FLINT REGIONAL SCIENCE & ENGINEERING FAIR

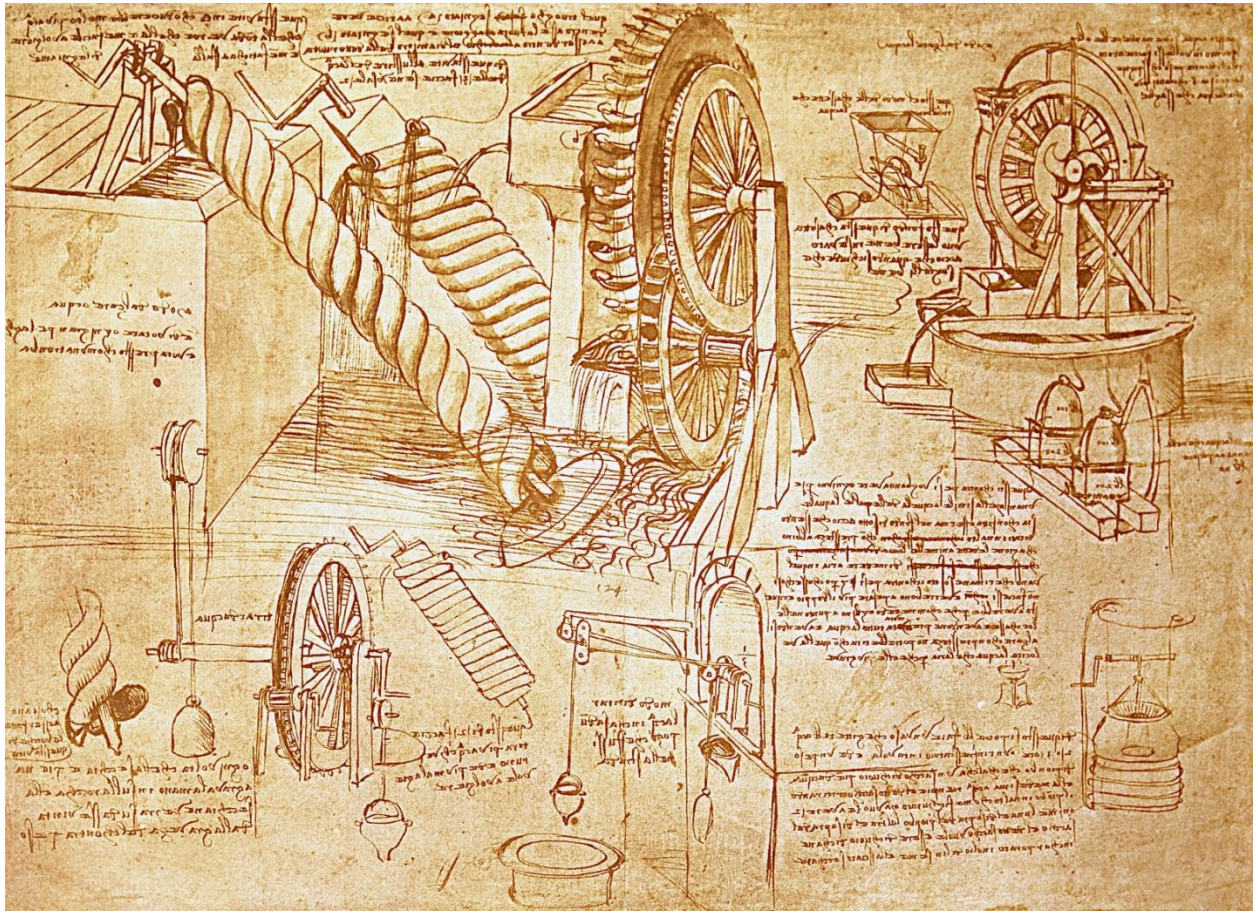
Quest for Discovery Series

Flint Regional Science & Engineering Fair

Inspiration, Invention, Innovation

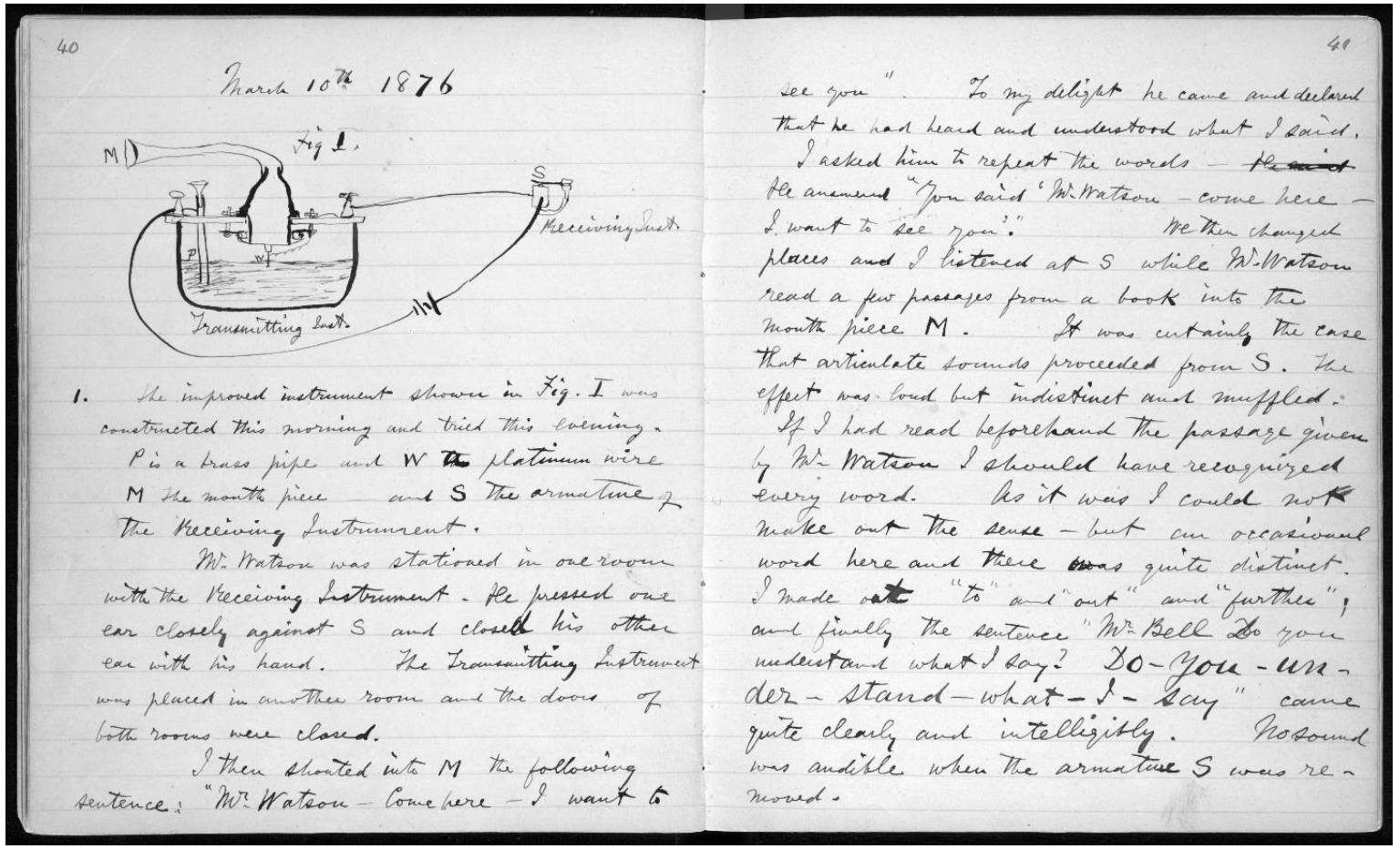
Topic 2:
The Invention Process & Log-Books

