

Puddles and Soil

Task Information

Subject: Earth Science

Content:

- NYS Syllabus - Topic VIII - Moisture and Energy Budgets and Environmental Change A1 - Ground water
- NYS Pro. Mod. Syllabus (1993 ed.) Unit 7 A3 - Climate and Water Cycle
- MST Framework Standard 4 - Many of the phenomena that we observe on Earth involve interactions of air, water, and land components.
- Middle Level Science Block D II A 2 - Ground Water

Format: Manipulative

Purpose: To observe and analyze the permeability of different soils.

Skills:

Primary: Observing, interpreting data

Secondary: Generalizing/infering, predicting

Time: 30 minutes

Materials:

Teacher

- sieve screens
- source of sand and soil

per Student

- soil sample (2-3 spoonfuls)
- sand sample (2-3 spoonfuls)
- silt sample (2-3 spoonfuls)
- spoon (tbs.)
- stop watch or clock w/ second hand
- 10mL graduated cylinder
- funnel (small)
- hand lens
- plastic bottle or cylinder
- filter paper (3 sheets)
- paper towels
- 50-100ml water container

Preparation:

- Place about 1 - 1 1/2 cups of each soil sample in a labeled zip lock bag.
- Do not let soil samples dry out. They should be slightly damp to the touch.
- The sand sample should have approximately the all the same sized grains.
- Do not mix two different samples.
- White construction sand works well for this activity
- Silt samples may be obtained by using the sieve screens using the finest or second grade materials (0.086 - 0.014mm)
- Check soil / sand / silt samples to make sure they have different infiltration rates.

Safety: N/A

Extensions/Modifications: Students may bring their own samples to test.

Puddles and Soil

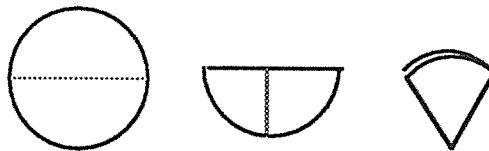
Task: At this station, you will be determining which of several soil samples produces puddles.

Materials:

- | | |
|------------------|-------------------|
| • soil sample | • funnel |
| • sand sample | • filter paper |
| • silt sample | • spoon |
| • hand lens | • paper towels |
| • plastic bottle | • water container |
| • 10 mL graduate | • stop watch |

Directions:

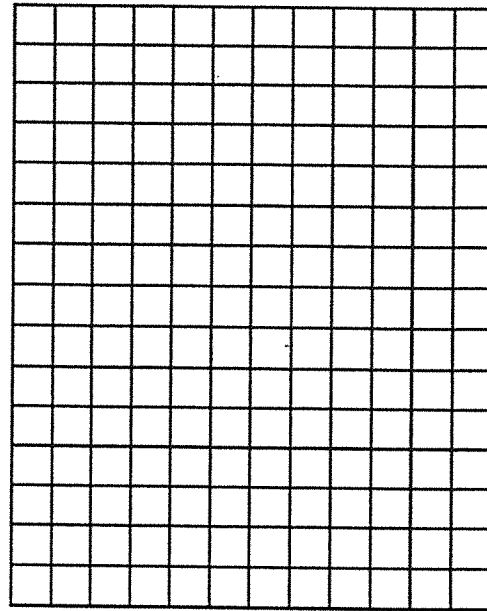
- Place a small amount of soil, sand, and silt on a paper towel. Label them soil (SL), sand (SD) and silt (ST)
- Observe each sample with the hand lens and set them to the side.
- Which sample has the largest pieces? _____
- Which sample has the smallest pieces? _____
- Place the funnel into the plastic bottle.
- Fold the filter paper and place a filter in each funnel.
Directions for folding: Fold paper in half, then in half again. Open to form a cone with 3 quarters on one side and one on the other (see diagram).



- Fill the filter paper with water to wet the filter paper. As soon as the water flows out of the funnel, dump the water back into the water container. The filter paper should stick to the sides of the funnel without any air bubbles. Be sure to let all the water drip through the filter before placing the soil sample in it.
- Measure out 10ml of water in the graduated cylinder.
- Put 2 spoonfuls of the soil sample (SL) into the wet filter paper and gently pack down the sample with the back of the spoon.
- Pour 10 mL of water on top of the soil in the funnel.
- Time how long it takes for the 10 mL of water to disappear into the soil.
- Record your time on the data table.
- Repeat step #8 - 12 with each of the remaining samples. (SD & ST)

14. Make a bar graph of your data using sample and time as your variables. Label both axes.

Sample	Time (in seconds)
Soil (SL)	
Sand (SD)	
Silt (ST)	



15. Which sample made the best puddle? _____
Using complete sentences, write a statement explaining why you think this sample made the best puddle.

