

# Sinkhole in a Cup



**SUBJECT:** Science

**GRADES:** K-8

**ACTIVITY SUMMARY:** Students will learn how sinkholes form as well as the impact humans can have on the groundwater supply. (See extension below for the version to illustrate human impact.)

**DURATION:** approximately 30-45 minutes (longer for younger students to ensure they have time to build their models)

**OBJECTIVES:**

Students will be able to demonstrate how sinkholes and caves form.

**TEKS ADDRESSED:**

**Kindergarten**

1A-identify and demonstrate safe practices as described in the Texas Safety Standards during classroom and outdoor investigations, including wearing safety goggles, washing hands, and using materials appropriately.

2E-communicate observations with others about simple descriptive investigations.

7C-give examples of ways rocks, soil, and water are useful.

**1<sup>st</sup> grade**

1A-identify and demonstrate safe practices as described in the Texas Safety Standards during classroom and outdoor investigations, including wearing safety goggles, washing hands, and using materials appropriately.

2E-communicate observations and provide reasons for explanations using student-generated data from simple descriptive investigations.

**2<sup>nd</sup> grade**

1A-identify and demonstrate safe practices as described in the Texas Safety Standards during classroom and outdoor investigations, including wearing safety goggles, washing hands, and using materials appropriately.

2E-communicate observations and justify explanations using student-generated data from simple descriptive investigations.

**3<sup>rd</sup> grade**

1A-demonstrate safe practices as described in the Texas Safety Standards during classroom and outdoor investigations, including observing a schoolyard habitat.

2B-collect data by observing and measuring using the metric system and recognize differences between observed and measured data.

2F-communicate valid conclusions supported by data in writing, by drawing pictures, and through verbal discussion.

3C-represent the natural world using models such as volcanoes or Sun, Earth and Moon systems and identify their limitations, including size, properties, and materials.

7C-identify and compare different landforms, including mountains, hills, valleys, and plains.

**4<sup>th</sup> grade**

1A-demonstrate safe practices and the use of safety equipment as described in the Texas Safety Standards during classroom and outdoor investigations.

2B-collect and record data by observing and measuring, using the metric system, and using descriptive words and numerals such as labeled drawings, writing and concept maps.

2F-communicate valid, oral, and written results supported by data.

3C-represent the natural world using models such as rivers, stream tables, or fossils and identify their limitations, including accuracy and size.

7B-observe and identify slow changes to Earth's surface caused by weathering, erosion, and deposition from water, wind, and ice.

**5<sup>th</sup> grade**

1A-demonstrate safe practices and the use of safety equipment as described in the Texas Safety Standards during classroom and outdoor investigations.

2C-collect information by detailed observations and accurate measuring.

2F-communicate valid conclusions in both written and verbal forms.

7B-recognize how landforms such as deltas, canyons, and sand dunes are the result of changes to Earth's surface by wind, water, and ice.

**6<sup>th</sup> grade**

1A-demonstrate safe practices during laboratory and field investigations as outlined in the Texas Safety Standards.

2C-collect and record data using the International System of Units (SI) and qualitative means such as labeled drawings, writing, and graphic organizers.

2E-analyze data to formulate reasonable explanations, communicate valid conclusions supported by the data, and predict trends.

3B-use models to represent aspects of the natural world such as a model of the Earth's layers.

3C-identify advantages and limitations of models such as size, scale, properties, and materials.

**7<sup>th</sup> grade**

1A-demonstrate safe practices during laboratory and field investigations as outlined in the Texas Safety Standards.

2C-collect and record data using the International System of Units (SI) and qualitative means such as labeled drawings, writing, and graphic organizers.

2E-analyze data to formulate reasonable explanations, communicate valid conclusions supported by the data, and predict trends.

3B-use models to represent aspects of the natural world such as human body systems and plant and animal cells.

3C-identify advantages and limitations of models such as size, scale, properties, and materials.

8B-analyze the effects of weathering, erosion, and deposition on the environment in ecoregions of Texas.

