HONORS SCIENCE
SCIENCE FAIR/BRIDGE INFORMATION
Fall 2020

All Honors Earth Science and Biology students will be participating in the BRCS Science Fair OR the Palm Beach Regional Bridge Competition. Because this is a major project, there will be no other Honors assignments given during the first quarter. The following pages outline the procedures for traditional projects; procedures for bridges follow.

Traditional projects (include testing a hypothesis or designing and building something to meet a need):
All projects are to be done **individually** without assistance from anyone except the teacher, unless specific permission is granted by the teacher. A significant exception to this rule is if a student knows or is able to find a scientist willing and able to oversee and assist with the project. **All projects must be approved by the teacher before experimentation begins.**

Deadlines for the project are as follows:

Log book purchased, labeled, table of contents	Due August 17
Idea worksheet #'s 1-7 (EC if 1-9 are complete). . .	Due August 21
Research paper rough draft/ Bibliography.	Due September 4
Research paper/turnitin.com,Research Plan Template, Forms 1A,1B, Blank data table.	Due September 18
Experiment Data/Log book, Analysis/Conclusion . .	Due October 22
Backboard/Abstract/Final Research Paper.	Due October 22
Science Fair	October 29 during school hours

Use the guidelines below to help you do an awesome project:

1. **Topic**
   Choose a topic that interests you!! You will be researching this topic before you do your experiment, so that your hypothesis will truly be an educated prediction. One of the best ways to find a topic is to look around you and begin to ask questions about what you see. For example, if you are a Biology student and find plants interesting, you may wonder what nutrients are the most important for the growth of a certain type of plant. You do some research into the needs of a particular type of plant and the composition of soil, as well as different types of fertilizer. You then form a hypothesis about which combination of nutrients will result in the most plant growth, and then design an experiment to test that hypothesis. Below are three website that may help to get you started.

   https://www.sciencebuddies.org/science-fair-projects/science-projects
   https://www.education.com/science-fair/high-school/
   https://www.thoughtco.com/high-school-science-fair-projects-609076

   Additionally, if you know a scientist who is doing research, he/she might have ideas for you. Ask around!!

2. **Science Fair Log Book**

Purchase a composition book to be used as your log book. Your log book is VERY important. Every time you work on your project, you must make an entry in the book showing what you did. Each entry must be dated. You may use abbreviations and incomplete sentences. This is a record of all you do. If you make a mistake, cross it out. **Do not** erase or use whiteout. Set up your log book according to the instructions below:

LOGBOOK CONTENT: Number every page of your composition book. Page 1 should be the **Table of Contents**. Then leave **2 blank pages** between each of the following titles:

- **Topic**: make a list of topics that interest you, things that you are really curious about and that you want to find answers to; explain how you came up with your topic, why you decided to do it.
- **Timetable :** Come up with a timetable for doing each of the steps of your project and try to stick to it
- **Background Research**: Record your background research about your topic from books, magazines, TV programs, the Internet (with supervision), people and companies. Keep a record about where you gathered your information for your bibliography/list of references and acknowledgements.
- **Testable Question/Purpose:** Based on your background research, write down your testable question/purpose
- **Hypothesis**: write down what you think the results of your experiment will be based on the research that you've done
- **Materials:** List everything that you will need to do your experiment, such as equipment, ingredients, quantities of ingredients, measuring tools etc. Be very specific – give lots of details
- **Procedure**: List the steps you will go through to do your experiment. If you make any changes to the procedure after you start your experiment, describe them in your logbook with an explanation about why you made the change(s) and if the change(s) will affect the results collected prior to the change.
- **Variables**: list the controlled variables, the manipulated (independent) variable, and the responding (dependent) variable
- **Data:** record all of your measurements/raw data that you collected on data sheets in your logbook
- **Results:** record your collected data in charts, tables, graphs, pictures and use these to help you explain what happened in your testing; describe any problems you might have had while you were testing , any changes that you had to make to your original plans, and whether those changes would affect the results collected before you made the changes
- **Conclusions:** write down your conclusions, whether or not your hypothesis was supported by your data and why. It is OK if your results do not support your hypothesis – the information you collected still supports science.
- **Recommendations/Applications**: Make recommendations for improving your project, for further study, and applications you can make from your research.
  For further information on keeping a log book, visit
  http://www.sciencebuddies.org/science-fair-projects/printable_project_logbook.pdf

3. **Bibliography/resources**
   Your research paper must include a bibliography of at least five resources. One of your sources **must** be a recognized scientific journal or magazine. These resources may be online resources; however, be careful where you get your online information. Be sure each source is credible! Do

NOT use Wikipedia as a resource. Your bibliography will include all sources consulted, according to the MLA format, found on the BRCS website.

