2014-2015

Dundee Ridge Middle School

SCIENCE FAIR PROJECT
RULES AND GUIDELINES

Science Fair Deadlines

Tuesday, 9/23	Introduce Science Fair, Distribute Folders and Booklets
Wednesday, 9/24	Begin Log Books
Monday, 9/29	Topics Due pg 12 in packet
Thursday, 10/2	Purpose, Variables, and Hypothesis Due pg 13, 14 & 15 in packet
Monday, 10/6	Rough Draft of Materials and Procedures Due (typed and emailed or printed)
Wednesday, 10/8	Student Created Safety Procedures Due (typed and emailed or printed)
Friday, 10/10	Proofread materials and procedures returned by teacher
Monday, 10/13	Paperwork pg 19-23 Due and typed outline not including bibliography
Friday, 10/17	Teachers to return paperwork with changes or go ahead to begin project
Wednesday, 11/5	Conference with teacher, update on project status, log book review
Wednesday, 12/3	Conference with teacher, update on project status and board status, log book review
Monday, 12/8	Classroom Science Fair (all boards must be brought to school along with logbooks)
Wednesday, 12/10	School Science Fair (winners from classroom fair)
Friday, 12/12	Top 15 projects submitted to the District

Dear Students and Parents,

This year Dundee Ridge Academy will be hosting a science fair. Last year we sent 12 projects to the county fair and we received a 1st and two 3rd place. We are very excited to continue this exciting tradition.

The Science Fair Project will be a graded assignment for all science students. While this can instill “fear” in some and a “challenge” in others, we hope to make the guidelines simple to follow in this manual. We feel a science fair project will enrich the student’s knowledge of the scientific method. It is our belief that the skills learned in completing a science fair project are skills that can be used in all aspects of a student’s education and growth. Some of the skills included are *observation, communication, researching, measuring, comparing, inferring, record keeping, and analyzing*.

This manual is a detailed guide for completing your project. It provides specific instructions and an example for each section using an actual student’s project. Included is a copy of the rubric that will be used to grade your final project. Teachers will collect each section, make corrections, and return to you to correct. The final project will be turned in at the beginning of December (see time line page). WE ENCOURAGE YOU TO KEEP THE TIME LINE HANDY AND TURN IN ALL SECTIONS ON TIME IN ORDER TO DO A QUALITY PROJECT.

We understand that the goal of each student completing this project is different. As science teachers and a past participant in many science fairs, we know that this can be a valuable learning opportunity for students. Regardless of whether the goal is reaching a further level of competition or just completing the project, We challenge each student to strive to achieve his/her best and will do everything to help our students to achieve their goals.

Message to the Parents

Children are naturally curious. An excellent way to teach them to develop problem-solving skills is to direct this curiosity toward scientific investigation. A scientific investigation that uses the scientific method helps develop your child's thinking skills.

You, as the parent, play one of the most important roles in your child's education. The encouragement, guidance, and support that you give your child will not only help him or her develop valuable *thinking skills*, but the time you and your child work together will deepen the child-parent relationship that will last forever. There are many things that you, as a parent, can do to help your child with a science project:

Although this is your child's project and it is to be *his or her* effort, there is no substitute for your support. Make sure you *encourage your child* to do his/her individual best.

Listen to and praise your child. Let your child know that you are interested in his or her ideas.

Help your child with skills that he or she has not yet been taught or mastered, such as *organizing, measuring, calculating, and constructing.*

Help your child *construct and follow a schedule* to complete the project on time. Be sure to pay attention to deadlines, including those for *forms* that are due. Check the Intel ISEF website for all rules and guidelines.

Provide a space at home where your child can work without worrying about siblings or pets.

Help your child *acquire the materials* needed for the project.

Help your child take the necessary *safety precautions* to ensure a safe project.

Offer to *provide transportation* to places such as libraries, museums, nature centers, resource persons, etc. that can help your child find information about the topic.

