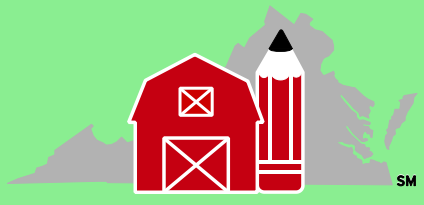
Elementary Science:
Soil, Water, & the Environment

A collection of hands-on lessons and activities for the elementary classroom investigating the natural world around us with an emphasis on soil, water, and various habitats.

Table of Contents



Apple Earth

Standards of Learning
Science 1.1, 1.8, 3.1, 3.7, 3.9, 3.10, 4.1, 4.9
Social Studies 2.7

Objective
Students will:
- Understand that natural resources are limited
- Discuss the importance of managing natural resources
- Identify the effects of humans and weather on land

Materials
- An apple
- A knife

Background Knowledge
How much of the Earth's land is available to feed, clothe, and fuel the world's population? Explore this question as well as the importance of soil as a natural resource in "Apple Earth."

Farmers are keenly aware of the importance of soil and its value as a natural resource. Thus, they may adopt one or several ways to protect the soil. Examples include conservation tillage, wind breaks, contour farming, and crop rotation. As the population increases, vital cropland is being covered and lost from production. Thus, today's farmers must find ways to be more efficient and produce more food on less land, especially as it is projected that the world's population will reach 9 billion by 2050. In the 1960s, one farmer supplied food for 25.8 persons in the U.S. and abroad. Today, even as the population increases but the number of farms decreases, one farmer supplies food for 155 people in the U.S. and abroad. Modern technology that creates farming efficiency is crucial to generating a food supply to sustain the growing world.

An apple can also be a great way to demonstrate to your students the concept of fractions. For example, as you cut the apple it is important to point out that you are left with two halves and the halves make a whole. One half is ½ of the whole apple and the same for the other half. Then when you cut the halves once you are left with 4 fourths of the apple. The 4 fourths make up the whole and a fourth can also be written as ¼. This cycle continues as you continue to cut the apple.

Procedure:
1. Cut the apple into four equal parts and do the following:
    - Remove three parts –
      These three parts represent the portion of the earth covered by water.
      Locate the Earth's oceans on a map.
    - The part that is left, one-fourth of the earth, represents land.
2. Cut the remaining portion (quarter) in half lengthwise and do the following:
    - Remove one part –
      This half represents areas of Earth where plants we eat can't grow because the climate is too hot or cold.
      What places are too hot? (identify major deserts)
      What places are too cold? (identify the poles and places where the ground is frozen)
3. Cut the remaining portion crosswise into four equal parts and do the following:
    - Remove three parts –
      These three parts represent land that is too rocky or steep, too marshy, or where something has already been built.
      The fourth part – only 1/32 of the earth – represents the land that can be used for growing crops to sustain more than seven billion people and all of the billions of animals in their care.

4. Ask students if we can grow plants all the way into the core of the earth. Once they have identified that this is not a possibility, discuss what part of the earth we do use for planting and growing crops **(topsoil on the crust of the earth)**.
5. Peel the skin off of the remaining section and do the following:
    - Show the skin –
      This tiny piece of the apple represents the topsoil – the part of the earth where plants grow.
      This small amount of soil is important for growing all of the food needed to feed all of the people and animals on our planet.
6. Discuss the importance of soil conservation and ways that erosion can be prevented.

Changes in Weather

Standards of Learning
Science K.1, K.9, 1.1, 1.7, 2.1, 2.6, 2.7
English K.11, K.12, 1.12, 1.13, 2.12
Math K.9, 2.14

Objective
Students will:
- Investigate basic types, changes, and patterns of weather
- Measure and record weather data; record daily temperature using a thermometer
- Keep a weather journal to track changes over a two week period

Materials
- *Whatever the Weather* by Karen Wallace

If this book is unavailable, you may omit it or substitute another book about the weather.
- Weather Journal (one for each student), handout included
- Thermometer
- Clock
- Crayons/markers/colored pencils

Background Knowledge
This lesson focuses on different types of weather and the fact that weather changes over time. Students will keep a weather journal for a two week period and track the changes in the weather and temperature.

