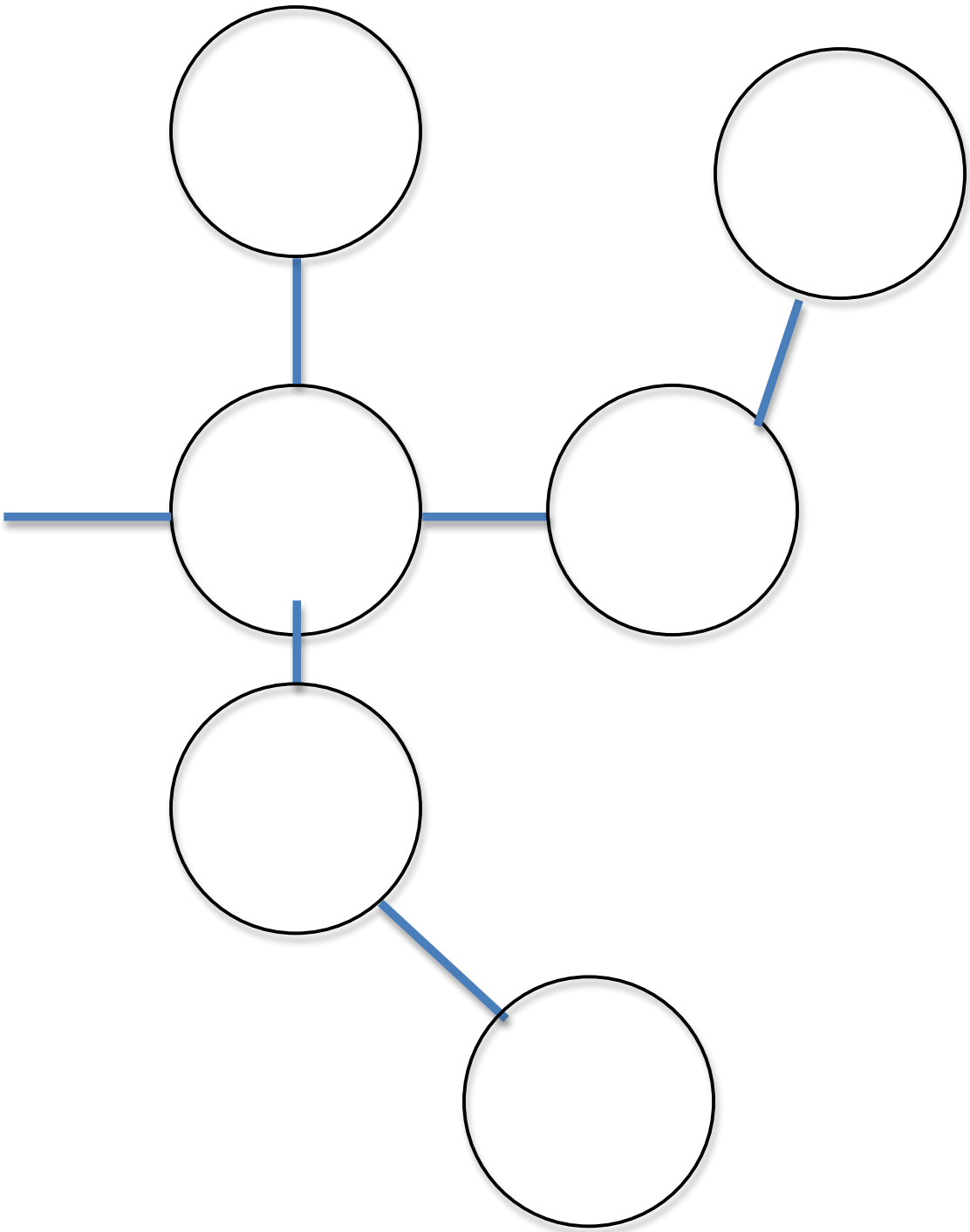
Science Fair 2015/2016 **Name: _____**

1. Idea Brainstorm:



2. Variables:

Dependent Variable –	**Independent Variable –**	**Controlled Variable –**
Something that might be affected by the change in the independent variable 1. What is observed 2. What is measured 3. The data collected during the investigation	Something that is changed by the scientist 1. What is tested 2. What is manipulated	A variable that is not changed 1. Also called constants 2. Allow for a "fair test"

Don't Forget: The independent variable and the dependent variable for an experimental investigation **must** be measurable.

