

A Leg To Stand On

Can you create a lower leg to replace a missing limb?

Instructions

Students grasp the art and science involved in creating prosthetics by making one of their own for a lower limb.

- 1 Divide class into teams of 4 and distribute materials, including one type of structural prosthetic material per team.
- 2 Instruct teams to consider the features that would make a useful leg and how to incorporate these qualities in a prosthetic leg.
- 3 One team member becomes the model for the prosthesis; this person's leg gets measured starting at the bend of the knee.



Materials

PER TEAM OF 4 STUDENTS:

- Yardstick, ruler, or tape measure
- Scissors
- Thin metal duct material (to roll into tube shape)
- For comfort: large sponges, bubble wrap, scrap cardboard, etc.
- For lifelikeness: bath towels, pairs of pants, shoes (use students')
- For body attachment: string, rope, twine (about 30')
- 1 roll duct tape

- 4 Teams construct their prosthetics, keeping the requirements of strength, stability, durability, longevity, shock absorption, lifelikeness, and comfort in mind. They can pre-test the strength of their prosthetic with heavy objects such as books, with the prosthetic held steady, until it's strong enough for the student model to test.
- 5 Ask each team to present their prosthetic by attaching it to their model and explaining their ideas. Have spotters positioned around the model to prevent falls.

Engineering & Science Connections

-  Prosthetics are mechanical devices that replace human (or animal) body parts lost through accident, illness, or congenital conditions. They can be simply for cosmetics, or may be more structural and functional. Some prosthetics are external and removable, like artificial arms and legs, while others are internal, like hip, knee, and heart valve replacements. Recently, a prosthetic leg was designed for an elephant!
-  Biomedical engineers design solutions for medical and health-related challenges. To design prosthetics, biomedical engineering requires integrated knowledge of biology, medicine, materials engineering, and mechanical engineering.
-  The construction of a prosthetic depends on the job it will have to do. Prosthetic hands should be very lifelike looking, while prosthetic legs must be able to withstand a person's weight. Most prosthetic limbs are made from durable and lightweight materials, like carbon fiber and/or silicon.
-  Engineers have made tremendous advancements in prosthetic design from the creation of lighter, stronger, and more durable materials to developing artificial limbs that can be controlled with direct neural feedback!

- Structural material with which to create a prototype, about 1.5' long. Each team should work with one material, such as:
 - Unused toilet plunger
 - Plastic pipe
 - Metal pipe
 - Metal strips
 - Cardboard tubes (wrapping paper rolls)
 - 2" x 4" wood board

Guiding Questions ?

How can you make your prosthetic comfortable to wear?

Is there a way to get your prosthetic to move at the ankle?

What materials would you use to make your prosthetic more lifelike?

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