Procedure
1. Ask the students what their favorite type of weather is and why it is their favorite.
2. After receiving some student responses, tell the students that even though they may have a favorite type of weather, they would not want the weather to be the same all the time.
3. Ask the students: If someone's favorite type of weather is snow, what are some reasons we may not want it to snow all the time?
4. Tell the students that plants and animals which cannot live in cold weather would not be able to survive if it was always snowing.
5. Tell the students that the weather is always changing from one day to the next.
6. Read the book, *Whatever the Weather* by Karen Wallace, aloud to the class.
7. After reading the book, ask the students the following questions:
    - How many different types of weather did William see from his window?
      Look back through the book with the students.
    - What are some other types of weather that William did not see?
      Hurricane, tornado
8. Tell the students that over the next two weeks they are going to observe the weather like William did.
9. Tell them that they will be recording the weather and temperature every day for these two weeks.
10. Show the students the class thermometer and how to read it. They will read and record the temperature every day over the two week period.
11. Give a journal to each student.

12. Tell the students that each entry in the journal should have the day's date; the time they wrote the entry; a short description of the day's weather; a picture showing the day's weather; and the temperature.
13. At the end of the two week period, discuss with the students the different types of weather they observed.
14. Ask them how the weather may have been affected by the current season.
15. Ask the students how the weather changes may have affected the plants and animals.

Extension

Have the students graph the temperature changes they record over the two weeks.

Ask students to pick a Virginia agriculture commodity (corn, soybeans, cattle, dairy cows, etc.) to raise on a farm. Using the graphed temperatures how would the weather affect the plants and animals on the farm? What would they need to survive?

References

Wallace, K. (1999). *Whatever the Weather.* New York, NY: Dorling Kindersley Publishing. ISBN: 0-7894-4751-7

This book can be found in your school library, county library or can be purchased from your favorite book seller.

Date	Time	Description	Picture	Temperature

Compost Lab

Standards of Learning
Science: 3.1, 3.7, 4.1, 4.4

Objective
Students will:
- Explore how organic material decomposes and becomes part of the soil.
- Create 2 sets of composting bottles.

Materials
- How Groundhog's Garden Grew, by Lynne Cherry
- 4 clear 2-liter bottles, with labels removed, per group of 4-6 students
    a. Cut off the tops of the 2 bottles so they are 10 centimeters (4 inches) tall.
    b. Cut off the tops of the other 2 bottles so they are 23 centimeters (9 inches) tall.
- Scissors & rulers
- Magnifying glasses
- Paper plates & plastic spoons
- 2-3 liters of natural topsoil
- Vegetable scraps, grass clippings, leaves, shredded newspapers
- Spray bottle filled with water per group
- Thermometer
- Handout, attached

Background Knowledge
In the book, the author writes, "… When they finished, Squirrel added composted leaves to her garden as fertilizer for the coming year." What does this mean? It means that natural soil is something that comes from rotting plants and other materials. The rotting plant materials make the soil rich in nutrients. This is a natural cycle called *decomposition*. If there was no decomposition, there would be no plants. There are microscopic organisms in the soil such as bacteria. Temperature plays a role in decomposition. The warmer the temperature, the better the rotting plant material decomposes.

Procedure
1. Teacher reads How Groundhog's Garden Grew to students. Be sure to point out where Squirrel adds composted leaves to her garden for the coming year.
2. Discuss the purpose of composting with students. List examples of things that may be used for composting (examples: leaves, food scraps, grass clippings, coffee grounds). Explain that it is a form of recycling.
3. Tell students that they will be creating their own compost.
4. Each group will create 2 sets of composting bottles.
5. Students should collect topsoil near school. If possible, include in soil sample, leaf litter and grass clippings.
6. Give each group of students a paper plate, a plastic spoon, and magnifying glasses. Place a large scoop of soil on each plate and ask students to list what they see in the soil.
7. Create a class list of what students observed in the soil. Look at the list to see if the items can be categorized (***living*** – *organic* and ***nonliving*** – *inorganic* things).
8. Ask students: How will the organic part of the soil change over time? ***It will decompose.***
9. Each student should complete the handout that is attached.