4. **Research paper/Literature review**
   The purpose of your research is to find out all you can about your topic, so that you know specifically what you want to test in your experiment. In the example above, you would research the needs of a particular type of plant and the composition of soil, as well as different types of fertilizer. **You must also find out what research has already been done about your topic.** This is NOT a report; it is a research paper. The length of the paper should be approximately 1000 words for grades 10 through 12, and 800 words for 9th grade. The conclusion of your research paper will flow naturally into your experimental design. Within the body of your paper, be sure to include source citations for anything that is not your own idea, even if it is not a direct quote. In APA, source citations should be (Author, publication year) for a general idea, but for a direct quote, include the page number as well. Also, state all your research in the **third person** (don't use 'I').
   Note: All research papers must be turned in to turnitin.com. The class name is Science Fair and its ID # is **21342691**. Your password is sciencerocks. If you have an ID from a previous class, use it. If not, please create a new user profile. If you have any questions, please email me at barnhillp@bocachristian.org.

5. **Research Plan Template and Data Table**
   a. Use the template provided to help you plan your research project.
   b. Using a list format, describe in detail the steps of the experiment you plan to carry out to test your hypothesis. Keep in mind the following principles of experimental design when testing a hypothesis:
      i. Identify your **independent variable** (the one you are manipulating – in this case, the type of fertilizer) and your **dependent variable** (plant growth).
      ii. Identify as many **constants** as possible: in this case, the type and approximate size of the plants, the temperature, amount of water, and light each plant receives, the type of container in which it is growing, etc.
      iii. Identify your **control group**, the basis for comparison. In this case, you would have a group of plants that receive no fertilizer.
      iv. Remember the importance of **repetition!** You should test your hypothesis **at least** 3 times; in the above example, you would want at least 5 plants in each group: liquid fertilizer, time-release fertilizer, and control.
   c. Include a blank copy of your data table, in which you will collect data.

6. **Experiment Data**
   If possible, **take pictures** during the process of experimenting. Your pictures should go on your backboard, not in your log book; however, you will have to block out your face in any pictures on your board. If you are creating a design, show the results of your testing process and how the design was modified as a result of testing.
   Also, print out a **data table** to be included on your backboard.

7. **Analysis/Conclusion/Abstract**
   a. **Analysis:** Graph your data using the most appropriate type of graph. **Only graph averages, not every data point!** Summarize and discuss your findings. **This is a very**

important part of the project! What do the results show? Is there more than one interpretation of the results? Were the results what you expected? Why or why not, to the best of your understanding? What are the possible sources of experimental error? Include ideas for further experimentation.

b. **Conclusion:** Point back to your hypothesis, stating whether or not your data supports your hypothesis. Only a few sentences are necessary for this.
c. **Abstract:** The abstract is a summary of the experiment. It should be no longer than 250 words and should include the purpose, procedures, data, and conclusions. It may also include any possible applications of the research.

Your **abstract** should include:

Purpose of the Experiment

- An introductory statement of the reason for investigating the topic of the project.
- A statement of the problem or hypothesis being studied.

Procedures Used

- A summarization of the key points and an overview of how the investigation was conducted.
- An abstract does not give details about the materials used unless it greatly influenced the procedure or had to be developed to do the investigation.
- An abstract should only include procedures done by the student. Work done by a mentor (such as surgical procedures) or work done prior to student involvement must not be included.

Observation/Data/Results

- This section should provide key results that lead directly to the conclusions you have drawn.
- It should not give too many details about the results nor include tables or graphs.

Conclusions

- Conclusions from the investigation should be described briefly.
- The summary paragraph should reflect on the process and possibly state some applications and extensions of the investigation.