Example: How does light affect plant growth?
The **Independent Variable** is the amount of light the plant received.

- Do you want to measure how different types of light sources, such as sunlight, artificial light, or colored light effects plant growth?
- Do you want to measure how changes in the amount of one type of light effects plants growth?

The **Dependent Variable** the growth of the plant that being observed. The plant growth is in response to changes in the amount of light the plant receives (the independent variable).
The **Controlled Variables** include: the type of plant tested, container, type of soil, temperature, amount of water, humidity, type of light, etc…needs to be the same for every plant tested. Some variable are difficult to control, but you should try to make every effort to keep them the same during the testing.

Now write your own:

Independent Variable	Dependent Variable	Controlled Variable(s)

3. The Problem Statement:

This statement is ALWAYS written as a question. The question should always start with either **which** or **how**. The one you choose will depend on your independent and dependent variable. The form should be:

Which or How will the independent variable affect the dependent variable.

Example problem statement: "How does the amount of water affect the height of plants?"
Independent variable**: amount of water** Dependent variable**: height of plants**

It's much better to test only one variable than to test many at once. For example, if you're testing the effects of different amounts of water on plant growth, don't add other variables like lighting source and nutrients as well.

Notice in the example above that both the independent and the dependent variables are measurable. Think about your topic and brainstorm possible independent and dependent variables that are measurable.

Now write your own:

Which / How does _____
_____ affect
_____
_____

Quick Tips:

- It cannot be answered with "yes" or "no".
- It doesn't use the words "I" or "you" (or any form of them).
- It can be researched through experimentation.

4. The Hypothesis:

The Hypothesis always follows the format of:
IF (I do this)… **Then** (this will happen)…

1. ***The question comes first.*** Before you make a hypothesis, you have to clearly identify the question you are interested in studying.
2. ***A hypothesis is a statement, not a question.*** Your hypothesis is not the scientific question in your project. The hypothesis is an educated, testable prediction about what will happen.
3. ***Make it clear.*** A good hypothesis is written in clear and simple language. Reading your hypothesis should tell a teacher or judge exactly what you thought was going to happen when you started your project.
4. ***Keep the variables in mind.*** A good hypothesis defines the variables in easy-to-measure terms, like who the participants are, what changes during the testing, and what the effect of the changes will be.
5. ***Make sure your hypothesis is "testable."*** To prove or disprove your hypothesis, you need to be able to do an experiment and take measurements or make observations to see how two things (your variables) are related. You should also be able to repeat your experiment over and over again, if necessary.
6. ***Do your research.*** You may find many studies similar to yours have already been conducted. What you learn from available research and data can help you shape your project and hypothesis.

Don't bite off more than you can chew! Answering some scientific questions can involve more than one experiment, each with its own hypothesis. **Make sure your hypothesis is a specific statement relating to a single experiment.**

Now write your own:

If _____
_____ then
_____
_____

Quick Tips:

- It uses the proper "if…then" format.
- It answers the question/ offers an explanation of the purpose.
- It explains *why* you think this is the answer.

5. Background Information:

1. Identify the keywords in the question for your science fair project. Brainstorm additional keywords and concepts.
2. Generate research questions from your keywords (Use why, how, who, what, when, where) For example: **What** is the difference between a series and parallel circuit? **When** does a plant grow the most, during the day or night? **Where** is the focal point of a lens? **How** does a java applet work? **Does** a truss make a bridge stronger? **Why** are moths attracted to light? **Which** cleaning products kill the most bacteria?
3. Add to your background research plan a list of mathematical formulas or equations (if any) that you will need to describe the results of your experiment.
4. You should also plan to do background research on the history of similar experiments or inventions.

Network with other people with more experience than yourself: your mentors, parents, and teachers. Ask them: "What science concepts should I study to better understand my science fair project?" and "What area of science covers my project?" Better yet, ask even more specific questions.

