KANSAS CORN STEM

Kansas Corn: Sifting Through Soil Breakout Box

This breakout is made possible with the support and content contributions of the Kansas Corn Commission.

KANSAS CORN COMMISSION

Kansas Corn: Sifting Through Soil Breakout Box
Grade Level: Middle School / High School

Overview
Soil is a vital part of agriculture. As cities grow, many people move away from an understanding of agriculture, even though it is essential to their lives. This breakout is designed to provide students basic knowledge of soil and the many benefits that it provides to us. Students will also be introduced to the various soil qualities, the differences between soil and dirt, and management practices for retaining soil in fields. This breakout compliments the Kansas Corn Stem labs Soil Sleuths, Soil Erosion, and Just Dirt found at kansascornstem.com. It can be used as an introductory to one or all of those labs or this activity can be altered to serve as more of an assessment following the completion of the three labs.

Next Generation Science Standards (NGSS)
Middle School Science

- **LS1-7.** Develop a model to describe how food is rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism.
- **LS1-5.** Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.

High School Science

- **ESS3-2.** Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.

Learning Objectives
- Students will understand the difference between soil and dirt.
- Students will identify different soil types.
- Students will analyze and interpret data to provide evidence of the effects of soil erosion.

Materials
- Soil Texture Triangle
- Soil vs. Dirt cards
- Earth as an Apple graph
- Soil Measurement cards
- Potted Plant cards
- QR code cards
- Potted Plant Question Cards
- Soil Texture Triangle Pieces
- Soil Measurement Hint Card

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Breakout Edu Tips

If this is your first time using a Breakout Edu box, you are in for a treat. Once you've done one breakout box your students will be ready for the next time.

- You can use breakout boxes as a whole class, in addition to small group.
- You have the opportunity to give students hints. Every box comes with at least two hint cards. If you have a higher performing group, you may want to challenge them with less hints, while a different hour may need more hints.
- Having a visual timer for students while they are working is really helpful. It allows them to budget their time and when they may want to use their hints.
- As the teacher, you have the discretion to hide things wherever best fit in your room. Feel free to make adjustments! Just make sure the clues for the locks don't change, otherwise students may not be able to get in.
- Do note, when programming the locks, there is a starter rina that has mini-teeth. This rina needs to come first.

Background

As the population of our planet continues to grow, the lands allotted to farming and growing food has remained close to the same amount. Soil is essential to our survival as well as for nearly every organism on Earth. Soil is created slowly by the weathering of rocks and decomposition of living matter. You may hear scientists refer to rocks as inorganic matter, while decaying plant and animal matter would be considered organic. Both inorganic and organic material are needed to support plant growth.

Soil is composed mainly of minerals, but it would not be as beneficial without the presence of fungi, bacteria, roundworms, and additional organic material. It is important to remember that not all soil is the same quality. The type of soil depends on the rocks that were weathered, amount of organic material, time, and additional factors. Soil can be classified into three main groups – clay, silt, and sand. The ideal soil for agriculture is loam. This kind of soil is very airy and gives the roots room to breathe.

Soil is an important part to the economy of Kansas. Roughly 50 percent of the state is covered in crops and another 34 percent is pasture land. Even with Kansas' abundant soil, each year, 190 million tons of Kansas topsoil is degraded through human activities. This many not seem like such a big deal until you consider the Harney silt loam in Kansas and the time it takes to renew itself. To help reduce the amount lost, farmers use sustainable practices, such as cover cropping and no-till.

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Breakout Activity

Game Name
Sifting Through Soil

Game Designer
Kansas Corn Commission and Jessica Sadler

Content Areas
STEM, Agriculture, Corn, Science, Soil

Recommended Ages
K-Adult

Ideal Group Size
Can be used in small groups or whole class

Suggested Time
30-40 minutes

Story
While hanging outside with your friends, you notice the recent storm has washed a mound of soil out onto the road and the plants it once supported are now lopsided. You suggest replacing the soil around the plants. Your friends don't see the point since it is "just dirt" and they are "just plants." This makes you wonder, "Are soil and dirt the same thing? "Could there be a difference between the two?" "Could have something been done differently to help prevent the soil from washing away?" For the answers to your questions and to save the plants, you must solve some clues. Hurry, there's no time to waste!

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Lock Combinations
The following codes will open the locks on the box:

3-Digit Lock - 3 Numbers
7, 3, 6

4-Digit Lock - 4 Numbers
4, 8, 2, 1

Shape Lock
○,◇,☆, ⇨ ,△ (silt, silty-clay, loam, sandy-clay, sand)

