to the point that it is no longer freestanding.

### Project Display Board Identification

- Student’s name, school name, and grade must appear on the back of the project board.

- As you face the back of the board, this information should appear on the top left-hand side of the project board (as shown as  $\surd$  in the diagram above).
- Students may use the cutout label below.
- Photographs on the front of the Project Board showing the student's face must be covered with a "post-it" or similar arrangement.

Cut out board label:

Student's Name	
Student's School Name:	
Student's Grade:	

## Science Fair Display Board Checklist

After you have completed your display board take time to complete this checklist yourself to be sure you have everything included on your display board. Then add or revise any areas that you did not check off as being complete. After you have made any changes to your board, have your parent complete the checklist as a final review of your work before turning it in at school.

	Self	Parent
1. Overall appearance is neat and attractive. Judges will assess based on how much your board draws others in.		
2. All necessary parts are included and labeled ( <b>Question, Hypothesis, Methods, Experiment (materials and procedures), Results (data and analysis), Conclusion and Abstract.</b> )		
3. I used no more than three colors when doing my backboard. You don't want your board too busy that it distracts from your information.		
4. My display board has a short and catchy title.		
5. All of the words on my display board are spelled correctly.		
6. I have used proper grammar and punctuation.		
7. My procedures are written in clear sequential order.		

8. My procedure shows that I conducted repeated trials (at least 3) or used an adequate sample size, if necessary.		
9. I have identified my independent, dependent and control variables.		
10. All necessary parts are included on my chart (title, labels, and units) and it is neatly drawn and filled in with appropriate data.		
11. I have the correct type of graph that displays my data from my chart and the graph includes all the necessary parts (title, axes, increments, labels, and scale). A key is present if necessary.		
12. I included a written explanation of my chart, graph and any other observations I made.		
13. My conclusion includes the answer to the original problem, accuracy of my hypothesis, what I learned supported with data, and any problems and real world applications.		

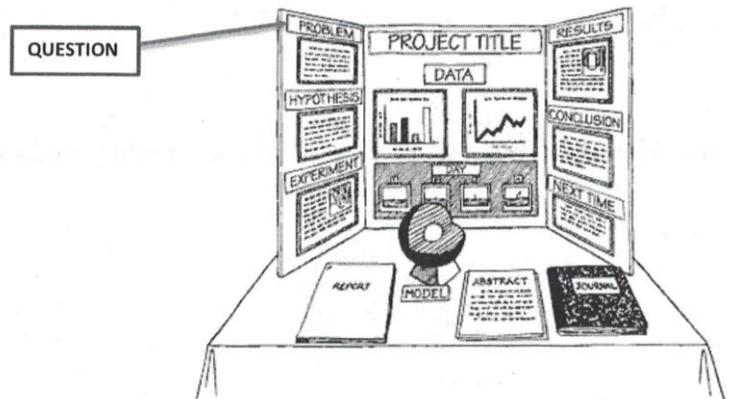
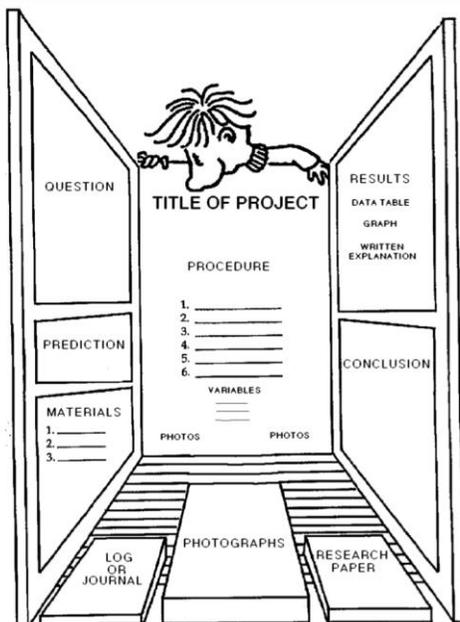
### ADDITIONAL TIPS FOR CREATING OUTSTANDING DISPLAYS:

- **BE NEAT-** Avoid frayed or ripped edges of paper, glue globs, lots of cross outs or white outs etc.
- **USE COLORS TO ATTRACT ATTENTION BUT DON'T OVER DO IT--** No more than (3) three colors should be used on a project except for special situations. Too much color can be distracting. Instead develop a color pattern that is pleasing to the eye.
- **FRAME OR MATTE YOUR WORK-**Use construction paper or other colored materials to provide a background for your written work and labels (construction paper, newspaper, wrapping paper, old wall paper, contact paper etc...)
- **TITLES SHOULD BE SHORT, CATCHY AND RELATED TO THE PROJECT IDEA.** For example: Color of Cool Cubes is better than The Melting Rate of the Different Colors of Ice Cubes Sizing Up Seeds is better than The Relationship between the Size of the Seed and the Size of the Plant
- **WRITING SHOULD BE NEAT AND LEGIBLE-** If you choose to use a computer or typewriter, stick to one or two fonts to type your work. Too many fonts can be distracting and difficult to read. If you hand write your work, print or use cursive, don't mix the two. Also, if you are handwriting the information, be extra careful to write so it can easily be read by others. Pen is easier to read than pencil. Messy or illegible writing can really lower your score.
- **SPELLING DOES COUNT-**Take time to check over your work before you put it on your display board. Don't overuse white out. Scratching out mistakes is not acceptable. If you do recognize an error after finishing, place a single line through it and write the correct word above. However, too many of these types of marks will affect the overall appeal of your project.
- **PRACTICE YOUR LAYOUT-** Before you begin gluing things down, practice moving the parts of the display around until they are evenly spaced and centered. Crowding together or large gaps can take away from your project's appeal. Trying to rip off or move things once they are glued down can be messy and often ruins the paper or display board.