Contact your child's teacher if there are any questions regarding the science project.

Recognize that the real prize of a science project is *the development of your child's skills*, not the blue ribbon presented by a science fair judge.

A Quality Science Fair Project

As stated on the first page of this manual, we realize that students have different goals for completing their projects. For those whose goal is to have their project qualify for further competition the following is a list to consider *when choosing and performing a project.* However, many of these points apply to all projects, not just those wishing to proceed to further competition.

A quality science fair project……

- is unique – has not been done over and over.
- shows creativity on the student's behalf – especially in the experimental design.
- can be a "hot topic" (current issue).
- is relevant – the information is useful.
- is in a category that there is not a lot of other competition (botany and physics have the most, math and computers the least).
- has had ALL aspects of the project researched thoroughly by the student.
- has procedures that show consideration for all variables and has a control group which is easily identifiable.
- has been performed an adequate number of times (this will vary for the type of project).
- has data which is numerically measurable.
- has a conclusion that is not only relevant, but explains discrepancies and
- offers solutions to any problems that may have occurred.
- has a thorough log book that *is handwritten* and contains all data
- including observations.

    can be explained easily and thoroughly to the judges by the student (especially without the use of the word "we").

- may be a continuing project

Rules and Guidelines

1. Teacher and parent must approve topic before beginning project.
2. The following topics will not be allowed due to safety: no toxic chemicals, no collection of specimens from the environment.
3. The following topics will need preapproval and additional paperwork: vertebrate animals, microbiology (ex: mold), human testing.
4. Please do not work ahead without teachers permission.
5. All projects will need to be displayed on a standard size display board (36" x 48"). Keep boards at home until asked to bring them in.
6. If absent, it is the student's responsibility to stay caught up.
7. Please review all Polk County Science Safety Rules in your child's science folder before considering a topic.
8.

Please read and check each of the following statements, then sign at the bottom of the page to acknowledge you understand the rules and guidelines.

◊ We have read and understand ALL sections of the Science Fair Rules and Guidelines. If we have any questions, we will contact the student's science teacher.

◊ We understand that we need to review the International Rules on the following website in order to understand requirements and forms needed: http://student.societyforscience.org/intel-isef

◊ We understand that the actual experimentation may not begin until all required forms have been filled out and signed by the proper individuals.

◊ We have reviewed the rubric and understand the guidelines by which the project will be graded. We understand that the final project is worth 200 points or two test grades.

Students Signature: ____

Parents Signature: ____

Date: ____________________

Roles and Responsibilities of Student Researcher

I, ______________________________, accept responsibility for all aspects of the research project on which I am working including enlisting any needed supervisory adults (adult sponsor, qualified scientist, etc.), obtaining necessary approvals (SRC, IRB, etc.), following the Rules and Guidelines of the Polk Science and Engineering Fair, Florida State Science and Engineering Fair, and International Science and Engineering Fair, and doing the experimentation, engineering, data analysis, etc. involved in the project.

I understand the ethics of scientific research as stated here:

> **Scientific fraud and misconduct is not condoned at any level of research or competition. Plagiarism, use or presentation of other researcher's work as one's own, forgery of approval signatures and fabrication or falsification of data will not be tolerated. Fraudulent projects will fail to qualify for competition in the Polk Region Science and Engineering Fair.**

I understand that I am to retain all original signed forms related to the project on which I am working and that these forms are to be included in the Project Data Book.

I understand that in order to continue a project from year to year I must have all previous years' original paperwork.

Student Signature ______________________________ Date: __________

Log Book

To do scientific research authentically it is important to observe and follow the procedures and rituals of a professional researcher for the project you are conducting. **Background research** is important; **Safety** is vital. And, your research is not considered meaningful by professionals if you have not kept accurate records that can be understood by others and by which others can duplicate your experiment.

