

Engineering: Prosthetic Hand Prototype Final Project

Step 1: The problem

Your task at the end of our unit:

Design, build, and evaluate, and improve a hand that performs a specific task.

Step 2: Discuss constraints (limitations)

The prototype must:

- Function to complete the selected task.
- Be an original design (you must create your own!) and look like a hand (not perfect representation)
- Your design must be able to attach/insert quickly (5 minutes) to a “wrist”. It should be adjustable to fit a small or large wrist.
- Durable and strong construction--it should be able to do the task repeatedly. Repairs will need to be noted once testing on the prototype has begun or validity of data will be impacted.
- Prototype functions once attached to wrist, without interference from other hand for muscle contractions/motion. Touching the prototype to function in a direct way will result in a lower score.
- All construction will be completed at school and you will have class time to do that. Bring all additional supplies from home. If needed, you may stay after school to complete.

Step 3: Brainstorm and Design

- Engineering Design Log

During this step you need to keep all research, ideas, sketches, brainstorm, problems, solutions & changes, and explain your choices. Some of these could be construction issues and changes. Others should be based on activities and labs done in class. This does not have to be long and detailed for each choice but could be a phrase or sentence. This portion will be compiled together and submitted as part of your project. (This is a messy part of the project and should have lots of editing apparent, like a rough draft in English.)



Step 4: Build

You will build a prototype of your design. Your prototype will need to be sturdy enough to do multiple trials of the task.

Your final design needs to be neatly sketched on white paper with a list of materials or a Bill of Materials completed. This is part of the Engineering Design Log.

Step 5: Construction and modifications during build

Feel free to photo your progress. Make notes of your mini tests during construction in your engineering log. Make notes of modifications made during the build and WHY you made the change.

Step 6: Performance Test

You will need to discuss a performance test that all the members of your team will do. It must be consistent to share and compare data. Each person will conduct 5 trials of their prototype. Required data: range of motion measurements. Other data: of your own choice. Just make sure that it is data that can be used to determine if the design is poor, good or great. You will take a video of your prototype performing your task, which will be used later in a presentation.

Step 7: Evaluate and share with a Google Doc Powerpoint

You will be assigned to a group of 3 students to evaluate your prototypes based on the data from your performance test. You will then redesign and build a new group prototype that incorporate the best parts of all the prototypes. The new prototype must be built in class, and be a part of your presentation. A portion of your grade will be dependent on the prototype's performance of your assigned task, which will be done during the presentation by a group member.

You will need to discuss the following points during the presentation

Your prototype: (each person will share about their own prototype) ~3-4 mins per person

- Picture of actual prototype, as well as the actual prototype
- Include video of task performance
- Describe one key challenge for the prototype to work properly and how you solved the problem.
- Describe one key component of the prototype (not the same one as the challenge) that makes it function
 - a close up photo of the component in the final prototype
 - an explanation to justify the design of the component and description of the motion using anatomical knowledge

**this could be done during the first week of the project and is highly recommended to prevent procrastination

Redesigned prototype: (you will need to share this portion of the presentation with your group) ~5 minutes

- The new and improved prototype (built in class by team members during week 2); Highlight the best parts of each individual's prototypes as seen in the new design.
- Evaluate 2-3 design solutions and why you eliminated them. Use evidence from performance tests to support your choices.
- Include a sketch of the redesigned new prototype and a building supply sheet or a Bill of materials for this new prototype.
- Perform the task with the new prototype to demonstrate successful design.

What is the time frame? What will you turn in? (These are summative grades.)

Due: Friday, January 15 at the end of the period.

1. Your Hand Prototype
2. Engineering Design Log

Monday, January 18:

3. Performance tests. You can continue on Tuesday if needed. Results will be in presentation.

Tuesday January 19- Friday January 22:

4. Evaluate, redesign, build and test; Work on PPT presentations

Due: Monday January 25:

5. Final redesigned group prototype
6. Presentation of individual/group PPT: **due by 6:30am** (I will start downloading projects)

Presentation date: _____

Engineering Design Log for Name _____ per _____

Use this to document the engineering process from start to finished prototype.

Due the day of your prototype.

Page 1: Brainstorming and Research

Write down any ideas that you have about how to complete the challenge successfully. Include sketches and materials you have in mind. Write down questions you have.

Page 2: More Brainstorming and ideas.

Page 3: Class Investigations

After in class activities and investigations, you wrote down what you have learned on our learning chart go back to Stage 1. In a different color, make any changes/additions to your original ideas. Continue to do this as you learn more about collisions. You will tape or glue that the learning chart here to complete this page.

Page 4: Design

Make initial prototype sketch and list materials you will need to make your prototype.

Page 5: Construction and Testing

Construct your design. After each trial, write suggestions to improve your design. Then go back to page 4 and make changes/additions to your design in a different color.

Suggested changes based on testing:

Page 6: Final Redesign and Prototype

Based on your at home tests and design modifications, revise and design your final prototype.

Sketch the final version of your design here with a list of materials.

Or include a Bill of Materials--tape it on this page.

Page 7: Evaluation of design process and prototype performance.

Evaluate your design from page 6 based on the original design in page 1. Why did your improvements to each component work to improve the car's performance. Support your reasoning with evidence from class activities and observations from your at home tests.