Directional Lock
Right, Up, Up, Left, Right

Key Lock -
Teacher's Choice

Setup Instructions
Steps

1. For the shapes lock, students will need one copy of the Soil Texture Triangle and Soil Texture Triangle pieces. Once all pieces are matched, they will read the graphic by following the sand separated percent arrow at the bottom. This will tell them what shape comes first, second, third, fourth, and fifth, respectively, on the lock. The colored pieces will be locked inside of the small box with the key lock. Feel free to hide the small box or leave it near the black and white triangle print out, depending on your students.
2. Use the Soil vs. Dirt cards to help students find the hidden key. These cards should be printed off. The three soil cards should have the words "the, key, and is," written on them in invisible ink, one word per card. The three dirt cards should have the words "hidden, in/by/under, and the location" written on them in invisible ink. Again, "hidden" would be written on one card, the preposition on the next card, and the location on the third and final card. You may want to leave the blacklight by this clue. If you have a group that works quickly, you can hide the light and even the batteries to make it more difficult. Choose the area best fit to hide the key according to your classroom. I like to hide it in an area under an item they may not traditionally look under without the clue. Place the key lock on the small box.
3. Students will need to use the Earth as an Apple graph. Only partial fractions of the composition of Earth's Valuable Soil are present. Students will need to use the pie graph to identify the missing numbers of the fractions and add those numbers to the boxes. The answer is 4-8-2-1, and it will open the 4-digit lock.
4. Have the 10 Soil Measurement cards printed out. These can also be laminated for use again later. Students

will order them from highest to lowest sand percentages. The hint card saying, "Ready for this clue, I'll give you a hand. Order highest to lowest percentages of sand." Once they have the arrows on the cards in order, they will have the code for the directional lock.

5. Print the potted plant image, Planted Pot Questions and QR code cards. Cut the potted plant cards on the line as perfect as possible. Students will need to match the plant to the correct pot. Students will need the pots in order of the Potted Plant Questions. These numbers have been bolded to draw attention to them. The answers for the 3-digit lock will come from this clue. Leaving the plant and pot pieces cut apart and spread out around the room can create an extra challenge.
6. Place the multi-lock mechanism on the larger breakout box. Place the 3 digit, 4 digit, shape and directional lock on the multi-lock mechanism. It is always a good idea to double check your locks before beginning the lesson.
7. When students unlock the large box, they will find a prize inside, typically candy. You can also include the questions below on half sheets of paper for students to turn in as exit tickets.
8. It is also possible to include other supplies that would lead your students into completing other Kansas Corn STEM labs.

Resources

To access the full lab descriptions for Soil Sleuths, Soil Erosion, and Just Dirt, visit kansascornstem.com

Reflection and Conclusion

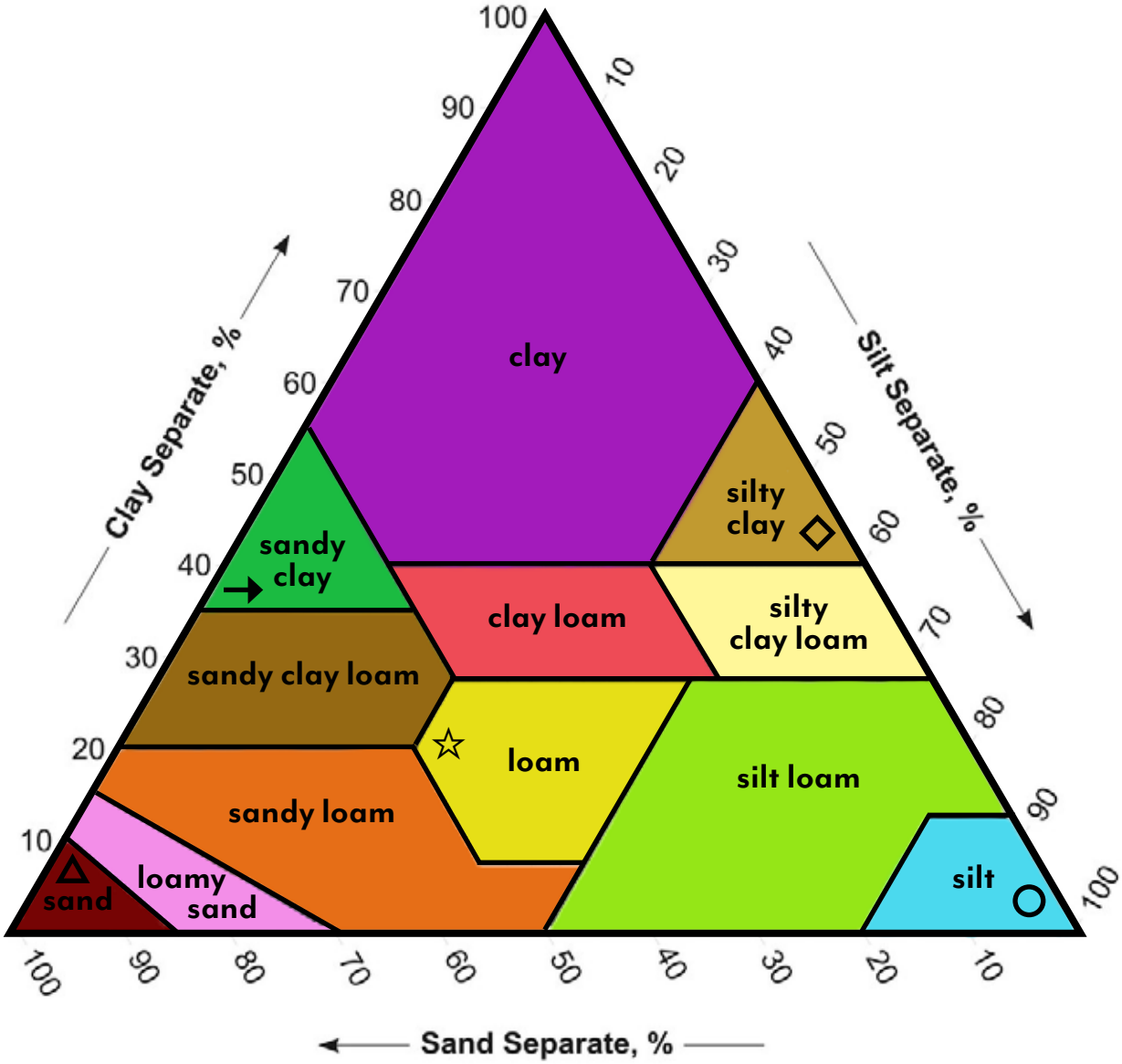
At the completion of this Breakout, your students should have a better understanding of soil types and textures, the difference between soil and dirt, and how to take soil measurements. Feel free to give students the following questions as an exit ticket or knowledge check at the end of the Breakout. If you have groups that do not breakout, it is always nice to go over the information and clues that would have led to the last locks coming off.

