TEXAS 4-H
4-H STEM District-Wide Research Project

Title: Soil Texture
Grade Level: 3rd to 5th
TEKS: Science
3.1(A), 3.2(B)(C)(D)(F), 3.3(A), 3.4(A)(B), 3.5(D)
4.1(A), 4.2(A)(B)(C)(D)(E)(F)(G), 4.3(A)(B)(C), 4.4(A), 4.7(A)
5.1(A)(B), 5.2(A)(B)(C)(D)(E)(F)(G), 5.3(D), 5.4(A)(B)

Title of Lesson: Soil Particles, Texture and Permeability

Objectives (2 to 4):
The participant will:
Learn the Steps of the Scientific Method
Learn about Soil Particles and Texture
Practice the 15 SET Abilities (build, categorize, collaborate, demonstrate, describe, contrast, solve, design, evaluate, hypothesize, invent, infer, interpret, measure and learn basics of graphical representation)

Supplies:
Sand – how much 20lb bag
Potting Soil – how much? 20lb bag
Gravel- how much 20lb bag
4 Clear plastic containers (plastic liter bottles from soda/soft drinks)
Marker
Large glass jar
Cotton balls – 4 or more

Time Allotment (lesson should be a minimum of 30 minutes to be considered an experience): 60 minutes for original experience followed by 30 minutes observation and recording sessions
For more accurate results, the permeability experiment using the 4 different soil types is recommended to be repeated at least 3 times, concluding by averaging the results.

Explore the Content:
Vocabulary: Define these
Loam: Soil with roughly equal proportions of sand, silt and clay
Silt: earthy matter, fine sand, or the like carried by moving or running water and deposited as a sediment

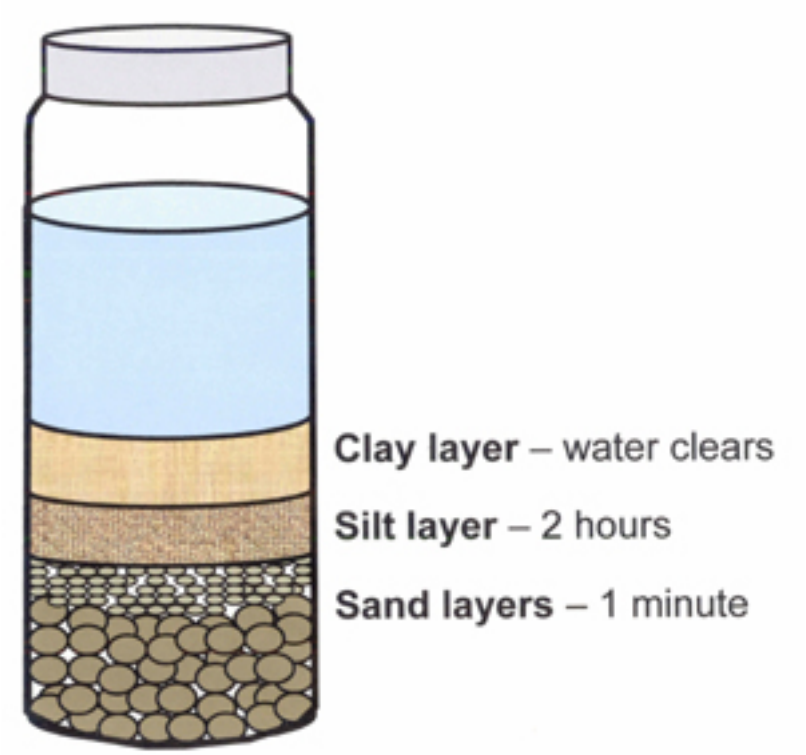
Clay: A stiff, sticky fine-grained earth, typically yellow, red, or bluish-gray in color and often forming an impermeable layer in the soil. It can be molded when wet, and is dried and baked to make bricks, pottery, and ceramics.
Sand: a loose granular substance, typically pale yellowish brown, resulting from the erosion of siliceous and other rocks and forming a major constituent of beaches, riverbeds, the seabed, and deserts.
Soil permeability: Is the property of the **soil** to transmit water and air
Soil Nutrients: The three main nutrients are **nitrogen** (N), **phosphorus** (**P**) and **potassium (K)**. Together they make up the trio known as **NPK**. Other important nutrients are **calcium**, **magnesium** and **sulfur**
Soil content: Most soils contain a mixture of minerals, organic matter, gases, liquids, and countless organisms.
Main Question: Which soil type is more permeable?
Independent variable: Soil type (Sand, Potting soil, gravel and combination)
Dependent variable: Water recovered after going through the 4 different types of soils.
Possible Hypothesis: The soil comprised of sand will be less permeable than the other types of soils