Now write it yourself:

Web address: _____
Date published : _____ Author: _____
Information found: _____
_____
_____
_____
_____
Remaining Questions: _____
Web address: _____
Date published : _____ Author: _____
Information found: _____
_____
_____
_____
Remaining Questions: _____
Web address: _____
Date published : _____ Author: _____
Information found: _____
_____
_____
_____
Remaining Questions: _____

6. Materials:

(List all of the materials that you will be using)

7. Procedure:

1._____
2._____
3._____
4._____
5._____
6._____
7._____
8._____
9._____
10._____
11._____
12._____
13._____
14._____
15._____
16._____
17._____
18._____
19._____
20._____
21._____
22._____
23._____
24._____
25._____
26._____
27._____

Quick Tips:

- You use a numbered list.
- You include EVERY step that you did.
- The first step is, “Gather your materials. They should include: ”.
- The steps only include what to do for the experiment, NOT what to do to write the lab report.

8. Notebook Set Up:

Your research log is a diary, detailing all activities. It is kept in ink. Clippings and other materials may be taped into the book.

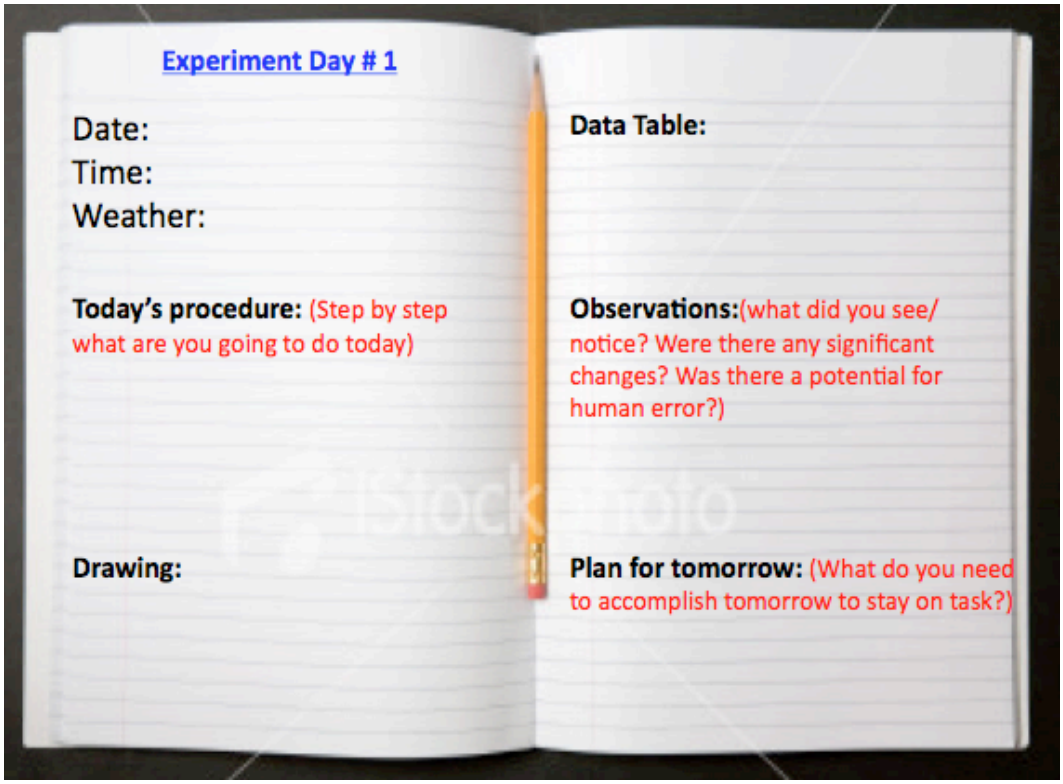
On the first page, write your name, address, phone number, and Ms. Salzburg. Then write your problem statement and a brief summary of the kind of experiment you plan to do.

All other entries start with the date and location of the activity. You should record all of the following activities:

1. Conference with Ms. Salzburg: Write a brief summary of the discussion and any conclusions reached.
2. Telephone calls: Specify the contact person and tell what the conversation was about.
3. Library research: Write a brief statement of the pertinent points that you found in your reading.

