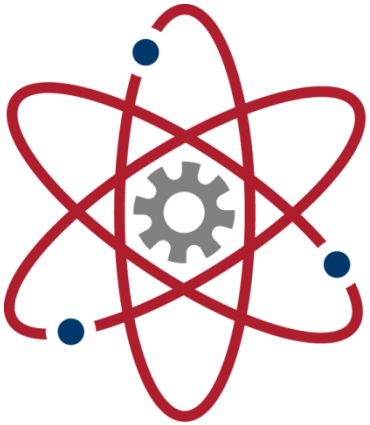


Engineering Notebook

Engineering Notebook

- What Is an Engineering Notebook?
- Why Keep an Engineering Notebook?
- Who Keeps an Engineering Notebook?
- Contents
- Engineering Notebook Sections
- Standard Page Layout
- Best Practices
- Historical Examples

What Is an Engineering Notebook?

An engineering notebook is a book in which an engineer will formally document, in chronological order, all of his/her work that is associated with a specific design project.

- Clear and detailed description of your design process
- Someone unfamiliar with work could take over project without additional information

Why Keep an Engineering Notebook?

An engineering notebook is recognized as a *legal document* that is used in patent activities to…

- Prove the origin of an idea that led to a solution
- Prove when events or ideas occurred
- Prove diligence in turning the idea into a solution
- Prove when an idea became a working solution (“reduced to practice”)

Who Keeps an Engineering Notebook?

Engineers that work on R & D

- Legal documentation of work
- Continuity in projects

Engineering students

- K-12 school and college
- Develop time management skills
- Improve research, documentation, and communication skills
- Basis for professional presentation of work

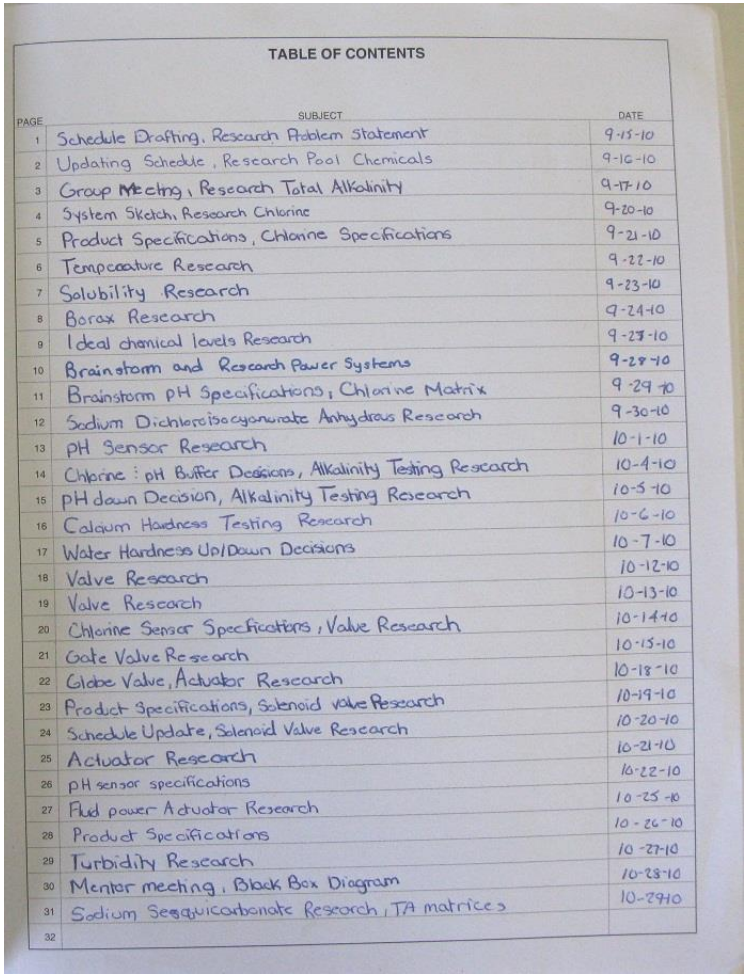
Contents

- Discovering the problem
- Research
- Sketches with labels and descriptions
- Brainstorming
- Calculations
- Your daily thoughts and ideas
- Pictures
- Expert input (names, positions, contact info, details of conversations)
- Work session and meeting summaries
- Test procedures, results, and conclusions
- Digital technical drawings
- Design modifications

Everything you do/think related to a specific design project

Engineering Notebook Sections

- Title Page
- Table of Contents
- General Chronological Entries
- References
- Business/Expert Contacts



