

## Soil Horizons and Slope

## Teacher's Guide

**Subject:** Integrated Science (Life; Earth-Space; Physical)

**Topics:** Percent Slope, Soil Horizons, Karst Features

**Summary:** Students will examine a soil core and measure the slope of a dry sink at Madison Blue Springs State Park.

After completing the field lab, students will be able to:

**Objective(s):**

1. Calculate percent slope and examine soil core samples.
2. Relate their data to the development and age of sinkholes (karst features).

**Ecosystem(s):** Hammocks; Pinelands

### Equipment:

- |                               |                              |               |
|-------------------------------|------------------------------|---------------|
| • Auger                       | • Sand Gauge                 | • String/line |
| • GPS                         | • Data Sheets and clipboards | • Line Level  |
| • Munsell Charts (7.5, 10 YR) | • Tape measure               | • PVC posts   |

### Background:

- Vocabulary: Percent slope, Angle of Slope, soil horizon
- Reference Material: Every Soil has a Story: <http://soil.gsfc.nasa.gov/story/story1.htm>  
Review math: Slope
- Equipment Training: Auger, GPS

### Procedure (Engage; Explore; Explain)

#### Slope Measurement

1. Students will work on the trail near a dry sink. Ask the students: How can you tell the age of a sink by its relative slope? Have the students complete the Hypothesis and Rationale.
2. Hold posts at two points down the slope at about 5 meters apart (along the trail is fine);
3. Run string from the bottom of the uphill post to the lower post and use line level to ensure the string is level.
4. Measure the horizontal distance of the string (run)
5. Measure the vertical distance from the bottom of the lower post to the string (rise)
6. Calculate percent slope (rise/run x 100)
7. Repeat measurement over a somewhat longer horizontal distance and compare your results.
8. Once your data is complete, proceed to the Soil Horizon study.

## Procedure (Engage; Explore; Explain) Cont.

### Soil Horizons

1. Students will work off the trail down in the sink. Ask the students: Compare soil horizons to tree rings. What might they tell you about the ground underfoot? Have the students complete the Hypothesis and Rationale.
2. Find a ground area that is free of obvious roots. Sweep away any surface leaves, etc.
3. Each student will take a turn using the soil auger.
4. Extract soil cores/buckets and lay them horizontally on the ground until one auger length has been obtained. The handle of the auger should always be closest to you when laying down core sections.
5. Be careful to keep each soil core/bucket as close to the size extracted from the ground. This will help to prevent elongating the core once laid out.
6. Use the metric tape to mark where each horizon begins and ends.
7. Observe soil color and texture for any obvious changes and note the depth at which the change occurs. Use the Color Chart and the Sand Gauge.
8. Record on your data sheet the number of horizons.
9. Complete observations for each distinct layer/horizon.
10. Put the soil back in the hole you augured.
11. Tamp the hole to make sure it is refilled. Recover the ground with any leaf litter (as you first saw it).
12. Switch with the other half group and measure slope.

### Sunshine State Standards:

**Science:** SC.A.1.3.1; SC.D.1.3.1.2; SC.H.1.3.4-7; SC.H.2.3.1

**Language Arts:** LA.A.1.3.3; LA.C.1.3.1, 4

**Mathematics:** MA.A.3.3.3; MA.B.1.3.2; MA.B.2.3.1; MA.B.3.3.1; MA.B.4.3.2

**Social Studies:** SS.A.6.3; SS.B.2.3.9

# Soil Core and Slope

# Student Data Sheet

## General Information

Full Name:		Date:	
School (teacher):		Time:	
Latitude:		Longitude:	

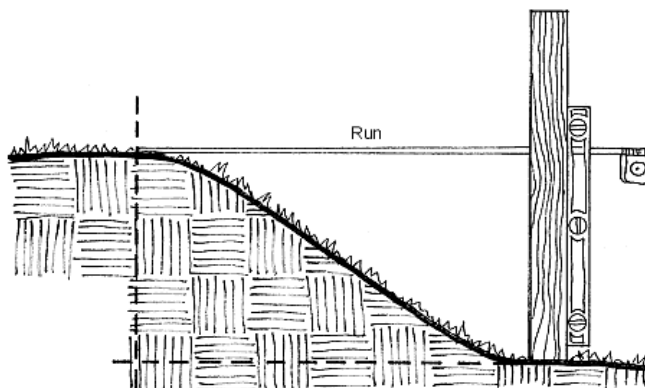
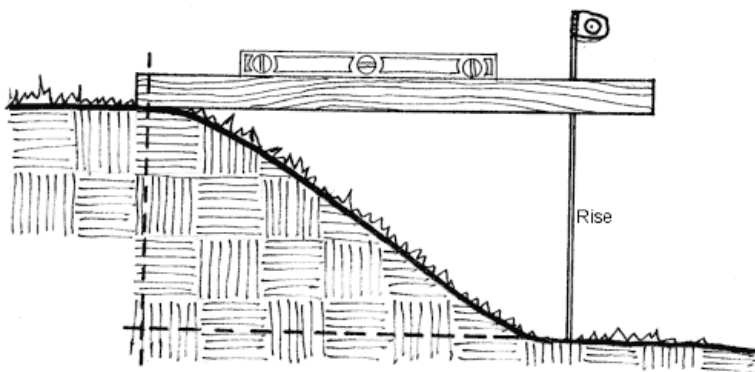
## Slope- Student Hypothesis and Rationale