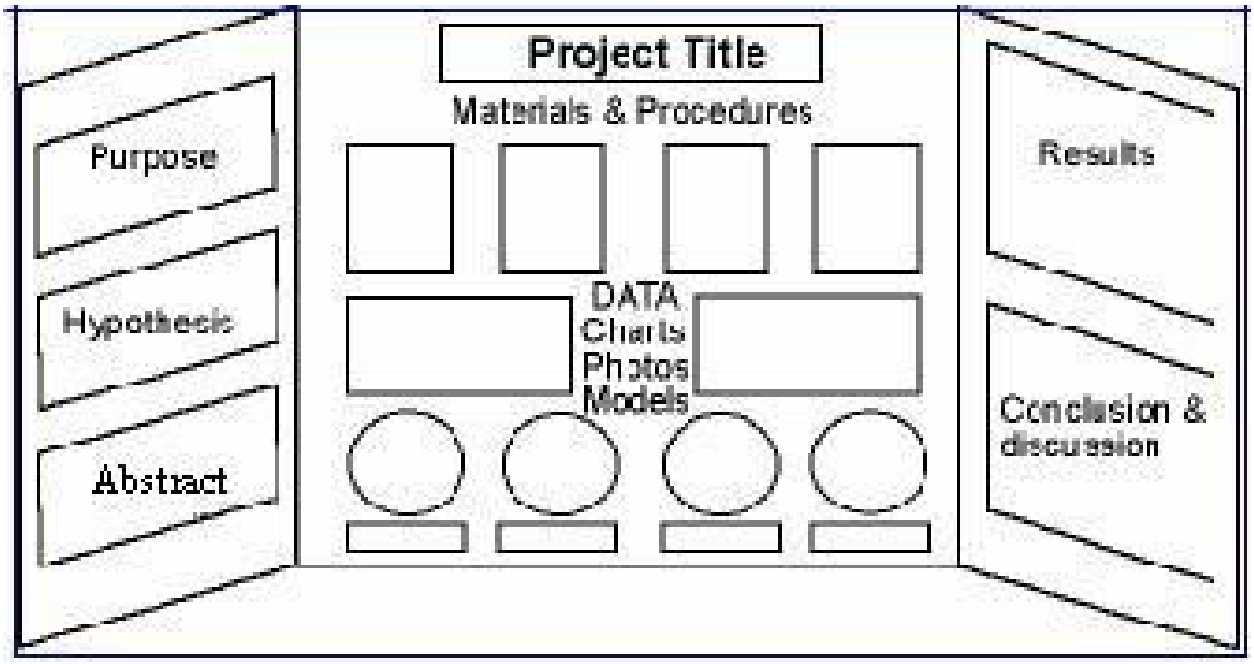
An abstract does not include a bibliography unless specifically required by your local fair. The Intel ISEF requires the bibliography as part of the research plan to be provided on Form 1A.

Here is a fairly simple sample abstract (although the writer incorrectly uses first person):

Advertisers are always touting more powerful and longer lasting batteries, but which batteries really do last longer, and is battery life impacted by the speed of the current drain? This project looks at which AA battery maintains its voltage for the longest period of time in low, medium, and high current drain devices. The batteries were tested in a CD player (low drain device), a flashlight (medium drain device), and a camera flash (high drain device) by measuring the battery voltage (dependent variable) at different time intervals (independent variable) for each of the battery types in each of the devices. My hypothesis was that Energizer would last the longest in all of the devices tested. The experimental results supported my hypothesis by showing that the Energizer performs with

increasing superiority, the higher the current drain of the device. The experiment also showed that the heavy-duty non-alkaline batteries do not maintain their voltage as long as either alkaline battery at any level of current drain.

8. **Backboard**
   Your backboard should be neat and attractive with a catchy title. It should include your **problem statement (purpose)**, **hypothesis**, **procedures (**including materials, variables and constants as applicable), **data table, graph, analysis, conclusion, applications,** and **abstract.** The abstract **must** be placed at the bottom of the left side of the board. See sample below:



Science Fair Grading Sheet

Student's Name: **Grade:**

Topic:

Project Component	Due date	Date submitted	Points possible	Points given	Comments
Log book purchased, labeled, table of contents	Aug 17		10		
Idea Worksheet 1-7	Aug 21		10		
Research paper rough draft, Bibliography	Sept 4		5 10		
Research paper/turnitin.com	Sept 18		45		
Research plan template (Forms 1A,1B if competitive) Blank Data Table	Sept 18		25 +5 5		
Experiment Data Log book Graph/Analysis Conclusion/ Discussion	Oct 22		15 20 15 15		
Abstract Backboard	Oct 22		15 30		

This project is worth two test grades; Rows 1-5 will be added together for 1 grade in the first quarter; rows 6 and 7 will be added for the second test grade, which will count in the second quarter.