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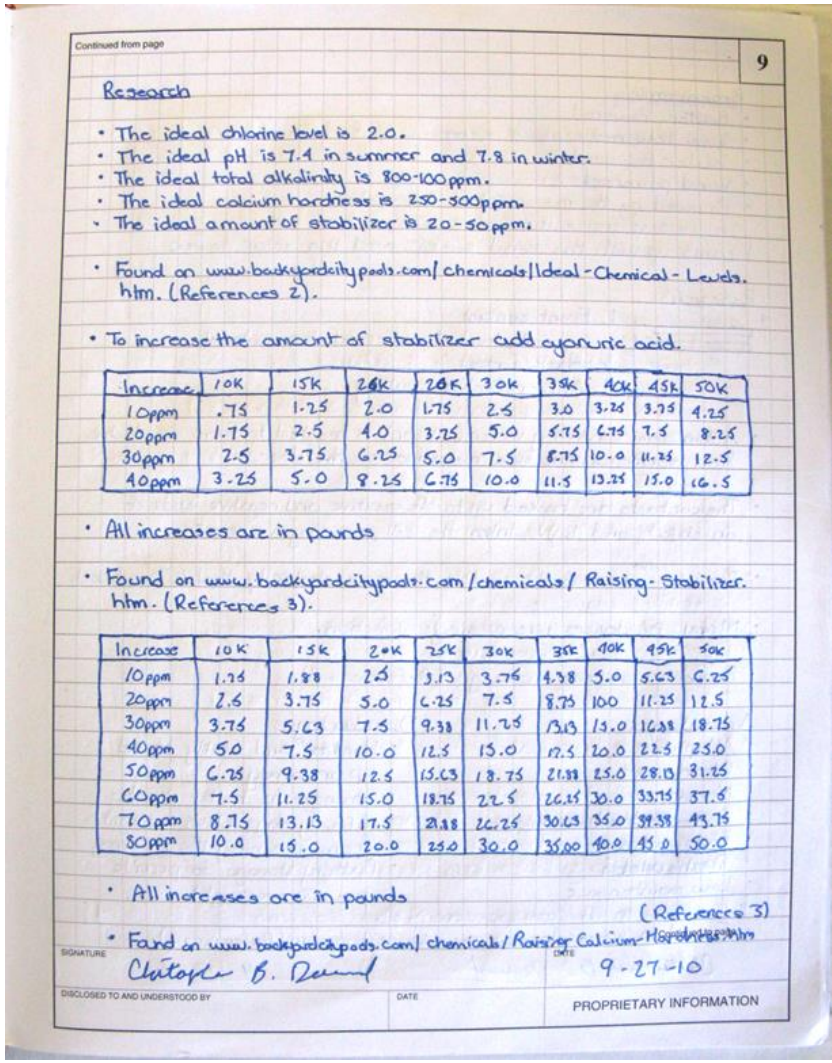
Standard Page Layout

- Quad ruled paper
- All pages are
  - Numbered
  - Dated
  - Signed by the designer
  - Signed by a witness
  - Include a statement of the proprietary nature of notebook



Continued from page

9

Research

- The ideal chlorine level is 2.0.
- The ideal pH is 7.4 in summer and 7.8 in winter.
- The ideal total alkalinity is 800-100ppm.
- The ideal calcium hardness is 250-500ppm.
- The ideal amount of stabilizer is 20-50ppm.

- Found on www.backyardcitypools.com/chemicals/Ideal-Chemical-Levels.htm. (References 2).

- To increase the amount of stabilizer add cyanuric acid.

Increase	10K	15K	20K	25K	30K	35K	40K	45K	50K
10ppm	.75	1.25	2.0	1.75	2.5	3.0	3.25	3.75	4.25
20ppm	1.75	2.5	4.0	3.75	5.0	5.75	6.75	7.5	8.25
30ppm	2.5	3.75	6.25	5.0	7.5	8.75	10.0	11.25	12.5
40ppm	3.25	5.0	8.25	6.75	10.0	11.5	13.25	15.0	16.5

- All increases are in pounds

- Found on www.backyardcitypools.com/chemicals/Raising-Stabilizer.htm. (References 3).

Increase	10K	15K	20K	25K	30K	35K	40K	45K	50K
10ppm	1.75	1.88	2.5	3.13	3.75	4.38	5.0	5.63	6.25
20ppm	2.5	3.75	5.0	6.25	7.5	8.75	10.0	11.25	12.5
30ppm	3.75	5.63	7.5	9.38	11.25	13.13	15.0	16.88	18.75
40ppm	5.0	7.5	10.0	12.5	15.0	17.5	20.0	22.5	25.0
50ppm	6.25	9.38	12.5	15.63	18.75	21.88	25.0	28.13	31.25
60ppm	7.5	11.25	15.0	18.75	22.5	26.25	30.0	33.75	37.5
70ppm	8.75	13.13	17.5	21.88	26.25	30.63	35.0	39.38	43.75
80ppm	10.0	15.0	20.0	25.0	30.0	35.00	40.0	45.0	50.0

- All increases are in pounds

(References 3)