Extension

Include other variables in the lab. Examples: place one bottle near and heat source and the other in a cool place; place an earthworm in one of the bottles.

Have students graph the rates of decomposition of the two bottles.

Compost Lab for How Groundhog's Garden Grew by Lynne Cherry

Your teacher will give you the necessary materials to complete this lab. Please follow the directions carefully. You will have to record your observations over the next 7 days.

1. Start with the 2 short soda bottles (4 inches) that have their tops already cut off. Fill each of them with a mixture of grass clippings, leaves, vegetable scraps, and shredded newspapers. Fill until it is 1 inch from the top. Spray one bottle with water until it's very damp. Leave the other bottle dry.

2. Take a tall soda bottle (9 inches) and turn it upside down over the damp bottle. Slip the tapered end of the taller bottle inside the shorter one and push them together, making sure the seal is snug. Repeat the same thing to the dry bottle. Make sure both soda bottle cylinders fit tightly. If the compost bottle with the holes (see below) begins to dry out, take it apart and spray more water on it.

3. On the WET composting bottle, use a thumbtack to gently punch 15 small holes into the top cylinder of the bottle. Do NOT punch any holes in the other compost bottle. Use tape to seal the connection between the 2 bottles.

4. What are the environmental differences between your two compost bottles? Is that going to impact what will happen in the compost bottles? Explain.

   _____

   _____

   _____

   _____

5. Predict what you will see in each bottle over time.

   _____

   _____

   _____

   _____

6. Over the next 7 days, you will record your observations on the chart. At the end of 7 days, which compost bottle promoted faster decomposition? Explain.

   _____

   _____

   _____

   _____

Date & Time	Wet Compost Bottle	Dry Compost Bottle	Air Temperature
1			
2			
3			
4			
5			
6			
7			

Dirt for Dessert

Standards of Learning
Science: 3.1, 3.7

Objective
The students will:
- identify layers of soil.
- identify the importance of soil as a natural resource.

Materials (one per student)
- small container of chocolate pudding
- clear plastic cup
- two vanilla wafers
- plastic baggie
- spoon
- spoonful of chocolate chips
- 2 gummy worms
- 2 chocolate wafer cookies

Background Knowledge
A natural resource is something of wealth that occurs in the environment around us without any help from man. It is important to know that soil is a very important natural resource that everyone in the world uses. Soil is also a reusable resource, which is important for your students to know. Plants need it to survive and animals, in turn, need to eat the plants for food. There are also the many people all over the world who live off of soil whether it is by growing the food that they eat or using it in their home. This lesson will review the layers of soil as they are in the ground. On the bottom is bedrock, which is the parent material for the soil that will not be shown until erosion or an earthquake exposes it to the world. Next is subsoil, which is mostly sand/silt and clay. This is where most of the nutrients are found and deep plant roots will come here for water. Next is topsoil, which is where plant roots grow and animals live. This is sometimes called the organic layer where decomposers recycle dead plants and animals into the top layer. On top is humus, which includes more decomposing organic material.

Procedure
1. Ask why soil is considered an important natural resource.
2. Review with students the layers of soil. Draw a diagram on the board that shows the bedrock, subsoil, topsoil, and humus.
3. Tell students that they will be making their own “dirt for dessert” to illustrate the layers of soil.
4. Pass out a clear plastic cup to each student.
5. Place one vanilla wafer in the bottom of the cup. This is the bedrock.
6. Put the chocolate chips on the wafer. These represent boulders.
7. Dab a bit of chocolate pudding over the chips.
8. Place the other vanilla wafer in the plastic baggie and crush it up into fine pieces. Sprinkle it on top of the pudding. This represents the silt and sand.
9. Spoon the remaining chocolate pudding on top.
10. Place the gummy worms in the pudding (one may be sticking up!).
11. Put the chocolate wafers in the baggie and crush. Pour these on top, representing topsoil.

