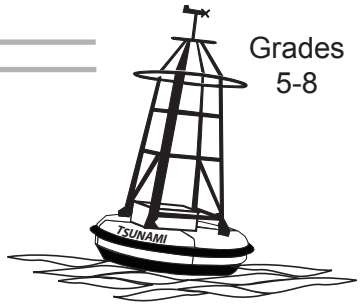
Kodiak Living, Long Ago

Grades 5-8



Overview:

In this lesson, students explore the properties of three different soils and the motivations behind choosing a location of a home on the Kodiak Archipelago about 400 years ago.

Targeted Alaska Grade Level Expectations:

Science

[5-8] SA1.1 The student demonstrates an understanding of the processes of science by asking questions, predicting, observing, describing, measuring, classifying, making generalizations, inferring, and communicating.

[5] SA1.2 The student demonstrates an understanding of the processes of science by using quantitative and qualitative observations to create inferences and predictions.

[7] SA3.1 The student demonstrates an understanding that interactions with the environment provide an opportunity for understanding scientific concepts by designing and conducting a simple investigation about the local environment.

[6] SD2.1 The student demonstrates an understanding of the forces that shape Earth by describing the formation and composition (i.e., sand, silt, clay, organics) of soils.

[6] SD2.3 The student demonstrates an understanding of the forces that shape Earth by describing how the surface can change rapidly as a result of geological activities (i.e., earthquakes, tsunamis, volcanoes, floods, landslides, avalanches).

[6] SE1.1 The student demonstrates an understanding of how to integrate scientific knowledge and technology to address problems by recognizing that technology cannot always provide successful solutions for problems or fulfill every human need.

[7-8] SE2.1 The student demonstrates an understanding that solving problems involves different ways of thinking, perspectives, and curiosity by identifying, designing, testing, and revising solutions to a local problem.

[5] SE3.1 The student demonstrates an understanding of how scientific discoveries and technological innovations affect our lives and society by describing the various effects of an innovation (e.g., snow machines, airplanes, immunizations) on the safety, health, and environment of the local community.

[7] SF1.1-SF3.1 The student demonstrates an understanding of the dynamic relationships among scientific, cultural, social, and personal perspectives by investigating the basis of local knowledge (e.g., describing and predicting weather) and sharing that information.

Targeted Alaska Cultural Standards:

B2 Culturally knowledgeable students are able to build on the knowledge and skills of the local cultural community as a foundation from which to achieve personal and academic success throughout life. Students who meet this cultural standard are able to make effective use of the knowledge, skills, and ways of knowing from their own cultural traditions to learn about the larger world in which they live.

Objectives:

The student will:

- investigate the permeability of clay and sand;
- examine traditional Alutiiq motivations for building a *ciqlluaq* in a tsunami inundation zone; and
- identify the mitigation practice used by the Alutiit for earthquake subsidence and tsunamis hundreds of years ago.

Materials:

- Sand
- Clay
- Beach gravel
- Paper cups
- Push pins
- Water
- Beakers (250 ml)
- Graduated cylinders (100 ml)
- Stopwatch or timer
- STUDENT WORKSHEET: “Kodiak Living, Long Ago”

Whole Picture:

Where to build, and how to build a home are two very important considerations in earthquake and tsunami prone country. The indigenous people of the Kodiak Archipelago, the Alutiit, had hazard mitigation processes that differ from those we use today.

The traditional Alutiiq house is called a *ciqlluaq* (chick-shlu-ahq). A *ciqlluaq* is semisubterranean and made of driftwood and sod. The arrival of driftwood was dependent on the ocean currents. Driftwood would only pile up on certain beaches where the current was just right. These are called catcher beaches.

Because of the semisubterranean nature of the *ciqlluaq*, the Alutiiq had to consider the type of soil on which it was built. The rainy climate made it necessary that the soil be permeable enough to permit drainage. This meant constructing homes on beach gravel along the coast. The glacier-carved inland areas of the islands were covered in bedrock and clay-rich soil. Living along the coast had other benefits as well, such as proximity to food sources from the sea and catcher beaches for wood. A risk of living along the beach was the danger of tsunamis. The hazard of tsunamis was short-term compared to earthquakes. Earthquakes change the level of the land by dropping it (subsidence) or by raising it (uplift). For coastal homes such as the ones on Kodiak, the danger of subsidence meant that the home would be submerged in water for a long time. This was the case in the village of Afognak in 1964. Although the tsunami that struck caused damage, it was the long-term effects of the earthquake and subsidence that made it necessary for the community to relocate to the village of Port Lions.