Describe the item in the proper literature cited format, for later inclusion into your research paper.

4. Thought about your project, including new ideas, changes of program, plans for things to be done, revisions of the problem statement, etc.
5. Descriptions of the experiemntal setup and any changes in design.
6. Data taken while doing the actual experiement.



Quick Observation Tips:

- You are sure to include a written description (that has one sentence for every sense used to observe).
- You are sure to include a labeled diagram.
- You have used your 5 senses and any appropriate scientific tools to make the observation.

9. Data collection:

Set up your data table **BEFORE** you begin a trial

- **Review** your data. Try to look at the results of your experiment with a critical eye. Ask yourself these questions:
  - Is it complete, or did you forget something?
  - Do you need to collect more data?
  - Did you make any mistakes?
- **Calculate an average** for the different trials of your experiment, if appropriate.
- **Make sure to clearly label** all tables and graphs. And, include the **units of measurement** (volts, inches, grams, etc.).

Sample Data Table:

Battery #	#3	#4	
Time (hour)	Voltage	Voltage	Flashlight dead?
0.0	1.605	1.610	
0.5			
1.0	1.356	1.363	
1.5			
2.0	1.295	1.295	

Now create your own:

Quick Tips:

- You need to have a title for the table and labels for the rows and columns.
- You need to include units (cm, seconds, etc).
- You have used a ruler.

10.Data Analysis:

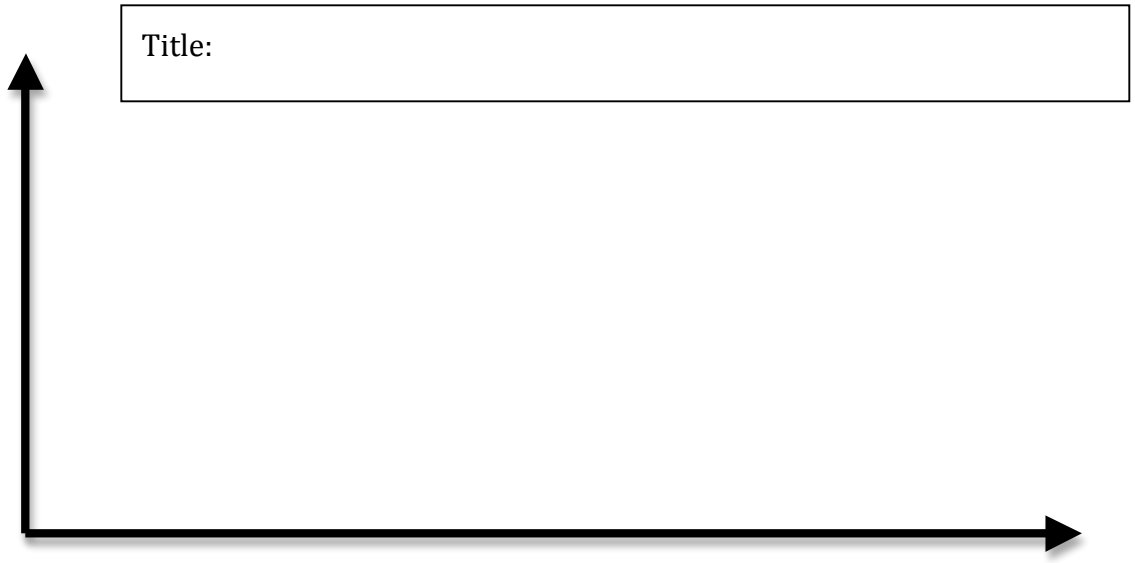
Take some time to carefully review all of the data you have collected from your experiment. Use charts and graphs to help you analyze the data and patterns. Really think about what you have discovered and use your data to help you explain why you think certain things happened.

Often, you will need to perform calculations on your raw data in order to get the results from which you will generate a conclusion. **You should have performed multiple trials of your experiment.** Think about the best way to summarize your data. Do you want to calculate the average for each group of trials, or summarize the results in some other way such as ratios, percentages, or error and significance for really advanced students? Or, is it better to display your data as individual data points?

