Eugenia B. Thomas
K-8 Center

Science Fair
Student Handbook
Grades 4-5

Schedule of Assignments

Grades 4 & 5

Science Fair Student Checklist – Keep in Log Notebook

Student _____ Teacher_____ Date _____

Working Plan	Due Date	Parent's Signature & Date	Teacher's Signature & Date
Review Science Fair Student Handbook and Contract form for parents	Friday, 9/13/19		
Review & complete the Project Proposal form Select Topic/Problem Statement • Identify variables	Wednesday, 9/18/19		
Complete Research: • Bibliography for resources • Form a hypothesis	Friday, 9/27/19		
Experiment Design: • Complete all three variables • Materials • Procedures	Friday, 10/4/19		
Perform Experiment • Collect data • Take pictures • Create a graph	Friday, 10/18/19		
Analyze Data: • Results • Conclusion	Thursday, 10/24/19		
Write the Abstract & Bibliography	Friday, 11/1/19		
Create the Display Board	Friday, 11/8/19		
Turn in Science Fair Project	Friday, 11/15/19		
Oral Class Presentation	BEGINS Monday, 11/18/19		

Introduction

The Elementary Science Fair is a school-sponsored activity that supplements the regular curriculum of classroom instruction. The classroom teacher and school principal have the responsibility to regulate the content and presentation of all student projects to assure that they are consistent with the interests of the school community. The purpose of the Science Fair in Miami-Dade County Public Schools is to encourage students' interest in science, to develop their inquiry and investigation skills, and to enhance children's pride in completing research projects. Elementary-level science fairs:

- Enable students to exhibit their projects and share ideas with other students and community members;
- Provide opportunities for students to receive feedback from professional scientists and community members;
- Provide students with exciting opportunities to work with science process skills and the scientific method on a topic of their own choosing that relates to the science curriculum as it connects to real life.

What is a Science Project?

A science fair project is a unique way for students to pose questions for which they must seek out answers and to satisfy their own curiosity about the world around them. A science fair project is an experiment, a research effort, a collection of scientific items, or display of scientific apparatus presented for viewing. It represents the efforts of a student's investigation into some area of interest and provides a way for the student to share the results of those investigations. Through the development of a science fair project, students gain a first-hand appreciation of the work of scientists and the value of their discoveries.

Science Fair Categories

	Physical Science: Projects that study the nature and properties of nonliving matter, energy and/or force and motion.
	**Behavioral Science**: Projects that observe the behavior of invertebrate animals. **The use of vertebrate animals** is not allowed except for human observational projects (example: Do boys have a faster reaction time than girls?).
	**Botany**: Projects that use subjects such as plants (mosses, seed plants), agriculture, conservation, and forestry. **NO LIVE PLANTS** may be displayed. **Experiments using mold or fungi are NOT allowed**.
	**Chemistry**: Projects that examine chemical reactions, the chemistry of living things, photosynthesis, solubility, heat capacity, etc. **No prescription drugs, dangerous or illegal substances should be used** in the experiments.
	**Earth and Space Science**: These are projects investigating principles of geology (for example, weathering and erosion), geography, astronomy, meteorology, and related fields.
	**Environmental Science**: Projects that deal with global change, issues related to Earth, such as water, air, climate, waste and pollution, green living, human health, ecosystems and related fields.
	**Medicine and Health**: The project's emphasis will be on human health. (STUDIES ARE LIMITED TO OBSERVATIONAL PROJECTS ONLY.)
	**Zoology**: Projects that observe and record the growth or behavior of animals **(INVERTEBRATES).** VERTEBRATE STUDIES ARE LIMITED TO OBSERVATIONAL PROJECTS ONLY.

Science Fair Rules and Guidelines

1. Only individual projects are allowed.

2. Only two types of projects may be entered into the District Fair, they are a scientific investigation or an invention.

3. Projects must fit in one of the 11 science fair project category criteria listed in this handbook.

4. **No mold growth, or bacteria projects are allowed**.

5. **No use of vertebrate animals is allowed except for human observational projects**.

