ENGINEERING A HAB

Grade Levels 6-12

Activity

Students will design and build an "air-tight" habitat, similar to the one Mark Watney built for his long-distance journey to the Schiaparelli crater in Andy Weir's novel *The Martian*.

Materials Required

- A variety of materials students can use to construct their habs (tissue paper, computer paper, aluminum foil, construction paper, etc.)
- Masking tape
- Scissors
- A cardboard circle or square cut at least 14 inches wide for each group
- Air pump (the kind used to inflate air mattresses works well)

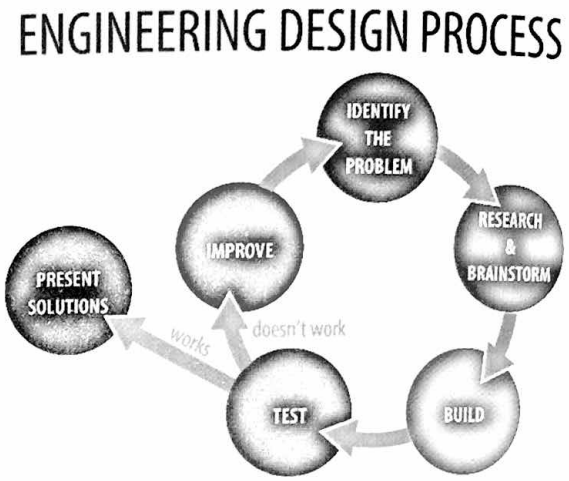
Procedure

For this activity, students will be posed with the following problem:

> The trip to Schiaparelli crater will require you to live in your rover for about a month and a half. You had previously spent a fraction of this time in the rover during your trip to acquire the Pathfinder Lander and the Sojourner rover, and the cramped quarters nearly drove you insane. To prevent you from going crazy on your much longer journey, build a small habitat to attach to your rover that will increase the livable space available during your journey.

Students will work in groups of 2 to 3 to design and build an air-tight model hab on a piece of cardboard. Prior to starting this activity, prepare the piece of cardboard they will use for the base of their habs. Cut the piece of cardboard into a circle or square at least 14 inches wide. At the center of each piece of cardboard, cut a hole just large enough for your air pump to fit through. It is important not to make the hole too large, as you will use the pump to check that habs are air-tight. You do not want air to escape from your opening. The easiest way to do this is to trace on your cardboard around the opening of your air pump, then cut a hole a little smaller than what you traced. Students will build habs on this base.

A good rule-of-thumb is to tell students that their habs must be built at least half as tall as their base is wide. So if you cut your pieces of cardboard to 14 inches, their habs must be at least 7 inches tall. Your students can use whatever materials you supply them to build the rest of their habs, their only guidelines are that the hab must cover the entire cardboard base and must be able to hold air without leaking. Encourage students to try many different designs and materials, then test to determine which is best.



To test the habs, place your air pump through the hole you cut in the cardboard, turn your pump on, and check to see if air is leaking.

This is a great opportunity to have students implement the Engineering Design Process. Once you have introduced the problem to your students, give them time to plan and draw their hab design. Make sure to have them include the details about the materials they want to test. Then, give each group time to build their habs, test them for air-tightness, and improve their habs by testing different materials and designs. This entire process should take about 2 class periods. You can finish this activity by having each group present their creations for the rest of the class and comment on what did and didn't worked well during the activity.

Teacher Extras

Optional Extension

If the air pump you use for this activity has variable settings, you can challenge your students to build a hab capable of holding more air as the air pressure increases.

Ask the Students

- Was your hab able to hold air without leaking?
- What material worked best?
- What did the most successful hab designs have in common?
- Describe some of the difficulties you encountered during this activity.
- In this activity, you were given specific constraints on the types of materials you could use to construct your hab, what size your final design needed to be, and how much time you had to build. What constraints did Mark Watney face as he constructed the hab he attached to his rover?
- Describe a situation from *The Martian* in which Mark Watney most likely used the Engineering Design Process.