TAKE IT APART

DIGGING INTO DIAPERS

MOREHEAD PLANETARIUM & SCIENCE CENTER AFTERSCHOOL

BIG IDEA

Take apart (unused!) disposable diapers to discover what makes them so absorbent!

TIME

30–45 minutes

WHY WE LOVE IT

This activity offers a great way to see science applied to a real-life situation! Students take apart an everyday item to uncover the science hidden within.

READY...

Gather materials:

For a demonstration

- shallow bowl or tray
- 1 disposable diaper
- water
- ¼ measuring cup

Per group

- sheet of newspaper
- 3 disposable diapers of different brands
- 3 pairs of scissors
- 3 plastic sealable bags
- 3 plastic spoons
- water
- teaspoon measure
- measuring cup
- bowls
- markers for labeling bowls and bags
- *Optional:* stopwatch

SET...

Prepare materials for the demonstration, but do not hand out group materials yet.

Figure 1: Cutting open a diaper

GO!

PART 1: Demonstration

1. Divide students into small groups of two or three.

2. Discuss the **Big Idea**. *What does it mean to dissect something?* Dissection means taking something apart to see what's inside. *Has anyone ever dissected a ... diaper? Who uses diapers? How do they work?* Let's find out!

3. Unfold a diaper and place it in a shallow bowl or on a tray so that everyone can see.

4. Slowly pour water in the diaper, a quarter of a cup at a time. Count aloud with each pour. Eventually, the diaper will reach a point of saturation when it will not be able to hold any more water. When the water begins to pool at the surface of the diaper, stop.

5. *How much water was the diaper able to absorb? Where did all that water go? How is a diaper able to absorb so much water? Carefully cut the wet diaper down the middle and pull away the cotton pieces. What's inside? What do you notice?* Students should notice a squishy gel.

Figure 2: Extracting polymer crystals

PART 2: Dissect

1. Distribute supplies to each group.

2. Have students label one bowl and one plastic sealable bag for

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each brand of diaper. They can do this based on the diaper's appearance (for example, "tiger diaper" or "teddy bear diaper").

3. Have students begin by carefully cutting open the diaper in one long, continuous cut. It's best to use the seams at the side. **(Figure 1)**

4. Students can use a spoon to scrape down the cotton and outer coating and then to carefully pull out the tiny polymer crystals to put in the labeled bowls. The crystals will be tiny—the size of sand. **(Figure 2)**

5. Ask students to observe whether different diapers produced different quantities of crystals. **(Figure 3)**

Figure 3: A closeup of the crystals in a bowl

PART 3: Experiment

1. Explain to students that they need to standardize the experiment. *Would it be a fair test to compare how absorbent the different diapers' crystals are if there were four teaspoons of one diaper's crystal and only one teaspoon of another diaper's crystal?* No. Students should compare the same quantities of crystals for each diaper to be able to accurately compare their absorbency.

2. Students can compare the diapers by figuring out which one produced the smallest quantity of crystals. They should then measure that amount from all the diapers' crystals into the labeled sealable bags. For example, if Diaper A produced four teaspoons of crystals, Diaper B produced three teaspoons of crystals, and Diaper C produced one teaspoon of crystals, students should measure one teaspoon of each diaper's crystals into their respective bags.

3. Divide the crystals so that each baggie has the same amount. Have students add water to the bags of crystals for all the diapers, one spoonful at a time. Have them see which diaper's crystals are the first to stop absorbing water. Determine which bag is able to absorb the most water without the water separating or leaking out.

4. Ask students to share their findings as well as their experiences while dissecting the diapers.

Figure 4: Crystals with water added

Figure 5: Crystals without water added

TRY THIS

1. Try comparing different brands and types of diapers to see how well they absorb water (e.g., Huggies, store brand, swimming diaper, overnight diaper).

2. Use a stopwatch to time how long it takes for the polymers to absorb the same amount of water. Discuss if/why this would be beneficial for consumers.

3. Use food coloring to dye the water you pour on the polymer crystals.

4. Explore some other superabsorbent polymers like instant snow and jelly marbles to really crank up the fun! Both are available online from Steve Spangler Science.

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DIGGING INTO DIAPERS (cont.)

WHY IS THIS SCIENCE?

That squishy gel is a type of chemical called a **polymer.** Polymers are groups of chemicals made of long chains of molecules. (Imagine a chain of paper clips linked together end to end.) Polymers can be soft and squishy like chewing gum, or hard and strong like plastic. This superabsorbent polymer is called sodium polyacrylate. It is added to diapers because it absorbs a lot of liquid. This is the same material in rubbery toy animals that grow in water.

Superabsorbent polymers expand when they come in contact with water. Because water is drawn into and held by the molecules of the polymer, they act like giant sponges. It is estimated that the diaper polymer can soak up as much as 800 times its weight in water!

The cotton fibers students remove from the diaper help spread out both the sodium polyacrylate and any liquids added to the diaper. Even a little bit of polymer will hold a huge quantity of water, but it does have its limits. At some point, the gel becomes saturated and it is time for a diaper change!

DIFFERENTIATION

- **K-1:** Let students extract as much polymer as they can, but they may not get enough of the polymer to do the water experiment. If they have enough, they may also need assistance measuring the liquid.
- **2-3:** Have students examine all parts of the diaper (e.g., the elastic leggings) to see how they contribute to the overall effectiveness.
- **4-5:** Challenge students to record accurate information about how much water the diapers hold. They can measure how much a set amount (one teaspoon) of polyacrylate can absorb, and then multiply to figure out how much an entire diaper can absorb. Alternatively, they could weigh the diaper before and after soaking it in water.
- **6-8:** Students can imagine they own a diaper company and write about how to produce a diaper that will hold the most liquid and be comfortable to babies.

WITH THANKS AND FOR MORE INFORMATION, VISIT:

http://www.acs.org/content/dam/acsorg/education/outreach/ncw/celebrating-chemistry-2012-nanotechnology.pdf
http://www.omsi.edu/sites/all/FTP/files/chemistry/Side_Displays/U5DiaperDissection_OpGuide.pdf

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