- Found on www.backyardcitypools.com/chemicals/Raising Calcium-Hardness.htm

SIGNATURE Christopher B. Dennard

DATE 9-27-10

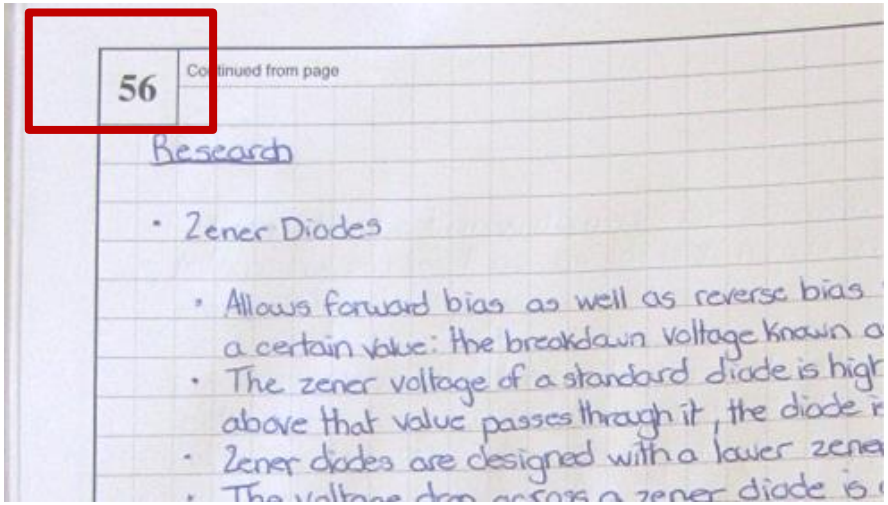
DISCLOSED TO AND UNDERSTOOD BY

DATE

PROPRIETARY INFORMATION

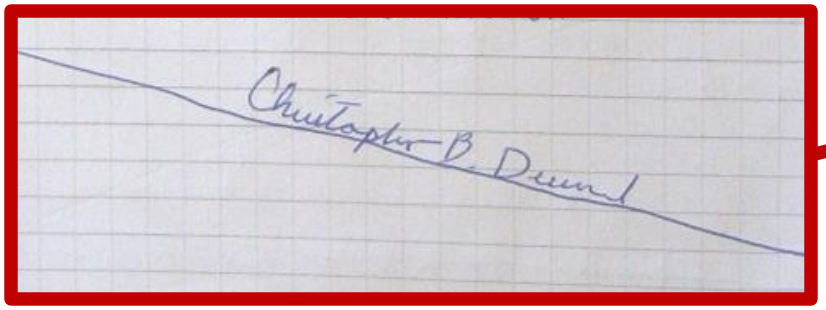
Best Practices

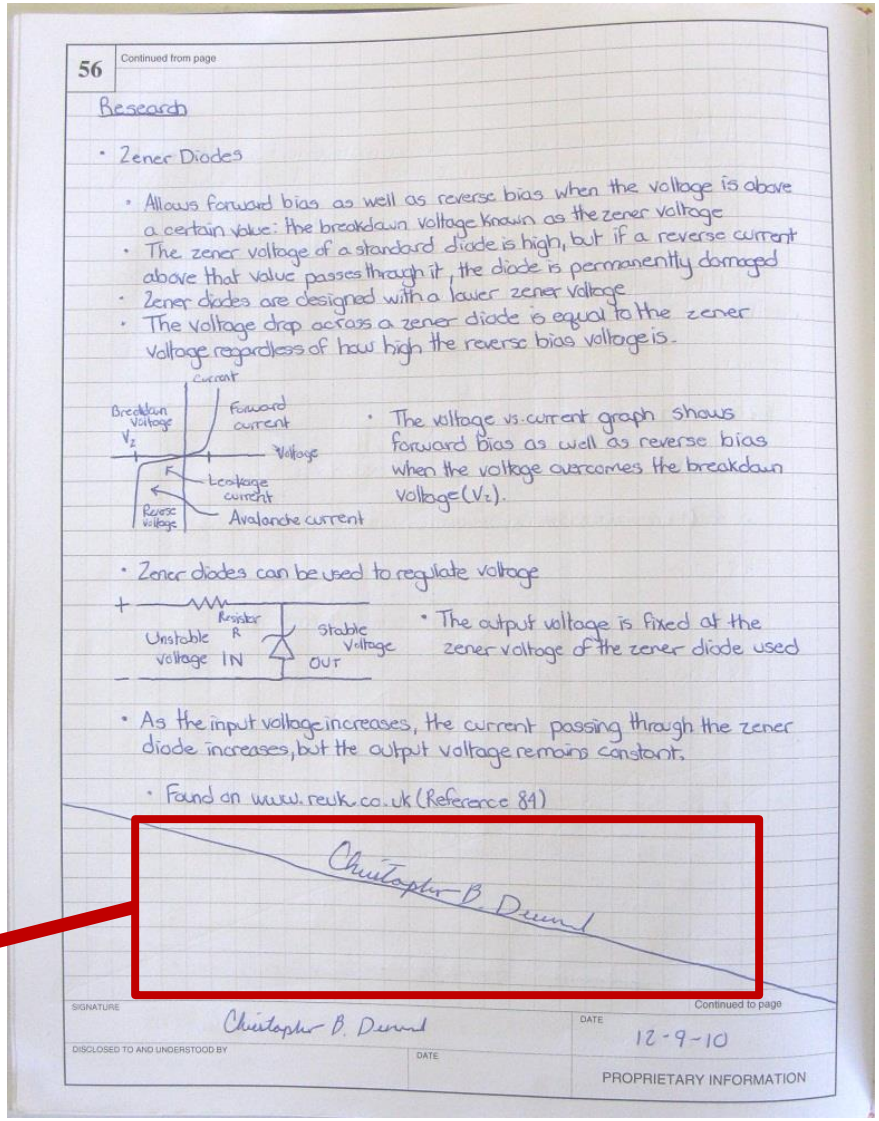
- All work is in pen.
- Markers that bleed through the paper are not used.
- Pages are sequentially numbered in ink on the top outside edge.
- Notebooks are bound.
  - Cannot add pages
  - Cannot remove pages