Questions

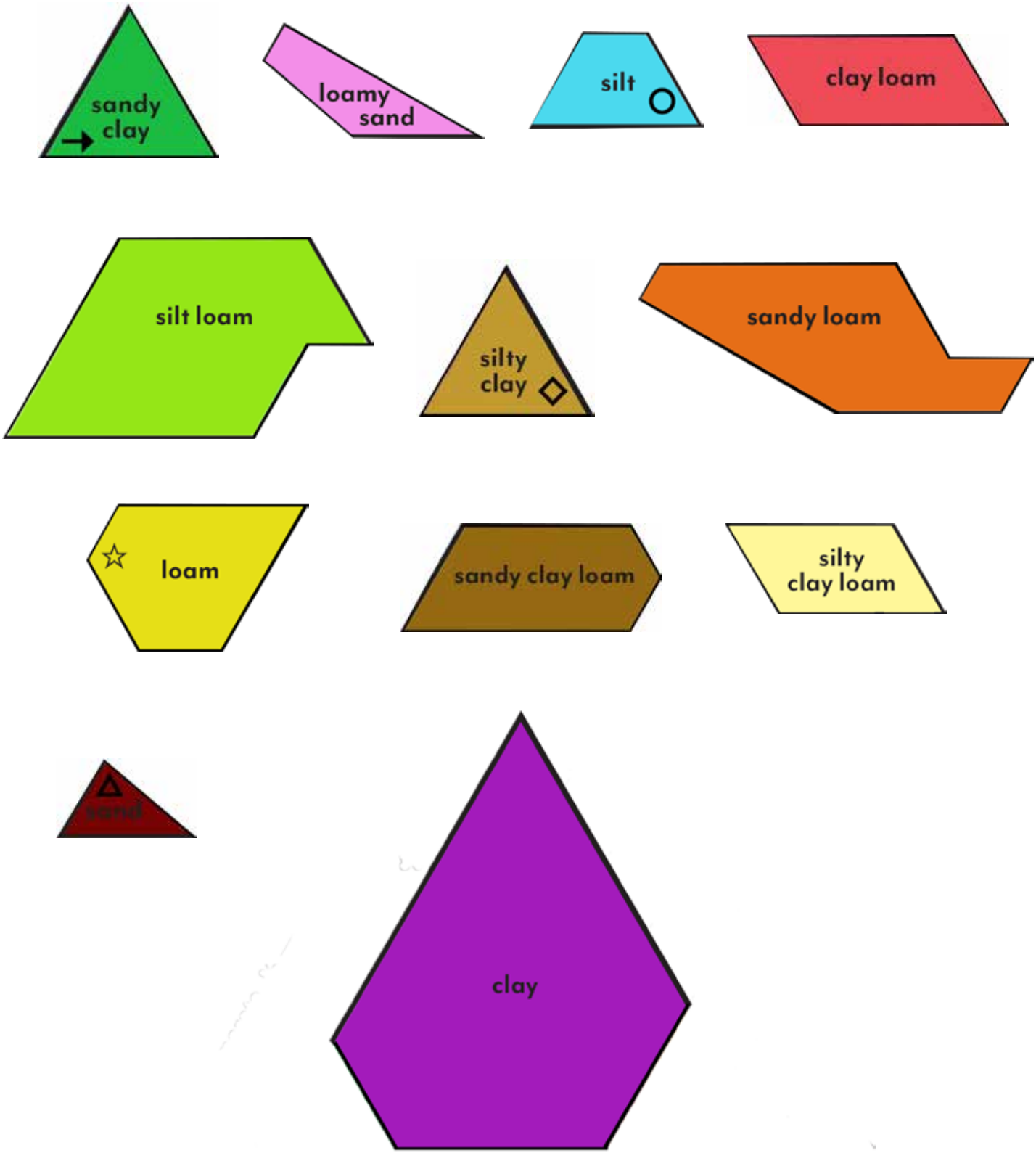
1. What are the three categories of soil? Answer: Clay, silt, and loam.
2. What are the main parts that make up soil? Answer: Water, air, organic material, inorganic material, and minerals.
3. How many soil texture variations are listed on the soil texture triangle? Answer: 12.
4. What are some sustainable practices farmers use to reduce soil erosion? Answer: Cover crops.
5. What three types of soil did you measure on the soil measurement cards? Answer: Sand, silt, and clay.