16. Gardeners believe that the smaller soil particles are, the more slowly water will travel through the soil. Based on your results, use complete sentences to tell why you think they are or are not correct.

Puddles and Soil - Scoring Rubric

Maximum Score - 12 points

Tasks 1 & 2 Directions **No credit**

Tasks 3 & 4 Soil Observations **2 points total**

Standard: The student will examine the soil samples and make conclusions about the size of the particles that make up the sample.

Criteria:

- Largest pieces
(sand or soil - based on teacher's observation) 1 point
- Smallest pieces (silt) 1 point

Tasks 5 - 11 Directions **No credit**

Task 12-13 - Data Table **1 point total**

Standard: The students will record their data in a data table

Criteria:

- All three times should be recorded in seconds 1 point

Task 14 - Bar Graph **4 points total**

Standard: The students will graph the data from their data chart

Criteria:

- Both axes labeled 1 point
- Appropriate scale 1 point
- Bar graph drawn and consistent with 3 values from student's data 2 points
- Two values from data plotted correctly 1 point

Task 15 - Best Puddle **3 points total**

Standard: The students will choose the sample that makes the best puddle

Criteria:

- Sample that makes the best puddles (silt - based on data) 1 point
- Statement explaining choice in complete sentences 2 points
- Correct statement not in complete sentences 1 point

Sample of acceptable answers:

- statement describes porosity, permeability, or capillarity

Task 16 - Gardener's Belief **2 points total**

Standard: The students will explain why or why not they support the beliefs of the gardeners.

Criteria:

- Students generalizes about permeability depending on particle size and/or sorting in complete sentences 2 points
- Correct explanation, not in complete sentences 1 point

Highest possible score - 12 points

Student ID _____

Puddles and Soil - Scoring Form

Male /Female (circle one)

Circle the student's score for each question. Add the points for each question and write the total score at the bottom of the scoring form.

Tasks 1 - 2 - Directions

no credit

3. Largest pieces - sand or soil

0 1

4. Smallest pieces - silt

0 1

Tasks 5 - 11 - Directions

no credit

12. Data Table

0 1

14. Graph of data

- Both axis labeled
- Appropriate scale
- Bar graph drawn and consistent with data

0 1

0 1

0 1 2

15. Best puddle

- Choice of silt sample or longest time
- Statement explain choice

0 1

0 1 2

16. Gardeners' belief

- Explanation about permeability depending on particle size and/or sorting

0 1 2

TOTAL SCORE _____

Highest possible score - 12 points

Student ID ES-PH-1

Scoring Form - Puddles and Soil

Circle the student's score for each question. Add the points for each question and write the total score at the bottom of the scoring form.

Tasks 1 - 2 - Directions

no credit

3. Largest pieces - sand or soil

0 (1)

4. Smallest pieces - silt

0 (1)

Tasks 5 - 11 - Directions

no credit

12. Data Table

0 (1)

14. Graph of data

- Both axis labeled
- Appropriate scale
- Bar graph drawn and consistent with data

0 (1)

0 (1)

0 1 (2)

15. Best puddle

- Choice of silt sample or longest time
- Statement explain choice

0 (1)

0 1 (2)

16. Gardeners' belief

0 1 (2)

TOTAL SCORE 12
(Highest possible score - 12 points)

Puddles and Soil

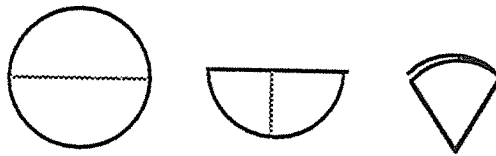
Task: At this station, you will be determining which of several soil samples produces puddles.

Materials:

- soil sample
- sand sample
- silt sample
- hand lens
- plastic bottle
- 10 mL graduate
- funnel
- filter paper
- spoon
- paper towels
- water container
- stop watch

Directions:

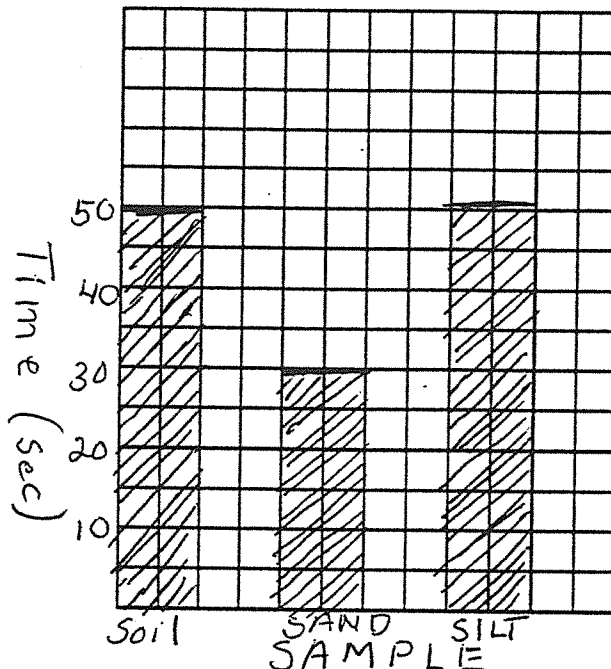
1. Place a small amount of soil, sand, and silt on a paper towel. Label them soil (SL), sand (SD) and silt (ST)
2. Observe each sample with the hand lens and set them to the side.
3. Which sample has the largest pieces? Top Soil
4. Which sample has the smallest pieces? Silt
5. Place the funnel into the plastic bottle.
6. Fold the filter paper and place a filter in each funnel.
Directions for folding: Fold paper in half, then in half again. Open to form a cone with 3 quarters on one side and one on the other (see diagram).



7. Fill the filter paper with water to wet the filter paper. As soon as the water flows out of the funnel, dump the water back into the water container. The filter paper should stick to the sides of the funnel without any air bubbles. Be sure to let all the water drip through the filter before placing the soil sample in it.
8. Measure out 10ml of water in the graduated cylinder.
9. Put 2 spoonfuls of one soil sample (SL) into the wet filter paper and gently pack down the sample with the back of the spoon.
10. Pour 10 mL of water into the funnel.
11. Time how long it takes for the 10 mL of water to disappear into the soil.
12. Record your time on the data table.
13. Repeat step #8 - 12 with each of the remaining samples. (SD & ST)

14. Make a bar graph of your data using sample and time as your variables. Label both axes.

Sample	Time (in seconds)
Soil (SL)	50
Sand (SD)	30
Silt (ST)	51



15. Which sample made the best puddle? Silt
 Using complete sentences, write a statement explaining why you think this sample made the best puddle.

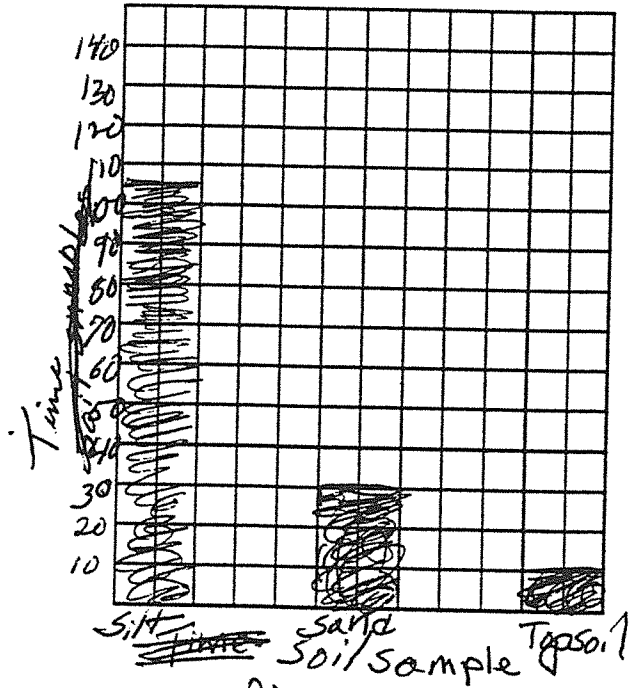
Silt probably made the best puddle because the particles are smaller and close together so less water gets through.

16. Gardeners believe that the smaller soil particles are, the more slowly water will travel through the soil. Based on your results, use complete sentences to tell why you think they are or are not correct.

I think they are correct because Silt had the smallest particles and longest puddles. But it's not right because Soil has larger particles but longer puddles than Sand.

14. Make a bar graph of your data using sample and time as your variables. Label both axes.

Sample	Time (in seconds)
Soil (SL)	10 sec
Sand (SD)	30 sec
Silt (ST)	1:05



15. Which sample made the best puddle? silt
 Using complete sentences, write a statement explaining why you think this sample made the best puddle.

I think it made the best because the water traveled through the silt without soaking into the silt.

16. Gardeners believe that the smaller soil particles are, the more slowly water will travel through the soil. Based on your results, use complete sentences to tell why you think they are or are not correct.

I think they are correct. The water travels through the top soil very fast, but then again I think that more water flows through smaller particles.