12. After they have made the soil sample they need to write a sentence about each layer before they can eat it.
13. Enjoy!

Extension

Take students to the computer lab and have them visit the following site, which will require them to further investigate soil layers: http://www.urbanext.uiuc.edu/gpe/case2/index.html

References

http://www.ttaconline.org/d/sol/Science/Sci3_OT11LN01.doc

Dirt Pudding

Standards of Learning
Science 3.1, 3.7

Objective
Students will:
- model the major components and layers of soil using pudding.

Materials
- Clear plastic cups
- Vanilla cookies, semi-crushed
- Vanilla pudding
- Graham crackers, crushed
- Butterscotch pudding
- Chocolate cookies, semi-crushed
- 1 gummy worm per student
- Chocolate pudding (mix with chocolate cookies, semi-crushed)
- Shredded coconut (dyed green)

Background Knowledge
There are three main types of soil—sand, silt and clay. When all three are mixed together they create loam. Humus, anything in the process of decaying, is the organic matter found in soil. In this activity, students will layer pudding and cookies to model the major components and layers of soil.

This lesson will review the layers of soil as they are in the ground. On the bottom is bedrock, which is the parent material for the soil that will not be shown until erosion or an earthquake exposes it to the world. Next is subsoil, which is mostly sand/silt and clay. This is where most of the nutrients are found and deep plant roots will come here for water. Next is topsoil, which is where plant roots grow and animals live. This is sometimes called the organic layer where decomposers recycle dead plants and animals into the top layer. On top is humus, which includes more decomposing organic material.

Procedure
1. Give each student a plastic cup.
2. Have students layer the ingredients in the following way:
   - ¼" layer of vanilla cookie (semi-crushed for larger crumbs)
   - ½" layer of vanilla pudding
   - ½" layer of graham cracker crumbs
   - ½"layer of butterscotch pudding
   - ¼" layer of chocolate pudding / chocolate cookies mixture
   - sprinkle of dyed coconut (enough to cover top layer)
   - gummy worm
3. Discuss what each layer of food represents in reference to soil layers
   - vanilla cookie (semi-crushed) = rock
   - vanilla pudding / graham cracker crumbs / butterscotch pudding = subsoil
   - chocolate pudding / chocolate cookie (semi-crushed) = topsoil

Or you could break it down as follows:
   - vanilla cookie (semi-crushed) = rock
   - vanilla pudding = sand
   - graham cracker crumbs = silt
   - butterscotch pudding = clay
   - chocolate pudding / chocolate cookies (semi-crushed) = topsoil with humus
4. Enjoy dirt pudding!

Dirt Shake

Standards of Learning
Science 3.1, 3.7

Objective
Students will:
- separate out and investigate the major components of soil.

Materials
- Soil samples – sand, silt, clay, humus
- Plastic jars
- Small bowls
- Spoons
- Water
- Bucket
- Newspaper

Background Knowledge
There are three main types of soil—sand, silt and clay. When all three are mixed together they create loam. Humus, anything in the process of decaying, is the organic matter found in soil. In this activity, the students will take soil samples, place them in a jar with water, then shake. The soil will settle out in different layers. Sand, being the largest and heaviest soil particle, will settle at the bottom of the container first. Silt, a fine textured soil that feels like talcum powder, settles out next. The final soil, clay, will settle out last. Clay is the smallest and lightest particle of soil. The material floating on top of the water will be organic matter in the process of decaying.