Soil Texture Triangle

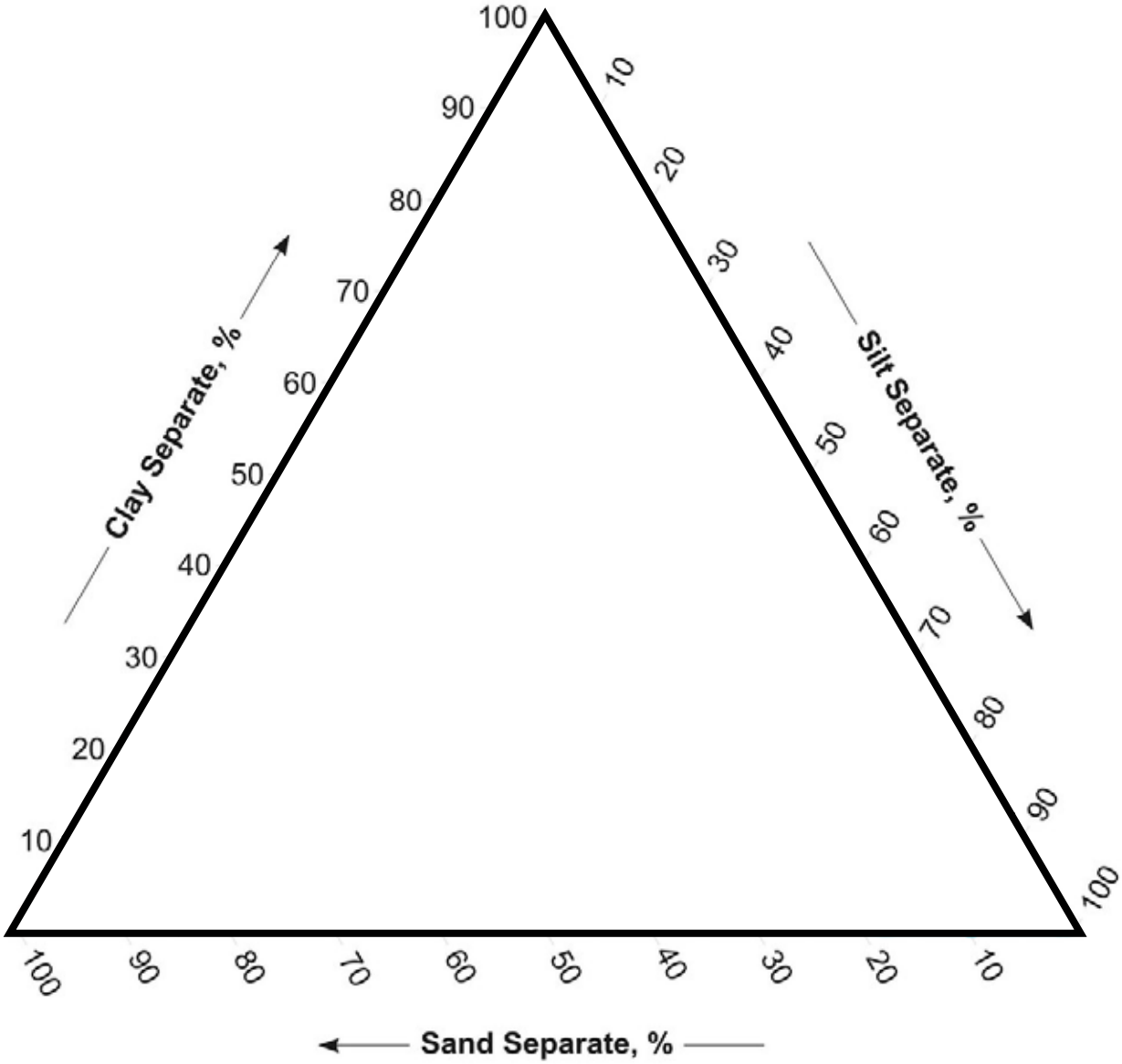
ANSWER KEY



Soil Texture Triangle



Soil Texture Triangle



Soil

Combination of air, water, minerals, organic and inorganic matter

Soil

Alive

Soil

Made by weathering parent material: mostly rocks

Dirt

Disassociated or removed from its ecosystem

Dirt

Dead

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Dirt

example:
under your
fingernails

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Potted Plant Questions Card

1. Best soil for carrots?

2. Best soil for corn?

3. Best soil for broccoli?

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Soil Measurement Hint Card

Ready for this clue, I'll give you a hand. Order highest to lowest percentages of sand.