The mitigation practice of the Alutiiq depended on their seafaring ability, their kin in other villages and self-sufficiency. The Alutiiq were skilled at moving large numbers of people in their boats called an *angyaq*. Easily moving to communities that were less affected by a hazard with relatives made it easier for them to recover. Also, they were less dependent on the buildings and infrastructure of their damaged community.

Activity Preparation:

Collect gravel, preferably from the beach.

Activity Procedure:

1. Distribute and review student worksheet: “Kodiak Living, Long Ago.” For maximum flexibility, this activity may be completed as a class, groups, pairs or individually. Check student answers to questions 1 and 2 of the *Background Information* section before they write hypotheses.
2. After students have completed the worksheet, discuss results of the investigation and responses to Further Questions.

3. Based on archaeological evidence, the Alutiiq would most likely have chosen Site B. Although it is a high risk for tsunami and damage from subsidence, the soil is best for a ciqlluaq. The salmon stream and catcher beach are also close by. The Alutiiq who lived in this time period were very mobile. In the case of tsunamis or changes in land conditions from earthquakes, the Alutiiq loaded their boats, called *angyaqs*, and moved to a more suitable site.

Extension Ideas:

- Address more Alaska Science Grade Level Expectations by comparing results of the class. On a class graph, students record their results and compare and explain differing results for the amount of percolated water for each soil sample [5-8] SG2.1. Students calculate the range, median, and mode for each soil sample [7-8] SA1.2.
- Make a soil collection from various places around your community. Note the location where the sample was collected. Display the collection with magnifying glasses for people to examine the samples.

Answers:

Background Information:

1.

Less Porous *More Porous*

C *A* *B*

2.

Less Permeable More Permeable

D. Clay *A. Silt* *B. Sand* *C. Gravel*

Hypotheses:

Answers will vary.

Data:

1. *Answers will vary but should show that the water did not permeate well through the clay with most of the water staying above the clay.*
2. *Answers will vary but should show that the water permeated the sand more freely than the clay but the surface was less stable.*
3. *Answers will vary but should show that the percolation was greatest in the beach gravel with little to no affect on the surface.*
4. *Answers will vary but should show that the beach gravel had the highest permeability, followed by the sand and clay.*

Analysis of Data:

1. *Beach gravel*

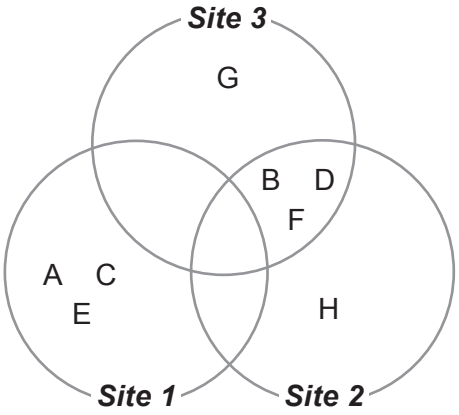
2. *The ciqlluaq would be full of water because the permeability of the clay is so low.*
3. *The sand is more permeable than the clay so the water would drain out more but the sand is not very stable.*
4. *The beach gravel is the most permeable and more stable than the sand.*

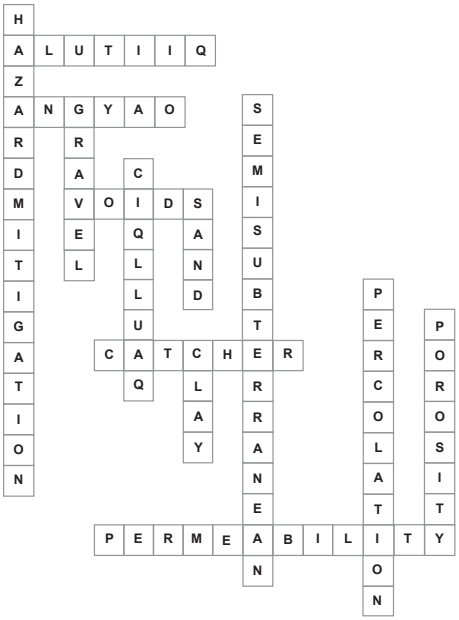
Conclusion:

1. *Beach gravel, because it is the least likely to hold water inside the house.*
2. *Answers will vary*

Further Questions:

1. *See diagram at right.*
2. *Answers will vary.*
3. *Site B. Although it is a high risk for tsunami and damage from subsidence, the soil is best for a ciqlluaq. The salmon stream and catcher beach are also close by.*
4. *The Alutiiq who lived in this time period were very mobile. In the case of tsunamis or changes in land conditions from earthquakes, the alutiiq more easily loaded their boats, called angyaqs, and moved to a more suitable site.*
5. *Answers will vary.*





Lesson Information Sources:

Crowell, A., Steffian, A.F., & Pullar, G.L. (2001). *Looking both ways: Heritage and identity of the Alutiiq people.* Fairbanks, Alaska: University of Alaska Press.

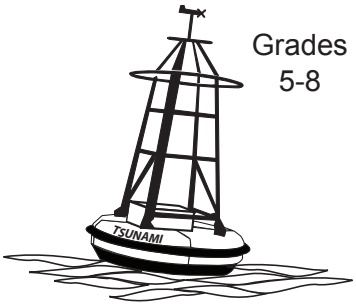
Pestrikoff, J.P., Adams, K.R., & Drabek, A.S. (2004). *The red cedar of Afognak: A driftwood journey.* Afognak, Alaska: Native Village of Afognak.

Saltonstall, P.& Carver, G.A. (2002). *Earthquakes, subsidence, prehistoric site attrition and the archaeological record: A view from the Settlement Point site, Kodiak archipelago, Alaska*. In R. Torrence and J. Grattan (eds.), *Natural Disasters and Cultural Change, 45,172-192.*

Name:_____

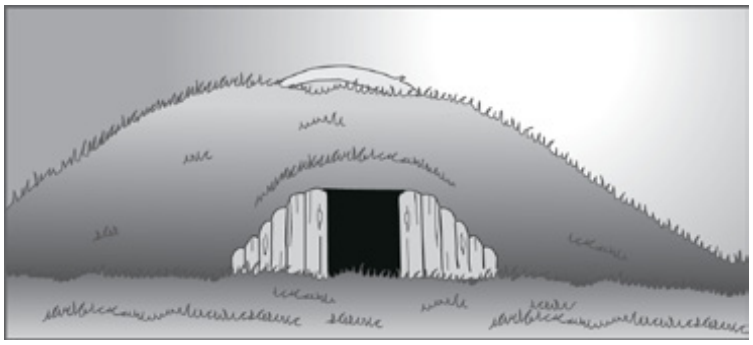
Kodiak Living, Long Ago

Student Worksheet (page 1 of 7)



Grades 5-8

How do different societies view construction and hazard mitigation? *Hazard mitigation* is any action taken to reduce the long-term risk to human life and property from natural hazards. The Kodiak Archipelago has a long history of earthquakes and tsunamis. The Native people of this region, the Alutiit, have experienced living in this environment for thousands of years.



Imagine that you live on Kodiak Island 400 years in the past. You need to build a *ciqlluaq* (chick-shlu-ahq). This is an Alutiiq house that is partially underground, *semisubterranean,* and made of wooden planks covered with sod.

Consider your construction needs:

Materials:

- Driftwood from a catcher beach. A catcher beach is a beach that is curved and catches driftwood as it floats in on ocean currents.
- Sod is readily available throughout the island.

Your *ciqlluaq* must also be partially underground.

The soils at possible sites include:

- Clay-rich soil
- Sand
- Beach gravel

It was very important for the Alutiiq to consider how rain would affect the soil into which their homes were built. The Kodiak Islands are in a cool, wet environment and often experience rain. The roof and wall of a *ciqlluaq* are made of a driftwood frame, plank walls, sod and a thatched roof that helped protect the people inside from the weather. These homes were entered through an entryway that opened up into a common room. A steam room for bathing was attached at the back. Floors were covered with grass or planks. An ideal floor is one that allows water to drain through the soil.

Testable Question:

How will a rainy climate influence a *ciqlluaq* that is partially built underground, or semisubterranean, in different soils?