6. **No use of prescription drugs, harmful, or illegal substances are allowed.** Grocery items (i.e., baking soda, vinegar, salt, lemon juice, etc.) are appropriate.

7. No Human subjects used to test (i.e., taste test, poking, pain reaction, sniffing, etc.)

8. Any projects that promote violence, weapons, or instill fear to the public, the exhibitor, or other exhibitors are PROHIBITED.

9. Project display boards must follow safety guidelines listed in this handbook.

10. Projects must be approved by the classroom teacher or a science fair committee.

Project Selection and Approval

All project ideas must be submitted to the classroom teacher on a Project Proposal form. The proposal should contain a topic and problem statement for the project. Projects must follow the MDCPS science fair rules and guidelines outlined in this handbook. Projects will be approved by the classroom teacher. Projects without prior approval, projects inconsistent with the prior approved proposal, or projects that have been substantially changed from what was previously approved will only be displayed at the teacher's discretion and cannot be submitted to the District science fair.

SCIENTIFIC INVESTIGATION: In this type of experimental project you ask a question, construct a hypothesis, **test your hypothesis using an experiment** and draw conclusions from your experiment. It involves using the scientific method. It must follow an experimental design.

A. **Experiment:** In this kind of investigation, your purpose is to change something (test or independent/manipulated variable) and record the outcome of this change (outcome or dependent/responding variable). EXAMPLE: Which material, aluminum foil or plastic wrap, will insulate cold water better?

B. **Experiment with a Control Group**: This kind of investigation involves a more complex investigation that is designed to test the effects of a single condition or factor on a system. For example, you might have a group of plants as an experimental group and another group of the same type of plants as a control group. The test or independent variable in this experiment is the amount of chemical fertilizer added only to the experimental plant group. No fertilizer would be added to the control group. Both the control group and the experimental group would have the same constants (the normal conditions) such as amount of water and sunlight. The outcome or dependent variable is the difference observed in the growth of the plants.

Scientific Investigation Project Guidelines

THE SCIENTIFIC METHOD:

1. Asking a question.
2. Forming a hypothesis.
3. Designing an experiment.
    a. Identifying variables
    b. Developing procedures
    c. Gathering materials and equipment
4. Collecting data.
5. Analyzing the data.
6. Forming a conclusion.

Step 1 – Choose a Topic and Problem Statement

Begin by exploring a scientific concept that you are interested in. This can be something that was read about or were introduced in the classroom. Go to the library or internet to learn more about your topic. Write a brief summary of the background information you gather for your science fair topic. Keep a record of where the background information came from. This information will be listed in your bibliography in Step 12.

- At this point, your brain will start asking "What **if**...." questions. One of these questions is what you will use to design your experiment. It is called the "**TESTABLE QUESTION**". This will become your problem statement. Make sure that this has been approved by your teacher.
- Anything to do with your project should be recorded in your lab notebook.

Step 2 – Form a Hypothesis

Once you have a testable question, you have some decisions to make that should be recorded in your lab notebook.

- How do you design the experiment to answer your question?
- What measurements do you need to take to record your results?
- Think about what might happen in your experiment. This is called a **HYPOTHESIS**. Write down what you think will happen BEFORE actually doing the experiment.
- Be specific.

Step 3 – Experimental Design

The experimental design is a plan to test your hypothesis. This is not a specific item on your display board; but it is determined by what your hypothesis is, the variables (test or independent, outcome or dependent, and control) and the materials that you need and the procedures that you will carry out.

Step 4 – Materials/Equipment

Now that you have planned your experiment, gather all the materials you will need to do the experiment. As you begin the experiment, make detailed observations of what is happening. Take your measurements carefully. Keep written notes about what you do and how you do it. Display a list of materials used in column form with metric units identified. Make sure materials are available.

Step 5 – Procedure

Write a detailed description of how to do your experiment. As you work through it, you may find that you have to change it. Make notes and change your procedure afterwards, to show the changes. Remember, any scientist should be able to take your procedure and repeat your experiment following your instructions.