Log-Book Entries – What do you notice?



A 1503 page from **Leonardo da Vinci's** log-books depicts his work on water wheels and Archimedes pumps.

Log-Book Entries – What do you notice?



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March 10th 1876

Fig 1.

1. The improved instrument shown in Fig. I was constructed this morning and tried this evening. P is a brass pipe and W the platinum wire M the mouth piece — and S the armature of the Receiving Instrument.

Mr. Watson was stationed in one room with the Receiving Instrument - He pressed one ear closely against S and closed his other ear with his hand. The Transmitting Instrument was placed in another room and the doors of both rooms were closed.

I then shouted into M the following sentence: "Mr. Watson — Come here — I want to

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see you". To my delight he came and declared that he had heard and understood what I said.

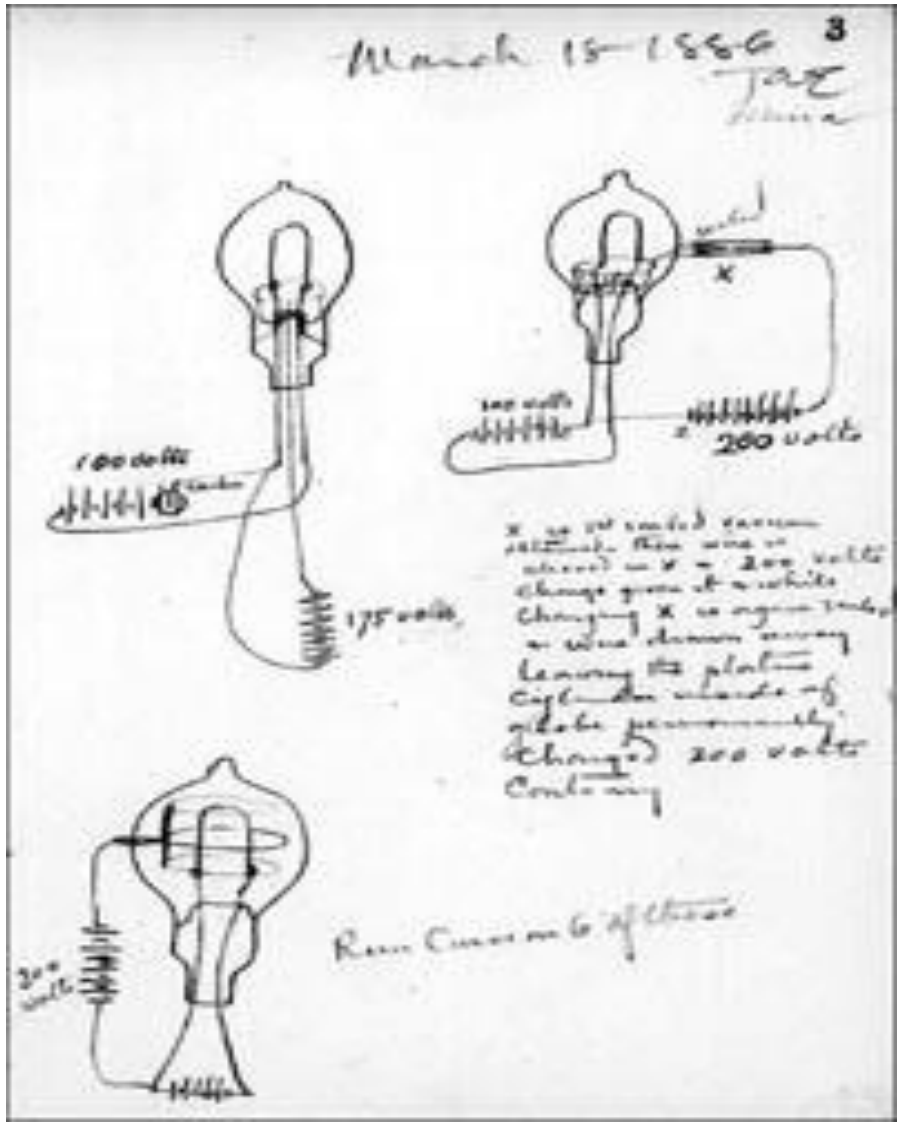
I asked him to repeat the words — He said He answered "You said 'Mr. Watson — come here — I want to see you'."

We then changed places and I listened at S while Mr. Watson read a few passages from a book into the mouth piece M. It was certainly the case that articulate sounds proceeded from S. The effect was loud but indistinct and muffled.

If I had read beforehand the passage given by Mr. Watson I should have recognized every word. As it was I could not make out the sense — but an occasional word here and there was quite distinct. I made out "to" and "out" and "further", and finally the sentence "Mr. Bell Do you understand what I say? Do-you-understand-what-I-say" came quite clearly and intelligibly. No sound was audible when the armature S was removed.

