2024 CEDAR MILL SCIENCE AND ENGINEERING FAIR

Thursday, March 7, 6:00-7:30 pm

All Cedar Mill students are invited to participate in the Cedar Mill Science and Engineering Fair, either individually or in groups to answer a scientific question (inquiry) or solve a problem (engineering). Plan your project and submit the Online Form to register by **MONDAY, FEBRUARY 12.**

The Fair is a celebration of science! A project reviewer will talk with each student and each student will receive a special gift and a certificate. All students and families are welcome at the event, whether or not they completed a project. Science is fun for everyone!

- ✔ Students can choose a Science Inquiry (pg 4-7) or an Engineering Design (pg 8-11) project
- ✔ Students should get started on projects...now (see timeline below)!

Science and Engineering Fair IMPORTANT Dates:

Monday, February 12	Deadline for filling out Online Entry Form
Wednesday, March 6	Set up projects between 5:30-7:30pm
Thursday, March 7	Science and Engineering Fair 6:00-7:30pm

F I L L O U T O N L I N E E N T R Y F O R M T O E N T E R

Link: https://forms.gle/fCiQYituMUeeYo7w7

Parents and Caregivers: Please Volunteer! We need your help to make the science fair fun, safe, and a great learning experience for the kids. More info to come on specific shifts but we will need help in the following areas. Please let us know if you're interested in helping on the entry form.

✔ Prepare gym	Wednesday, March 6, 4:00-5:30pm
✔ Supervise event tables	Thursday, March 7, 6:00-8:00pm
✔ Project reviewer*	Thursday, March 7, 5:30-8:00pm
✔ Security	Thursday, March 7, 5:30-8:00pm
✔ Clean up	Thursday, March 7, 7:30-8:30pm

**This is our area of greatest need and no science background is necessary!*

Please email sciencefair@cedarmillptc.org if you have any questions.

Suggested timeline*:

Late Jan/Early Feb	2 weeks of PLANNING: Choose a topic, and complete a planning sheet (included in this packet). Go online and fill out the **entry form.**
Mid-February	CONDUCT EXPERIMENT/CREATE-TEST PROTOTYPE: Collect data that helps you answer your question (inquiry) or helps you test your prototype (engineering), and repeat as necessary.
Late Feb/Early March	Make your DISPLAY BOARD: Write up your results and outcomes, and summarize your project on your display board – see examples below. (A limited quantity of display boards will be available to purchase from the PTC. See cedarmillptc.org/science-fair for details.)
Week before the fair	PRACTICE: Talk about your project with other people, practice explaining what you did and what you learned.

***NOTE: For guidance to give students plenty of time. Feel free to modify timeline based on your family's needs.**

Selecting a Project: Science Inquiry vs. Engineering Design

Science fair projects can start by either asking a question (science inquiry) or solving a problem (engineering design).

Examples:

Science question (science inquiry): What happens to the acceleration of a rocket when I increase its mass?
Engineering problem (engineering design): NASA needs a rocket to fly straighter because they need to predict where it will fly. How can we make a rocket fly straighter? Faster?

Example for younger scientists:

What happens to an egg when left in Vinegar for 2 weeks? Why?

Example for younger engineers:

Can you build a contraption to protect an egg from breaking when thrown from a height?

Scientific Inquiry (use pages 3-6)	Engineering Design (use pages 7-10)
Formulate a **question**.	Define a **problem**.
Research how others have answered it.	Research how others have solved it.
Brainstorm hypotheses and choose one.	Brainstorm solutions and select one.
Conduct an experiment.	Create and test a prototype.
Modify hypothesis based on results.	Redesign solution based on tests.
Draw conclusion, make a display board for the science fair.	Finalize design, make drawings, make a display board for the science fair.
Ask new questions.	Define new problem.

