**CUP IN THE CUPBOARD**

**Scenario**: Your very good friend was involved in a motor vehicle accident and suffered an incomplete spinal cord injury, at cervical spinal root 7 (C7). Your friend has finished acute rehabilitation and is now at home. As she begins to get used to her new life she comes across several obstacles in her day-to-day living, one of which is putting the dishes away. Your friend would like to put her cups away easily, but she has trouble reaching the top shelf where the cups belong. She is very independent and wants to be able to do this task on her own.

**Challenge:** Your task is to create a new device that will help your friend, who uses a wheelchair, place a cup on a high shelf in a cupboard. The cupboard is approximately 7 feet tall. Ongoing testing is allowed and encouraged before the final demonstration. At the time of the final demonstration, one member of the team will sit in a designated chair and use the team device to raise a cup into a “cupboard”.

**Design Requirements & Constraints:**

* Your invention may not cause damage or leave marks of any kind.
* The cup cannot be destroyed or damaged.
* The cup must be placed upright on the shelf.
* Your invention must be easily stored: no larger than 2 feet in any dimension when not being used.
* Your invention must be easily assembled. If it requires putting pieces together, it must be completed in less than 20 seconds.
* Your invention must take in to account the physical limitations of your friend’s injury.
* Each member of the team should participate in the brainstorming, building, testing and presentation of your invention.

**Materials:** Your team will be limited to the following materials

* 1 ¼” Round Dowel – 48” long
* 1 ½” Round Dowel – 48” long
* 2 ¾” Round Dowel – 24” long
* 1 ½” PVC pipe – 36” long
* 1 1” PVC pipe – 36” long
* 2 ½” x ½” stock wood – 36” long
* 5 Wood screws
* 5 Machine screws/Washers/Bolts
* 5 Zip ties
* 5 Rubber bands
* 5 Straws
* 5 Clothespins
* 2 Plastic spoons
* 5 Pipecleaners
* 10 ft String
* 3 ft Duct tape

**Tools and Safety:** The following tools will be available for your use during the construction process. Various safety precautions will be addressed by the teacher prior to construction. If you are cutting or drilling, **safety glasses must be worn**.

* Hand saw
* Power drill
* Miter box
* Hot glue gun
* Tape measure

**Schedule:** Your team will be responsible for having the following checkpoints completed:

* **Friday, 2/4 (A) & Monday, 2/8 (B)**
  + Brainstorm ideas with your team.
  + You should have at least ***3 ideas*** by the end of class with an idea of which one you would like to try.
  + Decide as a team which idea you’re going to try and build.
  + ***Sketch your idea, including dimensions and materials***.
* **Tuesday, 2/9 (A) & Wednesday, 2/10 (B)**
  + Beginning of class: Present pages 1 & 2 of your Design Journal to your teacher to sign off on.
  + Present your idea to one other group for peer review and complete a peer review for another team.
  + Present page 3 of your Design Journal to your teacher to sign off on.
  + Begin construction of your device.
* **Thursday, 2/11 (A) & Friday, 2/12 (B)**
  + Finish construction of your device.
  + Test your device.
  + Brainstorm ideas for revision.
  + Make necessary changes to device.
* **Tuesday, 2/16 (A) & Wednesday, 2/17 (B)**
  + Finish constructing your device.
  + Test your device.
* **Thursday, 2/18 (A) & Friday, 2/19 (B)**
  + Present your device to the class.

**Resources and Information**

**Process Guide**

Use the following resources as a guide to get started and keep the ball rolling… Think of the design process as a circular model rather than a linear model that has a clear beginning an end. You should come up with lots of ideas, try one out, see what worked or didn’t work, and then come up with a new idea to make it better. Make your changes, see what worked or didn’t work, and then come up with another way to tweak it. Keep revisiting ideas and making changes until you find something that works!

**Investigate**

* Research
  + Look at books or other resource materials to inform your design
  + Use “market research” from other teams to get a sense for what the other ideas are in the room
  + Record observations from research to remember what was found
  + Examine the materials to get some ideas about what to design
* Brainstorm
  + Try various brainstorming techniques (see next page for the SCAMPER technique)
  + Focus on the problem: Can it be restated more simply?
  + Write down ALL of your design ideas. What are the advantages and disadvantages of each?
  + Try sketching the problem to better define it.
  + Look through the materials to gather some ideas about what could be built.

**Create**

* Design
  + Select one idea to test
  + Sketch out how the device will work
  + Make a list of the materials that are needed

**Reflect**

* Complete a peer design review. Be open to suggestions and critiques.

**Create**

* Build and Test
  + Identify tools needed for building or modification
  + Make sure each team member has a role in constructing the device
  + Test the invention when ready
  + Record any necessary measurements

**Reflect**

* What happened during the test? Was the device successful?
* Does the device need alteration based on this test? Could anything be improved upon?
* Record observations, questions, and conclusions.
* Brainstorm new ideas or look at old notes for inspiration
* Ensure that each team member contributes to the redesign

**Create**

* Build and Test
  + Make changes to the original design
  + Test the invention when ready

**Engineering Design Journal**

Team Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Team Members: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**Engineering Design Journal**

**Brainstorming/Ideas:  
  
1. What problem do you need to solve?  
  
  
1a. What are 2-3 solutions to that problem?**

**2. What problem do you need to solve?  
  
  
2a. What are 2-3 solutions to that problem?**

**3. What problem do you need to solve?  
  
  
3a. What are 2-3 solutions to that problem?**

\*Put a star next to the idea(s) that your team chooses

\*You may use additional paper if needed, just attach it to the packet to be handed in

**Engineering Design Journal**

**Sketch of Device:**

Teacher signature: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Engineering Design Journal**

**Peer Design Review**  
Reviewed by: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  
  
**Reviewer’s Comments:**  
What do you think are the advantages of this solution?

What do you think are the disadvantages of this solution?

What is one idea that you can offer the team to help improve their idea?

Teacher signature: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_