During science competitions you will be asked for your **Research or Lab Notebooks.** Having one properly filled out can make a difference as to whether or not you are allowed to continue in a science competition.

Use the following guideline to record data in your **Research or Lab Notebook:**

1. Use a bound notebook so that pages cannot be torn out.
2. Write in pen, not pencil.
3. Print, if you do not have clear handwriting.
4. At the beginning of each day of research write the following in the top margin of the notebook:
   a. your name
   b. the date
   c. time you start your research
   d. time you finish research for that day
   e. total number of hours of research for that day
   f. Write exactly what **you** did, in the order it occurred. Include in very specific detail the following:
   g. theory or statement of the problem
   h. sources consulted
   i. safety procedures (be very detailed)
   j. equipment used
   k. quantitative data collected including variable and units
   l. qualitative data (observations)
   m. problems and any solutions

note: if part of the experiment was performed by an authorized adult include that information in the log

6. Include all necessary formulas, graphs, concepts, etc. that you learned or used in the lab.

7. Completely document all sources and references that were consulted. Be sure to include personal conversations and interviews either in person or by phone.

8. Think ahead. Include all plans for the next day's work. Writing down your thoughts will help in cases of forgotten facts and ideas.

9. DO NOT DESTROY any of the information recorded in the book. Do not erase, white out, tear out pages, etc. In order to correct information that was mistakenly recorded, simply mark through it with a single line and then initial and date the change.

Sign your name at the bottom of every lab page, even if the day has not ended.

Science and Engineering Fair Structure

The SSEF structure will help Donors select their award criteria. Each project at the SSEF is assigned to one of these categories. Projects are further divided into two divisions: Biological Sciences and Physical Sciences, with the following fourteen Categories:

CLARIFICATION OF CATEGORIES

Behavioral and Social Sciences
Clinical & Developmental Psychology
Cognitive Psychology
Physiological Psychology
Sociology
Anthropology
Archeology
Animal Behavior
Urban Problems
Other

Biochemistry
General Biochemistry
Metabolism
Structural Biochemistry
Molecular Biology
Other

Botany
Agriculture/Agronomy
Development
Ecology
Genetics
Plant Physiology (molecular, Cellular, organismal)

Chemistry
General/ Analytical Chemistry
Inorganic/ Organic Chemistry
Physical Chemistry
Other

Computer Science
Algorithms, Data Bases
Artificial Intelligence
Networking/ Communications
Computational Science, Computer Graphics
Software Engineering, Programming Languages
Computer System, Operating System
Other

Earth and Planetary Science
Climatology, Weather
Geochemistry, Mineralogy
Paleontology
Geophysics
Planetary Science
Tectonics
Other

Engineering
Electrical, Computer, Controls
Mechanical
Robotics
Thermodynamics, Solar
Bioengineering
Civil, Construction
Chemical
Industrial, Processing
Material Science
Aerospace, Aeronautical, Aerodynamics
Alternative Fuels
Fossil Fuel
Vehicle Development
Renewable Energies

Environmental Science
Bioremediation
Ecosystems Management
Environmental Engineering
Land Resource Management, Forestry
Recycling, Waste Management
Air Pollution and Air Quality
Soil Contamination and Soil Quality
Water Pollution and Water Quality
Other

Mathematics
Algebra
Analysis
Applied Mathematics
Geometry
Probability and Statistics
Other

Medicine and Health Sciences
Disease Diagnosis and Treatment
Epidemiology
Genetics
Molecular Biology of Diseases
Physiology and Pathophysiology
Other

Microbiology
Antibiotics, Antimicrobials
Bacteriology
Microbial Genetics
Virology
Other

Physics & Astronomy
Atoms, Molecules, Solids
Astronomy
Biological Physics
Instrumentation and Electronics
Magnetics and Electromagnetics
Nuclear and Particle Physics
Optics, Lasers, Masers
Theoretical Physics, Theoretical or Computational Astronomy
Other

Zoology
Animal Development
Ecology
Animal History
Pathology

Category/Topic—the subject of your experiment

Start by choosing several *large* subject areas in which you may be *interested.* Examples: electricity, weather, lakes, animals, human behavior, plants, space, sports.