Best Practices

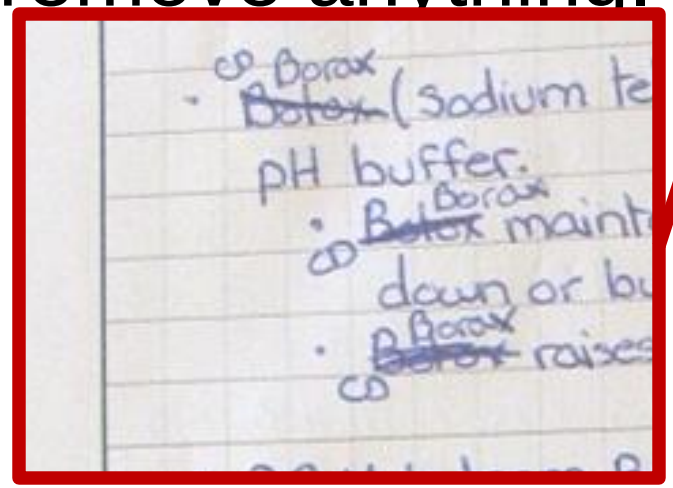
- Entries begin at the top of the page, working left-to-right and top-to-bottom
- Do not leave blank space. If there is extra space, draw an

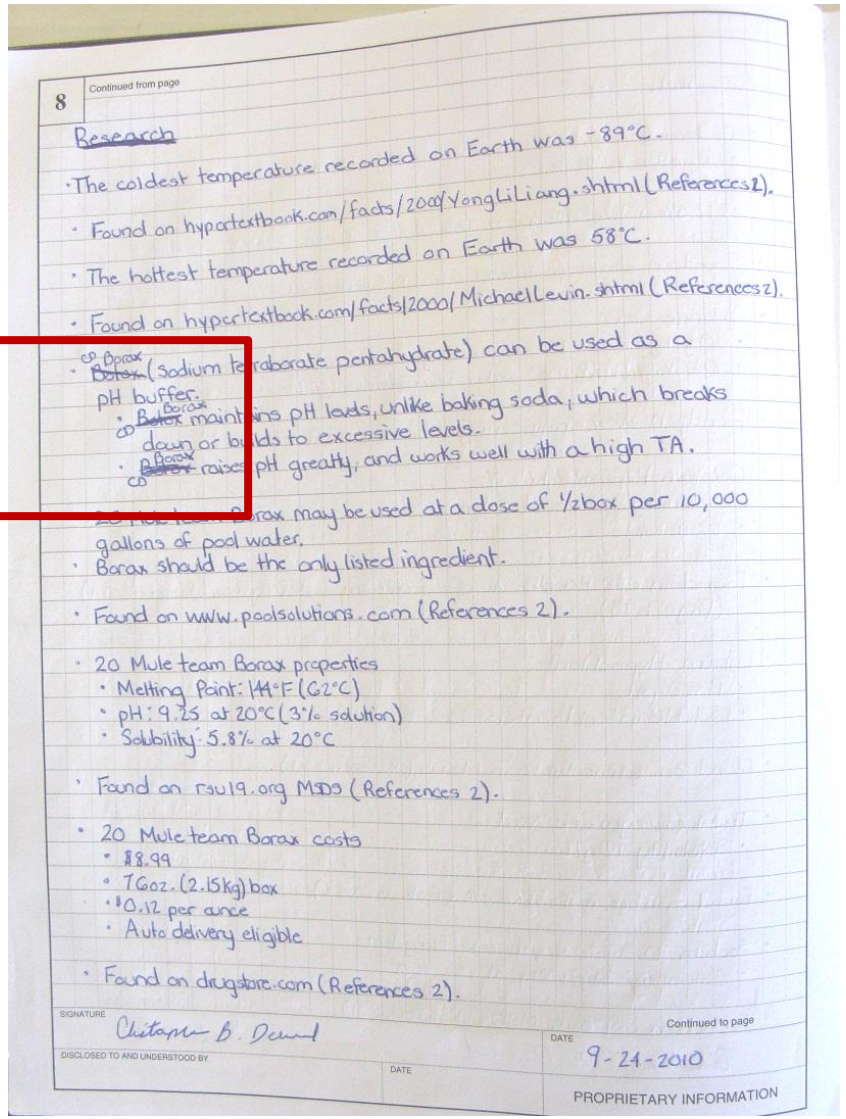




Best Practices

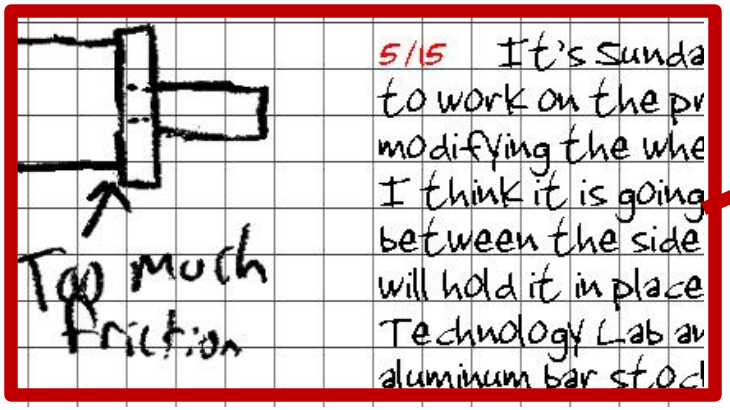
- If you make a mistake, draw a line through it, enter the correct information, and initial the change.
- Never erase or remove anything.