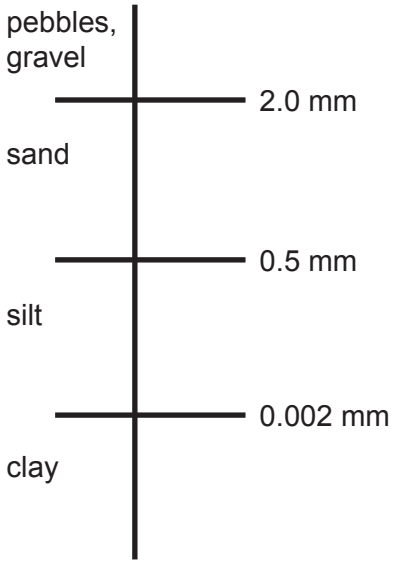
Name:_____

Kodiak Living, Long Ago

Student Worksheet (page 2 of 7)

Background Information:

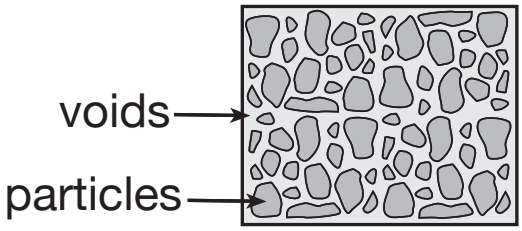
Soils are made of mineral (rock) particles and organic matter. Organic matter is decomposed animal and plant matter.



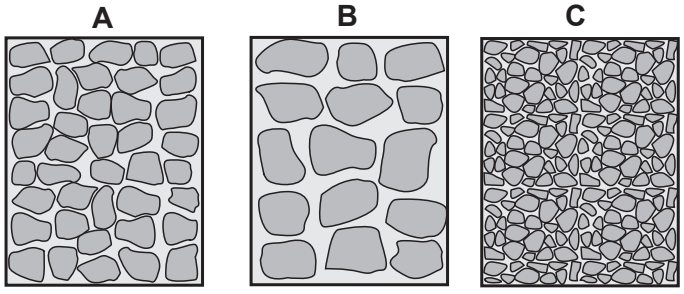
The mineral particles in soils are classified based on their diameter. The smallest type of soil particle is clay (< 0.002 mm).

Silt particles are larger than clay (0.002 mm to 0.5 mm). Sand particles are the largest mineral particles (0.5 mm to 2.0 mm). Pebbles, stones, or gravel make up mineral particles larger than sand and are not considered soil particles.

The spaces between particles are called voids or pores. Water and air can go into these spaces. *Porosity* describes the ratio of the void volume to the total volume of the soil (particles and voids). When soils are compacted the spaces between particles get smaller, so they become less porous.



1. Examine the pictures of soils below. Match the letter of the soil to the correct place on the continuum.



Less Porous — More Porous

_____ _____ _____

Name:_____

Kodiak Living, Long Ago

Student Worksheet (page 3 of 7)

The porosity of a soil is related to its *permeability*. The *permeability* of soil describes how freely water can flow through it. The movement of water through a material is called *percolation*.

2. Match the letter of each type of soil to it's correct place on the continuum.

A. Silt
B. Sand
C. Gravel
D. Clay

_____ _____ _____ _____

Check your answers before you continue.

Hypotheses:

If a *ciqlluaq* is built on clay, then _____

_____

If a *ciqlluaq* is built on sand, then _____

_____

If a *ciqlluaq* is built on beach gravel, then _____

_____

Name:_____

Kodiak Living, Long Ago

Student Worksheet (page 4 of 7)

Investigation:

Materials:

- push pin
- three paper cups
- three 250mL beakers
- three 100mL graduated cylinders
- clay
- sand
- beach gravel
- water
- stopwatch or timer

Procedure:

1. Poke holes in the bottom of the paper cups so that the pattern for drainage is the same for each cup.
2. Each cup should contain only one of the materials (clay, sand or beach gravel). The cups should be filled with the same amount (1/3 to 1/2 full). For the clay, take the time to form the clay to fit the cup well.
3. Place each paper cup of material into a 250mL beaker.
4. Fill each of the 100mL graduated cylinders with water.
5. With a partner, pour each graduated cylinder of water into each cup and note the time or start the stopwatch.
6. Start observations and record qualitative data in the *Data* section, #1-3.
7. At the end of 10 minutes, remove the cups from the beakers and measure the amount of water in the beakers using the graduated cylinder. Record results in the table in the *Data* section, #4.

