Name: Date: Period:

Design a Prosthetic Arm

When engineers design a prosthetic, they usually have a specific problem or task in mind. They have to select the materials, design, and construction that suits their prosthetic’s needs best. In this activity, you will design a prosthetic arm that needs to be able to pick up a Styrofoam cup. You’ll have a variety of limited materials to choose from. You’ll select your materials, sketch out your design, then build and test your prosthetic arm.  If it doesn’t work, go back to the drawing board and try again!

**Possible Materials to Use**

* 3-inch wide and approximately 22-inch long strips of cardboard, 4 max
* Binder clips (different sizes), 10 max
* Brads (aka paper/brass fasteners), 10 max
* Craft sticks, 15 max
* string, 10 feet max
* straws- 7 max
* Paper clips (different sizes), 15 max
* Pencils, 4 max (**provided by your group members!)**
* Rubber bands (different sizes), 15 max
* Tape, clear and masking
* Cardboard scraps of various sizes, 10 max

**Criterion**

Your goal is to design a Prosthetic arm that can pick up a cup. The arm must be built using materials from the list above and must be at least 18 inches long.

**Design Process Steps**

Step1- Ask

1. What is the problem?

2. How have others approached it? (HINT: Think about prosthetics you might have seen or robotics)

3. What are your constraints? Look at your supplies and the rubric on the back page!

Step 2- Imagine

What are some solutions to the problem? Brainstorm, share and explain your ideas with your group members. Copy down a rough sketch of each of your group members idea and choose an agreed upon design. Sketch it in your plan section.

|  |  |
| --- | --- |
| Partner 1 | Partner 2 |
| Partner 3 | Partner 4 |

**Step 3-** Plan

Draw a diagram, identify materials on the drawing, and list the materials needed (include Quantity).

Prototype sketch

Materials list

Step 4-Create

Follow your plan to create your Prosthetic arm. Test it out.

Step 5- Improve

##  *If your design was successful at picking up the cup, how could your group improve on it to make it so it could pick up a cup that is heavier? If your group’s design was not able to pick up the cup, what can you do to improve your design to try again?*

1. What works with your arm?

2. What doesn’t work?

2. What doesn’t work? How do you think you can improve the arm to make it better?

3. Describe any modifications you would like to do to make your project better and materials needed.

## *Share your answers with your group members. Discuss what changes you think will benefit your arm and record your new design bellow. Bring your new idea to your teacher for approval. Create and test your new design.*

Materials list

Draw and label materials used for your final design

# Follow up Questions!

Answer the following in complete sentences rephrasing the question in your answer.

1. **Think about how your arm work. How did your prosthetic arm function? Describe each part of your arm and explain how they moved together to attempt to pick up the cup.**
2. **Was your arm model able to pick up the cup? If your arm was able to pick up the cup, explain why you think it was successful. If your arm was not able to pick up the cup, explain why you think it was unable to.**
3. **What was your favorite part of the design process? Why?**
4. **How did your group work together? Give each member a score of 1-10 for the following. 10 is the highest.**

|  |  |  |
| --- | --- | --- |
| **Name** | **Participation/helping with the build** | **Working well with others** |
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|  |  |  |
|  |  |  |

Group member names:

Period\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

# Rubric for Arm Prosthetic

Design

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Criterion** | **5 points** | **4 points** | **3 points** |  **Total Points** |
| Does the arm follow the plan? | Yes 100% | Some 80% | Less than half  | \_\_\_\_\_\_/5 |
| Does the arm use only the materials listed in the plan? | Yes 100% | Some 80% | Less than half | \_\_\_\_\_\_/5 |
| Does the arm not require use of the holder’s hand? | No | 1-3 fingers | Yes 4-5 Fingers | \_\_\_\_\_\_/5 |
| Does the arm look robust and sturdy? | Yes very | Somewhat | Not really | \_\_\_\_\_\_/5 |
| Does the arm pick up the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_? | Yes & hold for 25 sec | Yes & hold for 10 sec | No or less than 10 secs | \_\_\_\_\_\_\_/5 |
|  |  |  | Total: | \_\_\_\_\_\_\_/25 |

Re-design

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Criterion** | **5 points** | **4 points** | **3 points** |  **Total Points** |
| Does the arm follow the plan? | Yes 100% | Some 80% | Less than half  | \_\_\_\_\_\_/5 |
| Does the arm use only the materials listed in the plan? | Yes 100% | Some 80% | Less than half | \_\_\_\_\_\_/5 |
| Does the arm not require use of the holder’s hand? | No | 1-3 fingers | Yes 4-5 Fingers | \_\_\_\_\_\_/5 |
| Does the arm look robust and sturdy? | Yes very | Somewhat | Not really | \_\_\_\_\_\_/5 |
| Does the arm pick up the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_? | Yes & hold for 25 sec | Yes & hold for 10 sec | No or less than 10 secs | \_\_\_\_\_\_\_/5 |
|  |  |  | Total: | \_\_\_\_\_\_\_/25 |