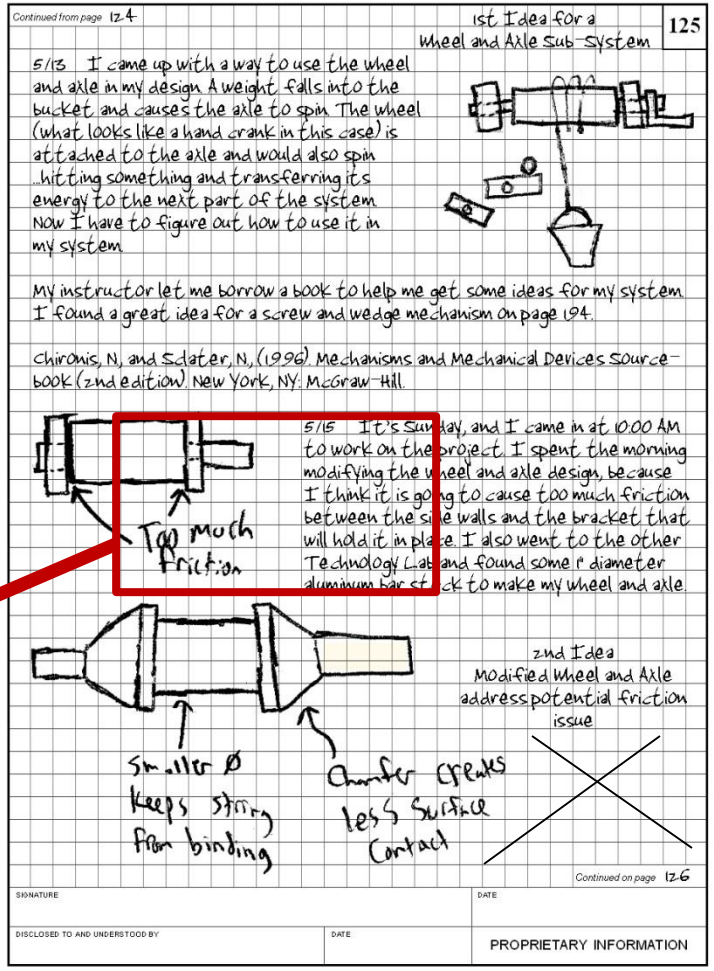




Best Practices

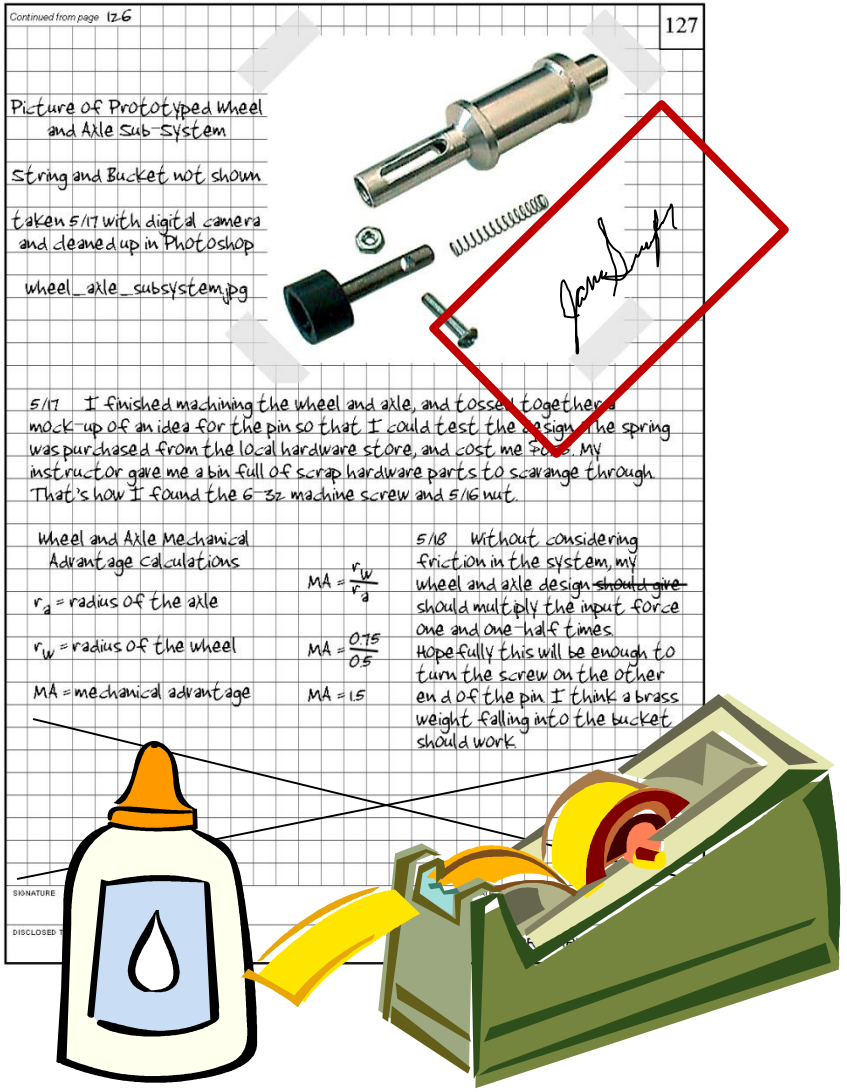
- Date each entry





Best Practices

- Inserted items are permanently attached
  - Glue is preferred
  - No loose leaf items
- Sign your name so that it extends across both the notebook page and the inserted document.