8C-model the effects of human activity on groundwater and surface water in a watershed.

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### 8<sup>th</sup> grade

1A-demonstrate safe practices during laboratory and field investigations as outlined in the Texas Safety Standards.

2C-collect and record data using the International System of Units (SI) and qualitative means such as labeled drawings, writing, and graphic organizers.

2E-analyze data to formulate reasonable explanations, communicate valid conclusions supported by the data, and predict trends.

3B-use models to represent aspects of the natural world such as an atom, a molecule, space, or a geologic feature.

## **NATIONAL SCIENCE STANDARDS:**

Content Standard D: Earth and Space Science

### Grades K-4

Properties of Earth Materials

- Earth materials are solid rocks and soils, water, and the gases of the atmosphere. The varied materials have different physical and chemical properties, which make them useful in different ways, for example, as building materials, as sources of fuel, or for growing the plants we use as food. Earth materials provide many of the resources that humans use.

Changes in Earth and Sky

- The surface of the earth changes. Some changes are due to slow processes, such as erosion and weathering, and some changes are due to rapid processes, such as landslides, volcanic eruptions, and earthquakes.

### Grades 5-8

Structure of the Earth System

- Land forms are the result of a combination of constructive and destructive forces. Constructive forces include crustal deformation, volcanic eruption, and deposition of sediment, while destructive forces include weathering and erosion.
- Water is a solvent. As it passes through the water cycle it dissolves minerals and gases and carries them to the oceans.

## **MATERIALS REQUIRED:**

Per group:

8 oz. Styrofoam cup , ½ sheet of transparency film, sharpie marker, ruler, tape, scissors, green rust-free scouring pad or very thin sponge, empty 3-liter soda bottle, sugar, sand

**EVALUATION:** Students can be assessed by their explanations of the observations made during the activity.

## **EXTENSIONS:**

- To illustrate how pollution from landfills can enter into the water cycle through the groundwater, add kool-aid powder to the sugar. As the sugar dissolves, the kool-aid will color the groundwater showing the pollution from the landfill contaminating the groundwater. Discuss measures that are taken to prevent this from happening.
- Little plastic houses could also be put on top to illustrate the problems land owners in karst areas face when they try to build on their land. Sinkholes sometimes form after the home is already built.

## **HELPFUL HINTS:**

- Younger students will benefit from watching a teacher build the model before making their own.
- It's easier to keep the transparency tube in place if you use a piece of tape to hold it together.
- Bigger tubes of sugar tend to work better than smaller ones (best is approx the size of a quarter).
- Coffee filters have also worked well instead of the sponge.
- You don't want the sand to be much higher than the height of the sugar—no more than ½ a centimeter.
- Activity works better if the sand is very dry.
- Be sure the hole is completely open, do not leave the Styrofoam piece hanging there.