Decide which of the topic areas can be TESTED. For example, it would be difficult to design an experiment to test research done on hurricanes or planets. (Brand comparisons are not valid for our school science fair.)

Narrow down the topic by listing relationships that are found within the topic area. Examples: Electricity: wire thickness and amps Plants: cattails and removal of Animals: mosquitoes and attraction of Microbiology: bacteria and band aids

Choose one of these topics to research.

When choosing a specific topic, ask yourself the following:

Can I design an experiment that measures the results in **numerical terms**?

Can I design an experiment that has a **cause/effect** relationship in the problem?

Is there something that can be **compared** (usually to a control)?

Is the topic **cost effective** and are the **materials readily available**?

Review the Rules and Guidelines. Our School, Regional and State Science Fairs follow the guidelines as set down by the International Science Fair. Please visit the following website: http://student.societyforscience.org/intel-isef

Consider the following BEFORE choosing your project:

Link to see the **description of all categories.**

Link to the **rules and guidelines**, then click on the rules wizard. This will let you know the rules and forms needed for each type of project.

ALL PROJECTS WILL REQUIRE THE FOLLOWING: Checklist for Adult Sponsor/Safety Assessment Form, The Research Plan (1a), and The Approval Form (1b). These will need to be filled out for approval **BEFORE** you begin your project.

*Topics using *humans, vertebrate animals, microbiology, collecting specimens from the environment, and hazardous substances and devices* will require extra forms to be filled out by **QUALIFIED SCIENTISTS BEFORE** experimentation begins.

***At this point, you may only want to choose a broad topic area. During research you may find the information you need to narrow down your topic.

Example*:* bacteria and band aids

Brainstorm Topics

My area of interest is ____

The question that I want to answer is ________________________________

____

Compare the question against the following criteria:

The question deals in cause and effect *TRUE/FALSE*

Fill in the blanks to verify: How does

__________________ effect ______________________

The answer to this question matters *TRUE/FALSE*

How might someone use this information?

____

Quantitative data could be gathered in order to test the hypothesis *TRUE/FALSE*

What measurement would you collect? ______________________________

The answer to this question is ***not*** common knowledge *TRUE/FALSE*

This question deals with a "hot" topic *TRUE/FALSE*

The question has ***nothing*** to do with specific brands of products *TRUE/FALSE*

The question ***does not*** deal with animals *TRUE/FALSE*

The question ***does not*** deal with blood *TRUE/FALSE*

The question ***does not*** require the testing of large numbers of people *TRUE/FALSE*

Research Process

At this point, you DO NOT KNOW THE ANSWER TO YOUR EXPERIMENT and the research paper is a document written ***before experimentation*** that helps organize background information ***in order to help form a hypothesis***. This paper needs **at least 5** sources. (1 is the rules for the Science Fair)

The goal of this outline is to help you organize your research information and develop a **good hypothesis**. Answer all questions using complete sentences.

Purpose - The purpose of the experiment tells ***the reason for doing the experiment***.

The purpose tells the **cause/effect relationship** that is to be determined.

IT MUST BE MEASURABLE in numerical terms.

A brief history of background information leading up to the explanation of the problem to be solved may also be included.

Example: *The purpose of this experiment is to determine whether fabric or sheer band aids will collect more bacteria. This would help if someone wants to know which band aid to buy if he/she wants a less chance of infection by bacteria.*

State your purpose. ____

____

____

Give a logical reason someone might be interested in your purpose.