If the slope is not the same from the top to the bottom of the sink hole, then I will get a more accurate description of the slope if I measure the slope in (choose one: one long measurement or multiple small measurements. I think this because... \_\_\_\_\_

\_\_\_\_\_

## Slope- Field Observations/Measurements/Data

Segment	Rise	Run	Percent Slope (Rise/Run x 100)
Segment 1			
Segment 2			
Segment 3 (optional)			



## Soil Core- Field Observations/Measurements/Data

### Location 1:

Latitude:	Longitude:
Habitat:	

	Horizon Depth (cm from the surface)	Color Chart (hue/value/chroma)	Texture/Content (see reference key)	Consistency (loose, friable, firm, extremely firm)	Grain Size (coarse, medium, fine, or very fine)
1					
2					
3					
4					

### Location 2:

Latitude:	Longitude:
Habitat:	

	Horizon Depth (cm from the surface)	Color Chart (hue/value/chroma)	Texture/Content (see reference key)	Consistency (loose, friable, firm, extremely firm)	Grain Size (coarse, medium, fine, or very fine)
1					
2					
3					
4					

## Soil Core and Slope

## Assessment

1. What was the soil description for horizon #2?

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2. What was the difference between the percent slope in segment 1 and segment 2? Why do you think this is?

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3. Was your hypothesis supported by your data? Whether your hypothesis is supported or not, what can you infer from your observations, measurements, and results?

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4. Do you think you can use the same procedure to look at soil horizons on a rocky mountain? Explain why or why not.

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5. If people build trails that go straight down a steep slope, what is likely to happen when it rains? How can this problem be avoided?

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6. Think about what you learned in this lab; has it generated any new questions? Write a new question about something you want to learn more about.

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# Reference Sheet

## Soil Texture

### Step 1 (Get and moisten sample)

Use the triangle to determine the soil texture of your horizon.

Place some soil from a horizon (about the size of a small egg) in your hand, and, using the spray mist bottle, moisten the soil. Let the water soak in and then work the soil between your fingers until it is the same moisture throughout. Once the soil is moist, try to form a ball. If the soil forms a ball, go on to Step 2. If the soil does not form a ball, go to Step 5.

### Step 3 (Refine initial soil texture classification from Step 2 for relative amounts of sand and silt)

Wet a small pinch of the soil in your palm and rub it with a forefinger.

If the soil:

- Feels very gritty, go to **E**
- Feels very smooth, with no gritty feeling, go to **F**
- Feels only a little gritty, go to **G**

### Step 2 (Test for Clay)

**A.** If the soil:

- Is really sticky
- Hard to squeeze
- Stains your hands
- Has a shine when rubbed
- Forms a long ribbon (5+ cm) without breaking,

Call it a **clay** and go to Step 3.

**Otherwise**, go to B.

**B.** If the soil:

- Is somewhat sticky
- Is somewhat hard to squeeze
- Forms a medium ribbon (between 2-5 cm)

Call it a **clay loam** and go to Step 3.

**Otherwise**, go to C.

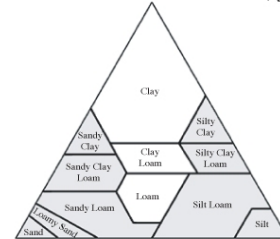
**C.** If the soil is:

- Soft
- Smooth
- Easy to squeeze,
- At most slightly sticky,
- Forms a short ribbon (less than 2 cm)

Call it a **loam** and go to Step 3.

**Otherwise**, go to **D**.

**D.** If the soil forms a ball but **no** ribbon, go to Step 4.



**E.** Add the word **sandy** to the initial classification.

Soil texture is (check one):  sandy clay,

sandy clay loam,  sandy loam

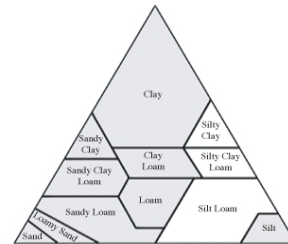
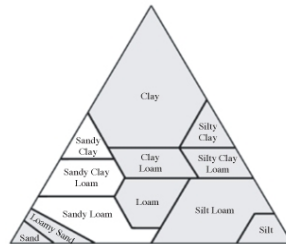
Soil Texture is complete.

**F.** Add the word **silt** or **silty** to the initial classification.

Soil texture is (check one):  silty clay,

silty clay loam,  silt loam

Soil Texture is complete.



**G.** Leave the original classification of (check one):

clay,  clay loam,  loam

Soil Texture is complete.

### Step 4 (Test for loamy sand or silt)

If the soil:

- Forms a ball
- Forms **no** ribbon
- And is

**H.** Very gritty

Soil texture is:  loamy sand

Soil Texture is complete.

Or

**I.** Very soft and smooth with **no** gritty feeling,

Soil texture is:  silt

Soil Texture is complete.

### Step 5 (Test for sand)

If the soil:

Forms **no** ball and falls apart in your hand,

Soil texture is:  sand

Soil Texture is complete.