The soil with only gravel will be the most permeable of all soil types

Do (Activity/Experience):
Activity 1
In order to understand the importance of soil, watch video. What video?
https://www.youtube.com/watch?v=rfwcLaqT7Kc

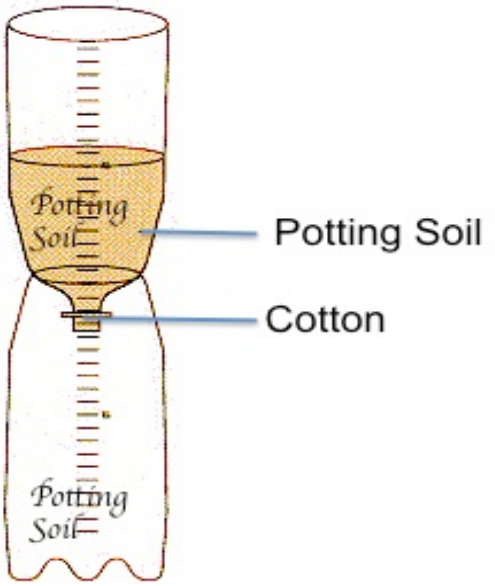
Activity 2
Soil Layers

1. Using a glass container add fill it half full of soil (from your school play ground or home back yard)
2. Add water to cover the soil until the container is almost filled
3. Cover the container and shake it
4. Let it set for 3 hrs.
5. Observe and classify the soil layers (clay, silt and sand) as shown in the picture



Activity 3
Conduct your own Research Project
Soil Permeability

1. Cut 4 plastic bottles in half
2. Label the 4 tops of the plastic bottles accordingly; sand, potting soil, gravel, and combination.
3. Label the 4 bottoms of the plastic bottles with the same labels (sand, potting soil, gravel, and combination).
4. Using a ruler, mark each bottle with a marker, every centimeter from bottom to top.
5. Place one cotton ball in the top at the bottle's neck.
6. Add sand (halfway) up the bottle top labeled "sand".
7. Add potting soil (halfway) up the bottle top labeled "potting soil".
8. Add gravel (halfway) up the bottle-top labeled "gravel"
9. Add a combination of the three types of soils (halfway) up the bottle top labeled "combination"
   Example:



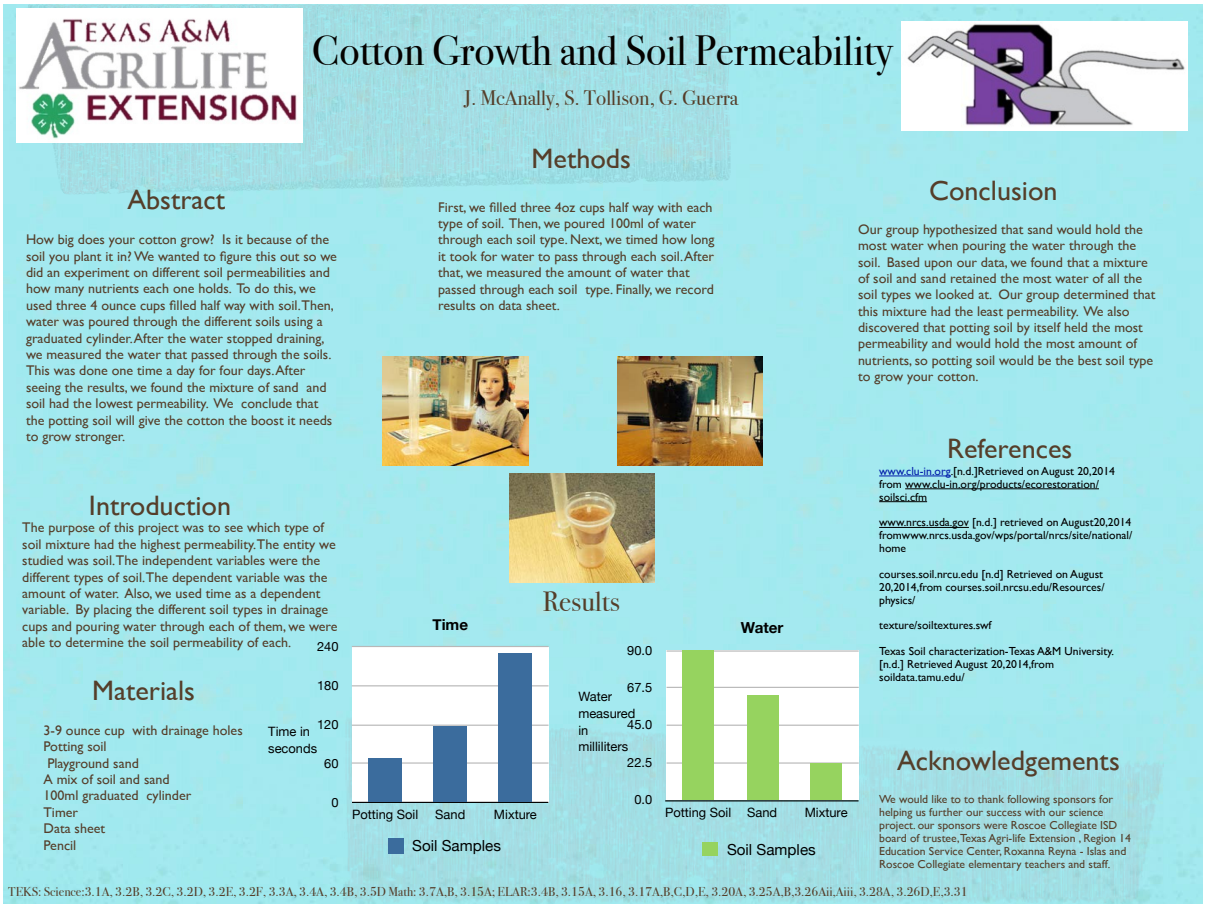
10. Place the 4 bottle tops in the bottoms and add water almost to the top.
11. Let the water set for 2 hours and dispose of excess water (do not measure).
12. Every day for a minimum of 3 days add the exact same amount of water to the four containers and measure the amount of water collected.
13. Record your data

Day	Soil Type	Amount water Added	Amount water Collected	Observations

Reflect:
Did you notice any differences between the different types of soil?
Which type of soil retained more water? Which water was clearer?
Why is soil permeability and nutrient holding important for agriculture?

Apply:
Report your results in a scientific manner. See revisions to Life Cycles
Report your results in a scientific manner – see handout at end for a graphic representation
Scientific Posters are commonly used to share your scientific project including the results.
Typically a Scientific Posters will have the following parts:
Abstract: The summary of the experiment which includes s the purpose of the experiment, and no more than three sentences explaining the procedure, results, and conclusion.
Introduction: Describes the problem or goal of the experiment, it offers background information about; the entity, independent variable, dependent variable and the hypothesis.
Materials and Methods: It describes the experiment's design ; what materials were used, how the data was collected, how often date was collected, and how the data was analyzed. Pictures and tables can be used for this section. .
Results: Describes and displays data using; tables, photographs. Remember - the figures must always have a descriptive text (figures and tables must have a title number and units of measurement).
Conclusions: The first sentence restates the hypothesis or research question and the second should answer the research question with additional sentences explaining the results and procedures that influenced the results.
References: If images from the web were used, it is important to refer the website used. The common method to cite the sources is APA style.(you find instructions for APA style on the internet)
Acknowledgments: A formal printed statement that recognizes individuals and institutions that contributed to the work being reported.

Example



Informative Video:

https://www.youtube.com/watch?v=rfwcLaqT7Kc

Websites to visit:

http://www.clu-in.org/products/ecorestoration/soilsci.cfm

http://courses.soil.ncsu.edu/resources/physics/texture/soiltexture.swf

http://www.nrcs.usda.gov/wps/portal/nrcs/site/national/home/

http://soildata.tamu.edu/

Videos to watch:

https://www.youtube.com/watch?v=ba_lamdgC4g

https://www.youtube.com/watch?v=knrmCbctGEA