St. Mary’s Junior High

(Based from Glenmary)

Science Fair Handbook

2013 - 2014

hm00363_

This handbook belongs to

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Science Teacher

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

St. Mary’s Junior High Science Fair

Project Checklist – Important Dates to Remember

The following dates are when you MUST hand in the written component to your science teacher. The section is due at the beginning of the class period. Please check off each section after it is completed.

|  |  |  |
| --- | --- | --- |
| Project Section | **Due Date** | **Completed?** |
| Problem/Variables | Jan 22nd , 2014 |  |
| Background Information and Hypothesis | Jan 22nd, 2014 |  |
| Procedure and Materials | Jan 22nd, 2014 |  |
| Diagrams, Observations, and Analysis | Feb 5th, 2014 |  |
| Conclusion | Feb 7th, 2014 |  |
| Completed backdrop | Feb 18th, 2014 |  |

***\*\* St. Mary’s SCIENCE FAIR – February 21st, 2014***

It is mandatory for all students to participate in the St. Mary’s Science Fair. You will be putting a lot of time and effort into putting together a science fair project – so *be proud of your efforts and share them with others!* The projects must meet a certain level of excellence. Keep this is mind as you work on your project! Everyone in the school will see it!

**Remember:** Your science teacher is available to help you through your project,

but attempt to work through any problems on your own, first!

One of the most important steps in completing a successful science fair project is to choose a topic that interests you! This is a *long-term* project and the quality of work is likely to suffer if you are not keen on your topic. When thinking of an idea, consider what you like to do for fun (e.g. sports, music, biking, reading, etc.) and try and find a project that incorporates that interest!

## St. Mary’s Junior High Science Fair

*Problem/Variables*

Problem – Asking questions is an essential part of science. Scientific questions can be answered by observations or evidence. This is an important difference from other types of questions. For your project, your problem must be stated as a **question** that you will attempt to answer using the *Scientific Method*.

**Note:** It is not acceptable to choose a problem from the *Science in Action* - textbook series.

**Writing Your Problem:**

1. Choose your **manipulated variable**. This is the **ONE** variable you will change on purpose.

2. Choose your **responding variable**. This is the **ONE** variable that changes, as you change the manipulated variable.

3. Identify your **controlled variables**. You must identify **everything else** that stays the same throughout the experiment (e.g. room temperature)

4. Write your **problem** using the variables (above) to create a question. It looks like this:

How does the (manipulated variable) affect the (responding variable)

When the (controlled variables) remain the same?

***Hints:*** Good questions that can be answered by scientific inquiry begin with:

*“What is the relationship between…?”*

*“What factors cause…?”*

*“What is the effect of…?”*

***Here are some resources that you might find useful:***

**[Note**: All Science Fair projects **must be testable!!** Not every project in these resources will meet the requirement for St. Mary’s Science Fair, so CHOOSE CAREFULLY!]

<http://standring.weebly.com/science-fair.html>

<http://cwsf.youthscience.ca/>

http://hippi-50.wix.com/sciencefair

**St. Mary’s Junior High Science Fair**

*Working through your variables & problem*

Your **1 manipulated** variable: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Your **1 responding** variable: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Your **many controlled** variables: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(\*\***Note**: Create a list of ALL of the other variables you can think of that might affect the responding variable. Consider things like time, temperature, length, width, height, mass, volume, number, and the substances being tested. There should be **MANY** controlled variables!!)

### Your *PROBLEM*: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**Problem & Variables Submitted**

##### Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**St. Mary’s Junior High Science Fair**

#### Background Information

Background information is **useful information that helps you understand the problem and will help you to make a hypothesis**. You must have a minimum of two pages (12 point font, double space). The research must be in your own words – *plagiarism is totally unacceptable.* Every magazine, book and/or website must be properly referenced. References must be balanced. That is, the source of information needs to examine the points of view of all sides.

The information gathered must relate specifically to your problem, and must provide information that will help you make an educated hypothesis.

For more information on gathering research, refer to the pages on “How to Research” in your Science Fair handbook.

**\*\* Please include your *Background Information* in this Science Fair Handbook when you have completed it. \*\***

* **Background Information Submitted**

**Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

## St. Mary’s Junior High Science Fair

#### Hypothesis

A hypothesis is a prediction about the outcome of a scientific investigation. A hypothesis is based on a person’s observations, previous knowledge or experience, and the **background information**.

In science, a hypothesis must be **testable**. That means that researchers (that’s YOU) should be able to carry out an investigation and obtain evidence that shows whether the hypothesis is true or false.

***Hints:***

A hypothesis looks something like this:

***If the (manipulated variable) changes (describe the change) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, then the (responding variable) will \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, because \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.***

\* Make sure your hypothesis can be tested through **scientific observations**!

\*\* **Do NOT use “**I think**…”**

Use the space below to write your hypothesis:

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

## St. Mary’s Junior High Science Fair

*Materials*

The materials section should look like a shopping list of requirements. It must include **all materials used, including sizes and quantities!** Everything used in the course of your experiment must be listed!

For example: two 500mL beakers

125 mL vinegar

50 g baking soda

Your list of materials:



## St. Mary’s Junior High Science Fair

*Procedure*

The **procedure** section is:

1. very detailed,
2. step-by-step,
3. point form,
4. numbered description,

of **everything** you did in completing your scientific investigation. It should be so detailed and clear that an elementary student could do your lab by following your procedure. A detailed procedure makes it easy to identify the materials required for the experiment, the same way that choosing a recipe makes it easy to know what to buy at the grocery store!