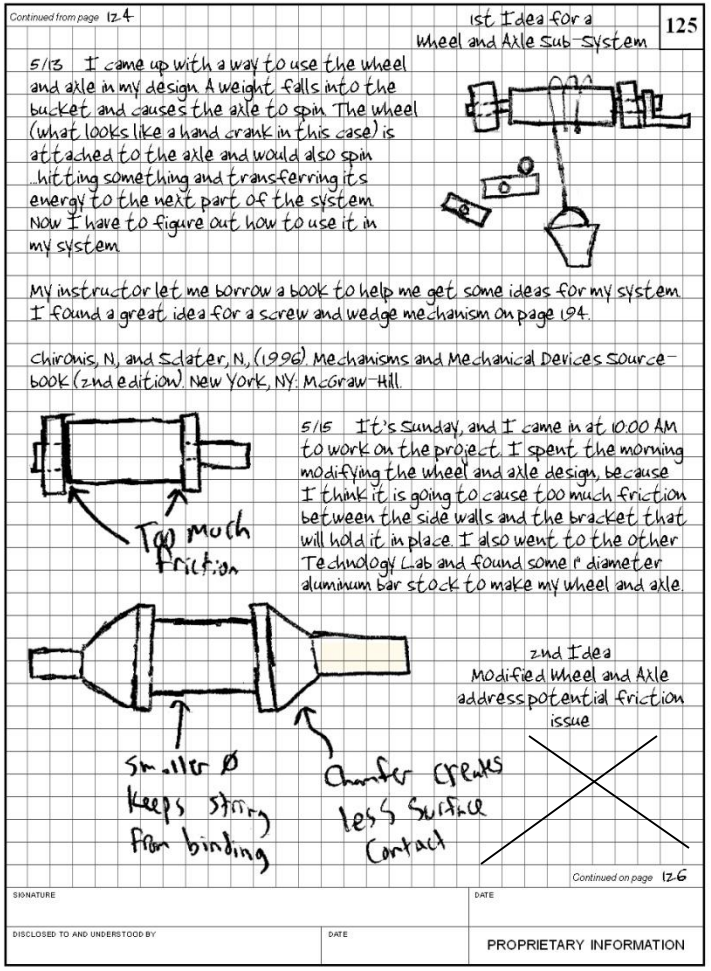
Best Practices

- Sign and date each page before the next page is started.
- A colleague or mentor should corroborate the events and facts on each page and sign as a witness.

- Store the notebook in a safe location.

Best Practices

- Sketches
  - Label all parts of the sketch
  - Describe each sketch



Best Practices

- Calculations and figures are clearly labeled.

Picture of Prototyped Wheel and Axle Sub-System

Wheel and Axle Mechanical Advantage Calculations

r_a = radius of the axle

r_w = radius of the wheel

MA = mechanical advantage

$MA = \frac{r_w}{r_a}$

$MA = \frac{0.75}{0.5}$

$MA = 1.5$

Picture of Prototyped Wheel and Axle Sub-System

String and bucket not shown

taken 5/17 with digital camera and cleaned up in Photoshop

wheel_axle_subsystem.jpg

5/17 I finished machining the wheel and axle, and tossed together a mock-up of an idea for the pin so that I could test the design. The spring was purchased from the local hardware store, and cost me $0.75. My instructor gave me a bin full of scrap hardware parts to scavange through. That's how I found the 6-32 machine screw and 5/16 nut.

Wheel and Axle Mechanical Advantage Calculations

r_a = radius of the axle

r_w = radius of the wheel

MA = mechanical advantage

$MA = \frac{r_w}{r_a}$

$MA = \frac{0.75}{0.5}$

$MA = 1.5$

5/18 Without considering friction in the system, my wheel and axle design ~~should give~~ should multiply the input force one and one-half times. Hopefully this will be enough to turn the screw on the other end of the pin. I think a brass weight falling into the bucket should work.

Continued on page

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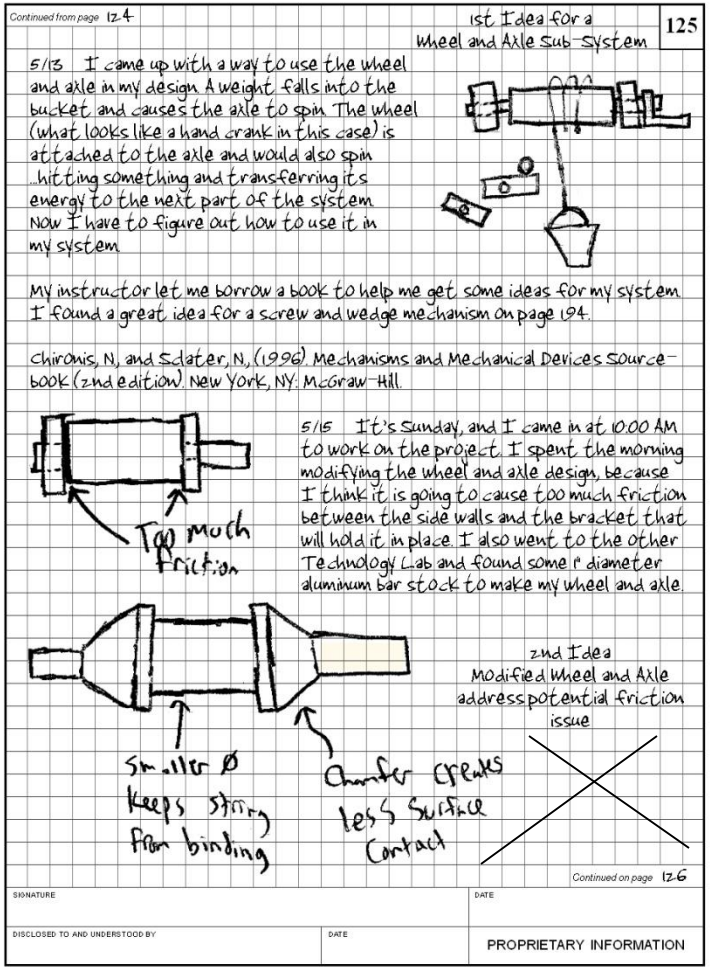
Best Practices