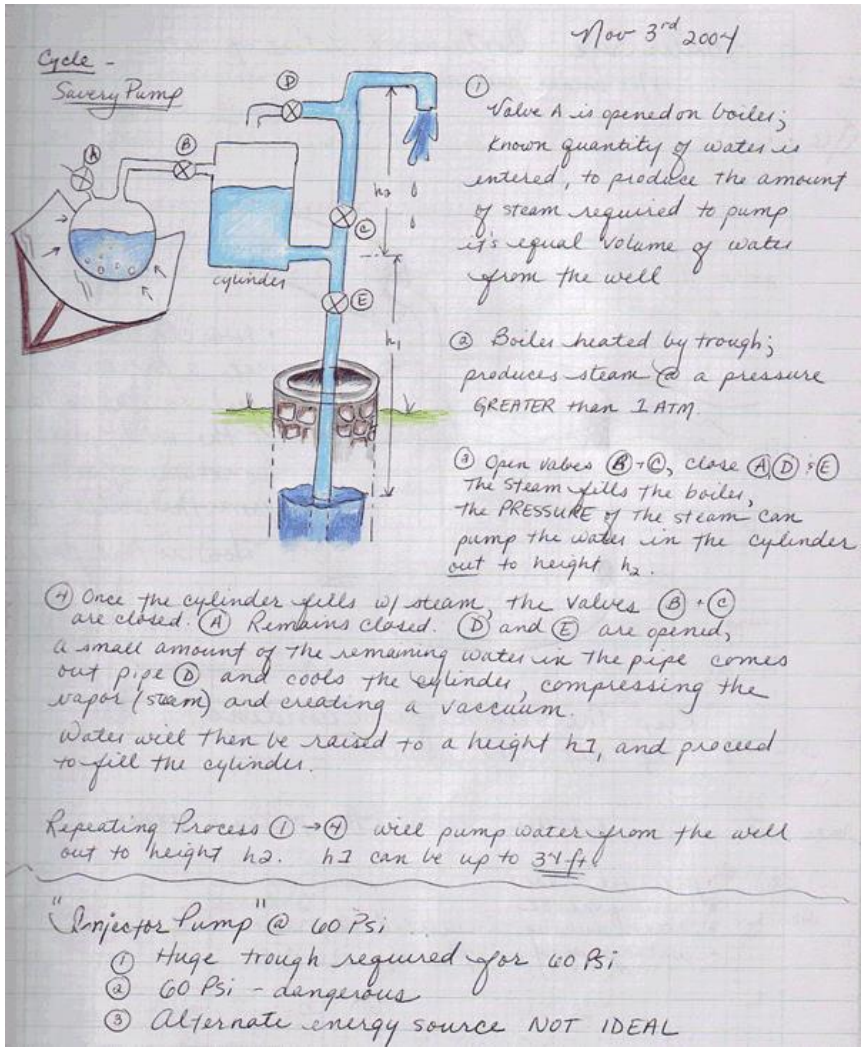
An entry from the log-books of Alexander Graham Bell.

Log-Book Entries – What do you notice?



An entry in **Thomas Edison's** log-book, the incandescent lightbulb.

More Log-Book Entries - What do you notice?



Nov 3rd 2004

Cycle - Savery Pump

① Valve A is opened on boiler; known quantity of water is entered, to produce the amount of steam required to pump it's equal volume of water from the well

② Boiler heated by trough; produces steam @ a pressure GREATER than 1 ATM.

③ Open valves (B)+(C), close (A)(D)&(E) The steam fills the boiler, the PRESSURE of the steam can pump the water in the cylinder out to height h_2.

④ Once the cylinder fills w/ steam, the valves (B)+(C) are closed. (A) Remains closed. (D) and (E) are opened, a small amount of the remaining water in the pipe comes out pipe (D) and cools the cylinder, compressing the vapor (steam) and creating a vaccuum. Water will then be raised to a height h_1, and proceed to fill the cylinder.

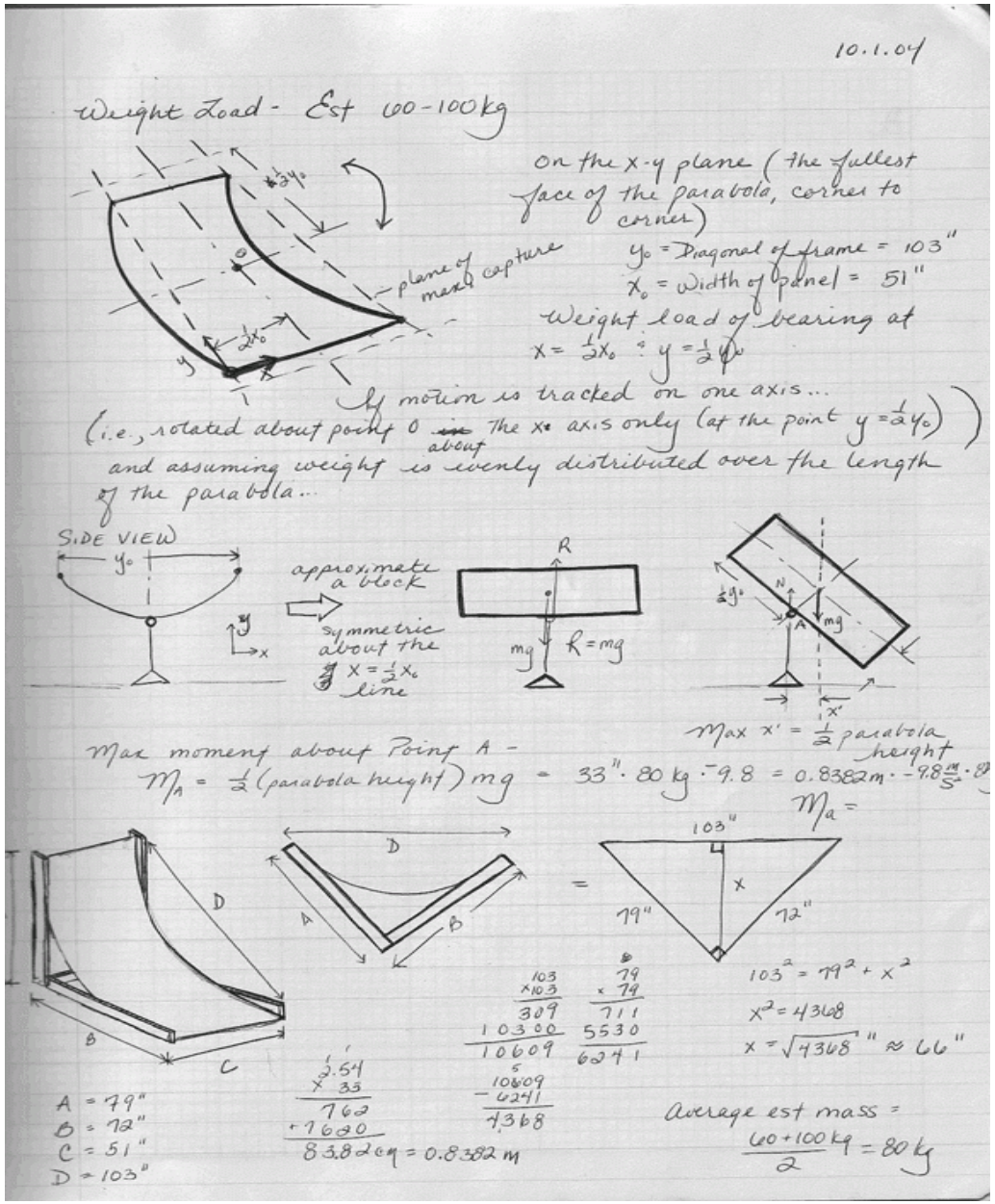
Repeating Process ①→④ will pump water from the well out to height h_2. h_1 can be up to 34 ft!