***\*\* Every experiment must include a minimum of three (3) trials!\*\****

By doing at least 3 trials, you gain confidence that your results are actually valid.

(More than 3 trials is even better!) ☺

So, the last step of your procedure should be something like, “Repeat step #\_\_ to # \_\_ five times. Record results in observation table.”

During the course of your experiment, any modifications or improvements to your project must be recorded and explained.

Operational definitions

Operational what?? It is really important that your experiment is repeatable. That is what allows other scientists to test each other’s theories and results! So, you have to include any **specific, unique steps** you used in your experiment. That is basically an operational definition!They are included as part of your procedure.

Hint:

*Check your definition by asking yourself: “Will this definition tell another person*

*what to observe or how to measure?” If necessary, revise your definition before starting your investigation.*

**St. Mary’s Junior High Science Fair**

*Procedure. (Use the space below to write out your procedure. Attach a separate sheet if necessary!)*

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## St. Mary’s Junior High Science Fair

*Diagrams*

Be sure to include labeled diagrams or photographs of any apparatus used in the experiment. It is also appropriate to include pictures of the project in progress. A picture is worth a thousand words, so including pictures throughout the experiment can REALLY help to clarify your work to your audience.

Use the space below for your diagrams/photographs. Attach additional pages, if necessary.

## St. Mary’s Junior High Science Fair

*Observations*

Observations should be recorded in a table format, and must include the dates of various observations. The manipulated variable and responding variable must be included in the table. If necessary, your control must also be included. (E.g. If you are studying the effect of music on plants, you must include a control plant growing with no music)

**Hints:**

* **Use a ruler to construct your table (or a computer)**
* **Your table must include:**
  + **All relevant data**
  + **All trials**
  + **The date/time of your observation**
  + **The manipulated variable**
  + **The responding variable**
  + **The control (if you use one)**

\*\*Use the following space (or attach an additional page) for your Observation Table\*\*

## St. Mary’s Junior High Science Fair

#### Analysis

Graphing is an important way to organize and present results in science. A graph lets you see patterns and trends that are very difficult to spot from a table of numbers. There are several types of graphs you can use; from bar to line to circle, and specialized types of graphs, such as best fit, line, and scatter plots. Be sure you are comfortable with all of these, because they will be very helpful as you interpret the results of your experiments.

***Hints for Graphing Data:***

* 1. Start by organizing your data in a table. A table makes it easier for you to construct a graph (see *Observations* section).
  2. Give your graph a title that identifies the variables of the relationship between the variables in the graph. For example, “Number of Frog Croaks at Different Temperatures” is a complete title tat clearly describes a graph.
  3. On graph paper, draw a horizontal (x) axis and a vertical (y) axis.
  4. Label the x-axis with the name of the manipulated variable (what you are changing). Label the y-axis with the name of the responding variable (measurements you have made). Include the units of measure.
  5. Determine the scale for the measurements to be shown on the vertical axis. Choose a scale that lets you represent all the values in your data table on the same page. Each square on the graph paper will represent a certain amount. All squares have the same value.
  6. If making a **bar** graph: on the x-axis, show a bar for each category being represented. Using your data, draw in the bars. Remember, all bars must be the same width. Use an equal number of squares for the width of each bar and leave a space of at least one square between the bars.
  7. If making a **line** graph: plot each point where the variables intersect. You can do this by following an imaginary line up from the measurement on the x-axis. Then, follow a second imaginary line across from the corresponding measurement on the y-axis. Place a dot where the two lines intersect.
  8. Consider whether you will plot from point to point or make a best-fit graph. If you plot from point to point, each segment connecting two adjacent points should be straight. If you make a best-fit graph, the connecting line should be smooth through ALL the points.

**\*\* Attach graph paper to plot your observations/results. \*\***

When you are doing a scientific inquiry, you make observations and measurements. These recorded values are called your data. Once your data is collected, you need to interpret it. Interpreting data means looking for a pattern or trend. One way to find a pattern is by graphing your data. By analyzing your graph, you can determine if a pattern exists. Comparing your interpretation to something you already know will help you figure out if you have made a logical interpretation.

***Hints (Analyzing Data):***

1. Make a graph for your data.
2. Review your graph for patterns or trends.
3. Using your data, infer what you think may be happening and compare your inferences with what you already know or have researched.

Use the space below for analyzing your data. Attach a separate sheet, if necessary.

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## St. Mary’s Junior High Science Fair

*Conclusion*

The conclusion will be a minimum of one page in length (12 point font, double-spaced) or MORE depending on the complexity of your experiment. The conclusion is a summary of the entire report. After summarizing the report, the following points must also be addressed:

1. what did you do in your experiment?
2. What is your answer to your hypothesis?
   1. Is it correct? Why? Explain.
   2. Is it incorrect? Why? Explain.
3. What are the possible sources of error in your experiment.
   1. Be very critical of your own design. This shows objectivity and critical thinking skills!
4. Identify how your experiment could be improved.
5. Where could you go from there? What are other questions that were identified during the course of the experiment?

**\*\* Please include your *Conclusion* in this Science Fair Handbook when you have completed it. \*\***

**Conclusion Submitted**

**Date: \_\_\_\_\_\_\_\_\_\_\_\_\_**