- Progress Entries
  - Reflect on tasks accomplished, successes, and failures
  - Reflect on future needs and tasks to be completed



Best Practices

Be **NEAT**,

be **ACCURATE**,

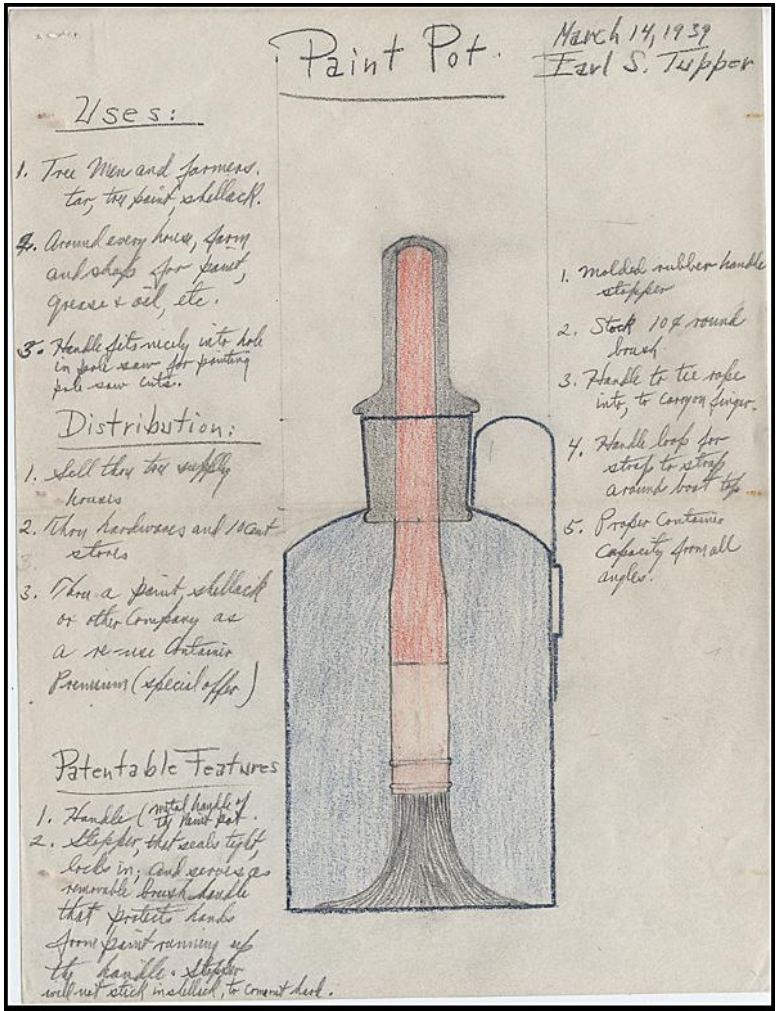
be **LEGIBLE**,

and be **THOROUGH**.

Historical Example

- Page from Earl Silas Tupper's (1907 - 1983) "Invention Diary and Sketchbook"