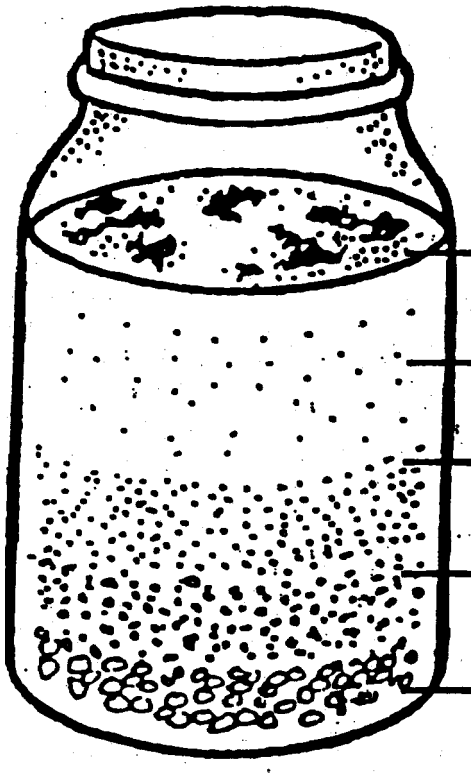
This lesson will review the layers of soil as they are in the ground. On the bottom is bedrock, which is the parent material for the soil that will not be shown until erosion or an earthquake exposes it to the world. Next is subsoil, which is mostly sand/silt and clay. This is where most of the nutrients are found and deep plant roots will come here for water. Next is topsoil, which is where plant roots grow and animals live. This is sometimes called the organic layer where decomposers recycle dead plants and animals into the top layer. On top is humus, which includes more decomposing organic material.

Procedure
1. Divide the students into groups of 3 to 4. Provide each group with a soil sample.
2. Have each group place 3-4 inches of the soil into the jar provided. Allow each group to add water to the jar until the jar is ¾ full. Tighten the jar lid.
3. Shake the jar vigorously until all the particles are sufficiently wet and separated by the water (about two minutes).
4. Set the jar down and allow the soil to settle.
5. After one minute, observe the amount of soil on the bottom of the jar.
6. Allow the sample to settle for 3 to 4 hours. Observe the various layers. Create a simple drawing of the different levels.
7. The rest of the soil, mainly clay particles, may take a couple of days to a week to completely settle out. This depends on the amount of clay in the soil sample.

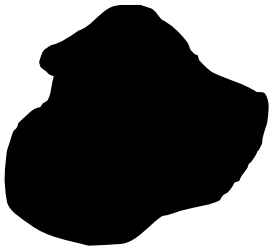
Extension

- Allow the students to feel the texture of the three soil samples with their fingers. Keep a bucket of water handy for rinsing hands off between samples so there will be no confusion to the various textures.
- Complete a soil Venn Diagram with similarities and differences of the soil types.
- Experiment with soil erosion. Set up each type of soil and place them under various conditions (water, wind, human impact, etc.) that may cause erosion to see which type would erode faster.

Dirt Shake



Particle Size



Sand

Silt

Clay

Relative particle sizes of sand, silt, and clay. Remember, silt and clay cannot be seen with the naked eye.

Earth Beads

Standards of Learning
Science 1.7, 2.4, 2.5, 2.7, 3.8, 3.10, 4.5

Objective
Students will:
- model the interdependency between plants, animals, and the Earth.
- investigate cycles in nature.

Materials
- Yarn
- Pony beads in the following colors: red, blue, green, brown, white, black, clear, and yellow

Background Knowledge
In this activity, students make bracelets which represent the many factors that make up our complex world. From plants and animals, to air and water – every bead represents an important part of the planet Earth.

Procedure
1. Tie a knot on one end of the yarn at about 4"- 5".
2. String the colored beads onto the strap in the following order:
    - **Red beads** represent people. All people, regardless of race, color or religion have blood. The earth provides us with everything we need to survive. We must take great care of our valuable resources.
    - **Blue beads** represent water. Water travels through a cycle. Water showers down on the land and collects in oceans, rivers, lakes, and streams. It evaporates back into the sky and collects in clouds. The clouds become heavy and liquid precipitates down to land again.
    - **Green and Brown beads** represent plants and soil, respectively. Plants and soil go through cycles. Plants grow from soil. Plants provide food for animals. Animals provide food for other animals. Animals die and decompose putting nutrients back into the soil. New soil is made from erosion of rocks. New plants grow from the soil.
    - **White and Black beads** represent day and night. Earth is a sphere. Earth is spinning through space, rotating on its axis, revolving around the sun. The Earth and sun give the cycle of seasons and the cycle of night and day.
    - **Clear beads** represent air. Animals breathe in oxygen and exhale carbon dioxide. Plants take in carbon dioxide, use it to make food, and give off oxygen.
    - **Yellow beads** represent the sun. The sun provides light for all of the Earth. Without the sun, plants and animals would not survive. The sun binds us all together.