"Injector Pump" @ 60 Psi

① Huge trough required for 60 Psi
② 60 Psi - dangerous
③ Alternate energy source NOT IDEAL

College student research

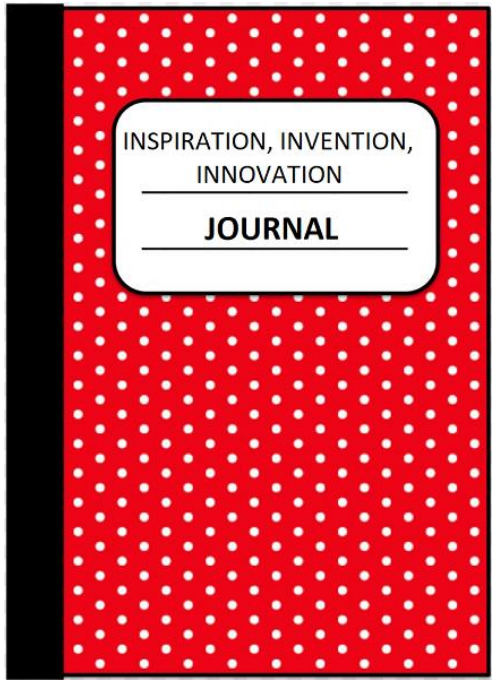
More Log-Book Entries - What do you notice?



College student research

What is a Log-Book?

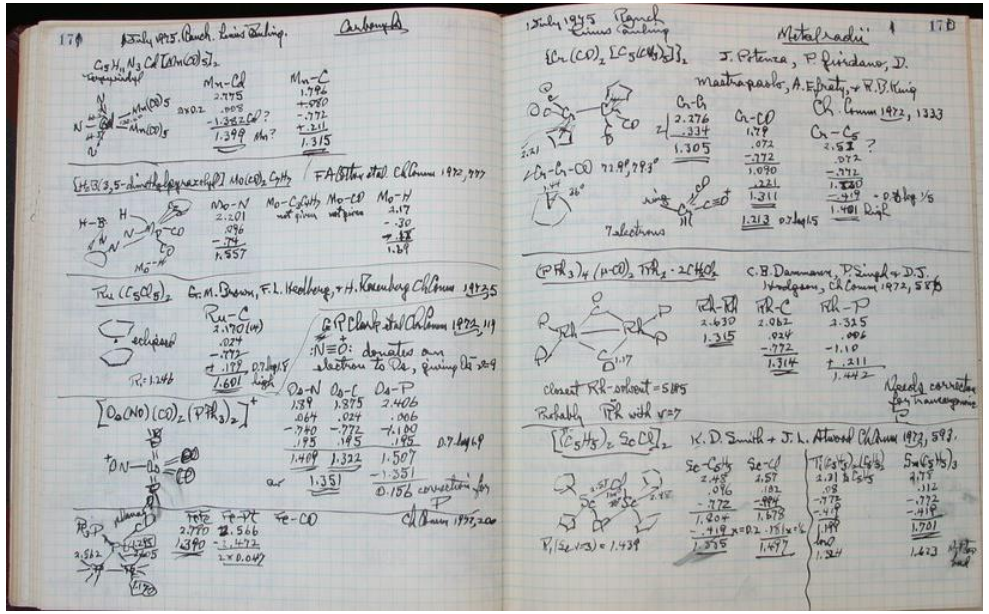
- A log-book is a place to keep a history of your project from start to finish.
- It is a place to record your:
    - research progress
    - observations
    - ideas
    - drawings
    - comments
    - questions
- At the end of your project, someone reviewing your log-book should be able to understand fully how you got to your solution.



Edited from: https://www.sciencebuddies.org/science-fair-projects/engineering-design-process/engineering-design-log-book#designlog-bookfaq

Log-Book – The Basics

1. **Label your Log-Book.**
   Put your name, and some form of contact information, like an email address or phone number, in a prominent location, like the inside cover. Also, label the log-book with the project title and the year.



An entry in **Linus Pauling's** (great chemist) log-book

2. **Use ink.**
   Make your log-book entries in pen, not in pencil. If you make a mistake in your log-book, simply *cross out* the error and write in the necessary correction.

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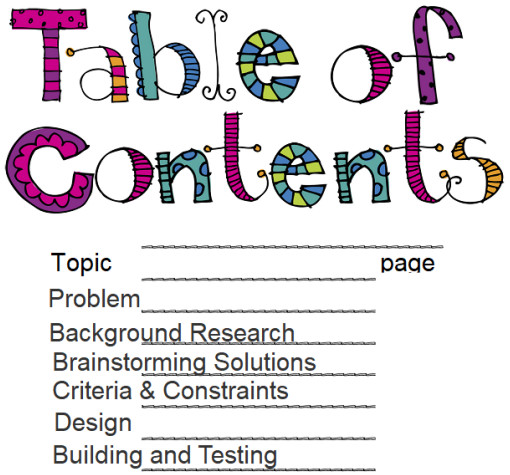
Log-Book – The Basics



3. Create a table of contents. Label the first page in your log-book "Table of Contents," and then as you work on the project, enter important pages in the Table of Contents.

