

Date: _____

Your Name: _____

Name(s) of Partner(s): _____



**NEW ENGLAND
COMMON ASSESSMENT PROGRAM**

Released Science Inquiry Task

Percolation

2015

Grade 4

Inquiry Booklet

Science

Directions:

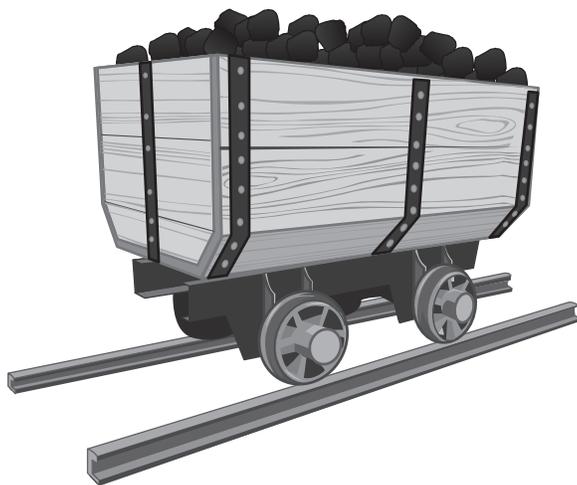
You will read a story about two students who go on a field trip and then do three different investigations. Then you and your partner will do one of the same investigations as the students.

Word Bank

Frost heave	a bump in the ground or pavement caused by the freezing of water in the soil (earth materials)
Median	the middle number in a list of numbers arranged from smallest to largest Example: The median for 2 cm, 4 cm, and 5 cm is 4 cm.
Percolation	the process of water moving downward through openings in earth material
Trial	each time a test is repeated

Percolation

Claire and Thomas's class are on a field trip to tour the Lackawanna Coal Mine in Pennsylvania. The coal mine is in an area that has cold winters and hot summers. Claire and Thomas see an old coal car outside the mine. The tour guide explains that it was important that the tracks for the coal cars were kept smooth and straight so that coal did not spill out. A coal car on tracks is shown below.



Later on the tour, Thomas takes a picture of an old railroad track that leads away from the coal mine. The track is bumpy and crooked. The guide says that a crooked track, like the one shown below, would no longer be used.



© Carl Crumley

Section of Pennsylvania Railroad 2015

During the coal mine tour, Claire and Thomas see a drawing of railroad tracks near the coal mine. The guide says that the drawing of the tracks, shown below, was made when the tracks that Thomas took a picture of earlier were built over 100 years ago.

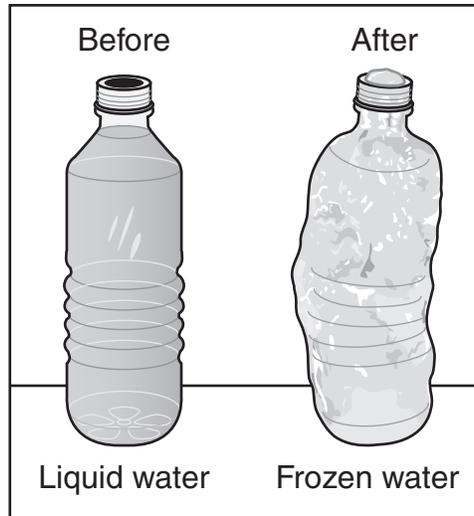


Section of Pennsylvania Railroad 1890

Both students are surprised at how different the tracks look now. The students wonder what caused the railroad tracks to become so crooked since they were built. Thomas thought that there must have been an earthquake. Claire thought that the changes must have happened slowly over the years. The students decide to ask their science teacher, Ms. Sanders, when they return from their field trip.

Back at school, Ms. Sanders suggests that Claire and Thomas do some research as well as try a few investigations to find out why the tracks changed. For their first investigation, they place a bottle of water in the school freezer. The next day, they find that the water had expanded when it froze. The results of their investigation are shown below.

