Engineering Notebook
Touchdown

1. **Identify the problem:** NASA has found safe landing sites on the moon. Now they need to **design and build** a spacecraft that can land there safely without injuring astronauts or damaging the spacecraft. Our challenge is to construct a lander—a spacecraft that can land safely when you drop it on the floor. In order or the spacecraft to land safely the lander must have a shock absorber. A shock absorber absorbs the energy on impact so the spacecraft lands safely**.**

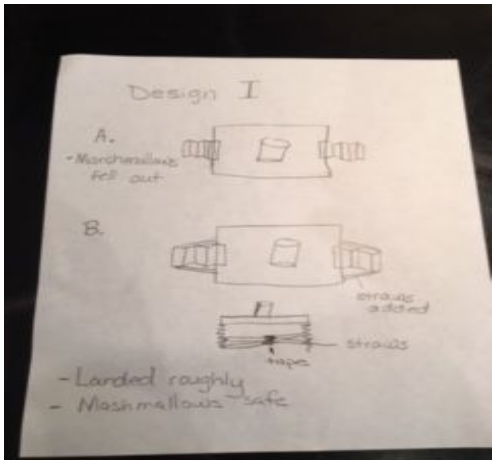
2. **Brainstorming:**

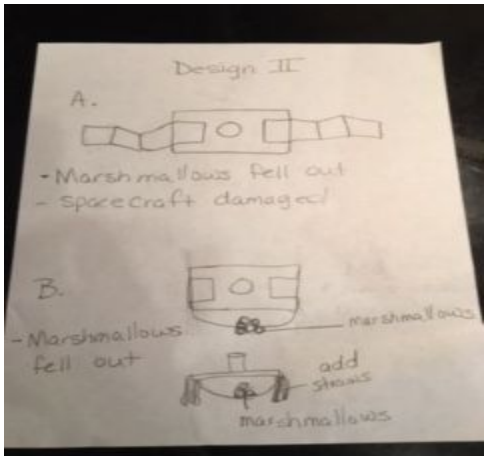
   What types of materials can absorb energy? Materials that are soft or materials that can form a spring.

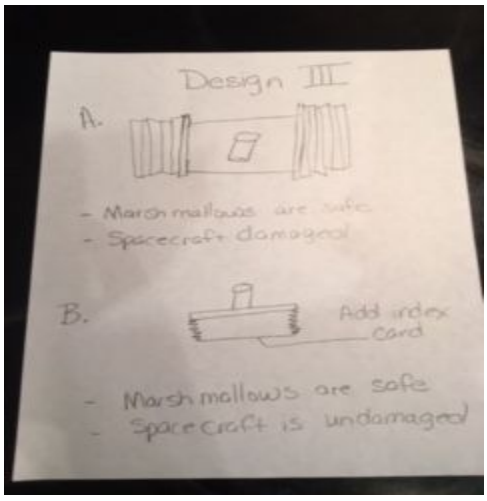
   What kind of shock absorber can you make from these materials to help soften a landing? Mini-marshmallows can be used as feet. Cards can be folded into springs. Straws can make the bottom flexible. Rubber bands can hold things together

   How will you make sure the lander doesn't tip over as it falls through the air? It is important that the parts below the platform weigh more than the parts on the top and the parts on the top are centered to keep the spacecraft from leaning to one side.

3. **Design:**







3. **Build:**

Design I Build and First Test- Marshmallow fell out of the spacecraft and spacecraft was damaged

Design II Build and First Test- Marshmallows fell out of spacecraft and spacecraft was damaged.

Design III Build and First Test- Marshmallows were safe but spacecraft was damaged

4. **Test and Evaluate:**

   A. Design I was tested and needed to be redesigned. I added crossed straws taped to the bottom and tested again. The second design caused the marshmallows to fall out again. I then made a new plan for a new design.

   B. Design II was tested and needed to be redesigned. I added marshmallows and tested again. The second design caused the

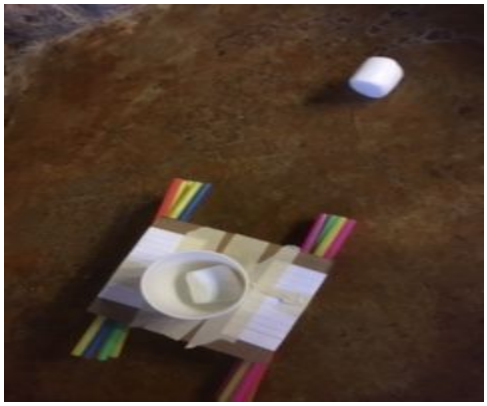
marshmallows to fall out again. The final design had straws added and the marshmallows fell out again. I then made a new plan for a new design.

C. Design III was tested and the marshmallows were safe, however the spacecraft was slightly damaged. I added an index card to connect the index card springs I had created. After testing the marshmallows were safe and the spacecraft was undamaged.

5. **Redesign:**

Design I Redesign Images


Design II Redesign Images

Design III Redesign Images

6. **Share the solution:**

Design II was the solution. The cup was centered on the cardboard. The index cards were folded like fans along the long side of the cared to provide more space hitting the ground to absorb energy. The fanned cards were then connected on the bottom with an index card to keep them in place.