OR

Create tabs. This *optional* approach may help you keep your notes and records organized.

Use the topics:

1. Problems
2. Background Research
3. Brainstorming Solutions
4. Criteria & Constraints
5. Design
6. Building and Testing

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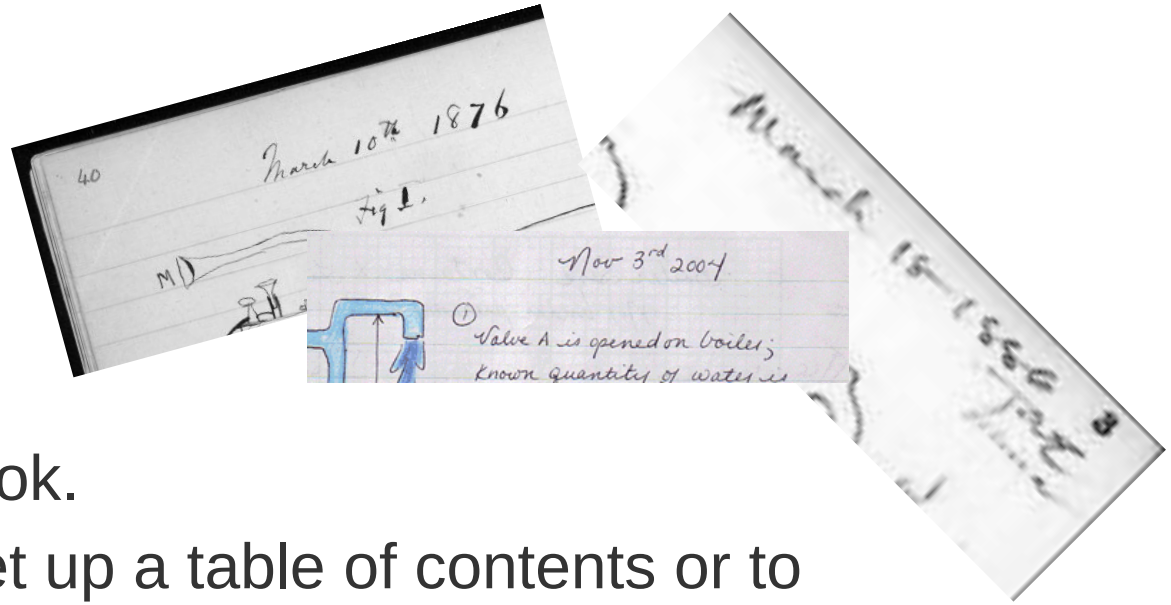
Log-Book – The Basics



4. **Number the pages.**
   Number the pages in your log-book.
   You can use these numbers to set up a table of contents or to cross-reference earlier observations within your log-book.

5. **Date your entries.**
   Always date your log-book entries. Even if your entry is very short, adding a date helps you track *when* you took certain steps or made certain observations. Your log-book will be a *sequential* record of your project, so the dates are important.

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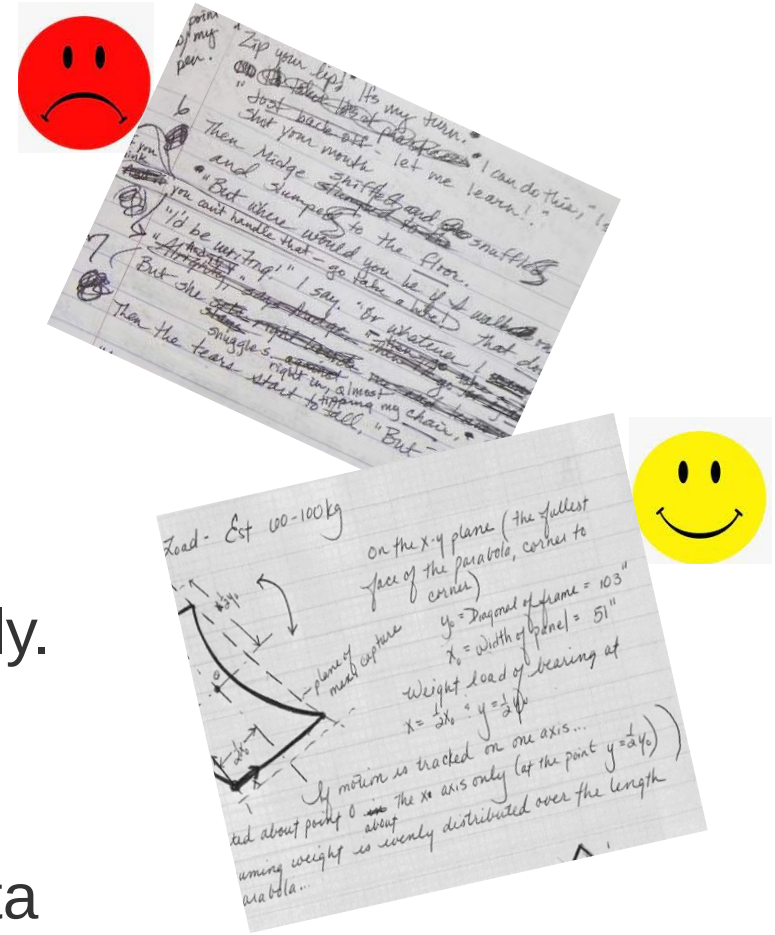
Log-Book – The Basics



6. Keep it legible.

- Your log-book entries should be easy to read, but do not worry if the entries are not perfectly neat or if you make a mistake.

7. No blank pages.

- Your log-book entries should be entered consecutively.
- When making entries, *do not skip pages*.
- Cross out unused sections of a page so that nothing can be added later that might alter or confuse the data originally recorded.

8. Do not remove pages. If something is wrong on a page, or if you discover an accidental blank page, simply put a large "x" through the area or page, signaling that it should be ignored. Do not tear pages out.

