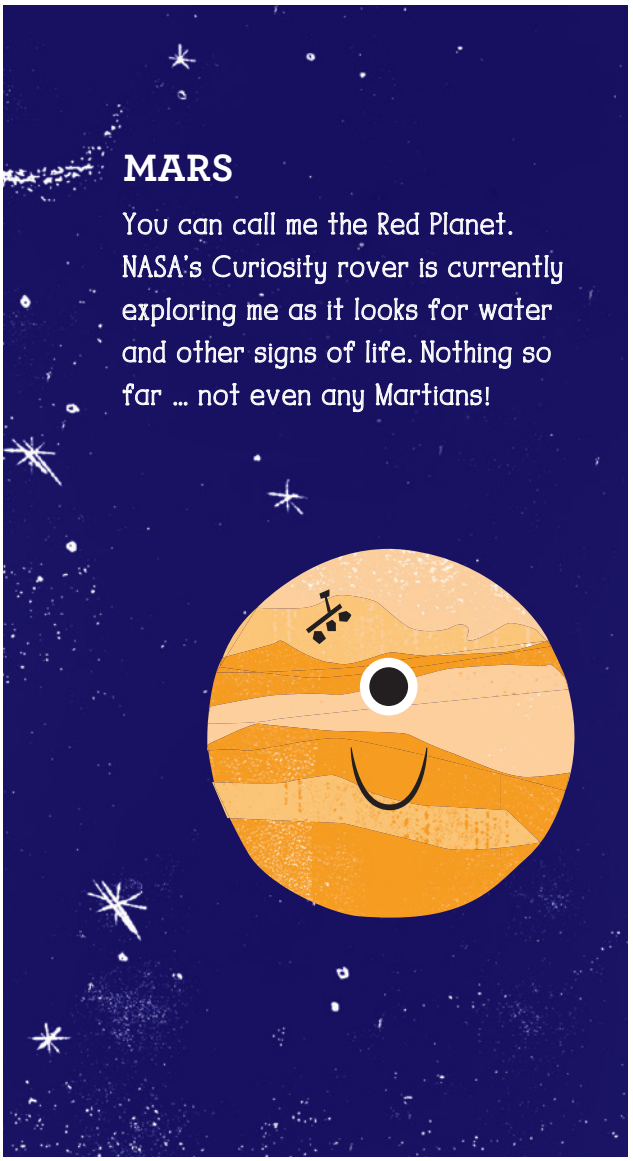
MISSION: MEALS

EXPERIMENT: PLANT AND FISH SYSTEM

If you are going to live on Mars, you will need to be able to grow your own food. But the soil and air on Mars are not like that on Earth. Greenhouses control the environment so you can get fresh, healthy food. Try building a special type of greenhouse that also provides a home for fish in this simple system.

MATERIALS

- ☐ Dirt
- ☐ Gravel
- ☐ Two clear, two-liter bottles
- ☐ Betta fish, or a toy fish
- ☐ Scissors
- ☐ Utility knife
- ☐ Duct tape
- ☐ Small plant or seeds
- ☐ Cotton wick, like a piece of fabric, rope or yarn
- ☐ Aquarium plant, real or fake (optional)
- ☐ Clear, wide tape
- ☐ Thermometer