- It is easier to use a numbered list, like in a cookbook rather than write a paragraph.
- Start each sentence with an action verb: mix, stir, get, measure, etc.
- Include quantities or amounts that you will measure using metric units.

Step 6 – Variables and Control Group

- Identify the **test variable** (independent/manipulated). This is the variable that you are changing on purpose in your experiment to observe what will happen. For example; the temperature of the water or the battery strength.
- Identify the **outcome variable** (dependent/responding variable), this is the one that reacts or changes in response to the **test** or independent/manipulated variable, i.e., amount of salt that dissolves or number of paper clips held by a magnet.
- Identify the **constant variables** in your experiment. These are the variables in your experiment that you do not change so that you can compare the effects from only one **test** (independent/manipulated) **variable**. Constant variables are quantities that a scientist wants to remain the same or be held constant. Most experiments have more than one constant variable. Some people refer to controlled variables as "constant variables."
- Use a **control group** if applicable in your experiment. A control group is the group that does not receive the experimental variable. Both it and the experimental group have what is usually considered normal conditions, i.e., room temperature, normal amount of water, normal amount of sunlight (constants). A control group helps you to be sure that what YOU DO in your experiment is affecting the test results.

Step 7 – Experiment

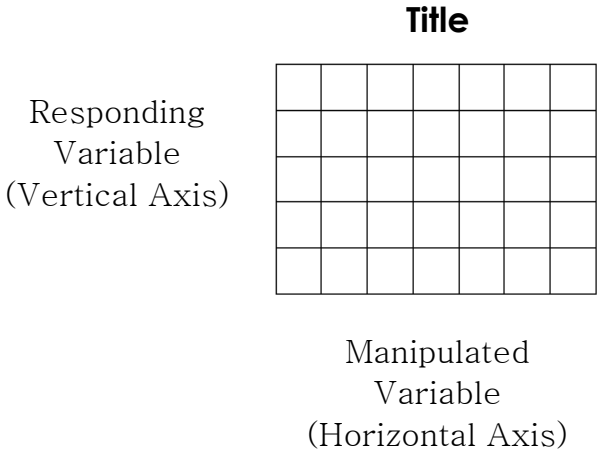
- Design a data table to keep track of your results.
- Carry out your experiment following your written procedures.
- Observe and record the results in a data table using metric units i.e., centimeters (cm); grams (g); or degrees Celsius (˚C).
- If qualitative observations are made, a numbered scale must be developed to quantify the observations.
- Use photographs whenever possible to record observations. **(NO FACES IN PHOTOS).** These can be shown on the display board.

Then, ***REPEAT THE EXPERIMENT*** at least two more times. Record your results as carefully as you did the first time. ALL scientists repeat their experiments; we **INSIST** you repeat yours as well. **All experiments must have a minimum of three trials.**

Step 8 – Results

- When you have all of your results, you need to design the way that you will report the data.
- Many students use graphs, charts and written summaries of what happened in the experiment.
- Determine averages or the mean when appropriate.
- Use photographs whenever possible to show changes **(NO FACES IN PHOTOS).**
- Display all your data in charts, graphs, and/or pictures even if it does not match what you thought was going to happen under the heading Data on your display board.
- Explain your results in words and display this narrative under the heading Results on the display board.

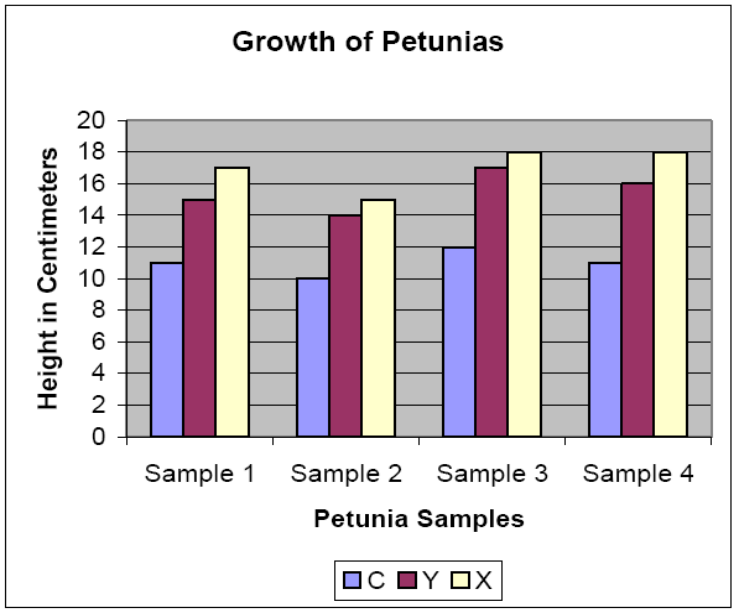
GRAPHS:



Title: The Title is a short description of the data being displayed.
Horizontal Axis: The Manipulated Variable (what you changed on purpose) is displayed on the horizontal axis.
Vertical Axis: The Responding Variable (what happened as a result of what you changed) is displayed on the vertical axis.

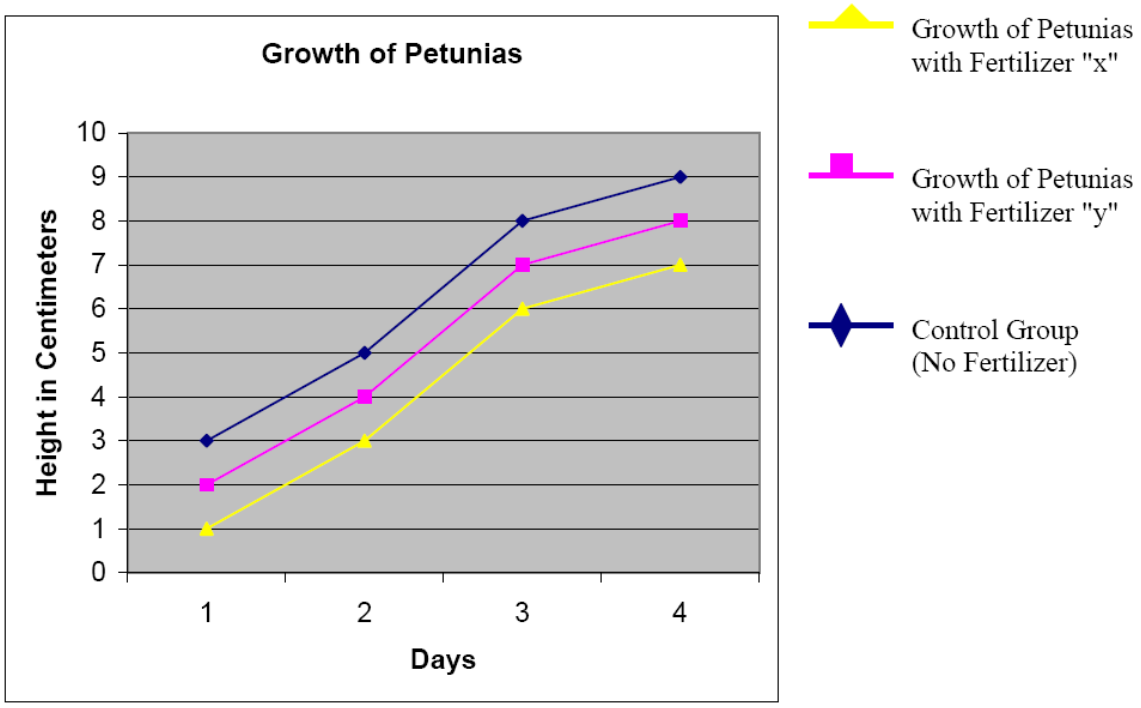
Bar Graphs: Used to compare quantities or amounts of similar things.

Here is a sample bar graph for an experiment on petunias. The vertical scale represents the responding variable. Notice that both the vertical and horizontal scales should be labeled and the graph should have a title.



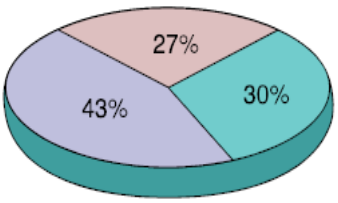
<u>Line Graphs</u>: Used to show change over a period of time.