Extension
- Brainstorm methods of conservation of natural resources.
- Research the phases of the moon using observation and moon charts found in the daily newspaper.
- Create posters depicting the various cycles – water, plant, day/night, moon, etc.
- Study various weather conditions and cloud formations.

Farm Charm

Standards of Learning
Science 1.7, 2.4, 2.5, 2.7, 3.8, 3.10, 4.5

Objective
Students will:
- Use a farm as an example of an ecosystem
- Model cycles found in nature
- Investigate the interdependency between animals, plants, and the Earth

Materials
- Soil
- Peat moss
- Blue construction paper – shredded
- Confetti trees
- Dry corn
- Soybeans
- Confetti animals
- Rock salt
- Flour
- Blue glitter
- Gold glitter
- Small jewelry-sized plastic bags
- Hole punch
- Yarn / string

Background Knowledge
A farm is an ecosystem because it is made of living and non-living things that interact and exchange energy. However, this ecosystem is different than many others because many of the interactions are controlled and made by humans. There is also a large amount of interaction going on between humans and other living and non-living things. There are so many things on the farm that make it a large and busy ecosystem. Humans grow crops and buy food like grain and hay to give to their animals while the animals provide food for the humans at times with milk, cheese, beef, and eggs. The soil, organic matter found in soil, and soil organisms all play another big part in the farm ecosystem by providing nutrients to crops and the breaking down of fertilizers. In between all of these interactions you can find a large amount of interdependency between the humans and animals and the resources that the earth provides. Without sun and water, humans and animals would not be able to live.

Another great concept with this activity is the idea behind cycles. It is important to point out to your students the many cycles that are present on the farm. For example, the farmer uses soil to grow crops and some crops get fed to the animals. The animals waste then serves as fertilizer for the soil to give it nutrients so the farmer can grow crops again. The cycle goes on and on. Encourage your students to point out other cycles they find on the farm. The students will be taking a small amount of each item and placing it into the small plastic bag. Each item above symbolizes something found on a farm. Below the procedure is the explanation of each item. Share this explanation with the students before they create the necklace.

Procedure
1. Place a bowl of each item on a centralized table.
2. Cut enough yarn at necklace length for each student.
3. Punch a hole in the top of each small jewelry bag.
4. Distribute small jewelry bag and yarn to each student.
5. Have each student place a pinch of each item into the small bag.
6. Zip the bag closed.
7. Thread the yarn through the hole and tie to create a necklace.