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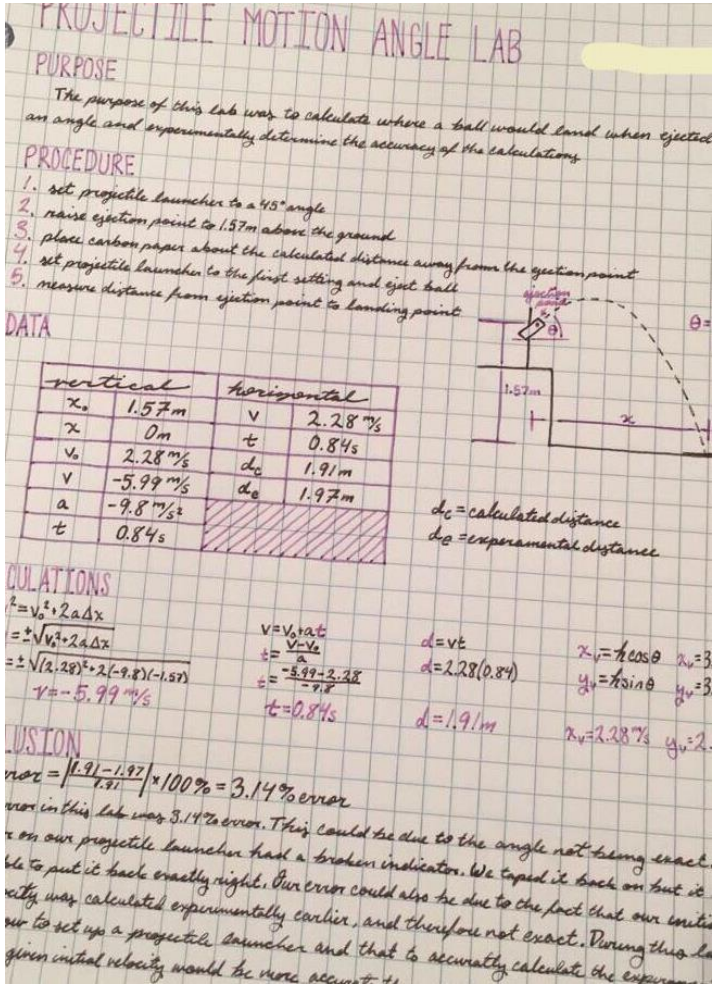
Log-Book – The Basics

9. Be brief.

- While some entries in your log-book may require in-depth notes, many of your entries will be *short and concise*. Full sentences are not required!
- Record enough information so that you fully understand the notes you've made and so that the notes contain all important or necessary details.
- Looking back at an entry, even months later, it should be clear to you *exactly* what you did on that day.
- *It should also be clear to your teacher or another scientist or engineer!*


PROJECTILE MOTION ANGLE LAB

PURPOSE

The purpose of this lab was to calculate where a ball would land when ejected at an angle and experimentally determine the accuracy of the calculations.

PROCEDURE

1. set projectile launcher to a 45° angle
2. raise ejection point to 1.57m above the ground
3. place carbon paper about the calculated distance away from the ejection point
4. set projectile launcher to the first setting and eject ball
5. measure distance from ejection point to landing point

DATA

vertical		horizontal	
x_0	1.57m	v	2.28 m/s
x	0m	t	0.84s
v_0	2.28 m/s	d_c	1.91m
v	-5.99 m/s	d_e	1.97m
a	-9.8 m/s²		
t	0.84s		

d_c = calculated distance
d_e = experimental distance

CULATIONS

$v^2 = v_0^2 + 2a\Delta x$

$= \pm\sqrt{v_0^2 + 2a\Delta x}$

$= \pm\sqrt{(2.28)^2 + 2(-9.8)(-1.57)}$

$v = -5.99$ m/s

$v = v_0 + at$

$t = \frac{v - v_0}{a}$

$t = \frac{-5.99 + 2.28}{-9.8}$

$t = 0.84$s

$d = vt$

$d = 2.28(0.84)$

$d = 1.91$m

$x_v = r\cos\theta$ $x_v = 3$

$y_v = r\sin\theta$ $y_v = 3$

$x_v = 2.28$ m/s $y_v = 2$

LUSION

$\text{error} = \left|\frac{1.91 - 1.97}{1.97}\right| \times 100\% = 3.14\%$ error

error in this lab was 3.14% error. This could be due to the angle not being exact. on our projectile launcher had a broken indicator. We taped it back on but it le to put it back exactly right. Our error could also be due to the fact that our initi city was calculated experimentally earlier, and therefore not exact. During this la ser to set up a projectile launcher and that to accurately calculate the experim given initial velocity would be more accurate

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Log-Book – The Basics

10. Do it every day.

- Write down the date and then record what you did.
- Get in the habit of starting a new entry as soon as you begin working on your project for the day, even if you are only taking a quick measurement or doing a visual check.
- *Do not take the chance that you will remember all of the details to record at a later date!!!*

Make entering notes about your project in your log-book a routine part of your science project. When it is time to put your final presentation together, you will be glad for the time you spent documenting your project in your log-book! An organized and well-maintained log-book will impress teachers and science fair judges, and if you are asked questions about specific steps of your project, you will have the information at hand!