Test 1 Grade:

Test 2 Grade:

Bridge Project

All bridges are to be built by the student. A parent or adult may act as a consultant, but all work MUST be done by the student and follow the Palm Beach Regional Challenge guidelines below. Bridges will be measured on or around September 24 for the Quarter 1 grade. Any bridge that is not built to specifications will earn a maximum of 35 points and **must be rebuilt** before the second measuring date. If the bridge is built to specs the first time, the student will need to make any improvements suggested by the teacher before the second measurement.
Do not choose this project if you are not comfortable with detail and measurements. Students often choose to build a bridge because it seems easier than a project. It isn't. You must be meticulous about your measurements or you will not be successful.

Deadlines for the project are as follows:

Research paper rough draft, bridge sketches, Bibliography.	Due August 28
Research paper/turnitin.com, Bridge design	Due September 11
Q1 Bridge measurement	September 24 (approx.)
Q 2 bridge measurement	December 2
Palm Beach Regional Bridge Competition (or BRCS competition).	December 8 (approx.)
Bridge reflection paper.	December 11

Below are the project requirements, modeled from the guidelines from 2017. Students will be notified of any changes for the coming year:

1. Research paper

The purpose of your research is to learn about and describe various types of bridges. From that, you will determine which type of bridge you would like to make. Research at least three types of bridges and trusses. For each one, describe the bridge and evaluate its advantages and disadvantages. Finally, determine which type of bridge you will build and explain why. You must have at least three resources and turn your paper in to turnitin.com. The class name is Science Fair and its ID # is **21342691**. Your password is sciencerocks. If you have an ID from a previous class, use it. If not, please create a new user profile. If you have any questions, please email me at barnhillp@bocachristian.org.

2. Bridge sketches

Sketch and label the types of bridges you researched. Indicate which type you plan to build. Make a rough sketch of your bridge as you envision it.

3. Final bridge design (blueprint)

a. This should have every dimension labeled for every piece of wood you will use. For specifications, see below.
b. You must include a side (lateral) view and a top view of the bridge.
c. A few design tips:
    i. Combinations of triangles usually provide the greatest strength.
    ii. Bridges with three or more panels are usually stronger.
    iii. Try to make sure that there are no long, unsupported sections of wood in the design.

4. Bridge Construction

a. Attach your blueprint to a piece of foam board or cardboard.
b. The average mass per cm is approximately. **0.0118** g/cm. Use your blueprint to estimate the approximate mass of each panel by totaling the length of all the bridge, continuously measure to make sure that it meets all of the requirements.
c. Tape a piece of wax paper over the blueprint to prevent glue from sticking to diagram.
d. Cut strips of wood to fit the outline of the bridge. Measure twice, cut once!
e. Once all the cut strips fit smoothly, glue them into place. If you can see the glue, then you are using too much. You may place small push pins on either side of wood to hold pieces.
f. After outline has been glued into place, fill in the wood strips which make up the other members of the side of bridge.
g. After first side has dried, carefully remove and construct other panel(s) in the same manner.
h. After panels are dry, make sure they are aligned and parallel. Attach panels with straight members and add additional cross braces to further connect your panels, as required by your design.
i. Complete bridge by checking all joints to see that they are well-glued and that all members are tightly in place.

5. Bridge Testing; will either be done at school or at the Palm Beach Regional Fair in December

a. The structure will be weighed.
b. An increasing load will be applied to bridge until the bridge fails.
c. Bridge efficiency will be determined.

$$\text{EFFICIENCY} = \frac{\text{Load (lbs.)}}{\text{Mass of bridge (g)}}$$

6. Bridge reflection paper

Following the competition, write a paper (approximately 250 words) explaining how your bridge did. What were the problems, what worked well, what would you do differently for if you were building another bridge? What did you learn about the physics of bridges?

Materials should be ordered from Pitsco
http://www.pitsco.com
item #W51730 Balsa wood strips 3/32' X 3/32" X 24" -50 pieces for $9.00

Glue item # DC56215 $5.95
Shipping & handling are separate. If several students want to build bridges, we will try to order the materials together to save on shipping costs.