Here is a sample line graph for the petunia experiment. Notice the vertical scale shows the height (in centimeters) of the manipulated variable (petunias).



<u>Pie Graphs</u>: Use percentages to show how parts are compared to a whole.

The petunia experiment results would not be represented appropriately with this type of graph. However, survey results are very clearly represented using a pie graph.



1	2	3
Survey students.	Calculate percentage. Divide the tally total for each subject by the total number of students surveyed.	Calculate degrees. Multiply the percent on decimal form by 360°.

Step 9 – Compare your results with your Hypothesis

Look again at your **HYPOTHESIS** and at the results of your experiment. Think about what happened and why it happened that way. Determine if your hypothesis was supported or not supported. You will use your observations to help you write your Conclusion in the next step.

Step 10 – Draw Conclusions

Answer the following questions to summarize what you have learned from the experiment.

- What was the purpose of the investigation?
- Was your hypothesis supported by the data? (Indicate evidence and reasoning that supports your conclusion. This is called Conclusion Evidence Reasoning (CER).
- What were the major findings? What are possible reasons for the results?

Step 11 – Applications

Answer the following questions to complete the Application.

- How can you use the findings from this investigation in your day-to-day life? How can the investigation be improved?
- What new question(s) has your experiment lead you to ask that could be tested in a new investigation.

Step 12 – Abstract and Bibliography

The abstract is a complete summary of the investigation and must consist of three to five paragraphs with a total of approximately 250 words that includes the following.

- Describe your purpose and hypothesis. Briefly describe your procedure.
- Describe and explain your results and state if your hypothesis was supported or not by the results. Suggest a reason why it was or was not supported.
- Explain your conclusion and application(s).

It's important to cite your sources for a science fair project. Put your bibliography of at least 3 different sources on the same page. Here are some examples of how to cite books, online references, and conversations. *Your bibliography needs to be written in alphabetical order.*

Book Author's last name, first name, initial, Title of Book, City of Publication; publisher, year, pages used.

(Example) Cured, Mary B., Medical Plants, New York; Moorehouse and Moorehouse Publications, 1988, pp. 84-86.

Magazine "Title of article," *Title of Magazine,* Volume and number, City of Publication: Publisher. Month, year, pages of article used.

(Example) "Problem Solving Processes," *The Science Teacher,* Volume 62 Number 2, Alexandria: National Science Teachers association, April, 1995, pp. 16-19.

Interview Interviewee's last name, first name, initial, title, type of interview, month, date, year of interview, department of one interviewed, institution where the interviewed works, phone number.

(Example) Brown, Joseph, T., Ph.D., telephone interview, September 17, 1994, Department of Botany, Somewhere University, (000) 123-467.

Internet Author's last name, first initial (year). Title of article [online] Available http://www….

(Example) Boscher, K. (1988). NetVet and the Electronic Zoo [online] Available http://www.netvet.com

Complete Project Abstract/Bibliography form and submit to the teacher for final approval before working on the science fair board. DO NOT NUMBER YOUR SOURCES

Step 13- Oral Presentation

The oral presentation is when you present your project to your classmates and teacher. Remember that your classmates also have to present their projects so keep it simple and short. You will be receiving a grade for your oral presentation so make sure you prepare before you have to present. Your oral presentation should include the following information.

- The title of your project and its purpose.
- Briefly explain why you became interested in this project.
- Explain your procedures, relate the number of trials, and show your results using tables, charts, or graphs.
- Explain your conclusions (what you've proven). If there were any errors or problems, explain how this may have affected the experiment's outcome.
- Tell what you might do differently next time.
- Explain how your project can help others.

Student's Name: Jordan Web

Project Title: Wrap It Up!