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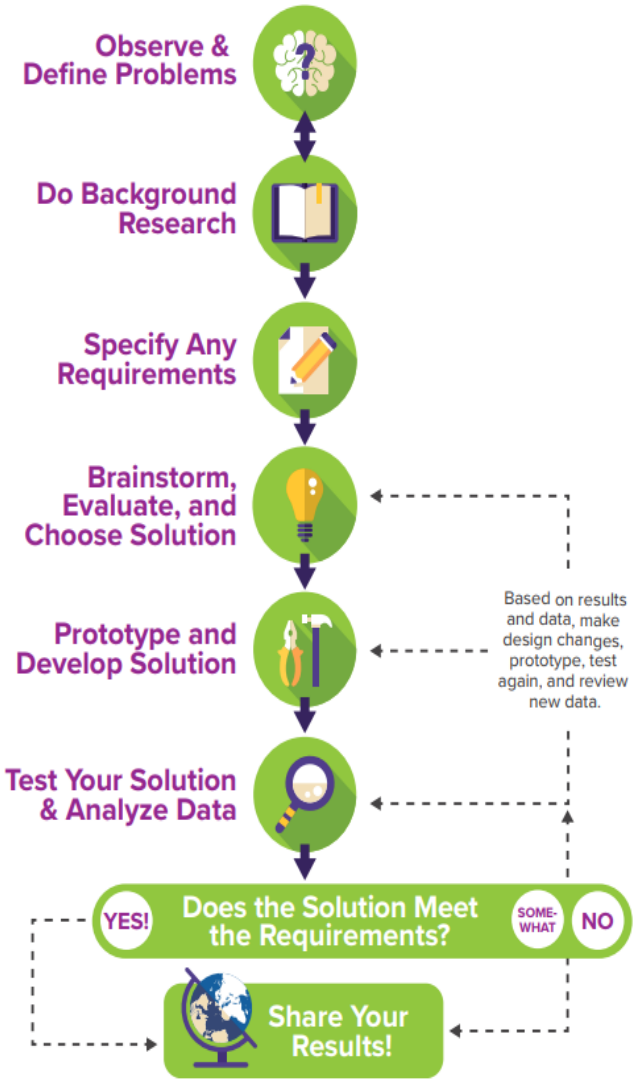
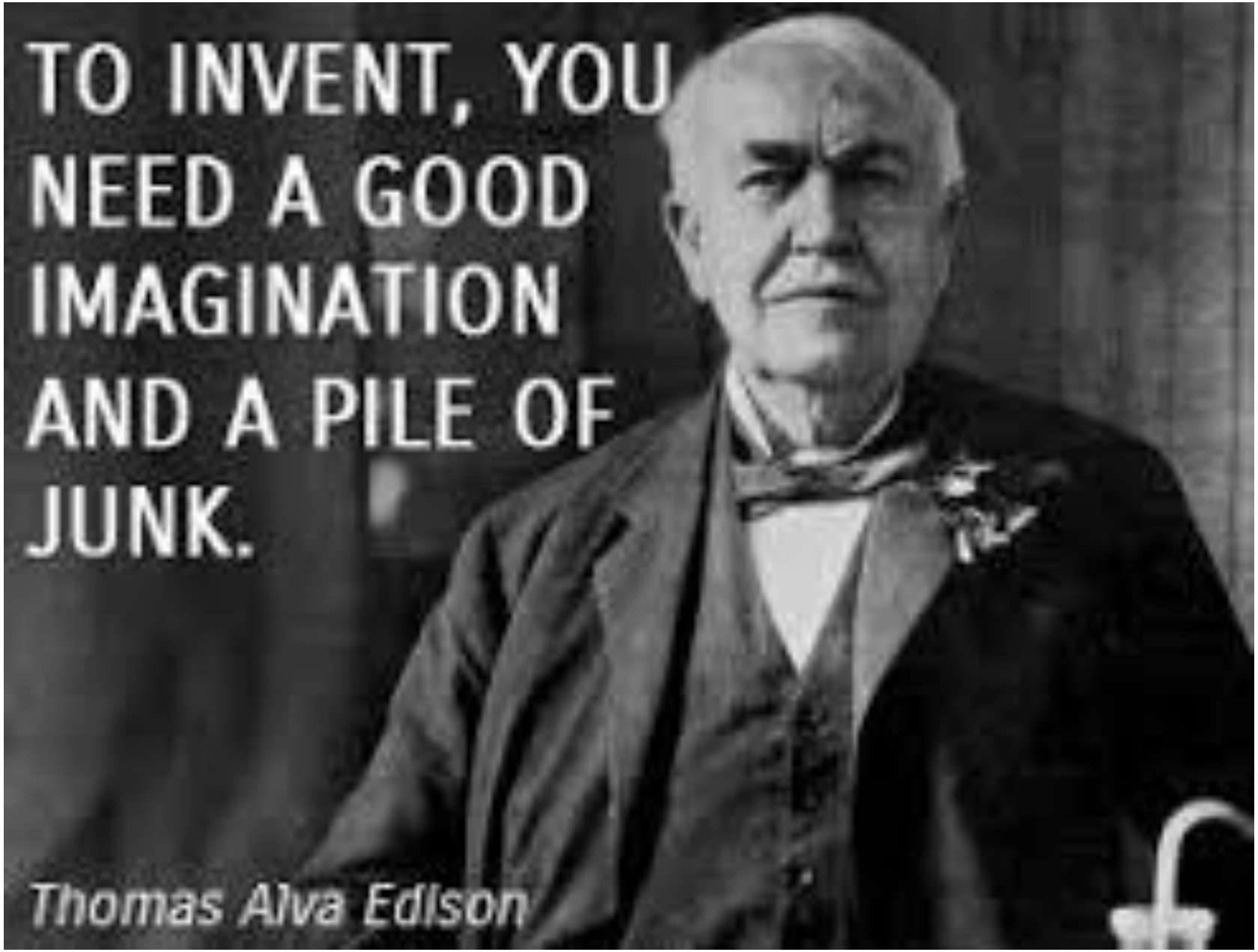
What goes in a Log-Book?

Everything!

- Your log-book should be used from the beginning of your project and should reflect all phases of your project.
- Someone looking at your log-book should be able to follow your steps through the engineering project, from beginning to end.
- Record what you did (in detail) during all the steps of the Invention Process (Engineering Method).




TO INVENT, YOU NEED A GOOD IMAGINATION AND A PILE OF JUNK.
Thomas Alva Edison

Invention Process (Engineering Method)

In this step you:

1. Observe the world around you and look for problems.
2. You may find these problem:
    - At home
    - At school
    - In your community
    - On the news
    - Anyplace

At this point you should be able to:

1. Clearly identify a problem you wish to solve.

Invention Process (Engineering Method)

Do Background Research

In this step you:

1. Gain a better understanding of the problem by:
   - Talking with people affected by it.
   - Reading first person accounts of the problem.
2. Search the Internet for how others have tried to solve this problem.

At this point you should be able to:

1. Clearly state the problem and who are most affected by it.
2. Explain why you chose to solve this problem.

Invention Process (Engineering Method)

In this step you:

1. Explain what you want to accomplish – **criteria** for knowing when you have successfully completed your project?
2. Identify any **constrains** – time, money, equipment, size, location, safety… (and possible ways to overcome them).

At this point you should be able to:

1. Clearly state what a successful project will look like and how it will function.

Invention Process (Engineering Method)

In this step you:

1. Brainstorm ideas for solving the problem. No ideas, no matter how silly, should be thrown out.
2. Look at all the ideas for a solution to decide on those that hold promises.
3. Choose the solution to most likely be successful. A few ideas may be combined.

At this point you should be able to:

1. Clearly state what you will build to solve your problem..

Invention Process (Engineering Method)

Prototype and Develop Solution

Part 1 - Design

In this step you:

1. Draw a model of your solution.
2. Decide the materials you will need and how you will obtain them.
3. Decide if you have all the skills needed to complete the project. If you don't, who can help you?
4. State how your project will work.