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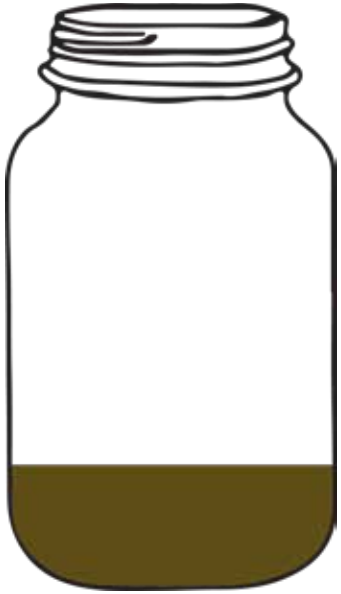

Draw you soil layers here...
Make sure you provide measurements!

Sand: 0 mm / 12 mm = 0%

Silt: 0 mm / 12 mm = 0%

Clay: 12 mm / 12 mm = 100%

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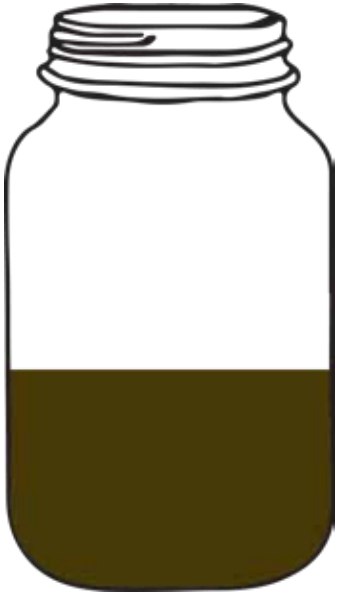

Draw you soil layers here...
Make sure you provide measurements!

Sand: 0 mm / 39 mm = 0%

Silt: 39 mm / 39 mm = 100%

Clay: 0 mm / 39 mm = 0%

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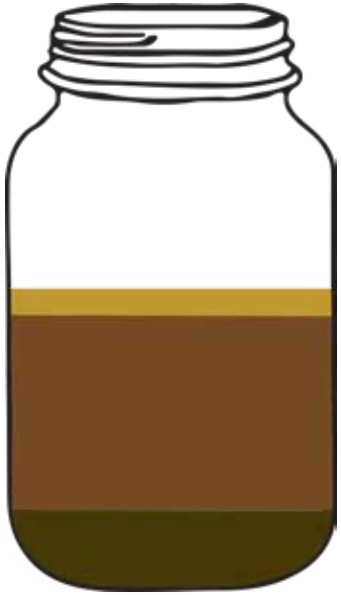

Draw you soil layers here...
Make sure you provide measurements!

Sand: 6 mm / 53 mm = 11.3%

Silt: 37 mm / 53 mm = 69.8%

Clay: 10 mm / 53 mm = 18.9%

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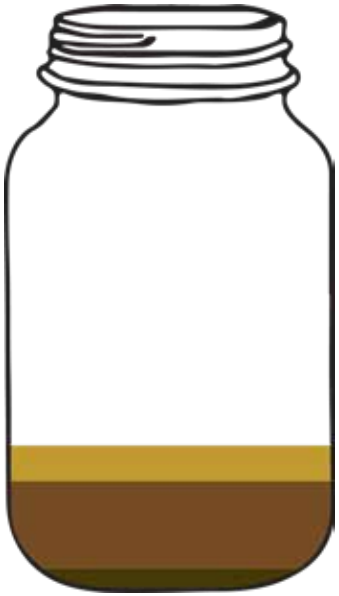

Draw you soil layers here...

Make sure you provide measurements!

Sand: 7 mm / 27 mm = 25.9%

Silt: 18 mm / 27 mm = 66.6%

Clay: 2 mm / 27 mm = 7%

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Draw you soil layers here...

Make sure you provide measurements!

Sand: 9 mm / 34 mm = 26.5%

Silt: 0 mm / 34 mm = 0%

Clay: 25 mm / 34 mm = 73.5%

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Draw you soil layers here...

Make sure you provide measurements!

Sand: 25 mm / 60 mm = 41.6%

Silt: 25 mm / 60 mm = 41.6%

Clay: 10 mm / 60 mm = 16.6%

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Draw you soil layers here...

Make sure you provide measurements!

Sand: 30 mm / 70 mm = 42.9%

Silt: 10 mm / 70 mm = 14.3%

Clay: 30 mm / 70 mm = 42.9%

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Draw you soil layers here...

Make sure you provide measurements!