- **SOIL** (represented by potting soil) is essential to plant growth. It provides plants with the nutrients needed to produce their own food. Healthy soil is important in agriculture. Animals (including humans) eat plants grown in soil and take energy from those plants. Soil needs to be protected from the abuse of erosion, pollution, and development.
- **ORGANIC MATTER (OM)** (represented by peat moss) is old plant or animal material that is being broken down by composting or decomposing in the ground. OM helps insure that the soils will absorb water and provide a habitat for soil organisms.
- **SOIL ORGANISMS** (represented by blue shredded paper) are present in healthy soil. These plants and animals are important in the breaking down of organic matter and excessive fertilizers.
- **PLANTS** (represented by confetti trees) can be trees, shrubs, grass or other crops. Plants provide food for humans and wildlife, help prevent the soil from washing away, and add to the beauty of our habitat. They are important in producing oxygen for us to breathe.
- **BASIC CROPS** (represented by corn) feed humans and animals. Corn is an example of one basic crop. Many products are made from corn (i.e. plastic, fuel, sweeteners and oil). Fuel made from corn helps conserve the fuel (gasoline) that cannot be renewed.
- **GRAINS** (represented by soybeans) are important in world food production. Modern technology has developed many uses for grain crops including the soybean. Soybeans are now made into building products and used as a diesel fuel. This crop contributes to the conservation of non-renewable resources and helps decrease pollution of the earth and atmosphere.
- **ANIMALS** (represented by confetti animals) contribute to the welfare of humans. They serve as a source of food for many people and can be used in the making of other products including clothing.
- **FERTILIZER** (represented by rock salt) is necessary to produce plants. The result is healthy plants for human and animal consumption. All plants need nutrients. Many times the soil cannot supply enough for plant growth so fertilizers are applied. Farmers have learned to use fertilizers properly.
- **PESTICIDES** (represented by flour) are used to control insects, weeds and diseases. Farmers are using less pesticide than ever before in modern agriculture history. Most farmers are using Integrated Pest Management (IPM) practices. These practices require much less chemicals than previously used. IPM uses many predators, insects, disease resistant varieties and genetically engineered plants.
- **WATER** (represented by blue glitter) is necessary for plant and animal life. It must be conserved in order to have what we need.
- **SUNLIGHT** (represented by gold glitter) is important in the process of photosynthesis which helps plants produce their own food and create the oxygen that animals need. All animals get energy from the sun as it is passed through a food chain.

Extension

- Have students write a descriptive paragraph about the Farm Charm and the different parts of a farm reviewed while creating the charm.
- Keep a monthly weather chart and discuss how weather may impact the farm.
- Brainstorm ways to conserve water at school and home.
- Collect packaging from products made primarily with corn and soybeans.
- Research the history of corn and soybeans.
- Have students create an oral presentation about corn and soybeans-how they were used historically and currently.

Here Today, Gone Tomorrow

Standards of Learning
Science 3.11, 4.9

Objective
Students will:

- Identify sources of energy and their uses
- Describe how fossil fuels are used as an energy source
- Understand renewable and nonrenewable energy resources
- Analyze the advantages and disadvantages of using different naturally occurring energy resources

Materials

- Dictionary
- Concept definition maps
- Clue cards (handout provided)
- Renewable or Not? worksheet for each student (handout provided)

Background Knowledge
This lesson focuses on the difference between renewable and nonrenewable resources and examples of each. It includes the use of solar energy as an alternative to nonrenewable fossil fuels for heat and electricity. A renewable resource is one which can be replaced or replenished. Examples are trees. A nonrenewable resource is one which cannot be replaced and once it is used up, it is gone forever. An example is gold. People use fossil fuels, such as coal, oil, and natural gas, for electricity, heat, and transportation. Since fossil fuels are nonrenewable, once they are used up, people must have other sources of energy for heat and electricity. The sun is another energy source we can use for heat and electricity. Corn, soybeans, sugar cane and other agricultural products are being used to produce fuel. These resources are renewable.

Procedure

1. Ask the students what the word "renewable" means. (*Tell them to make guesses using clues from the word even if they do not know its meaning*.)
2. If no one knows its meaning, ask a student to look up the word in a dictionary and read the definition to the class.
3. Discuss this definition as a class and ask a student to define the word in terms which are easier to understand.
4. Once students understand that renewable means it can be replenished or replaced, ask them to think about what a renewable resource may be.
5. Ask if any students know this term and if they can give an example of a renewable resource.
6. Tell the students that a renewable resource is a resource that we use that can be replaced or replenished. These resources may be replaced by nature or by people.
7. Tell the students that one example of a renewable resource is trees. Trees are renewable because even though trees die or are cut down, they naturally continue to grow from seeds or are planted by people.
8. Have students complete the concept-definition map for the term *renewable.*
9. Tell the students to use this information to define what a nonrenewable resource may be.