Name: \_\_\_\_\_

## Sinkhole in a Cup

### Background

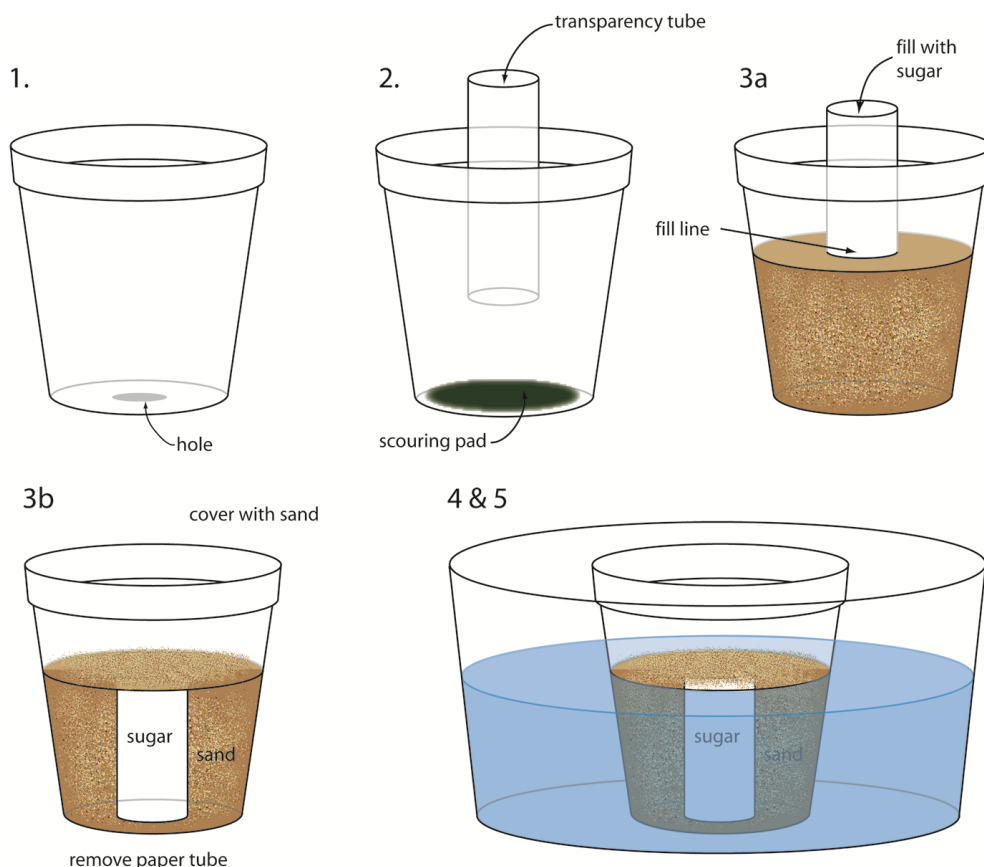
Sinkholes are natural depressions in the landscape caused by the dissolving of rock layers and the resulting sinking of the Earth's surface. They form as groundwater removes the subsurface rock and soil. Sinkholes can form by slow, gradual sinking or by the sudden collapse of an underlying void. Sinkholes are common throughout about one quarter of the United States. They can be small and localized or larger than a football field. Both circumstances have one thing in common—they indicate caves and/or broken, weathered limestone bedrock near the soil surface.


### Materials

- 8 oz. Styrofoam cup, ½ sheet of transparency film, sharpie marker, ruler, tape, scissors, green rust-free scouring pad or very thin sponge, empty 3-liter soda bottle, sugar, sand

### Procedure

1. Make a hole in the bottom of a Styrofoam cup about the size of your thumb. Be sure the hole is completely open, do not leave the Styrofoam piece hanging there.
2. Cut a circle the size of the cup bottom from a thin scouring pad. Place this circle in the bottom of the cup.
3. Measure the height of the Styrofoam cup. Figure out what  $\frac{3}{4}$  of the height is. Using the ruler and sharpie marker, draw a line on the transparency sheet that is this distance from the edge of the transparency. This will serve as the fill line for the sugar. The sugar should be about  $\frac{3}{4}$  the height of the cup.
4. Place a column of sugar in the center of the cup and surround it by sand. To do this, make a tube by rolling up the half sheet of transparency film and placing it in the center of the cup. The tube should be about the same width as a quarter. Fill the inside of the tube with sugar up to the fill line and the outside of the tube with sand (the sand is between the transparency tube and sides of the cup). Remove the transparency tube. Place a thin layer of sand over the sugar.
5. Cut the bottom off a three-liter soda bottle at about the same height as the cup. Fill it about half full of water. This symbolizes groundwater. (The level of the water in the tub and the sand in the cup should be about the same.)





6. Place the cup with sugar and sand in the water. Watch as the water fills into the cup and the sugar dissolves and runs out. A sinkhole is formed in the cup as the surface sand sinks into the area where the sugar dissolved. (You may need to remove the cup from the water to drain and for the sinkhole to form.) Describe what you see in the space below.

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**Analysis Questions**

1. What natural process does the water in the soda bottle represent?
2. What type of rock does the sugar represent?
3. What characteristics must a rock have to be suitable for forming sinkholes and caves?