Sand: 45 mm / 65 mm = 69.2%

Silt: 15 mm / 65 mm = 23%

Clay: 5 mm / 65 mm = 8%

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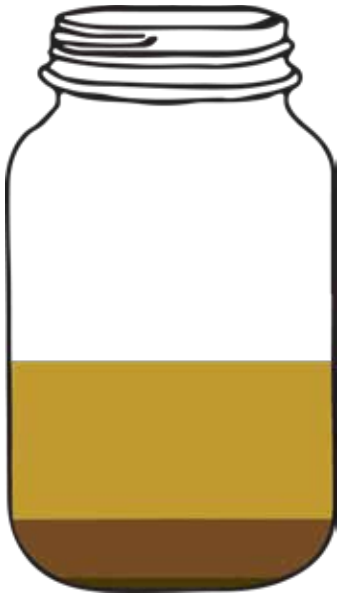

Draw you soil layers here...

Make sure you provide measurements!

Sand: 25 mm / 36 mm = 69.4%

Silt: 9 mm / 36 mm = 25%

Clay: 2 mm / 36 mm = 5.6%

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Draw you soil layers here...

Make sure you provide measurements!

Sand: 53 mm / 53 mm = 100%

Silt: 0 mm / 53 mm = 0%

Clay: 0 mm / 53 mm = 0%

△

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Earth's Valuable Soil

Label the following:

3/☐ of the Earth is covered with water

1/☐ of the Earth that is desert, swamp, mountains or polar regions

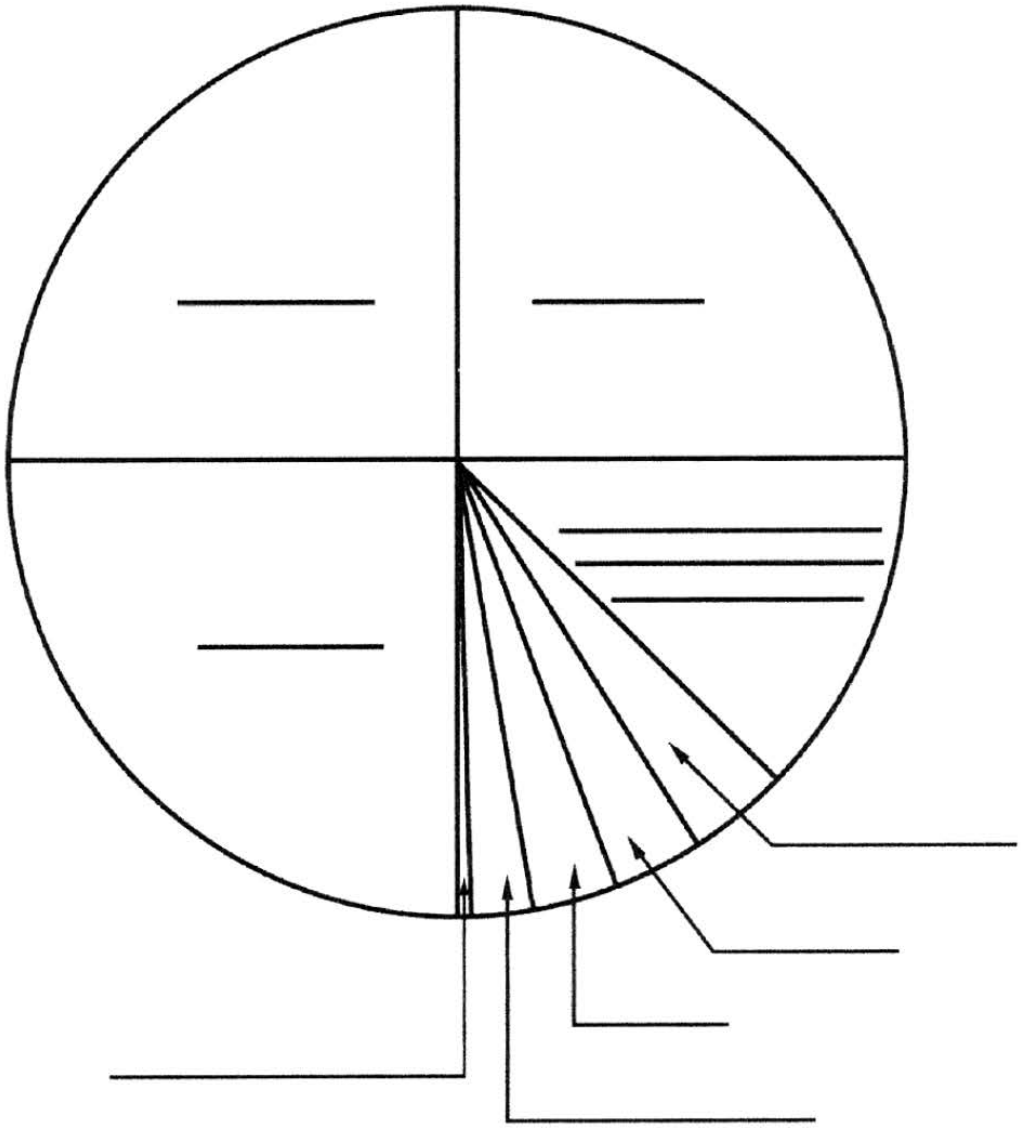
1/3☐ of the Earth that is too rocky for growing crops

