

Mech 309 Lab Report Writing Workshop

Your writing course (English 101 etc) says...

- Attributes of a good report include
 1. Rhetorical knowledge
 2. Organization
 3. Evidence
 4. Critical thinking
 5. Knowledge of Convention
 6. Holistic

They are the same in the Engineering courses!

→ Let us figure out what each mean in Mech 309 lab reports

Rhetorical knowledge



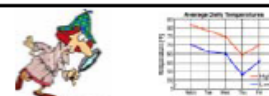
- The writer analyzes the **context (engineering)** and **audience (engineers)** and uses that analysis to comprehend and/or create the report.
- Common mistakes: 1) not clear about the purpose of the lab report; 2) writing "I" or "we" too often; 3) failure to provide background/theory in terms of engineering knowledge; 4) show feeling like "this lab is unsuccessful", "data makes sense", etc.
- Tips for improvement: Read engineering literacies, which are written by engineers. Good examples are engineering research papers from technical journals or conferences.

Organization



- The writer provides a **purposeful structure** that clearly articulates the experiment's purpose.
- Report structure is as consistent as what you wrote in writing courses: **Intro → Body (Procedure → Results and discussion) → Conclusion**
- Common mistakes: 1) No objective or background information in Intro; 2) lab results in Procedure; 3) no data presentation and/or discussion in Results and discussion; 4) extensive amount of discussion or new discussion in Conclusion, which is a summary of your findings (mostly repeat of your key claims in Results/discussion).
- Tips for improvement: Start early. Design your lab report before writing.

Evidence



- The writer clearly establishes connections between the objective, claims and the evidence in the report. The evidences can be the **experimental results** (data tables and figures) or the knowledge from **outside references**.
- Common mistakes: 1) Pick the sources from inappropriate places such as Wiki, About.com, etc., which anyone can update; 2) Use irrelevant or incomplete tables, figures or illustrations as evidence; 3) Inappropriate presentation of numerical information, such as non-tabular form or wrong figure format.
- Tips for improvement: Spend time to produce your data in the proper format. Spend time to read technical articles outside of the class materials.

Critical thinking



- The writer synthesizes, analyzes, interprets, and evaluates significant and well-chosen information and data in order to provide an **in-depth analysis** consistent with the complexity of the experiment.
- Common mistakes: 1) Not presenting data; 2) Presenting the data without mentioning them – "Let the data do the talking" is a wrong belief; 3) Listing the data without analysis or interpretation; 4) Make claims without relevant evidence, basically relying on gut feeling.
- Tips for improvement: Spend time to review if your write-up has a pattern of "presenting data → making a claim → support the claim using relevant evidence → summarizing the claim (optional)."

Knowledge of convention

- The writer provide a **good-looking report** in terms of style, tone, voice, mechanics, grammar, sentence structures, syntax, and diction appropriate to the engineering lab report.
- Common mistakes: 1) Missing of page number, figure titles, axis titles, legend, table brackets, etc; 2) No quote of references in the text; 3) Wrong citation style; 4) Lack of proofreading: typos, punctuations, formatting, fonts, grammatical mistakes, etc.
- Tips for improvement: Look at some engineering articles to see how professional they are. Be fluent in WORD and EXCEL. Proofread your report before submission.

Top 5 (most frequent) comments by DK

5. **Page number missing.**
4. **Trust your data, your teammate, or the equipment used.** (Not pulling some findings out of the results is due to lack of your study or analysis.)
3. **You only present the data but no analysis.** You need to interpret the data to pull your findings. (Obtaining the data is often what technicians do. Engineers conduct analysis to interpret the data – "what those numbers mean?")
2. **No objective statement in Intro. Your objective statement can be more specific.** (Establishment of clear objective is very important to inform readers what you try to do in the report.)
1. **Any evidence to support your claim?** (Without strong evidences, no one trust your claims)

Mock Lab Report Writing Practice

Lab report for Lab 3: Strengthening

- Report organization: Intro → Body → Conclusion

1. Writing “Introduction” – So What? In

1-1. Set up your objective.

Action A: Critically review the following objective statements to show good and bad things.

- The objective of the lab is to study mechanical properties of aluminum alloys including Al6061-T0, Al6061-T6, and Al7075-T6.
- This lab aims to test the ductility of different types of aluminum and steel alloys.
- The purpose of the lab is to conduct tensile testing of steels to investigate the effect of alloying elements on the mechanical properties.

1-2. Write the introduction section.

Action B: Circle what information you want to write in your introduction section.

Synopsis of the lab (what is going on during the lab)	Anything I learned from the lectures	Procedure of the lab (what I did on during the lab)	
Applications of aluminum alloys and/or steels	Definition of each mechanical property (ductility etc)	Effect of alloying elements on yield strength of steels	Relation between hardness and strength of steels
Contents of aluminum alloys and/or steels	How I expect the results	Testing method of tensile test	Summary of the findings from the lab

2. Writing “Body” – Process, Results, and Discussion to Pull your Findings

2-1. Write the procedure section.

A clear outline of what was actually done during the lab. Pictures of experimental setup or workpieces can be included.

2-2. Present your data.

Action C: Circle which of the following that your readers are interested in when reading in the body section.

