YOUR CHALLENGE
Design and build a way to protect a container so its contents aren’t damaged when dropped to the ground.

In this activity, kids:

• think about real-world instances in which airdropping is necessary
• design and build structures to keep a Ping Pong ball inside of a dropped cup
• discover ways to design a shock-absorbing system to protect a container as it drops to the ground
• explore gravity, air resistance, and how parachutes work to lessen the impact of a fall
• test their designs by dropping them from a height of at least 1 foot/30 centimeters

I. PREPARE AHEAD OF TIME

• Read these leader notes and the challenge sheet.
• Collect the materials.
• Try the activity yourself, so you’ll know what to expect and where kids may need help.

2. INTRODUCE THE CHALLENGE

• Ask kids: What situations can you think of where an airdrop from a plane might be necessary? (When people are in the midst of war or have been hit by a natural disaster such as a hurricane, flood, avalanche, or earthquake).

MATERIALS
(teams of 2 or 3)

• 1 or 2 pieces of cardboard (approximately 4 x 5 inches/10 x 13 centimeters—larger is also fine)
• 1 small paper or plastic cup
• 1 Ping Pong ball (a crumpled piece of paper can be substituted)
• 3 index cards (3 x 5 inches/8 x 13 centimeters) or a thick piece of construction paper
• 12 cotton balls (small pieces of crumpled paper can be substituted)
• 3 rubber bands
• 8 plastic straws
• plastic shopping bag cut in half
• string
• scissors
• masking and/or transparent tape
• ruler
• paper and pencil
• Demonstrate by dropping a cup (the container) with a Ping Pong ball (the supplies) to the ground (the cup will fall over and the ball will bounce out).

• Tell kids: If this were to happen to a package of medicine or food, the supplies would be damaged. What do you think could be done to make the cup land gently and stay upright?

3. BRAINSTORM & DESIGN

Explain that there are several ways engineers can protect packages that are airdropped:

• Slow the fall with a parachute.
  
  – When something drops, it falls because gravity pulls it to the ground. As a parachute falls, the part that fills with air is called the canopy.
  
  – A parachute works because air gets trapped in the canopy and slows its fall. This is the result of air resistance—the force of the air against the canopy.

• Use shock absorbers to lessen the impact upon landing.
  
  – A shock absorber can absorb the energy of the impact when something lands. Like a pillow, it cushions a package when gravity slams it to the ground. Soft materials make good shock absorbers. Think about shoes: the rubber or leather on the bottom cushions your feet each time you step on the ground.
  
  – Explain that springs can also serve as shock absorbers. Show them an index card folded into a spring (you can fold it ahead of time), and demonstrate what happens when you compress the paper and when you extend it. Tell them: That’s what happens when you jump off a high step: your body acts as a spring—you bend your back and knees to absorb some of the energy and break your fall.

Instruct kids to brainstorm about both methods, and to sketch design ideas in their teams before building.

4. BUILD

If kids run into problems, rather than offering them solutions right away, encourage them to think about why their structures are unstable, and ways they can add more support. If they get stuck, refer them to the Problem Solving Tips on their challenge sheet.
5. TEST, EVALUATE AND REDESIGN

- Have the teams test their designs by letting them fall from a starting height of 1 foot/30 centimeters.
- Redesign if necessary.
- Continue to increase the height from which the design is dropped to see how far it can safely fall.

6. DISCUSS WHAT HAPPENED

After everyone is finished, gather together and talk about their structures. Ask them:

- What’s the difference between adding a parachute and adding a shock-absorbing system?
- How does each help prevent the container and its supplies from getting damaged?
- After testing, what changes did you make to your design?
- Engineers’ early ideas rarely work out perfectly. How does testing help them to improve a design?