____

____

Research Process

1. Using books, magazines, computer references, people, etc, find as much information about each variable as you can. Especially information as related to the other variables.
2. Do not forget you need to have a works sited page at the end of your paper.
3. <u>Keep track of all of your research and your references in your logbook.</u> You should have at least 3 solid facts about your independent and dependent variable.
4. You must have at least 5 references (1 is the rule book).
5. Once again remember this is preliminary research. It is written BEFORE the experiment is conducted. It should not include data.

Independent Variable

A. State your manipulated/independent variable. This will be the **cause** of the changes in your experiment.

____

____

Dependent Variable

A. State your responding/dependent variable. This will be the **effect** that you are looking to measure in your experiment.

____

____

Controlled Variable

A. State your controlled variable. This is what you are going to leave the same on all of your experiments.

____

____

____

Hypothesis

Write your hypothesis using the if/then format. The first part will tell what you are doing and the second part will tell the results you expect.

The hypothesis is an *explanation* as to the expected outcome of the experiment based on research completed by the student.

A. Write the hypothesis in the form of an **If/Then** statement to show **cause/effect** relationship.

B. Specify exactly **what is to be done**, the **results expected** and the **reason why** the results are expected.

C. Write in ***narrative*** format – no pronouns. (No I, or the researcher)

D. Write the hypothesis ***AFTER RESEARCH* but *BEFORE EXPERIMENTATION***.

Example*:* *If sheer and fabric band aids are placed on sterilized fingers and worn for four hours, and plated for bacteria growth, then the fabric band aids will have more bacterial growth.*

IF____

then____

b) Remember that a hypothesis is an **educated** prediction. Using the information you wrote about your variables in questions 2, 3 and 4, explain how you arrived at your hypothesis (i.e. give your reasons).

____

____

____

Materials

Materials are a list of all items used or to **CONDUCT** the experiment.

- Include ***amounts*** *(quantities)* and ***measurements*** *(sizes).* Make sure to include enough materials to complete the total number of trials.
- Use **SI** units.
- Include **ALL** equipment used – except pen and paper unless it is part of the experiment.
- List in a **columnar** format.

Example:

10 girl students
10 boy students
30 sheer band aids
30 fabric band aids
2 - 16 oz bottles of rubbing alcohol
60 inoculating loops
60 sterile Petri dishes
with nutrient agar
1 roll of transparent tape
1 permanent marker
1 incubator
1 pair of scissors
2 sets of sterile gloves
1 roll of paper towels
1 large bowl
1 clock

Procedures

The procedure is a specific set of steps taken in order to do the experiment. Someone who does not know anything about the project should be able to read the procedure and duplicate the experiment without any questions.

- **Number** all procedures and **skip spaces** in between each step.
- Use a **NARRATIVE** tone – no pronouns and **PRESENT** tense.
- Match procedures to **purpose**.
- Include a **control** (comparison) group.
- Use only **ONE** variable – one type of thing that is changed.
- Use **SI** measurements.
- Write down **ALL** steps including ***when and/or how to record the information*** gained from the experiment.
- Write down **amounts** used in the steps.
- Include as ***many trials*** as possible (at least 5). When using plants or humans, the higher the number the better.
- Instead of retyping steps for another trial use the term "**repeat**". (See example)

Procedures Example

1. Select 20 students. 10 Girls and 10 boys. Assign each student a number from 1 – 20.
2. Pour 8 ounces of alcohol in a large bowl.
3. At the beginning of the school day, have each student dip their non-writing hand in alcohol for one minute. (Refill bowl with alcohol as needed.)
4. Dry each student's hand on a paper towel. Each student gets one paper towel.
5. Put sterile gloves on and put a fabric band aid on the student's index finger between the two knuckles of their non-writing hand.
6. Take a sheer band aid and put it on the middle finger between the two knuckles of the person's non-writing hand.
7. Tell him/her to go on like it was a normal day and tell him/her not to get soap on the band aid and try to avoid water.
8. At noon cut the band aids off each student's fingers by cutting the sticky part.
9. Lay the band aids on the Petri dishes' tops with the cloth pad facing the ceiling.
10. Have students go back to class.
11. Label 20 petri dishes with a student number and "Fabric –exp", 20 dishes with a student number and "Sheer – exp", 10 dishes "Fabric – control", and 10 dishes "Sheer-control".
12. Plate for bacteria using the following method:

    Open a Petri dish. Lay the lid with the band aid on it beside the open Petri dish.