- Mr. Tupper developed a wide range of inventions, including Tupperware

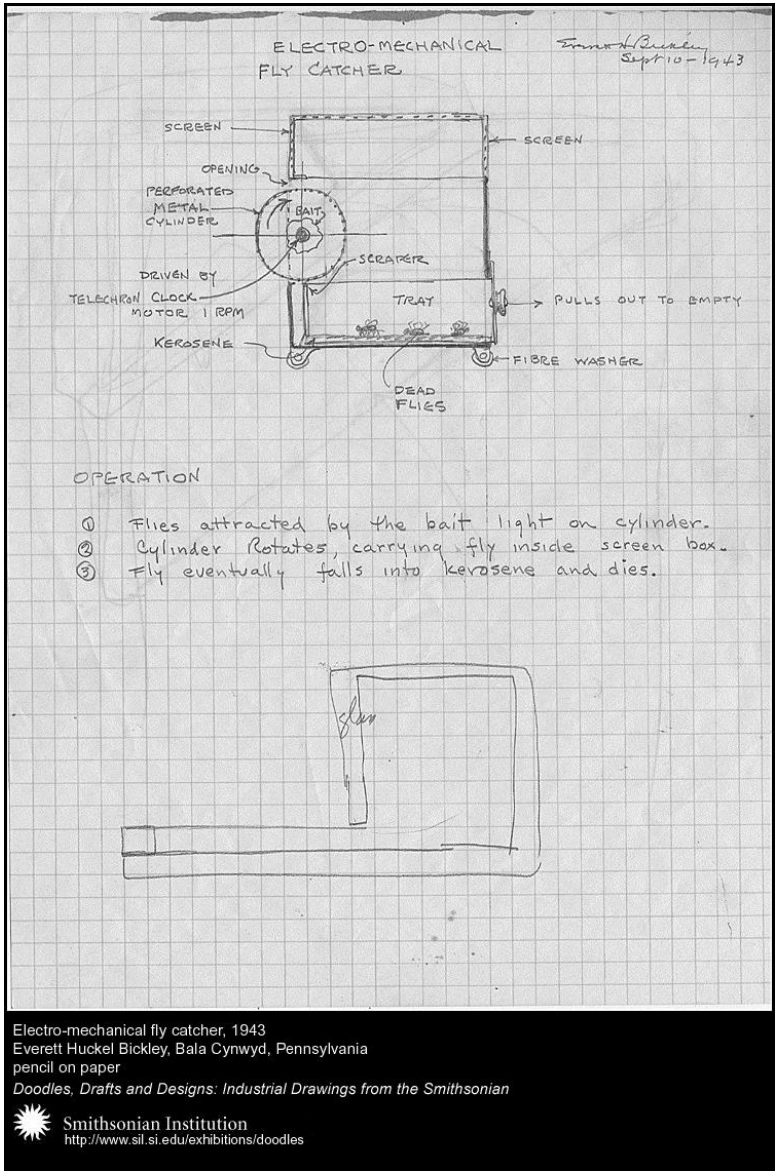


Courtesy of Smithsonian Institute: http://sil.si.exhibitions\doodles

Historical Example

- Everett Huckel Bickley (1888-1972) original design notes, for an electro-mechanical fly catcher, 1943

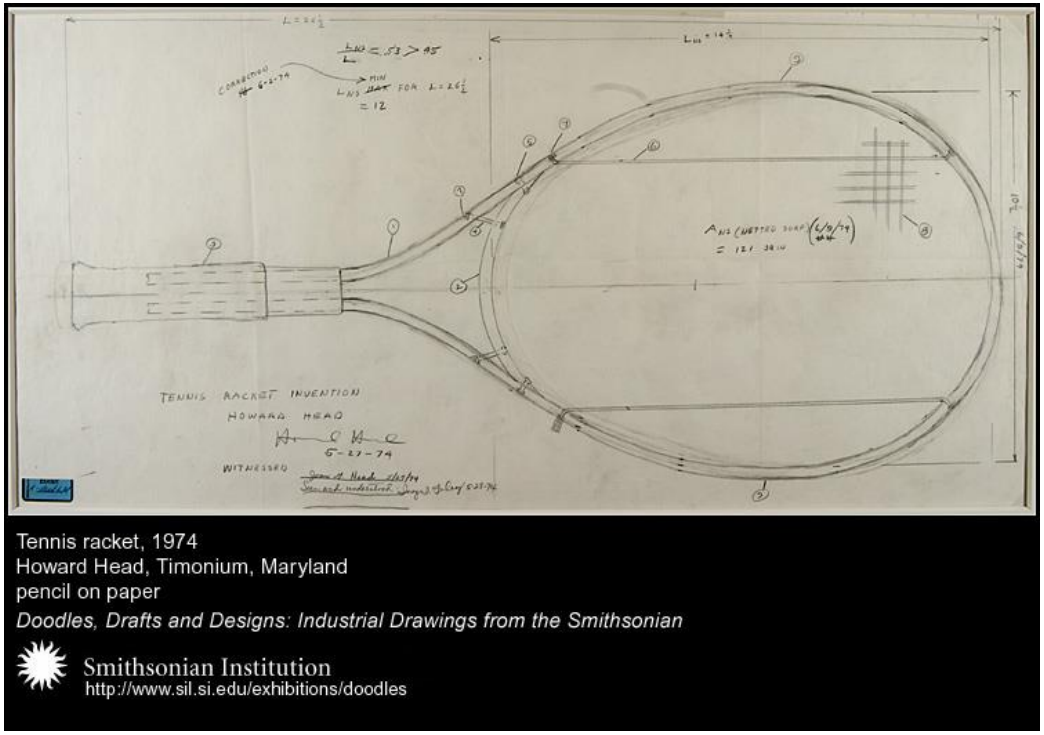
- Mr. Bickley developed dozens of inventions. His most lucrative invention was a bean-sorting machine that separated good beans from bad.



Courtesy of Smithsonian Institute: http://sil.si.exhibitions\doodles

Historical Example

- Howard Head (1914 – 1991) original design for an over-sized tennis racket, 1974
- The larger racket more than doubled the sweet spot of the traditional racket



Courtesy of Smithsonian Institute: http://sil.si.exhibitions\doodles

Course Binder

- Differs from the Engineering Notebook
- Used to store *all* course material not included in the Engineering Notebook including
  - Activities
  - Research
  - Reference material
  - Handouts

Engineering Notebook

- What Is an Engineering Notebook?
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- Who Keeps an Engineering Notebook?
- Contents
- Engineering Notebook Sections
- Standard Page Layout
- Best Practices
- Historical Examples

Reference

Tupper, E. S. (1939). *Invention diary and sketchbook*. Retrieved from Smithsonian Institute website:

http://www.sil.si.edu/exhibitions/doodles

Bickley, E. H. (1943). *Design notes*. Retrieved from Smithsonian Institute website: http://www.sil.si.edu/exhibitions/doodles

Head, H. (1974). *Design drawing*. Retrieved from Smithsonian Institute website: http://www.sil.si.edu/exhibitions/doodles