Abstract

The purpose of this project is to determine if increasing the number of wraps around an electromagnet will increase the magnet's strength. It is hypothesized that increasing the number of wraps around the nail will increase the strength of the electromagnet.
Wire, a nail, a D battery, and a battery holder were the materials used to build an electromagnet. The wire was cut 90 cm long so that 10, 20, and 30 wraps could be wrapped around the nail. An electromagnet with 10 wraps was used to pick up paper clips three times. Then using the same steps, the electromagnet was built using 20 wraps of wire, tested three times, and then tested with 30 wraps. The number of paper clips collected was recorded in a data table for all the trials.
Results showed that in all three trials, the average number of paper clips picked up the electromagnet increased as the number of wraps increased from 10 wraps to 20 wraps to 30 wraps. The hypothesis was correct.
This experiment shows that the number of wraps of wire on an electromagnet affects its strength, so that in real life if a stronger electromagnet is needed to separate metal from nonmetal objects, its strength can increase by increasing the number of wraps.
The project may have been improved and had better data if a new battery was used for each trial.

Bibliography

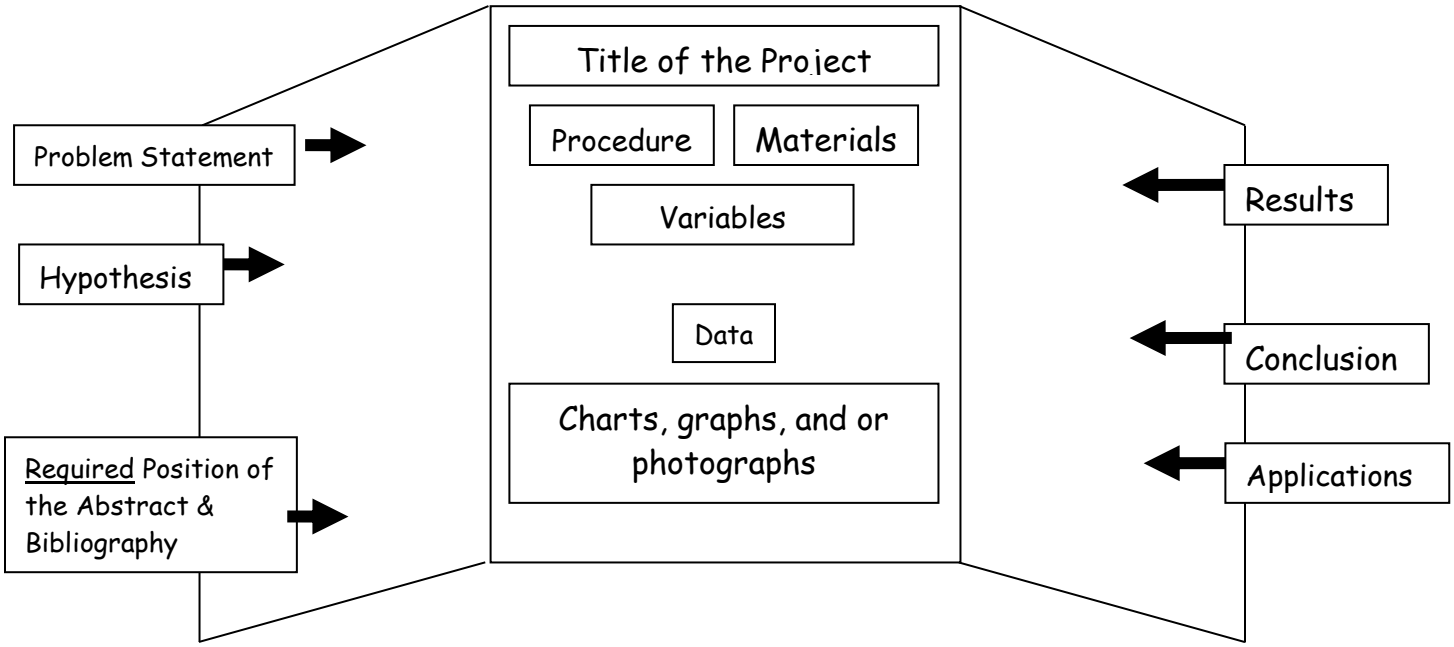
Brain, Marshall. How Electromagnets Work. 2000. URL: http://science.howstuffworks.com/electromagnet.htm/printable

ScienceSaurus: A Student Handbook. United States of America: Great Source Education Group. 2005. p. 306

Van Cleave, Janice. *Help My Science Project is Due Tomorrow*. Scholastic. 2002

SAMPLE

Elementary Science Fair
Board Set-up for an Investigation Project



Science Fair School Contract

I, _____, will submit an entry for the Elementary Science Fair due _____. I understand that this requirement must be fulfilled based on the criteria outlined in this guide.