    Take an inoculating loop and swab the little cloth of the band aid in the shape of an "X". Swab the Petri dish horizontally across one quarter near an edge.

    Starting at the end of that path, swab another horizontal line straight down.

    Starting at the end of that path, swab another horizontal line straight across.

    Starting at the end of that path swab another horizontal line straight up almost connecting with the original line. (There should be a square around the edge of the Petri dish.)

13. Repeat step 10 for all the experimental band aids.
14. Set up a control for each type of band aid by swabbing 10 cloth and 10 fabric sterile band aids that were not worn following the directions in step 10.
15. Put the band aids in a bio hazard bag and take to local hospital to be autoclaved.
16. Tape the swabbed Petri dishes closed by putting tape around the edges.
17. Place them in an incubator for 24 hours at 35 degrees Celsius.
18. When the twenty four hours is up, take the Petri dishes out and log the number of colonies according to the following rating scale.

    0=no growth 0

    1=1-5

    2=6-10

    3=11-15

    4=16-20

    5=21and up (confluent)

19. Place the Petri dishes in a biohazard bag and take to a local hospital be autoclaved.

Data Table

Data is information collected during the experiment that includes observations that are both descriptive and numerical.

A. The data in the ***log book should be handwritten in a chart format (data table).*** This is where the numbers being measured are **FIRST** recorded ***as the experiment is taking place.*** **Written observations** should also be included.

B. The data can then be placed into graphs or charts for comparison and analysis.

C. The final graph(s) for presentation should only include **averages of data**, not the individual data. (*The individual data will be in the chart in the log book.)*

D. All data tables and graphs must have the following:

1. A **Title**: descriptive, explains exactly what was tested and compared. (Do not use creative titles like "Colorful Candy" - this does not tell what was measured).
2. **Variables** – one for each axis: tells ***what*** *was being measured (ex. Height of plants, pH of soil, amount of candy)*
3. **Units**: tells ***how*** the variables were measured (ex. Centimeters, pH, numbers)
4. Give a key for any abbreviations used.

E. Data recorded must be **related** to the purpose.

Graphing the Data

The most common types of graphs include:

- **Line Graphs-**these are best for showing relationships between two variables, such as change over time (with time on the x-axis, for example, plant growth over time or decay over time.
- **Bar Graphs**-these graphs are best used for studies dealing with counts of items, such as population sizes or number of sprouted seeds
- **Circle Graphs**-these graphs are showing parts of whole (percentages)

Graphs must include the following:

1. **Title**: This should be descriptive and explain exactly what was tested and compared (do not use creative titles like "colorful candy". This does not tell what was measured. For line graphs the title should be "How does Time affect Plant Growth")
2. **Labels**: Manipulated/Independent Variable on the x-axis and the Respondent/Dependent Variable on the y-axis
3. **Units**: These should be in parentheses after the labels
4. **Evenly Spaced Scale**: should be on both axis
5. **"This graph shows…" statement**: must summarize the relationship between the variables of the experiment. All claims must be backed up with evidence from the data collected.

Conclusion

The conclusion is the evaluation of the results and a determination of whether or not the purpose was met and the hypothesis supported. It is based on the actual procedures.

Off to the "R.A.C.E.S."