Modified from National Research Council. (2012). *A framework for K-12 science education: Practices, crosscutting concepts, and core ideas.* Washington D.C.: National Academies Press

- Think about an area of science that interests you. Think of things you have learned about science in school this year or things that you have read about in newspapers, magazines, or books.
- Read about your subject in the school or public library.
- The following are some helpful websites:
  - A great start to finish resource - http://www.sciencebuddies.org
  - Get some other ideas here - http://www.all-science-fair-projects.com/
  - Projects to spark questions - https://www.exploratorium.edu/snacks

2024 CEDAR MILL SCIENCE AND ENGINEERING FAIR RULES:

Science Fair Projects **MUST:**

- ✔ Be based on a Science Inquiry Question or Engineering Problem
- ✔ Have a title and include each person's name from your group on the display
- ✔ Fit on a 3'x3' table area (except for whole-class projects)
- ✔ Be conducted before the fair. The fair is where the student reports results
- ✔ Have students accompanied by a parent or guardian on set-up night and at the fair.
- ✔ Be on a Display Board which might be available for purchase at craft/office supply stores, Target, and CVS. A limited supply available from the PTC. Visit cedarmillptc.org/science-fair for details.

Science Fair Projects **SHOULD:**

- ✔ Demonstrate science inquiry, engineering, math, or technology
- ✔ Be the student's own ideas and work
- ✔ Be creative, neat, and show careful work
- ✔ Show understanding of a science concept

Science Fair Projects **MUST NOT:**

- ✔ Require an electrical outlet at the fair
- ✔ Be a kit purchased from a store
- ✔ Involve expensive or non-replaceable property
- ✔ Involve live animals
- ✔ Involve hazardous or flammable materials such as chemicals, matches or flames, dry ice etc.
- ✔ Involve alcoholic beverages
- ✔ Involve a laser pointer or lasers of any type

Questions: Please contact sciencefair@cedarmillptc.org . We would love to help make this year's fair a success for all kids!

"The wise man doesn't give the right answers, he poses the right questions." Claude Levi-Strauss

S C I E N C E   I N Q U I R Y^2

Get ready to research! Science is a process to answer questions about our world and our universe! By carefully controlling experiments, ideas can be disproven or verified.

Science Inquiry (use the planning sheet to help you):

1. Form a **question.**
2. Research.
3. Make a **hypothesis.** (An idea you can test)
4. Design a **procedure.**
    a. Identify **one variable** (something that can be changed.)
    b. Identify a **control** (something that remains unchanged) for that variable.
5. **Measure** the results. (Run the experiment and gather data, and repeat if possible.)
6. Form a **conclusion**. Verify or disprove the **hypothesis** with the data.

Forming a Question

A successful project begins with a good question. The question should not be answered by a simple yes or no. For example, "*How does salt affect the freezing point of water?"* is a better question than "*Does salt affect the freezing point of water?"* Good scientific inquiry questions do not include taste, smell, and opinion-based responses. Good scientific inquiry questions have one **variable** and **measurable data**. If you can repeat the experiment several times, you will have more data to work with and your conclusion will be more accurate. Use the following templates to help you form a good question:
How does ________________ affect ________________? or Which _______________ is ________________?

For example: How does <u>bread type</u> affect <u>mold growth</u>? How does the amount <u>of sunlight</u> affect <u>plant growth</u>? How does <u>string length</u> affect the <u>sound</u> it makes? Which <u>type of boat</u> is <u>better at floating</u>? Which <u>brand of battery</u> is <u>longest lasting</u>?

Making a Hypothesis

A **hypothesis** is a prediction about what you think will happen. The **hypothesis** gives you a general guide as to what to expect from the experiment and does not need to be correct.

Designing the Procedure

A **procedure** is a step by step method of how you conduct your test. Your procedure needs to **measure** your **variable** (what you are changing) against your **control** (that which stays constant). It is the difference between the **variable** and the **control** that either verifies or disproves your **hypothesis**. For example, to answer "*How does salt affect the freezing point of water?"*, you would have two containers of water: a **control** and **test**. In the **control**, you would not add salt. In the **test** container, you would add salt. Then, you would put both containers at the same temperature and record if each froze. A successful procedure can be described and repeated by others.