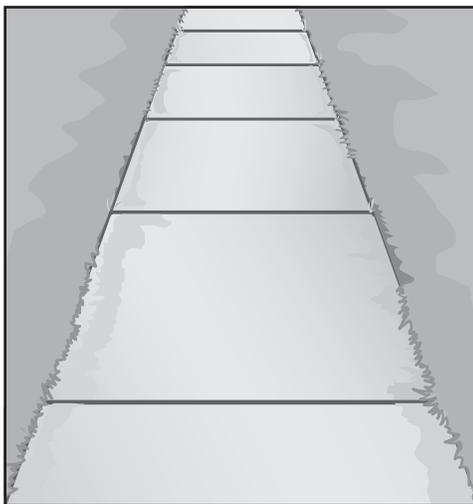
Water Bottle Investigation Results



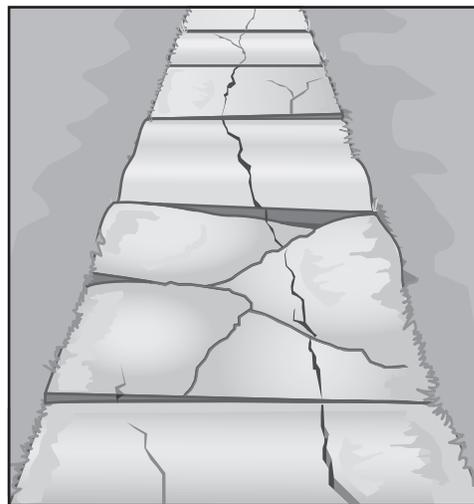
After Claire and Thomas see the changes to the bottle when the water froze, Claire remembers that after several winters her father had to replace the damaged walkway to her house because the earth material under it had pushed the walkway up. Her father had explained that in the winter, water in the earth materials under the walkway froze, expanded, and lifted up parts of the walkway, making bumps called frost heaves.

Pictures of Claire's walkway are shown below.

New Walkway

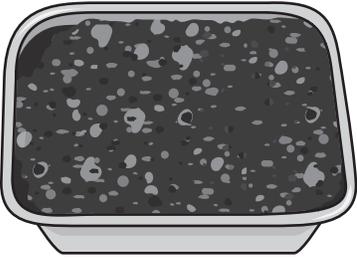


Damaged Walkway



For their second investigation, Claire and Thomas decide to use earth materials, water, and plaster to make a model of how frost heaves affect a walkway. Claire suggests that they use the school freezer again to test their model.

Claire and Thomas's frost heave model is shown below.

	Before Freezing: In the container filled with earth material and water, put a thin layer of plaster on top.	After Freezing: Observe the container filled with earth material and water with a thin layer of plaster on top.
Fill container with earth material and water.		

Conducting an Investigation

After making a model of how frost heaves affect a walkway, Claire and Thomas wonder if all earth materials hold the same amount of water and if the amount of water held by earth materials affected the railroad tracks.

Ms. Sanders suggests they find out how rainwater flows through earth materials, which is called **percolation**. The students realize that if they learn about percolation, they can figure out how much water an earth material will hold. Claire and Thomas decide to investigate the answer to this research question:

Does the amount of rainwater that an earth material can hold affect how frost heaves form?

Making a Prediction—What Do You Think?

Make a prediction **on your own** about the research question below.

Research Question:

Does the amount of rainwater that an earth material can hold affect how frost heaves form?

Use the information from the story and what you know about the characteristics of different types of earth materials to make and explain your prediction.

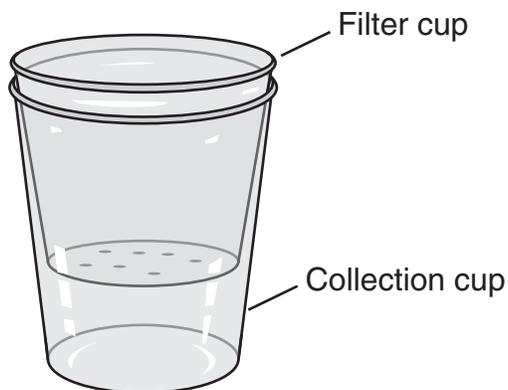
I predict

because



Claire and Thomas design a third investigation to test how water moves through three different unidentified earth materials that Ms. Sanders gave to them: X, Y, and Z. They make a percolation tester out of a plastic collection cup and a filter cup, as shown below.