- Restate the testable question
- Answer the testable question
- Cite evidence from experiment to back up your claim
- Explain or elaborate on your evidence
- Summative statement add any further experiments that could be done to extend on your research

Example:

The conclusion is that the hypothesis can not be readily denied or confirmed. The average number of colonies for fabric was 0.55 and for sheer was 0.45. Although these numbers look small, they show a 10% difference between the two types. This was with a small sample. A larger sample needs to be tested in order to confirm that this is a trend. Each of the control groups showed no significant bacteria growth. When looking at individual student data and comparing the number of colonies for each type of band aid, statistically there was not enough of a difference to say that one had more than the other. This experiment only measured normal skin bacteria; it could be applied to the bacteria that grow on a wound.

Sentence starters…

It was thought that…

It was found that…

The claim was made that…

The data (supported or did not support) the claim because it was observed that….

However… could have affected the results because…

Abstract

The abstract is a short summary of all parts of the project.

Official abstracts must be less than 250 words. The abstract will be placed on an **official form obtained from the website** listed under topics. *Exact format will be explained at that time. The form changes from year to year.*

The **heading** will follow the format shown on the form.

The first paragraph consists of the purpose and hypothesis. A short one or two sentence summary of background research can be included.

The second paragraph consists of methods and procedures. These are summarized and not detailed like in the procedure section.

The third paragraph consists of the results and conclusion.

Example:

The purpose of this project was to see if a sheer or fabric band aid would collect more bacteria. People might want to know this to see which band aid they should buy that has a lesser chance of getting an infection because of the amount of bacteria. It was hypothesized that the sheer band aid would have fewer bacteria because the fabric has more holes for the bacteria to get on and hold on to because it is woven.

Twenty students were selected and their index and middle fingers were cleaned with alcohol. A cloth band aid was placed on their index finger and a plastic one of the same brand on their middle finger of their non-writing hands. The students went on about their normal activities for the day. At the end of 4 hours, the band aids were cut off and then swabbed with inoculating loops. The loops were streaked on plates of nutrient agar. One control plate was set up for each type of band aid where sterile band aids were streaked. The plates were then incubated at 30 degrees Fahrenheit for 24 hours and the colonies counted on a rating scale. 0=no growth, 1=1-5 colonies, 2=6-10 colonies, 3=11-15 colonies, 4 = 16-20 colonies, and 5=21 and above colonies.

The conclusion is that the hypothesis can not be readily denied or confirmed. The average number of colonies for fabric was 0.55 and for sheer was 0.45. Although these numbers look small, they show a 10% difference between the two types. This was with a small sample. A larger sample needs to be tested in order to confirm that this is a trend. Each of the control groups showed no significant bacteria growth. When looking at individual student data and comparing the number of colonies for each type of band aid, statistically there was not enough of a difference to say that one had more than the other. This experiment only measured normal skin bacteria; it could be applied to the bacteria that grow on a wound.

Project Board

Each individual teacher will determine the format for presentation of the final project. However, the following will be required for all.