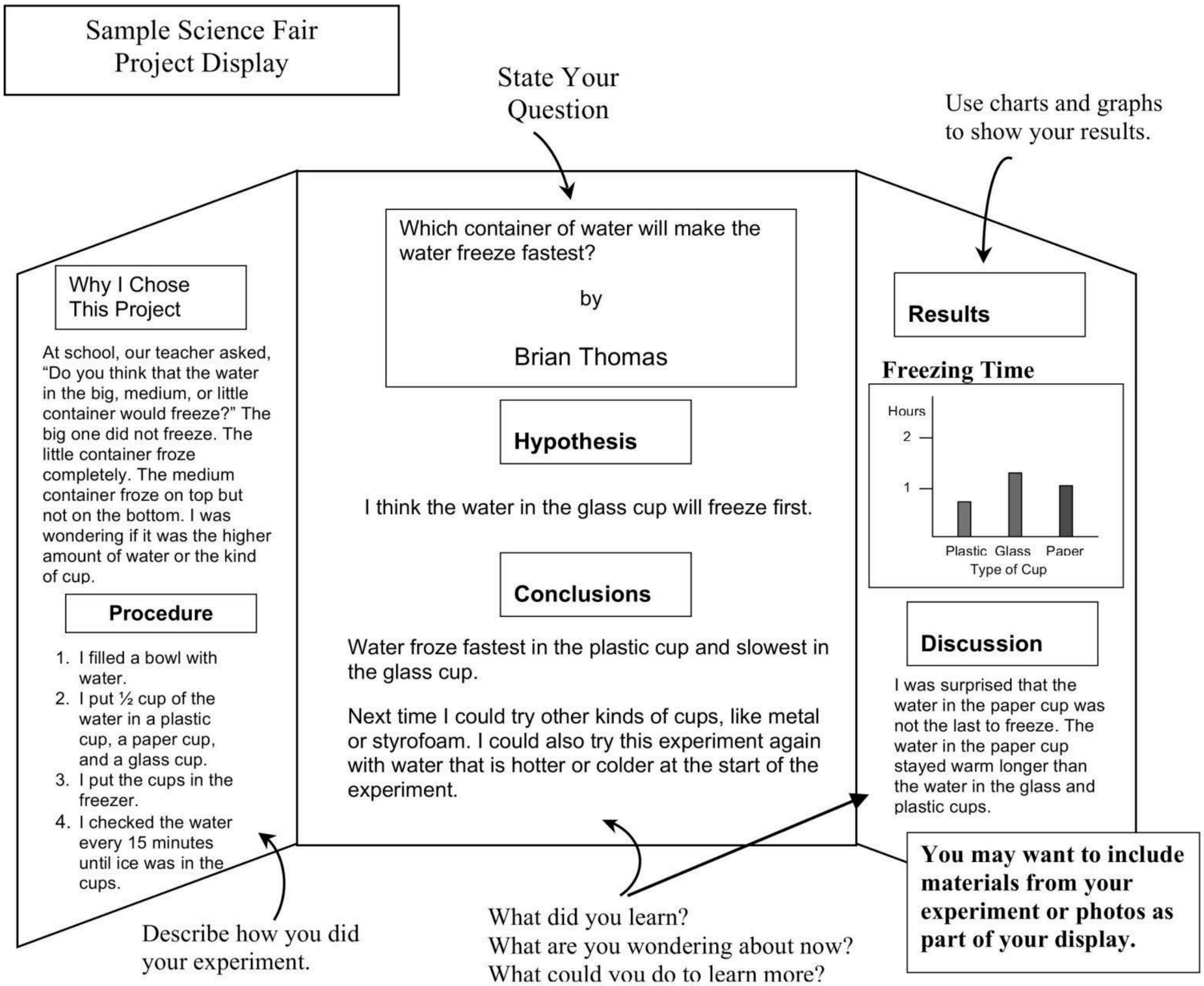
Examining the Data and forming a conclusion

Your conclusion is what you have observed about your test, and is based upon measurements, not opinions. Your data should compare your **variable** against your **control**. For example, *The salty water did not freeze in the freezer, but the control did.* Try graphing your results.

Making your Display Board

Once your experiment is complete, you are ready to create your display board for the fair. This can take some time, so **get started on this early**!