1/32 of the Earth that is too hot to grow coprs

1/32 of the Earth that is too wet to grow crops

☐/32 of the Earth where crops can be grown

Tiny fraction that represents soil of that cropland



This project presented by Alaska Agriculture in the Classroom through funding from the Alaska Division of Agriculture and the Alaska Farm Bureau. For more information, visit www.agclassroom.org/ak

KEY

Earth's Valuable Soil

Label the following:

3/**4** of the Earth is covered with water

1/**8** of the Earth that is desert, swamp, mountains or polar regions

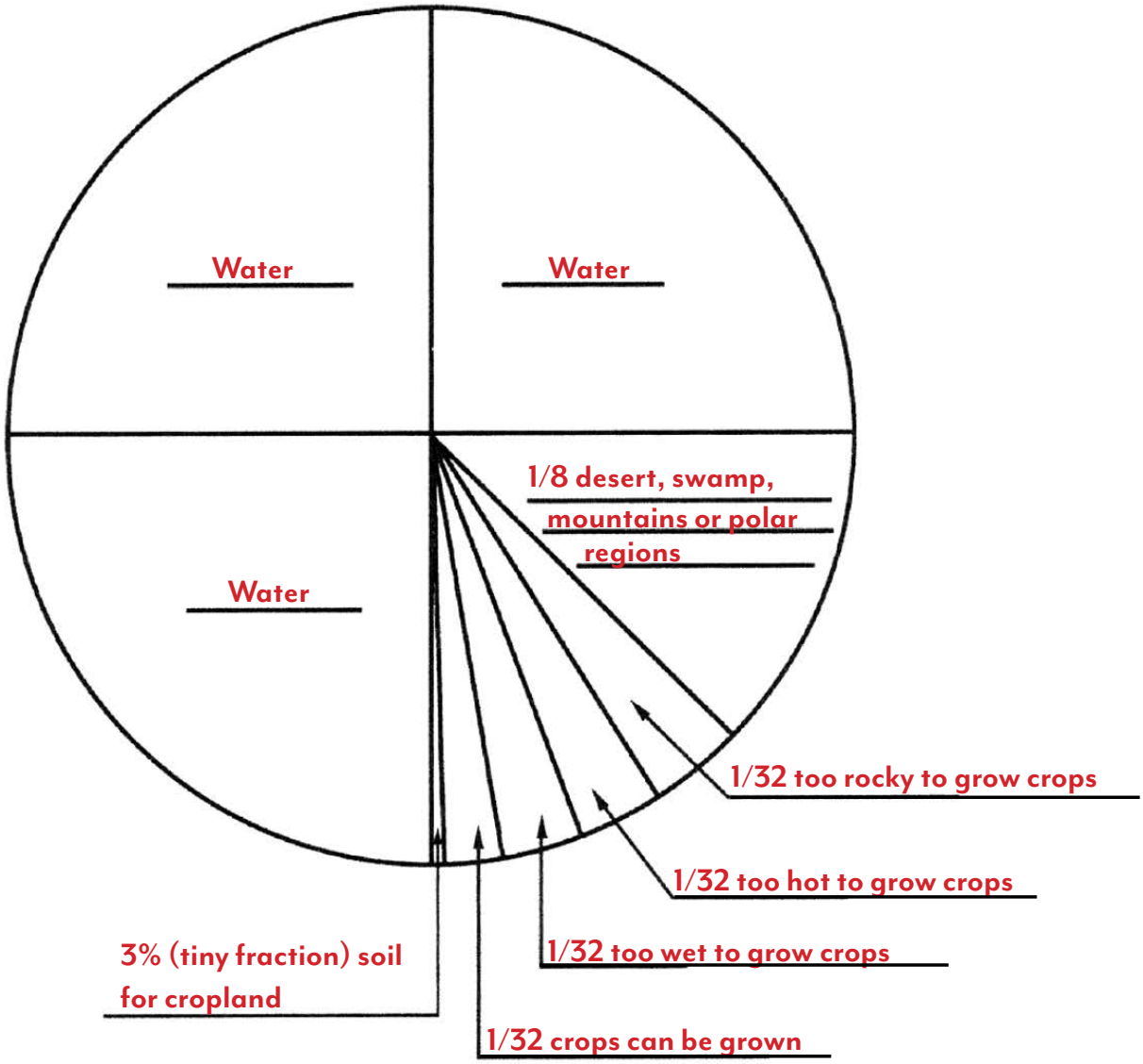
1/3**2** of the Earth that is too rocky for growing crops