A. **Title** – the title of the project should relate to the purpose.

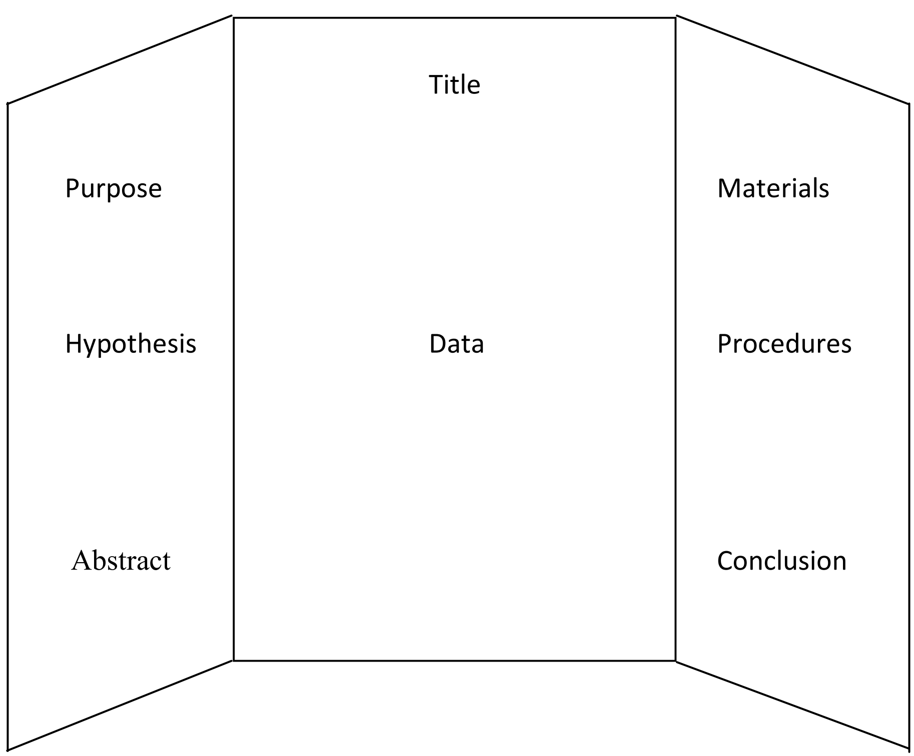
B. All **sections** should be **in order** as listed in this manual.

C. The presentation should be **neat**.

The **rubric** attached to this booklet must be included. **Double check** yourself by using the rubric to determine if all parts have been included and adhered to.

Remember that the point of turning in each section early is so that the teacher can suggest corrections. ***BE SURE TO MAKE ALL THOSE CORRECTIONS BEFORE TURNING IN THE FINAL PROJECT***.

Sample Board



Project Rubric

Criteria	**5 points per criterion**
Title is related to purpose of project	____ Title relates to purpose
Purpose of the study is clearly stated *A good format is "The purpose of this experiment is to determine if _________________________________".*	____ Purpose clearly stated in correct format ____ Quantitatively measurable
Hypothesis explains what you think will happen if you do something specific and is related to the purpose. *If __________________, then _______________(will occur).*	____ Cause/Effect Stated in correct format (testing to be done is clear) ____ Relates to purpose ____ Logical reason for hypothesis included
Materials used are stated with amounts and sizes, units are in metrics, and are listed in a straight down list.	____ All materials listed ____ Quantities given ____ Sizes given ____ Units in metrics ____ Vertical list format
Procedures are numbered, written in present tense and narrative tone, match purpose of experiment, explain every step in detail, include quantities used, and include how and when to record data.	____ Numbered and in correct format ____ Steps logically match purpose ____ Detailed and specific (easy to follow) ____ Tell what to measure and record
Only one **variable** is manipulated, others are purposely kept constant and the **control group** is easily identified.	____ Only one variable tested ____ Control group is easily identified
Data table includes at least 5 trials (when feasible), is measured numerically, and is measured in metrics.	____ At least 5 trials ____ Data is measured quantitatively ____ Metric units are used
Data graph is easily understood and relates the information collected to the hypothesis. *Headings and titles are descriptive and complete telling what is measured and the units measured in. Variables and units are labeled.*	____ Descriptive title includes both variables ____ Axes appropriately labeled ____ Regular units on each axis ____ Appropriate graph (line, bar, circle) is used ____ Data relates to hypothesis and procedures
Conclusion is clear and based on the data collected. It should include averages of data, reflect the hypothesis, and state what was learned and what could be done differently next time.	____ Written in correct format ____ Includes averages of data ____ States what was learned and reflects hypothesis ____ Is accurate and based on procedures ____ Suggests changes or future study
Abstract tells a complete but brief story of the project.	____ Correct format ____ Includes summary of all parts of project ____ Written in past tense ____ Written in correct format
Log book *begins with the selection of the project, all related background information and is handwritten. It .contains all data and observations related to the experiment.*	____ Handwritten ____ Entries include quantitative and qualitative data ____ Entries include all background work ____ Entries are dated