**Blackline Master #4**

### Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date \_\_\_\_\_\_\_\_\_\_\_\_\_ Period \_\_\_\_\_\_\_\_\_\_\_\_

**Student Lab Sheet: An Investigative Look at Florida’s Sinkholes**

**The Investigation**: It is believed that the amount of rainfall, pH of groundwater and the depth of the limestone layer *could* lead to the formation of sinkholes. In this investigation, you will hypothesize which of these three have the greatest effect on the formation of sinkholes, carryout your experiment with a scientific model, and conclude using your collected data along with comparing it to your classmates’ data.

List three interesting ideas/facts you know about sinkholes. This can be from the intro video or from your prior knowledge.

1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Develop a Hypothesis**

You may choose/be assigned one of the following things to investigate with your model:

* 1. If the amount of sand causes sinkholes to form faster.
* If you choose thickness of soil, the only thing you may change is the amount of soil.
  1. If the amount of water causes sinkholes to form faster.
     + If you chose amount of water, the only thing you may change is the amount of water.
  2. If the pH (acidity) of the water causes sinkholes to form faster.
     + If you chose pH, the only thing you may change is the *simulated* pH of the water you are using.

Why do you believe letter \_\_\_\_ will cause the fastest formation of sinkholes?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**The Science Process**

In each of the experiments, we are going to measure the amount of time it takes for the Alka-Seltzer tablet to break down. (The Alka-Seltzer represents the limestone layer) You will know when the tablet has fully broken down due to the appearance of a sinkhole in the container*.*

In your experiment, what is your independent (test) variable? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

In your experiment, what is your outcome (dependent) variable? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

What must be held constant, or stay the same in each of your tests? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Procedure**:

1. Create your sinkhole model using the, “*How to Construct Your Sinkhole Model***”** worksheet your teacher handed out.
2. Using your model, complete a control test using 100mL of water and 100g of sand.
   1. Measure 100 g of sand on a balance and place it over the Alka-Seltzer tablet*. Do not pound the sand down; gently flatten it out on the surface so it is smooth.*
   2. Measure 100 mL of water using a graduated cylinder.
   3. **Slowly and carefully** pour the 100 mL of water onto the sand. Try not to cause any erosion while dumping your water into your model.
3. Record the amount of time, in seconds, how long it takes until the sinkhole forms from the first second you pour the water into the container**. The timer should stop when you see the hole (Alka-Seltzer tablet) in the top of the Styrofoam bowl.**
4. Once the sinkhole has formed, throw away your model in the garbage, and create a new model for your next trial. With each trial, you are to have different levels of the independent variable. For example, if you are testing the amount of sand, try 50g and 200g.
5. Complete multiple trials, making a new model each time.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Quantitative Data Collected:** | | | | | | |
| We are testing the effect of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_on the amount of time it takes for our sinkhole to form. *Remember to ONLY change your independent variable, while keeping others constant!* | | | | | | |
|  | **Trial** | **Control** | **Trial 1** | **Trial 2** | **Trial 3** |  |
| **Amount of Water** | 100mL |  |  |  |
| **Amount of Sand** | 100 g |  |  |  |
| **pH of water** | Normal |  |  |  |
| **Time for sinkhole to form** |  |  |  |  |

1. Prepare to talk about your data: ***Answer the questions below after collecting all of your data****:*
   1. Based on what you tested with your model, is there a pattern with either the amount of soil, amount of water or pH of the water used?

* 1. What was the longest amount of time it took for the sinkhole to appear? Was there a reason for this?
  2. What was the shortest amount of time it took for the sinkhole to appear? Was there a reason for this?

**Additional Information:**

Sinkholes are a common feature of Florida's landscape. They are only one of many kinds of karst landforms, including caves, disappearing streams, springs, and underground drainage systems. A karst is a generic term which refers to a landform created by erosion associated with chemical weathering and the breakdown of limestone, which is one of the most common carbonate rocks in Florida. The breaking down of carbonate rocks begins when they are exposed to acidic water. Most rainwater is slightly acidic and usually becomes more acidic as it moves through decaying plant debris.

Limestone in Florida is porous, meaning it has a lot of tiny holes within it. This allows acidic water to enter through the rocks layers, dissolving some limestone and carrying it away in solution. Over long periods of time, this erosional process has created wide underground voids and drainage systems in much of the carbonate rocks throughout the state. The collapsing of covering sediments into the underground areas produces sinkholes.