For any type of graph:

- Generally, you should place your **independent variable** on the **x-axis** of your graph and the **dependent variable** on the **y-axis**.
- Be sure to label the axes of your graph— don't forget to include the units of measurement (grams, centimeters, liters, etc.).
- If you have more than one set of data, show each series in a different color or symbol and include a legend with clear labels.

Now create your own:



Quick Graphing Tips:

- It has a title.
- It has axis labels (ex. number of students, airplane distance, etc).
- It has variable labels (dependent and independent).
- It has even and equal intervals.
- The data that is graphed is accurately plotted.
- You have used a ruler.

11.Abstract Writing:

An abstract is an abbreviated version of your conclusion. It is limited to a maximum 250 words. The abstract should include:

Introduction. This is where you describe the purpose for doing your science fair project or invention. Why should anyone care about the work you did? If you made an invention or developed a new procedure how is it better, faster, or cheaper than what is already out there?

Problem Statement. Identify the problem you solved or the hypothesis you investigated.

Procedures. What was your approach for investigating the problem? Don't go into detail about materials unless they were critical to your success. Do describe the most important variables if you have room.

Results. What answer did you obtain? Be specific and use numbers to describe your results. Do not use vague terms like "most" or "some."

Conclusions. State what your science fair project or invention contributes to the area you worked in. Did you meet your objectives? For an engineering project state whether you met your design criteria.

Now write your own:

12. Conclusion Writing:

A **conclusion paragraph(s)** contains a description of the purpose of the experiment, a discussion of your major findings, an explanation of your findings, and recommendations for further study. Address the following points in paragraph form (don't just number off and answer each question)

1. Restate the overall purpose of the experiment (include IV and DV in this sentence.)

One format: The purpose of the experiment was to investigate the effect of the (IV) on the (DV)

Example: The purpose of the experiment was to investigate the effect of stress on the growth of bean plants by comparing the growth of bean plants subjected to stress for 15 days with a control (non-stressed plants.)

2. What were the major findings? (Summarize your data and graph results)

Example: No significant difference existed between the height of stressed plants and non-stressed plants. As the graph shows above, the average height of all the stressed plants was 10.2 cm and the average height of all the non-stressed plants was 10.4 cm.

3. Was the hypothesis supported by the data?

One format: The hypothesis that (insert your hypothesis) was (supported, partially supported, or not supported.) Please do not ever use the word "prove" – we do NOT prove hypotheses true in science.

Example: The hypothesis that stressed plants would have a dramatically lower mean height was not supported.

4. How could this experiment be improved?

Example: This experiment relied on a very artificial source of stress – just digging out the plants at one time and replanting them. Perhaps this experiment could be improved by simulating real-life stressors, including drought and lack of nutrients in soil.

NOT acceptable: This experiment would have been better if we had done it correctly – we did sloppy work and made careless measurements.

NOT acceptable: This experiment would have been better if we had more time to do more trials.

5. What could be studied next after this experiment? What new experiment could continue study of this topic?

Example: Additional investigations using various sources of stress at more frequent intervals would be a good additional experiment. Also, other crops could be subjected to the same experiment, such as corn and squash. Perhaps scientists could find a chemical that the plants release during stress.

Now try your own on a separate piece of paper

13.Oral Presentation Prep:

Please rehearse some of the common questions that will be asked of you.
Try answering them on paper first if you are nervous. Practicing in the mirror and with peers are also valuable tools.

- How did you come up with the idea for this project? What inspired you?
- What is the significance of this project to your life?
- What did you learn from your background search?
- What were your variables? Controls?
- How long did it take you t build the apparatus?
- Did you have help in building your apparatus?
- How did you build the apparatus?
- How did you make sure to run a fair (controlled) experiment?
- What were your significant findings (results)?
- What formulas did you use?
- Did your research match your results?
- How much time did it take to run the experiments?
- How many times did you run the experiment?
- Did you collect all of your data under the same conditions?
- What error might have affected your experiment?
- Do you think there is an application in industry for this knowledge?
- Were there any books/websites or experts that helped you do your analysis?
- Why did you choose this area of science?
- Do you want to go into the science field? What area?
- What new questions did your results suggest?
- What is the next experiment to o in continuing this study?

14. Poster Preparation:

You will be required to purchase your own **full size tri fold** board.