1/32 of the Earth that is too hot to grow coprs

1/32 of the Earth that is too wet to grow crops

1/32 of the Earth where crops can be grown

Tiny fraction that represents soil of that cropland



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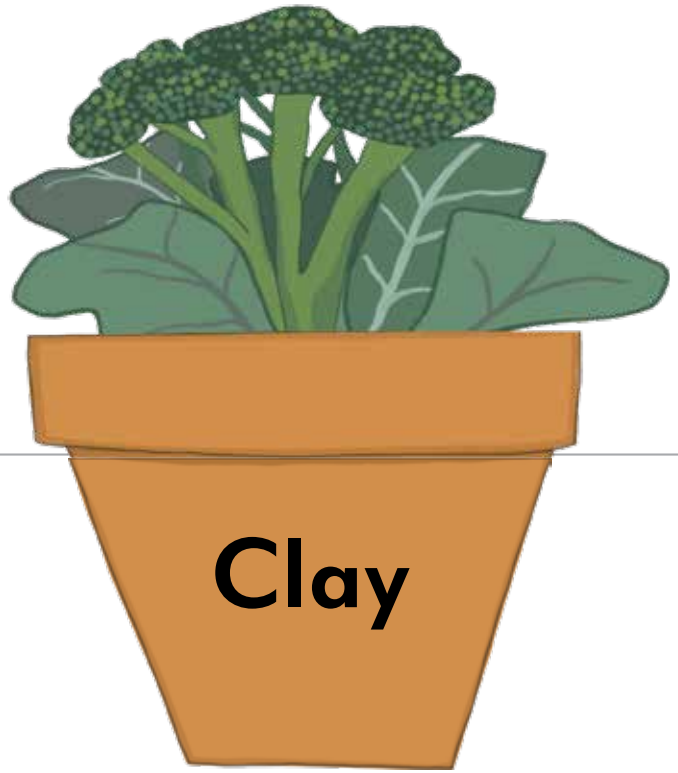

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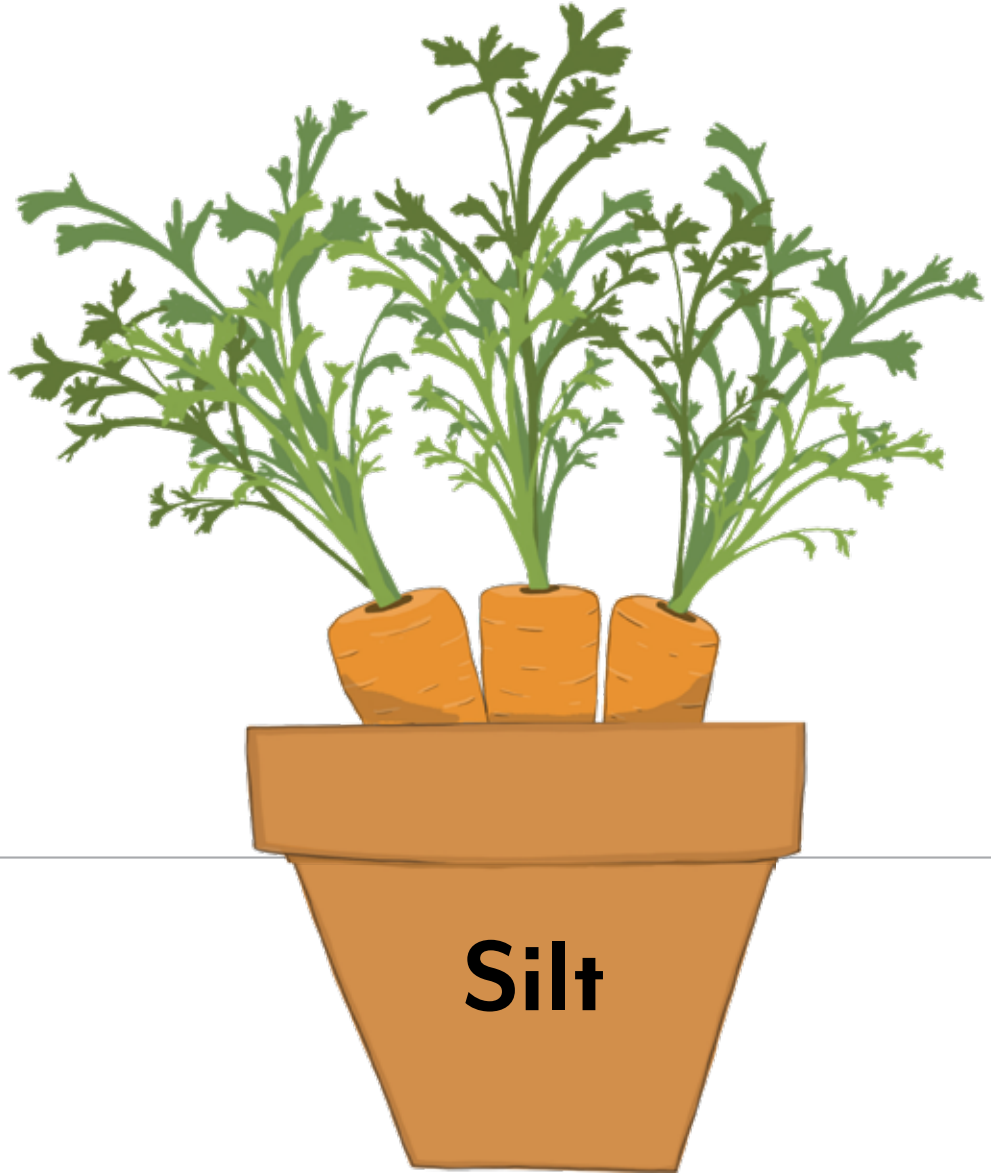

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