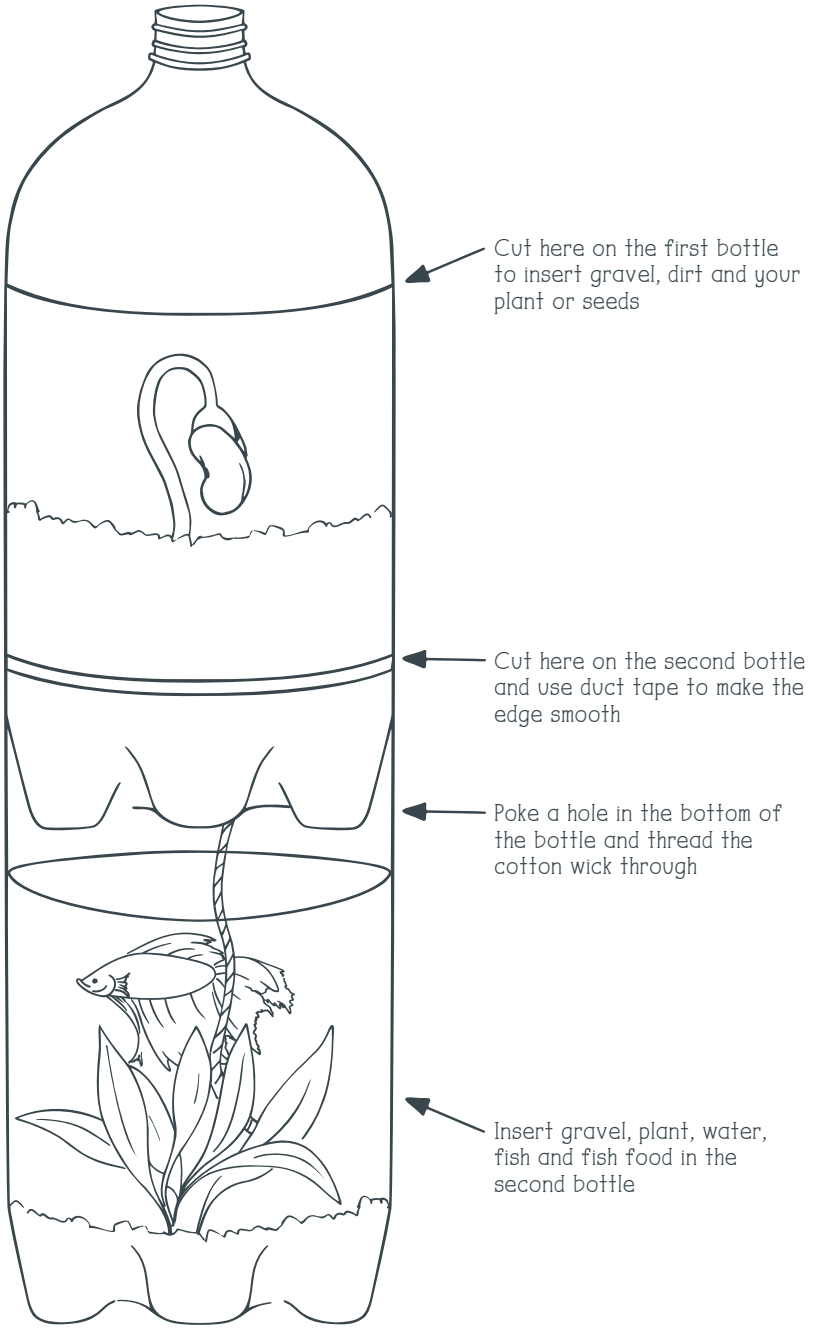


INSTRUCTIONS

Remove the label and cutting off the top third of one two-liter bottle to make the greenhouse. Poke a hole in the bottom of the bottle and thread the cotton wick through, leaving several inches hanging outside. Add a layer of gravel to the bottom of the bottle and then a layer of dirt, winding the cotton wick throughout. Place a small plant like lettuce or herbs in the dirt, or bury some seeds. Place a thermometer inside facing outward, so you can read it. Water the dirt so it's moist. Put the top of the bottle back on and use clear, wide tape to hold it in place. Leave the bottle cap off.

Make the aquarium by removing the label and cutting the top third off of the other two-liter bottle. Duct tape around the top edge so it's smooth and discard the top of the bottle. Add a layer of gravel to the bottom and, if you'd like, a real or fake aquarium plant. Fill with water that reaches about two inches below the top. Add a fish and some fish food. We even used a toy robotic fish in our aquarium.

Place the greenhouse bottle snugly on top of the aquarium bottle with the cotton wick reaching into the water. Remove the greenhouse bottle to feed the fish as needed.



WHAT'S HAPPENING?

A greenhouse protects plants by letting sunlight in and preventing heat from escaping. That's necessary on a planet like Mars, which is very cold and has a thin atmosphere that's mostly carbon dioxide, not suitable for plants to grow. You can tell your greenhouse is warm inside because of the condensation that collects on the sides; you also can check the thermometer to see just how warm it is. The water in the aquarium below travels up the cotton wick to help keep the dirt damp. A similar system that doesn't use dirt is called aquaponics: raising fish is called aquaculture, and growing plants in water is called hydroponics.

GAME ON

Keep track of the temperature inside your greenhouse, and see how it compares to the daily temperature outside. Or try growing your plants hydroponically – instead of dirt, place your plant in a growing medium like perlite or even shreds of cardboard. Make sure the roots are covered (they grow best in the dark) and the cotton wick is wound throughout so they get enough water.

TIPS

Don't put your system in direct sunlight, because that will make the water too warm for your fish. Bettas prefer water between 75 – 80 degrees. Keep the cap off the greenhouse bottle so air can circulate. Change the water in the aquarium bottle as needed.

MORE WAYS TO PLAY WITH PLANTS

Learn about vertical farms in MSI's *Fast Forward … Inventing the Future* exhibit and the latest in farming crops in *Farm Tech*.

RECOMMENDED READING

"How Do You Burp in Space? And Other Tips Every Space Tourist Needs to Know" by Susan E. Goodman

"Potatoes on Rooftops: Farming in the City" by Hadley Dyer