BRIDGE BUILDING REQUIREMENTS 2017-2018

Palm Beach Regional Challenge

The bridge is a spanning structure that would span across a river or a road. The purpose of this challenge is to test the bridge to its breaking point and judge its efficiency.
All BRIDGES MUST adhere to the following specifications:

1. Bridges are to be constructed from 2.38 millimeters (mm) 3/32-inch square balsa wood and any commonly available glue may be used.
2. The total mass of the complete bridge must not exceed sixteen (16.0) grams at the time of check-in.
3. Bridges will be free standing and will comply with the following dimensions:
4. The base length must be exactly 40.5 centimeters (cm).
5. The horizontal opening must be centered and at least (minimum) 26.0 cm. at the base.
6. Bridges must have a central vertical side opening 8.0 cm. or higher spanning a width of 26 cm or more.
7. The height of the bridge must be from 13.0 cm. (minimum) to 25.0 cm. (maximum).
8. **The width of the bridge must be from 11.0cm. (minimum) to 12.0cm. (maximum) from base to top. This means the bridge has consistent width throughout.**
9. The length of any wood strip used in the structure must be 2.0 cm. or greater.
10. There will be single member construction throughout. **No single stick extensions allowed.**
11. No wood strips may be cemented together side by side or laminated together at any point or joints.
12. All joints shall be constructed in a single plane (NO two pieces shall cross over each other or overlap each other).
13. Single structural members must be uniformly distributed throughout the entire body of the bridge.
14. All sides must be completed with no single member extensions used to meet requirements.

For judging:

1. All bridges will be loaded to the point of failure by a circular loading plate, 20.0 cm. in diameter, **placed on the highest point** of the bridge at the center of the span. The bridge testing committee will provide this plate. All bridges will be tested with a uniform base block, having 12.0 cm. wide cleats, 40.5 cm. apart. The testing committee will also provide the base block.
2. No structural members of the bridge may be coated or treated in any way, with any material. Bridges will be examined for type of wood and coating.
3. Excessive accumulation of cement at the joints is not allowed. Cement should be used only in area of contact between members.
4. Once a bridge has been checked in, it is not to be tampered with. Any alteration after check in will lead to the contestant being disqualified.

5. All bridges not meeting the above specifications will be disqualified.
6. All bridges will become the property of the Palm Beach Regional Challenge Committee and may be claimed by the builder or designee after testing.
7. Unclaimed bridges will be destroyed after testing.

Judging Criteria

After meeting the above entry criteria, bridges are judged solely by "efficiency". To determine this efficiency, the applied weight in pounds as shown on the tester is divided by the gram mass of the bridge. As an example, a 10 gram bridge that carries 40lbs applied will be judged more efficient than a 15 gram bridge that carries 50lbs applied.

Bridge Grading Sheet

Student's Name: **Grade:**

Project Component	Due date	Date submitted	Points possible	Points given	Comments
Research paper rough draft, bridge sketches, Bibliography	Aug 28		5 10 10		
Research paper/turnitin.com Final Bridge design sketch	Sept 11		35 20		
1st bridge measurement	Sept 24		50 (max 35 if doesn't meet specs)		
2nd bridge measurement	Dec 2		75 (max 55 if doesn't meet specs)		
Final bridge reflection paper	Dec 14		25		

This project is worth two test grades; Rows 1-3 will be added together for 1 grade in the first quarter; rows 4 -5 will be added for the second test grade, which will count in the second quarter.

Test 1 Grade:

Test 2 Grade:

Bridge Competition Checklist

Before turning in your bridge, make sure it meets ALL of the requirements below:

Requirement	Requirement	Actual measurement
Total mass	16.0 g max	
Base length	40.5 cm exactly	
Horizontal opening	Centered	(Yes or no)
Horizontal opening	Min 26 cm at base	
Central vertical side opening height	$\geq$ 8.0 cm	
Central vertical side opening width	$\geq$ 26 cm	
Total bridge height	13.0 - 25.0 cm	
Total bridge width	11.0 - 12.0 cm	
Total bridge width	Consistent throughout bridge	(Yes or no)
Length of wood strips	$\geq$ 2.0 cm	(Yes or no)
Wood strips are NOT cemented together side by side or laminated together at any points or joints		(Yes or no)
No two pieces cross over or overlap each other		(Yes or no)