SCIENCE INQUIRY DISPLAY BOARD EXAMPLE



Hints for Parents/Guardians:

Please provide your child with positive encouragement and support. Take time to discuss each discovery with your budding young scientist – students learn best through their <u>own</u> discoveries.
Make sure the project is at your <u>child's</u> level of understanding and is something in which they are interested. We do not expect Nobel Physicists.

Many good science and engineering experiments don't turn out as expected. Often, more is learned from initial failures than success. So, even if your child's project doesn't quite work out, please still encourage them to bring it to the science fair. We will still learn a lot.

Help your child choose a realistic project that passes the S.P.A.M. test. Ask yourself, is it:

Simple - minimal supplies, usually around a week to conduct
Practical - not too expensive, can be done at home
Answerable - an answer is attainable whether it matches your prediction or not
Measurable - *<u>all</u>* projects should have data to display results in the form of charts, graphs, diagrams, and/or photos

Science Inquiry Project Planning Sheet[2]

Use this form to plan your project and add additional pages as needed.

My Question:
What question will your experiment answer?

My Background Information (or why I chose this project):
What do you know about this topic?

My Hypothesis (or my prediction):
A prediction about what I think will happen. *The hypothesis gives you a general guide as to what to expect from the experiment and does not need to be correct*.

My variable:
What one thing will I change?

The procedure I will use:
How will I test my Hypothesis?

What materials I will use:

How I will measure my results:

PROJECT TITLE: (Make sure this matches your Entry Form)

Now it's time to do your experiment!

Science Inquiry Project Planning Sheet Part 2

Data:

What happened? Gather your data. Use graphs, charts, photos, and/or diagrams to summarize your data too. Your graphs, charts, photos, and/or diagrams are your RESULTS.

Discussion/Conclusions:

Overall, what did your experiment tell you about your hypothesis? What did you learn about the answer to your question? What are you wondering now?

Have you turned in your Entry Form? Now it's time to make your display board! See the previous pages for help.

Bring your completed board to set up for the fair on March 6 between 5:30-7:30pm (takes around 30 minutes).
See you at the fair on March 7 from 6:00-7:30pm!

E N G I N E E R I N G   D E S I G N

Engineers improve or create something for a particular purpose and their project needs to have a measurable result. Students can choose to do a **prototyping project,** where they invent something, or an **improvement project,** where they modify an existing product. If you are inventing something, you need to be able to measure your results to show that it fits its purpose. If you are improving something, you need to be able to measure how much it has improved.

To help you come up with an engineering problem…[1]

Create a list of all the things that annoy or bother the people around you. [1]

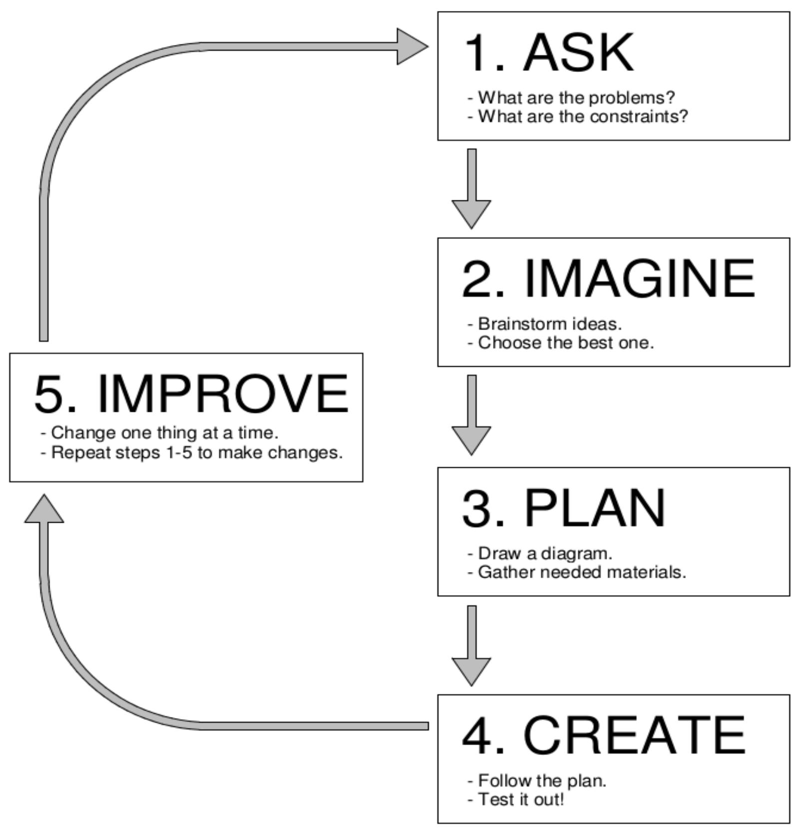
- **What** is the problem or need?
- **Who** has the problem or need?
- **Why** is it important to solve?