At this point you should be able to:

1. Clearly state your plan to complete your project.

Invention Process (Engineering Method)

Prototype and Develop Solution
Part 2 - Build

In this step you:

1. Obtain all the parts, material, and tools you will need.
2. Build your project.
3. Obtain adult help when needed.

At this point you should:

1. Have your 1st prototype built.

Invention Process (Engineering Method)

In this step you:

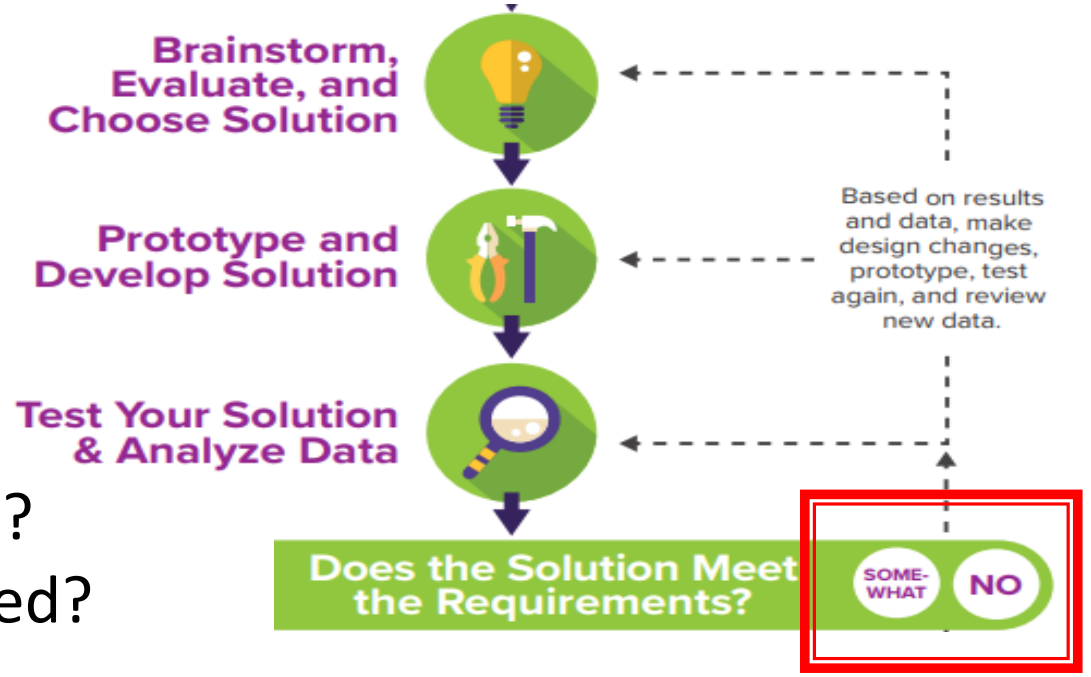
1. Test your protype – use it yourself and have others use it.
2. Get feedback.
   - Is it working as expected?
   - What could be changed to make it work better?

At this point you should:

1. Be able to answer the question, "*Does the Solution Meet the Criteria*?"

   Possible answers are 'Yes', 'No', and 'Somewhat'.

Invention Process (Engineering Method)



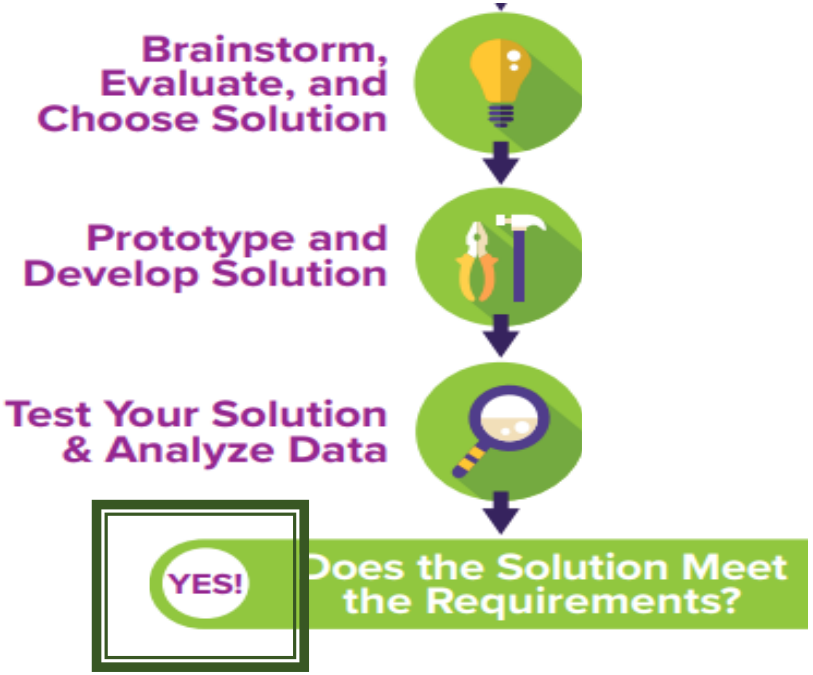
In this step you REFINE:

1. How well does it meet each criteria?
2. Does the criteria need to be modified?
3. Brainstorm new/modified solution
4. Design and build or alter your current design.
5. Test your prototype.
6. Repeat until you can answer 'Yes' to the question "*Does the solution meet the criteria?*"

At this point you should:

1. Have a working prototype.

Invention Process (Engineering Method)



In this step you:

1. Have a working prototype.
2. May do cosmetic touch-ups.
3. Be sure you can clearly explain:
   - your problem – who it affects and how you intend to solve it.
   - your building and testing phase, including all the revisions.
   - how your prototype works and solves the problem.

At this point you should be able to:

1. Clearly describe you project start to finish.

Invention Process (Engineering Method)

In this step you:

1. Name your invention.
2. Create a display board about your project. (Everyone)
3. Plan and create a slide presentation on your project. (Junior and Senior Division only)
4. Practice your presentation.
5. Talk with as many people as you can about your project.
6. Be proud of all you have accomplished!

At this point you should be able to:

1. Present your project.

To Do:

- **Prepare your log-book**:
  - Name, contact information, and year on the cover (add your project title later – when you know what it is)
  - Table of contents (no page numbers yet),
  - Numbering pages (back and front).