I further understand that failure to comply with the rules set forth in this guide will affect my final project grade.

Date _____ Classroom Teacher _____

Student's Name _____

Student's Signature _____

Parent's Name _____

Parent's Signature _____

Science Project Proposal Form

Name _____

Topic: _____

Problem Statement (The question I plan to investigate in my experiment.) What if……

_____

_____

Science Fair Project Question Checklist	
1. Is the topic interesting enough to read about and work on for the next few weeks?	Yes / No
2. Can you find at least 3 sources of written information on the subject?	Yes / No
3. Can you design a "fair test" to answer your question (problem statement)? In other words can you change only one variable (test/manipulated/independent) at a time, and control other factors that might influence your experiment, so that they do not interfere?	Yes / No
4. Can you measure the outcome/dependent/responding variable, which are the changes in response to the independent/responding variable using a number that represents a quantity such as a count, length, width, weight, percentage, time, etc.?	Yes / No
5. Did you read the science fair rules and guidelines? Is your experiment safe to perform?	Yes / No
6. Will you be able to obtain all the materials and equipment you need for your science fair project quickly and at a very low cost?	Yes / No
7. Do you have enough time to do your experiment and repeat it at least 2 more times before the school science fair?	Yes / No

I have discussed the project problem statement and the checklist with my parent(s) and I am willing to commit to following through on this project.

_____

Student Signature Date

I have discussed the project idea and the checklist with my child and I believe he or she can follow through with this project.

_____

Parent Name & Signature Date

Name _____ Date _____

SCIENCE PROJECT PLANNING FORM – **Keep in Notebook**

Topic: _____

Do Research to collect background information.
Write a brief summary of the background information.

Bibliography for Resources

Problem Statement: (It is written in the form of a question.)

Form a Hypothesis (An educated guess of what you think will happen.)

Experiment Design

Variables:

Independent/ Manipulated Variable (What do I change?)

_____
_____
_____
_____

Dependent/ Responding Variable (What data do I collect?)

_____
_____
_____
_____

Control /Constant Variables (What do I keep the same in the experiment?)

_____
_____
_____
_____
_____
_____
_____
_____

Materials (Use metric measurement tools and list in column form.)

Procedures (Use a step by step numbered list. Each step should also begin with a verb.)

Data: Create a data table to collect and record data observed and measured during the experiment.

Now you're ready to conduct the Experiment. Remember to take pictures and to repeat the experiment at least three times.
Make a graph to display the data collected and recorded on data table.

Results: (Record collected data from the experiment in a narrative summary form.)

Conclusion: Answer the following questions to complete the Conclusion:

1. **What was investigated?** (State the purpose of the experiment by describing the problem statement.)
2. **Was your hypothesis supported by the data?** (Write a statement as to whether the data supports or does not support the hypothesis including a restatement of the hypothesis.)
3. **What were the major findings?** (Describe the data collected that provides the evidence as to why the hypothesis was supported or not supported.)
4. **What possible explanations can you offer for your findings?** (Think about everything that may have affected your results.)

Application/Extension: Answer the following questions to complete the Application:

1. **How can the investigation be improved?**
2. **What are some possible applications of the experiment?** (Describe how the findings from this investigation can be used in day-to-day life.)
3. **What questions has your experiment lead you to ask that could be tested in a new investigation.**

Abstract

Write three or more paragraphs. Include what was being investigated and the hypothesis. Write about the procedures followed in the investigation. Include information on the data and conclusions reached. Last write about your project's applications. Use the sample in this handbook as a guide on formatting your paragraphs.

Edit and add your bibliography from the first page.