



Minor Challenge Set #1

STEM Field: Biomedical Engineering

Level: Intermediate

Challenge Name: Build a Prosthetic Leg

Project Cost: 0-20 USD

Materials Required:

- Ruler, or tape measure, for measuring
- Scissors
- Tape
- Pen and paper
- Prosthetic limb structural material - students can choose their preferred material. Here are some suggestions:
 - For leg structure: cardboard tube, wrapping paper roll, plastic pipes
 - For comfort: large sponges, cardboard, bubble wrap

Safety:

- Some adult supervision is advised with the scissors

Duration:

- This challenge takes approximately 3 hours to finish, however, the time guideline is an estimation only, and students and mentors can complete the tasks around their schedules.

Introduction

A prosthesis is an artificial body part. A prosthetic implant is an artificial device that replaces a missing part of the body. As a biomedical engineer, your task is to design and construct a prosthetic leg.

This is an engineering design project, and so, you have the flexibility to design and construct the prosthetic device as you want. We will then test the prototype by bending a knee and resting it on the prosthesis. Therefore, it is important to take into account the important features required for a good prosthetic leg. For example, strength, durability, shock absorption and comfort.

Here are some examples of prosthetic devices.



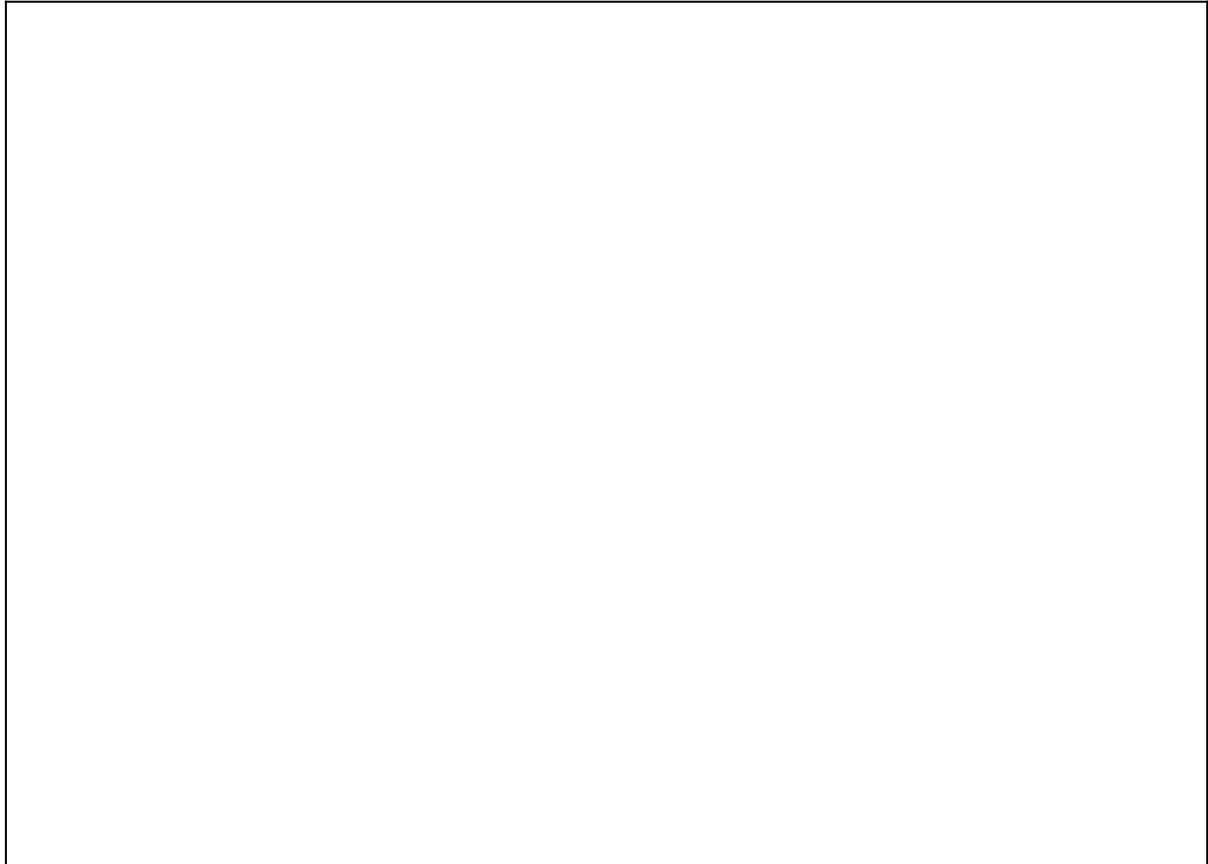
Figure 1: Examples of prosthetic lower legs. The leftmost picture shows a homemade prosthetic leg such as the one you will make in this challenge. This was made using black plastic pipe and a large sponge for comfort. The middle and right hand pictures are examples of professionally made prosthetic lower legs in real life.

Instruction

Note: You can print the instructions and write your answers in the provided space, or write your answers on a separate sheet of paper, and attach it to your submission.

1. What characteristics, qualities and features do you think your prosthetic lower leg needs? What materials do you think will be required?

2. Draw a picture of how your prosthetic lower leg will look. Label measurements and the materials you plan to use to construct the device.



3. Construct your prosthetic leg!
4. Test your prosthetic leg. Does the leg stay attached when you walk? Does it feel comfortable when you rest your knee on the prosthetic leg?

Reflection Questions

- Are there any improvements you would make to this challenge?
- What real world application/s can you apply this challenge to?
- What are the key science and engineering concepts that relate to this challenge?

- What are some challenges you faced when constructing the device?
- How did you overcome these problems?
- What design features did you take into account when designing the device? How do you ensure the comfortability and durability of the device?

Submission Guidelines

- Submit pictures of the prosthetic device you constructed, answers to questions 1 and 2 in the instructions section, and answers to the reflection questions.

Note: Remember, if you want to upload pictures of your Minor Challenge that also include you, please check if it is OK with your mentor first.

- The submission form is on the Minor Challenges page:
<https://sciencechallenge.org.au/index.php/minor-challenges/>
Fill out the details and make sure you upload your submission.

Learn More! Resources

- If you enjoyed this task, you may want to read more on possible careers to pursue in the biomedical engineering field.

Biomedical engineer:

<https://www.sciencebuddies.org/science-engineering-careers/health/biomedical-engineer>

Bibliography

- Podlogar, M., Zarske, M. and Carlson, D., 2022. Prosthetic Party: Build and Test Replacement Legs - Activity. [online] TeachEngineering.org. Available at: <https://www.teachengineering.org/activities/view/cub_biomed_lesson01_activity1> [Accessed 20 January 2022].
- Engineering 4 Kids. 2019. Prosthetic Design. [online] Available at: <<https://engineering4kids.org/2019/01/27/prosthetic-design/>> [Accessed 20 January 2022].