When groundwater discharges from an underground drainage system, it is a spring, such as Wakulla Springs, Silver Springs, or Rainbow Springs. Sinkholes can occur in the beds of streams, sometimes taking all of the stream's flow, creating a disappearing stream. Dry caves are parts of karst drainage systems that are above the water table, such as Marianna Caverns located on the Florida Panhandle (right).

*Photo Credit: https://commons.wikimedia.org/wiki/File%3ATourists\_look\_at\_rock\_formations\_inside\_the\_caves\_at\_Florida\_Caverns\_State\_Park.JPG*

**Use the above reading and your lab experience to answer the questions below:**

1. What is a karst? How are karsts related to sinkholes?

1. What are some of the causes of sinkholes?

1. Why are sinkholes common in Florida?

1. In your model, you are using an Alka-Seltzer tablet. Over time, the tablet dissolved and broke down. What layer of rock does the Alka-Seltzer tablet represent?
2. What similarities are there between the sinkhole described in the reading and the one you created with your model?

**Directions for Claim/Evidence/Justification Model of Lab Writing:**

Below is an example of the claim, evidence, and justification model of lab writing. On a separate, large sheet of paper place your claim at the top of the sheet, answering the question, “What factors contribute to sinkhole formation?”

Your **claim** must be defended with **evidence** you collected during the lab. This can be any of the following:

* + The amount of time it took for your sinkhole to form.
  + The effect of your independent variable (depth, amount of water, pH etc.)
  + Other group’s information that tested a different independent variable.
  + Evidence from the background information or video.
  + Any other qualitative or quantitative data your feel is relevant.

Your **justification** is planned, structured writing that uses your evidence and supports your claim. You must show that you understand the science concept of sinkholes by correctly utilizing key vocabulary and explaining how your model demonstrates the concepts.

**Your Poster Board:**

|  |  |
| --- | --- |
| **Guiding Question**: “What factors contribute to sinkhole formation?”  **Students Claim:** Answer to the guiding question using what you learned from your model. | |
| **Evidence**:  Students place all data below (quantitative and qualitative) - this can be data from your table. Create a graph of the amount of time it took for your sinkhole to occur.  Include mathematical connection such as max/min/mean when providing data.  Include any other observations including qualitative and quantitative data that you find important to explaining your claim.  Information can be included from the reading. | **Justification**:  Is a well-written paragraph reflecting on the group’s model, data and research?  All evidenced is tied to and supports students “claim.”  Must be in paragraph form.  Uses data from the evidence section to support the group’s claim.  Must *use* key vocabulary terms including   * erosion * weathering * sinkhole |

**Blackline Master #5**

Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Period \_\_\_\_\_\_\_\_\_\_\_

**Checking for Understanding: An Investigative Look at Sinkholes**

\_\_\_ 1. At what point did your model demonstrate chemical weathering? (SC.6.E.6.1)

1. When the model was first constructed.
2. When the small bubbles appeared, causing the limestone layer to break down.
3. When all of the sand fell through the opening, causing a sinkhole to form.
4. When the water was poured into the sand, causing some of the sand particles to move.

\_\_\_ 2. The model demonstrated erosion. (SC.6.E.6.1)

A. True B. False

Explain your answer.

\_\_\_ 3. List all of the factors that can contribute to the formation of a sinkhole. (SC.6.E.6.2)

Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Period \_\_\_\_\_\_\_\_\_\_\_

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A. True B. False

Explain your answer.

\_\_\_ 3. List all of the factors that can contribute to the formation of a sinkhole. (SC.6.E.6.2)

**Blackline Master #6**

### ANSWER KEY: Checking for Understanding: An Investigative Look at Sinkholes

**B**  1. At what point did your model demonstrate chemical weathering? (SC.6.E.6.1)

1. When the model was first constructed
2. When the small bubbles appeared, causing the limestone layer to break down.
3. When all of the sand fell through the opening, causing a sinkhole to form.
4. When the water was poured into the sand, causing some of the sand particles to move.

**A** 2. The model demonstrated erosion (SC.6.E.6.1)

A. True B. False

Explain your answer.

***When all of the sand fell through the hole created by the collapsing limestone layer, erosion occurred.***

\_\_\_ 3. List all of the factors that can contribute to the formation of a sinkhole. (SC.6.E.6.2)

***Low levels of pH, a large storm dumping a lot of water on an area, and a limestone layer that is located closer to the surface.***