Percolation Tester Setup



Claire and Thomas put earth material X in the percolation tester, pour water in the tester, measure the amount of water that flows through the earth material in one minute, and write the data in a table. They do three trials with each earth material and then find the median amount of percolation for each type of earth material.

You will be doing the same investigation as Claire and Thomas.

On the placemat in front of you, you have the same materials Claire and Thomas used.

Materials for the Investigation:

- 1 bag of earth material X
- 1 bag of earth material Y
- 1 bag of earth material Z
- 1 40 mL graduated vial
- 1 measuring scoop
- 3 small collection cups
- 3 filter cups
- 1 one-minute timer
- 1 large cup for used water
- 1 bottle with spout (filled with tapwater)
- 1 paper plate
- 1 large plastic bag (for used materials)

Safety: DO NOT put earth materials or water in your mouth or nose.

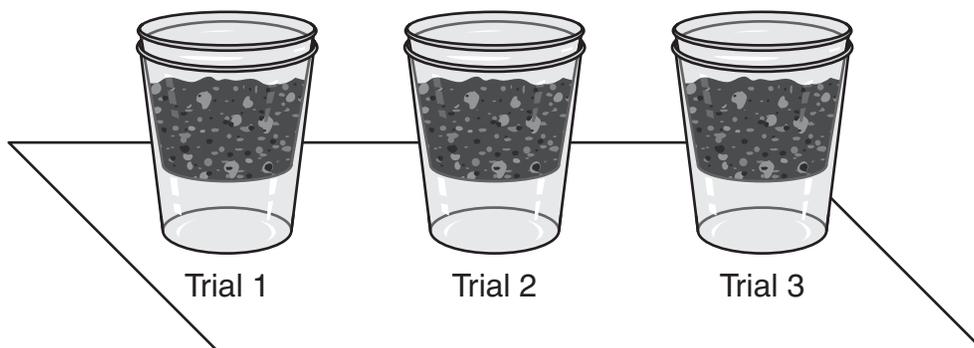
Procedure:

- You and your partner(s) will take turns using the materials in this investigation.
- You will test three different earth materials and take three measurements of each earth material's percolation.
- You will each record all of the data in your own Inquiry Booklet.

Read steps 1–15 that begin below and continue on page 8. Then add labels to the rows and columns in Data Table 1 on page 8 to collect the data from your investigation. Record your data in Data Table 1.

Investigate the amount of water that flows through an earth material in one minute and record your data in Data Table 1.

1. Place each filter cup inside a collection cup to make three percolation testers.
2. Place the percolation testers on the correct circles on the right side of your placemat.
3. Pour one level measuring scoop of earth material X into **each** of the percolation testers, as shown in the diagram below.



4. Pour 20 mL of water into the graduated vial.
5. Slowly pour the 20 mL of water into earth material X in the percolation tester for Trial 1. At the same time, have your partner start the timer.
6. After one minute, remove the filter cup and place it on the paper plate.
7. Pour the water from the collection cup into the graduated vial and measure the amount of water that moved through the earth material.
8. Record the amount of water that moved through the earth material in Data Table 1.
9. Pour the measured water into the large cup for used water.
10. Repeat steps 4–9 two more times with earth material X for Trials 2 and 3.
11. Empty all three filter cups into the large plastic bag.
12. Clean the percolation testers by rinsing the filter cups in the large cup for used water. Be sure that there is no earth material in the filter cups. Then, wipe them dry with a paper towel.

13. Repeat steps 1–12 with earth material Y, and then with earth material Z.
14. Place all remaining earth materials into the large plastic bag.
15. Record the median amount of water for each earth material in Data Table 1.

**Data Table 1: Amount of Water that Moves
through Three Different Earth Materials**

	Amount of Water that Moved Through			
				Median (mL)

After finishing the investigation, follow your teacher’s instructions to clean up your area.

You will complete the rest of the task in your Student Answer Booklet **on your own**.