Data:

1. Record your observations of the water on the clay. How does the water affect the surface of the material?

_____

_____

_____

2. Record your observations of the water on the sand. How does the water affect the surface of the material?

_____

_____

_____

3. Record your observations of the water on the beach gravel. How does the water affect the surface of the material?

_____

_____

_____

Name:_____

Kodiak Living, Long Ago

Student Worksheet (page 5 of 7)

4. After 10 minutes, this much water percolated through the material:

Material	Amount of percolated water in mL
Clay	
Sand	
Beach gravel	

Analysis of Data:

1. Which material experienced the most percolation? _____

2. How would the clay's permeability affect living in a *ciqlluaq*? _____

_____

3. How would the sand's permeability affect living in a *ciqlluaq*? _____

_____

4. How would the beach gravel's permeability affect living in a *ciqlluaq*?

_____

Conclusion:

1. Which soil is more favorable for building a *ciqlluaq*?_____

Why? _____

_____

_____

2. Were your hypotheses proved or disproved? _____

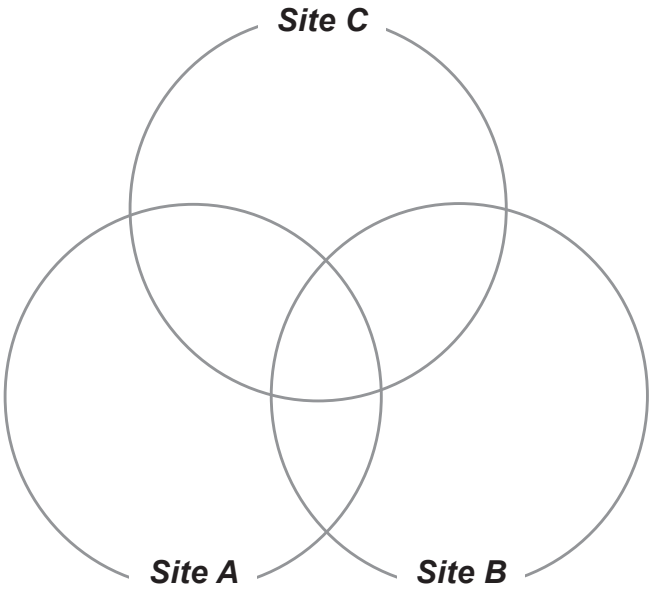
_____

_____

Name:_____

Kodiak Living, Long Ago

Student Worksheet (page 6 of 7)



Further Questions:

Refer to the map at the bottom of this page. Examine the possible sites for your *ciqlluaq*.

1. Sort the qualities of the three sites.
   - A. Poor soil for drainage
   - B. Good soil for drainage
   - C. Lower tsunami risk
   - D. Higher tsunami risk
   - E. Lower risk from subsidence
   - F. Higher risk from subsidence
   - G. Near salmon stream
   - H. Close to wood supply

2. Which site would you choose to build a *ciqlluaq*? _____

   Why? _____

   _____

3. Check with your teacher to see which site the Alutiiq people most likely would have chosen 400 years ago and record the answer here:

   _____

4. What did the Alutiit do in the case of a damaging earthquake and tsunami?

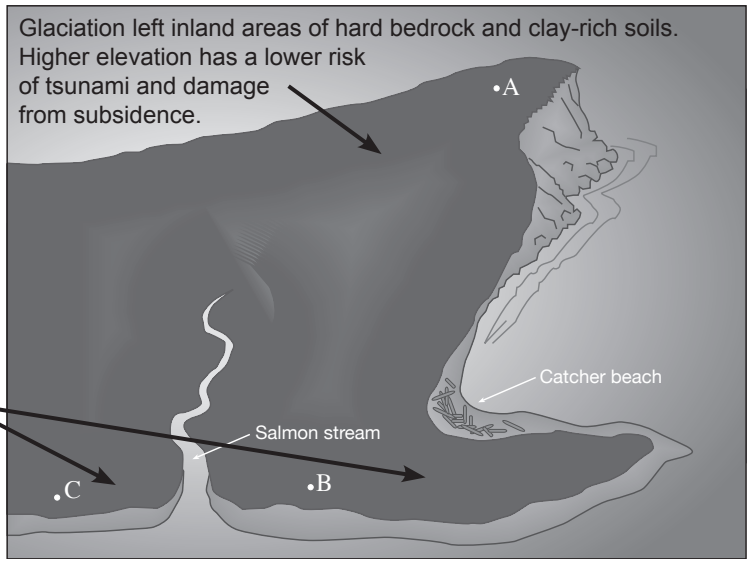
   _____

   _____

5. Was the Alutiiq choice different from, or the same as the site you chose?

   _____

   _____



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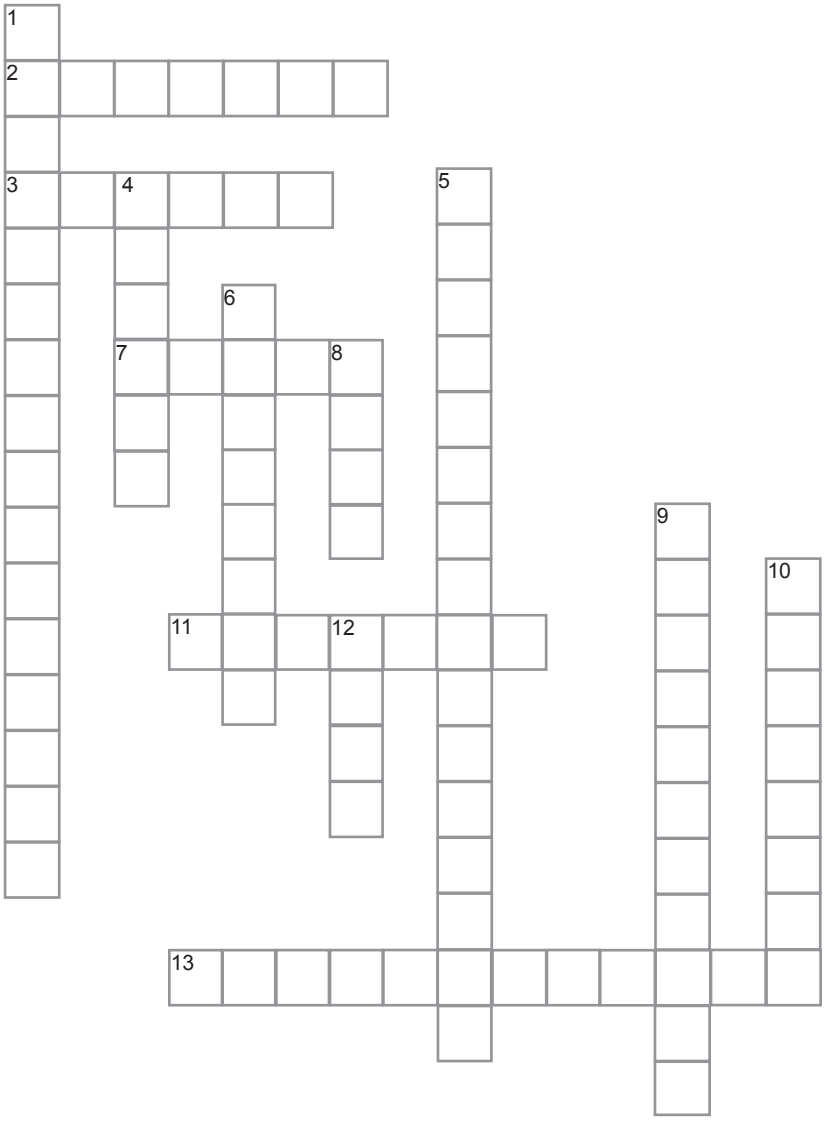
Kodiak Living, Long Ago

Student Worksheet (page 7 of 7)



ACROSS

2. The native people of the Kodiak Archipelago
3. A traditional Alutiiq boat that could transport many people at once
7. The spaces between particles
11. A beach where driftwood collects from ocean currents
13. A term that describes how freely water can flow through it

DOWN

1. Any action taken to reduce long-term risk to human life and property from natural hazards
4. The favored type of soil upon which to build a *ciqlluaq*
5. Partially underground
6. A traditional Alutiiq house
8. The largest type of mineral particle
9. The movement of fluid through porous material
10. The ratio of the void volume to the total volume of the soil
12. The smallest type of mineral particle