

ASTROBIOLOGY ALIVE!

Module 4: Blast Off Challenge!

1. Introduction

Students will begin by discussing how humans and rovers are able to leave Earth to travel space and land on its intended destination. We will talk about the importance of safely landing the rovers on Mars, as they cannot collect and analyze information should any part be damaged during their landing. In order to better understand this, students will be divided into groups to design and construct a device that will protect a falling egg from breaking. All groups will then assemble to test the contraptions. Once each device has been tested, students will discuss why it succeeded or failed.

Target Grades: K-6 (adapt discussion as appropriate for grade level)

2. Learning Objectives:

- Critical thinking about the conditions the rovers undergo as they prepare for landing.
 - High falling speed
 - Atmospheric conditions (winds, storms, etc.)
- Introduce concepts of physics like forces and motion
 - Potential and kinetic energy
 - How this energy effects speed
- Brainstorming about how to protect the egg (scientific equipment or astronauts!) during landing
 - Padding
 - Shock absorbers
 - Create drag (parachute, or balloons)
- Gain understanding of engineering and design process

3. Materials

- Eggs (1 per group)
- Straws
- Balloons
- Tape
- String
- Grocery or trash bags
- Newspaper
- Cotton balls
- Popsicle sticks
- Ziploc bags
- Paper crinkles
- Packing peanuts
- Poster of Mars rovers and their landing equipment
- Bookmark (*handout*)

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4. In-Class Guide

4.1 Introductory and Activity Discussion (5 min)

Introduce students to space travel via rocket ships! Discuss the purpose of sending rovers to Mars and the difficulties of landing them safely on the planet – many rovers have been lost to crashes and failed landings. Present pictures of the rovers and their landing devices, briefly discussing which ones have landed successfully and which ones have not.

Jump in! – Give students at least 30 minutes to design (draw) and then make their egg lander.

- Students will be divided into 4 groups
- Each group will be provided a bag of materials with which they may construct their landing device

4.2 Hands-On Activity (40 min)

1. Individually – everyone can draw their own lander design (~ 7 min), then come together as a group and vote on one design to make, or combine elements of each individual design.
2. Together, each group will brainstorm what their device will look like using the materials provided. They may refer to past Mars rovers landing devices for ideas or create new lander plans.
3. Groups will then construct their devices. Module volunteers will oversee each group and may help/ ask leading questions to assist with lander design.
4. Groups should also pick team names and even name their egg.
5. All groups will assemble to test their devices. Drop the landers 3 times each (15-20 m)

Round 1: Countdown! Drop each lander and check to see if the egg survived! If not, that group is out.

Round 2: Remove any balloons or parachutes – Drop the landers again! Check to see if the eggs survived. Any groups with broken eggs are out.

Round 3: Remove one layer of padding, or shock absorption – Drop the landers again! Check to see if the eggs survived. Any groups with intact eggs are the winners!

4.3 Summary Discussion (10 min)

Students will discuss why their devices succeeded or why they did not. As a class, students will also discuss what future adjustments could be made to improve each device. NASA scientists must reevaluate the rover landing devices to fix errors make new ones better than the previous!