SPACE STATION EXPLORERS

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CLASSROOM ACTIVITY:

THE ASTRONAUT DIAPER

GRADES: 4-8

DURATION: 30 MINUTES

BASED ON ACTIVITIES AT KENNEDY SPACE CENTER www.kennedyspacecenter.com
AND CHABOT SPACE & SCIENCE CENTER www.chabotspace.org

ACTIVITY STARTER

Imagine working for seven hours straight in a suit so stiff that you can barely bend your joints or curl your fingers. There's a valve in the helmet to access drinking water, but no food. And what if you have to pee?

The Maximum Absorbency Garment (MAG) is the astronaut diaper. Astronauts wear a MAG during launch, landing, and spacewalks – whenever they can't remove their spacesuits for long stretches of time. Like any diaper, the MAG absorbs liquid and pulls it away from the skin. The MAGs are similar to adult diapers but are modified so that they are pulled up like shorts.

OBJECTIVE

In this activity, you'll investigate the chemical that makes the MAG super-absorbent: sodium polyacrylate. It's a polymer (a molecule shaped like a long chain) that can rapidly absorb 500 to 1,000 times its mass in water.

TEACHER PREP

Students work in pairs or small groups. Each group needs:

- Water (each group will use about 2 liters)
- Liquid measuring cup or beaker
- Spoon
- Diapers (2 per group, any brand)
- Sealable bags
- Small disposable cups like Dixie cups (2 per group)
- Paper towels
- Salt
- Paper and pencil to record observations

PROCEDURE

First, test how much water a super-absorbent diaper can hold. Hold a diaper open. Use the measuring cup or beaker to measure 1-2 cups of water and pour along the entire length of the diaper. Keep track of how much water you use and record the final amount.

Next, investigate the materials that make these diapers so absorbent. Take a fresh diaper and cut out a square of the lining fabric. Seal the fabric in a sealable bag and shake it to make white granules fall out and collect in the bottom of the bag. The granules are sodium polyacrylate.

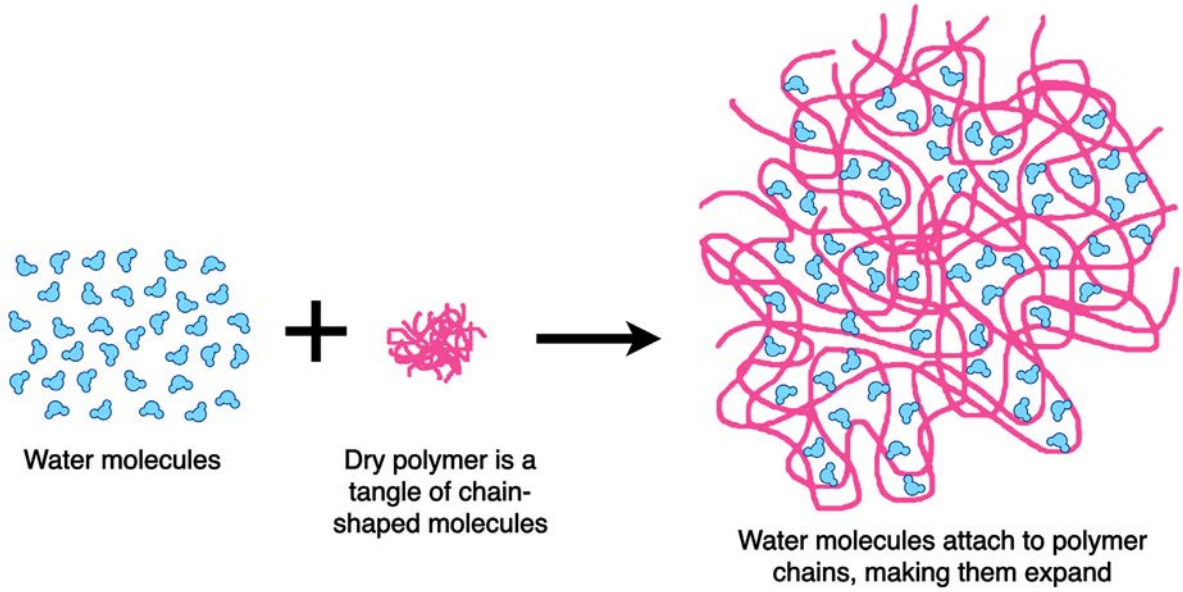
Open the bag, remove the fabric, and try adding a spoonful of water to the bag with the granules. Observe what happens.

In another sealable bag, collect a heaping spoonful of sodium polyacrylate granules; cut up more of the diaper lining if necessary. Put the granules in one Dixie cup and fill a second cup with water. Pour the water back and forth between the two cups to mix the granules with the water. Observe what happens.

This chemical change can be reversed. Add a few spoons of salt to the gel-filled Dixie cup and stir. Observe what happens. Isn't chemistry cool?

The long, chain-shaped molecules in sodium polyacrylate are cross-linked in a tangled network When you add water, the water molecules attach to the chains, making the network expand. The water molecules are trapped in the network so they no longer flow like a liquid.

As the salt dissolves, it attracts the water molecules so they detach from the polymer chains. The water molecules are released and they flow like a liquid again.



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www.spacestationexplorers.org

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NASA's Suited for Spacewalking Educator Guide:
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