

For your first lab you and a partner are going to participate in a design challenge to build an 11 inch column(s) to support a given load. Your performance criterion for this challenge is to minimize the weight of the column, i.e., the amount of material used in its construction. On first consideration, it seems that the two structural characteristics of the column that you can change are its perimeter and its wall thickness. To achieve your performance objectives, you will need to optimize the column perimeter to wall thickness ratio. You will then need to turn this knowledge into a structure-property relationship that you can pass on to future students. You will have access to conventional printer paper and tape. There is a 3 trial limit to construct the “best” column, so we encourage discussions with other groups about design options!

IN YOUR LAB NOTEBOOK, you should briefly describe:

All of your design attempts (2-3 sentences plus a diagram) and then answer the following questions:

- What approach and/or principles did you use in design and construction?
 - For example, did you use trial and error? Previous engineering knowledge? Scientific principles? Mathematic equations? Explain.
- What did you learn through your design approach?
- Compare how you approached this problem with the methods that were used by ancient engineers—e.g., those who built the Parthenon—and with more modern engineers—e.g., those who built the Eifel Tower.

Once you have completed your design challenge, take what you and your partner have learned about structure-property relationships and write a brief report. The goal of this letter is to share the process-structure-property relationships you discovered, so that future students can build on the insights you have gained. You can turn in 1 report per group, but the letter must be typed, neat, and no more than half page. Creativity and style count! **Your typed letter and notebook pages will be handed in next lab period.**

Questions to consider/helpful hints:

These questions are to help you begin thinking about structure-property relationships; you are not limited to these questions in your letter/notebook pages.

- **What do we mean by “process” “structure” and “properties”?**
 - **Process** is the steps taken to construct the **structure**, which includes all physical features of the actual thing (from the subatomic level up), which determine its **properties**, or how it behaves.
- **PROCESSING in any materials design and structure construction is crucial**
 - Did you crease/fold the paper? Why or why not?
 - Did you use a single piece vs. multiple? Why or why not?
 - Did you have one axis that didn't have any joints/folds/creases? Why or why not?
 - Did you roll the paper? Narrow or thick? Why?
- **STRUCTURE: What were common features of the strongest supports?**
 - Where did it fail? Why?
 - What do we call these types of “failure points”?
 - Where does structural integrity come from? What changes does the structure undergo during collapse, and how can those changes be prevented?