The format for writing a problem statement uses your answers to the questions and follows these guidelines:

- **Who** need(s) **what** because **why**.
- _____ need(s) _________ because ________.

Here are some additional examples of engineering design problem statements:

- Students need an easier way to _____________ at school, because ___________________.
- Families need a simple way to store large amounts of water, because if there is an earthquake they will need fresh water to drink.
- NASA needs rockets to fly straight and fast because they need to predict where the rocket will fly.



The Engineering Design Process

Engineers use this process to create or improve things.

Use the planning sheet on the following pages to help you

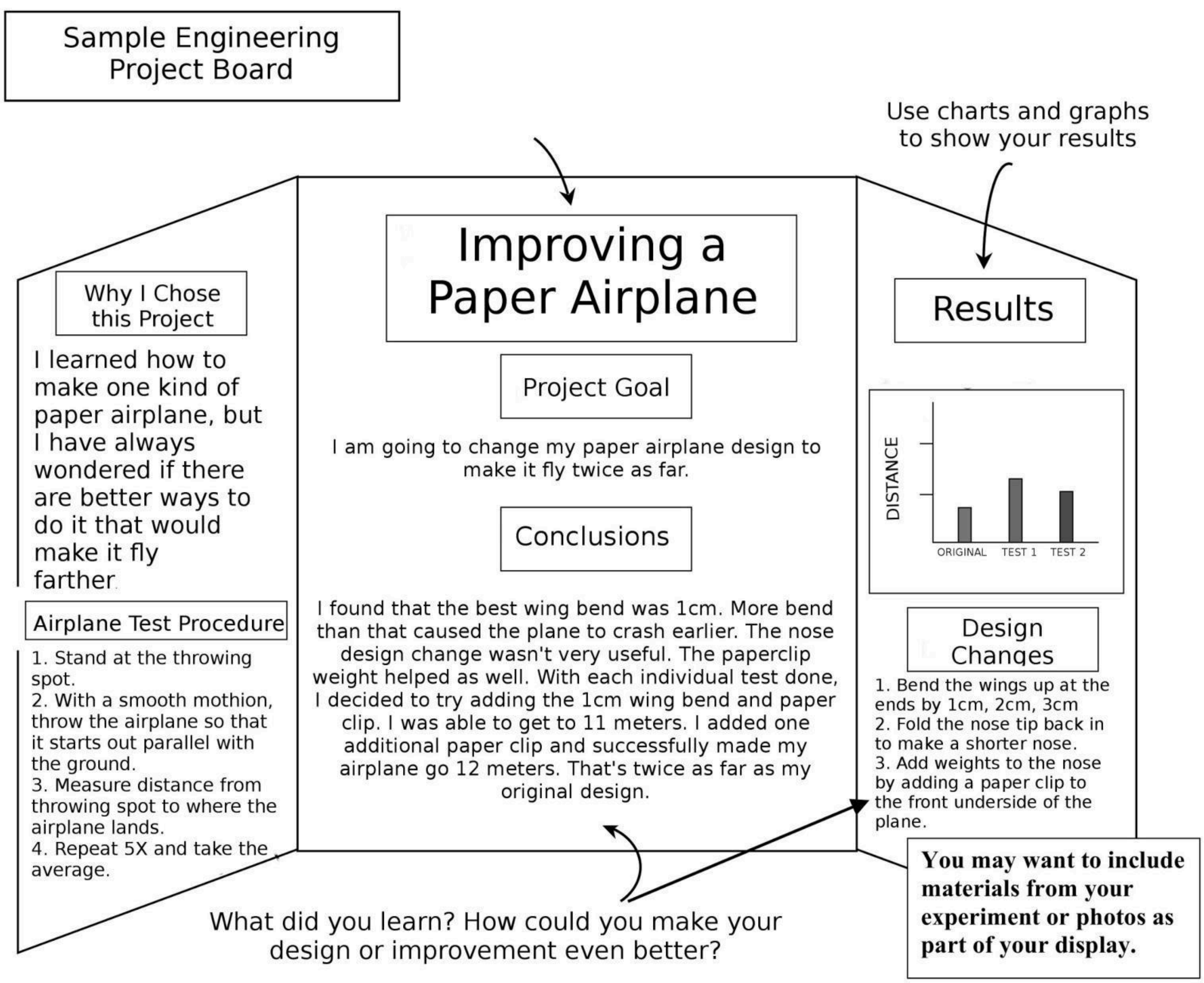
ENGINEERING CONTINUED ON NEXT PAGE...

