**At Home: Safe Landing**



**Student Instructions:**

**Challenge**

How can you ensure a safe landing when you drop a cup holding a ball?

Design a lander that includes a cup with a ball inside it. You’ll test your lander by dropping it from at least 1 foot off the ground. If the cup lands upright, doesn’t fall over, and the ball stays in the cup – you’ve successfully completed the challenge. And no, you cannot cover the top of the cup to keep the ball inside.

**Suggested Materials**

Substitutions can be made for almost any of these materials:

* 1 to 2 small pieces of cardboard
* Scissors
* Small cup
* Small ball
* Tape
* Plastic shopping bag
* String or yarn
* Index cards
* Straws
* Cotton balls
* Rubber bands
1. **Identify the Problem**
* The most critical step of any engineering challenge is to **understand the** **problem** you are trying to solve.
* The two problems you are trying to solve is **slowing the descent of your lander** and **absorbing the energy of impact** when your lander touches the ground**.**
* How might you slow your lander down?
	+ Explore how parachutes work. A canopy is the part of the parachute that fills with air. Air trapped in the canopy slows the fall of a parachute because of air resistance, or the force of the air pushing against the canopy.
* How can you lessen the impact on your lander when it hits the ground?
	+ Hint: Think about shock absorbers. They are used to absorb the energy of the impact when gravity slams something into the ground.
	+ Springs are a good shock absorbers. What is it about their shape that helps them absorb impact?
1. **Collect Materials**
* Start collecting materials for your lander.
* Don’t have all of the items on the list? That’s okay – you don’t need all of them. Look around and see if there are other materials you can use instead or do without.
	+ Don’t have a small ball? Can you make one out of tinfoil?
1. **Brainstorm Designs**
* Review the challenge and the problems you are trying to solve.
* Look at your materials. Which ones can help you soften the cup’s landing? How might you create a parachute to slow the lander’s fall?
1. **Build It**
* Start building! If possible, take pictures of the materials as you build. Maybe one at the beginning, one during the process, and one at the end.
* When you are finished building, **make a prediction**. Will your lander stay upright from a 1-foot drop? A 2-foot drop? A 3-foot drop?
* Record your prediction.
1. **Test It**
* Test your lander! Start with a 1-foot drop. Did it work? Then see how far a distance it can be dropped before it fails.
1. **Share Results**
* Share your results and your design with your teacher or parents.
* Did it work like you thought it would?
* What design changes would you make?
1. **Make Changes and Try Again!**