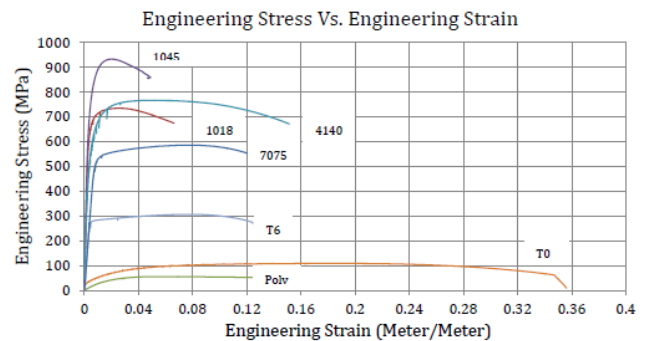
They are interested in my explanation only, not the data.	Sets of data being analyzed by the writer	Your explanations of any data sets presented
Summary of raw data	All of the raw data obtained from the lab experiments	Some raw data sets of writer's interests

2-3. Present entire data sets from the lab.

Raw data need to be presented in a table and/or figure format. Why?

Action D: Why do the readers like to have the data in the forms of table and/or figure?

	Steel Samples			Aluminum Samples		
	1018	1045	4140	6061-T0	6061-T6	7075
Proportional Limit (MPa)	490	515	360	10	255	443
Yield Stress (MPa)	655	775	587	33	278	519
Tensile Strength (MPa)	735	930	765	107	308	585
True Fracture Stress (MPa)	1554	1594	1175	496	449	797
Elongation to Fracture (mm)	2.07	1.75	4.16	9.36	3.59	3.21
Young's Modulus (GPa)	229	249	207	47.4	73.6	73.2
Modulus of Resilience (kJ/m^3)	938	1204	833	11.5	525	1840
Modulus of Toughness (MJ/m^3)	659	853	110	33.3	36.2	69.9



2-4. Conduct data analysis for the results and discussion section.

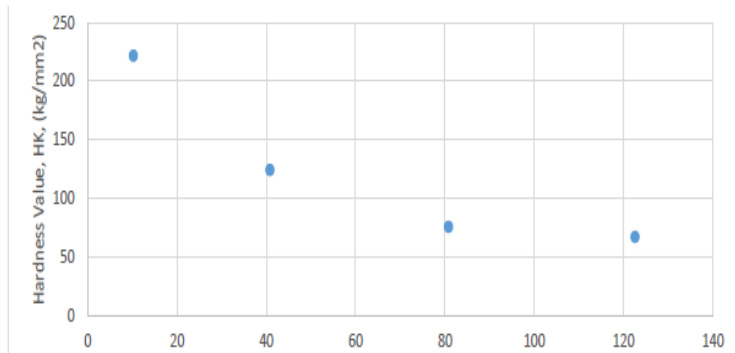
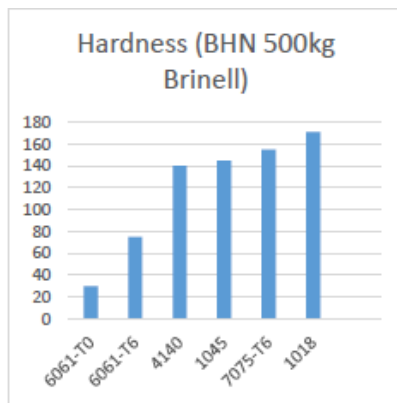
Action E: Circle what you might analyze further if this is your data set.

Why mechanical properties are varied among steel samples?

Why Al 6061-T0 and Al 6061-T6 are so different in terms of tensile testing results?

Effect of alloying elements on yield strength of steels?

Which mechanical properties are highly related to hardness in steels and/or aluminums?



2-5. Write paragraphs in the results and discussion section

Review of what we learned from English 101

Action F: Let us do deep reading. Conduct the following procedure.

1. Read carefully the example paragraph on the next page.
2. Next, read the paragraph aloud, sentence by sentence, rotating readers with each new sentence. As each sentence is read, the one reading aloud will describe what is happening in that sentence. For example, "the writer is offering evidence that supports the paragraph's main point"; or "The writer is developing his or her argument by _____." Keep this reading descriptive.
3. Let us talk about what you like and do not like about this paragraph.

Example paragraph:

Hardness values in BHN are 215.8, 250.2, and 222.0 for 1018, 1045, and 4140 steels, respectively. When considering the carbon contents of these steels, the hardness value increases with increasing carbon contents. As shown in Table 1, 1045 with 0.45 wt% of carbon has the highest hardness value while 1018 containing 0.18 wt% carbon has the lowest. Carbon atoms in steels are located in the interstitial sites of the iron lattice structures imposing lattice strains to restrict dislocation motions (Callister and Rethwisch, 2016).

Action G: Let us write a paragraph based on the data you obtained.

Instruction: Describe your data as they are. → Make a claim, which is your finding. → Support your claim based on the evidences (from the data and/or outside sources) → (Optional) Summarize the finding.

Table 1. Hardness and tensile strength results of three steel coupons (1018, 1045, 4140).

Types of coupon		1018	1045	4140
Approximate carbon wt%		0.18	0.45	0.40
Hardness (BHN)	Average	215.8	250.2	222.0
	Standard deviation	5.8	10.7	4.1
Tensile strength (MPa)		735	930	765

3. Write "Conclusion".

Action H: Critically review the following sentences in conclusion to present good and bad things.

- This lab was overall successful and provided good information.
- When Young's modulus values are compared to the reference values, it is generally found to agree, with the largest difference coming from the Al 6061-T0 sample.
- Taking the average of each of the average hardness values for each sample of Al 6061-T6 results in a hardness value of 49.57 HRB, which is approximately 16.6% lower than the typical hardness value given by the ASM (2015).
- It was observed that the stress and modulus values for any given material have a liner relationship, while the stress and modulus values have an inversely proportional relationship with the ductility.