[1] Modified from: http://www.sciencebuddies.org/engineering-design-process/engineering-design-problem-statement.shtml

ENGINEERING CONTINUED…

The **problem** (the thing you're making better) and the **requirements** (criteria and constraints) need to be measurable. The **criteria** are what the solution should do. For example, if the problem is to make a toy boat, the criteria for a successful solution would be that it floats. The **constraints** are what limitations you have. For the toy boat example, perhaps you only have wood as a material to use. For all projects, the deadline for the science fair is a constraint. Due to some constraints, using a model might be more practical (consider the rocket example on the previous page).

ENGINEERING DISPLAY BOARD EXAMPLE



Hints for Parents/Guardians:

Help your child choose a realistic project that passes the S.P.A.M. test. Ask yourself, is it:

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Engineering Project Planning Sheet[2]

Use this form to plan your project and add additional pages as needed.

What is the problem you are trying to solve?

- **What** is the problem or need?
- **Who** has the problem or need?
- **Why** is it important to solve?

What are your requirements for a successful solution *(see previous pages for more description)***?**

Criteria:

Constraints:

What is your expected outcome?

Does your project pass the SPAM Test? (Simple, **P**ractical, **A**nswerable, **M**easurable—see previous pages)

PROJECT TITLE (Make sure this matches your Entry Form)**:**

[2] Modified from the Oaks Hills Elementary School, Beaverton School District, Beaverton Oregon, STEM Night 2016 Packet, http://www.oakhillspto.org/wp-content/stem/STEMPacket.pdf

Engineering Project Planning Sheet Page 2

Exploring Different Solutions to Your Problem[3] *(use additional pages if needed)*

Problem to be solved: ____				
Each **Solution** is one possible design or way to solve the problem. Sketch or write the solutions in the boxes across the top. Each **Criterion** is one of the elements that you need to consider for each solution, such as cost, size, safety, etc. List below.	Importance: rank criteria or mark them +, ✔, or –	Solution A	Solution B	Solution C
Criterion 1				
Criterion 2 (you can have more than 2 criteria—just add more rows)				
After scoring each **solution** against each **criterion**, total the scores here: _________				

What solution do you want to test? ______________Why? What data will you collect when you test your solution? How will you know if your solution solves the problem?

Show your solution by sketching or drawing	**Explain** your solution with words and/or numbers

(*add additional pages to record your data as needed*)

Data: What happened when you tested your solution? Gather your data. Use graphs, charts, photos, and/or diagrams to summarize your data too. Your graphs, charts, photos, and/or diagrams are your RESULTS. (*add additional pages to record your data as needed*)

Discussion/Conclusions: Overall, what did the data you collected tell you about your solution to the problem? What changes would you make to your solution now? How would you test these changes? (*add additional pages to discuss your data and ideas for future designs as needed*)

Now it's time to make your display board (see the previous pages)! *Bring your completed board to set up for the fair on March 6, 5:30-7:30pm (takes around 30 minutes). See you at the fair on March 7, 6:00-7:30pm!*

[3] Modified from the Pugh Chart developed by the Center for Science Education, Portland State University, *Teaching Science Through Science Inquiry and Engineering Design* course, September 2015.