- **DON'T GLUE ON MATERIALS FROM YOUR PROJECT-** Don't glue on food items such as M & M's, popcorn or moldy bread to the board. Food products attract bugs, so do their wrappers. Don't place samples of chemicals or their containers on the board. This includes household items such as vinegar, dish soap, oil etc.
- **TAKE PHOTOS OR DRAW PICTURES/DIAGRAMS OF THE ITEMS FOR DISPLAY-** This will help you to avoid attaching materials from your experiment to your display.
- **RESEARCH REPORTS ARE PLACED IN FRONT OF THE DISPLAY-** Do not attach the report to the display board. It is placed in front of the display.

## SCIENCE FAIR PROJECT DISPLAY INFORMATION

- Title:** Short, catchy, related to the topic and results of the experiment
- Question:** The problem or testable question to be tested
- Hypothesis:** The predicted answer to the question/problem asked with a reason
- Methods:** This is your variables. What they were and how you used them.
- Experiment:** Materials: A list of the supplies, equipment to be used and Procedure: A list of the steps followed to perform the experiment
- Data:** Display of your tables that you used to organize the data you captured and then converted into your graphs or charts. Make sure your tables and graphs are labeled correctly.
- Results:** This is a written explanation of your data and an analysis (mean, medium, mode, range) of what it says to either support or refute your hypothesis.
- Conclusion:** Briefly answers the problem asked in the beginning; states the hypothesis to be supported or not supported, and makes suggestions for further research
- Abstract:** One-paragraph summary of the steps in the project and record this in their Science Logbook and on the Project Display Board.



## Items NOT Allowed on Project Display Board:

<https://www.unlv.edu/sites/default/files/24/science-display.pdf>

1. Living organisms
2. Taxidermy specimens or parts
3. Preserved vertebrate or invertebrate animals
4. Human or animal food or beverage
5. Human/animal parts or body fluids (for example, blood, urine)
6. Plant materials or products (living, dead, or preserved), UNLESS they are in a sealed bag or container (allergy or safety risk)
7. Any liquid, including water or laboratory/household chemicals
8. Poisons, illegal drugs or drug paraphernalia, over-the-counter medications, controlled substances, hazardous substances or devices (such as, firearms, weapons, ammunition, reloading devices)
9. Dry ice or other sublimating solids.
10. Sharp items (for example, syringes, needles, pipettes, knives, sharp metal, etc.)
11. Flames, highly flammable materials, or anything that would cause flames or burns.
12. Glass or glass objects unless deemed by Display & Safety Committee to be deemed a safe integral or necessary part of the project
13. Pressurized tanks
14. Awards, medals, business cards, flags, endorsements and/or acknowledgements (graphic or written)
15. Photographs or other visual presentations depicting vertebrate animals or humans in surgical techniques, dissections, necropsies, or other lab procedures
16. Photographs showing students faces, students' names or school name may not appear on the front of the board
17. Active Internet or e-mail computer connections as part of displaying the project
18. Lasers
19. Websites, email addresses, Facebook pages, telephone numbers, and fax numbers of individuals.
20. Any other item or apparatus deemed unsafe, offensive or inappropriate by the SNRSEF Display & Safety Committee
21. Models or any other items not affixed to the board

# Score Sheet for Science Fair Project

Checked boxes indicate something is complete.

1. **Overall Appearance and Organization of Display Board** \_\_\_\_\_/7  
**points**
  - All parts of project are included and clearly labeled
  - All parts are in the correct sequential order
  - Display board is neat and attractive
  - There are very few or no spelling errors
  - Good grammar was used throughout the writing
  - Any photographs used have captions
  - Any drawings included have labels and titles
  
2. **Problem** \_\_\_\_\_/3
  - Problem led to an investigation, not a report, demonstration or model
  - Problem is clearly written in the form of a question
  - A creative approach to problem-solving was used to formulate the problem
  
3. **Hypothesis** \_\_\_\_\_/3  
**points**
  - Hypothesis must state a possible outcome of the experiment
  - Hypothesis must include an explanation or reason for the prediction
  - Background information is present showing research was done
  
4. **Materials** \_\_\_\_\_/3  
**points**
  - All materials used in the experiment are listed
  - All materials list the quantity needed
  - All measurements are done in metric
  
5. **Procedures** \_\_\_\_\_/3  
**points**
  - All steps for the procedure are accurately stated and in sequential order
  - Procedures indicate that repeated trials (at least 3) were conducted
  - The independent, dependent and control variables are accurately identified
  
6. **Results - Graphic Representation** \_\_\_\_\_/3  
**points**
  - Data is present in the form of a table or chart
  - An appropriate type of graph is accurately constructed
  - If a graph is not possible- journal entries or other visual display of results is present
  
7. **Results- Written Explanation** \_\_\_\_\_/2  
**points**
  - Explanation analyzes and summarizes the data to note patterns and trends
  - Explanation interprets the graph

8. **Conclusion**

\_\_\_\_\_/4

**points**

- Conclusion answers original problem asked
- A statement reflecting whether or not the hypothesis was supported is included
- Supporting data is used
- Any problems with the experiment, changes for the future or addition research questions are mentioned as life application connections are made

**Total Score** \_\_\_\_\_

**Letter Grade** \_\_\_\_\_