10. Explain to the students that nonrenewable resources cannot be replaced and once they are used up, they are gone forever.
11. Have students create a concept-definition map for *nonrenewable.*
12. Break the class into groups of four.
13. Hand a clue card to each student. (The students in one group should all have different cards.)
14. Ask the students to read their clue aloud to their group.
15. After they have all read their clues, tell them to use this information to complete the Renewable or Nonrenewable? worksheet with their group members.
16. After all the groups have completed the worksheet, go over the questions as a class.
17. Ask the students if fossil fuels, such as coal, oil, and natural gas, are renewable or nonrenewable resources.
18. Tell the students that fossil fuels are nonrenewable because it takes millions of years for them to form in nature.
19. Ask the students the following questions:
    - What do we use coal, oil, and natural gas for?
    - If these are nonrenewable resources, what does that mean for our electricity, heat, and automobiles?
    - What do we need to do in case these fossil fuels become used up?
20. Tell the students that the sun is the source of almost all energy on Earth and its heat can be used as an energy source for heat and electricity.
21. Ask the students:
    - Do you think the sun's energy is a nonrenewable resource, like fossil fuels?
    - Since solar energy is continually available, would it be a good resource to use to generate electricity?
22. Tell the students that this is continually being studied and many people have already begun to use solar heaters to heat their homes and some businesses use solar energy as an electricity source.
23. Ask the students:
    - Do you think using solar heaters in homes is a good idea? Why or why not?
    - What are the advantages of using renewable resources in place of nonrenewable resources?
    - What are the disadvantages?

Some resources on Earth have only limited amounts and cannot be replaced by nature or by people's actions.	**Some resources on Earth are continually available to use if they are properly cared for.**
Once resources such as fossil fuels (oil, coal, and natural gas) and minerals (iron and copper) are used up, they are gone forever.	**Resources such as crops and animals can be continually replaced through nature or by people's actions.**

Renewable or Nonrenewable?

Instructions: With your group, answer the following questions using your group's clue cards.

1. Decide if these resources are renewable or nonrenewable and write the answer in the blank.

a) corn grown in fields _____

b) oil found in the ground _____

c) trout living in streams _____

d) trees growing in a forest _____

e) coal found in a mountain _____

f) apples grown in an orchard _____

g) cows living on a dairy farm _____

h) gold found in rocks _____

2. If there is a limited amount of a resource, can it be replenished?

_____

3. Once our limited resources are used up, how long will they be gone?

_____

4. What do we need to do now so that some of our resources will stay available all the time?

_____

_____

5. How do our renewable resources get replenished?

_____

_____

Mud in a Bag

Standards of Learning
Science: 3.7

Objective
The student will be able to describe the importance of topsoil to the earth.

Materials
- 1 package (6 oz.) instant chocolate pudding mix
- 3 cups cold milk
- 6 whole graham crackers
- Seeds (peanuts, M&M's, sunflower seeds)
- 6 gummy worms
- 2 1 gallon Ziploc bags

Background Knowledge
Topsoil is key to growing food for our friends and family. It is made from humus, minerals and composted materials which is needed by plants for the essential nutrients for survival. Your favorite vegetables including tomatoes, corn, and beans all grow out of rich topsoil. Eight inches of topsoil is all that is needed to grow a healthy crop.

Soil can be eroded by wind and water. A gentle rain is desirable to provide the soil with needed moisture but not a pounding rain. A little mud can be fun but not a roaring river of mud which strips the topsoil from the land. Wind can blow topsoil away as well. For this reason contour farming and wind breaks are methods the farmer used to conserve the soil in his/her fields.

Procedure
1. Discuss with class how mud is made. Ask leading question to what is beneficial about mud or harmful. Without water there would be no mud is this desirable or not for growing crops.
2. Share your favorite soil book with the class such as *Mud* by Mary Lyn Ray.
3. Create mud pudding for the class to share. Discuss planting seeds in moist soil and what living things exist in soil.
4. Crush the graham crackers in a Ziploc bag. Set aside.
5. Combine pudding and milk in a Ziploc bag. Remove air.
6. Squeeze and kneed with hands until well blended about 3 minutes.
7. Cut corner off bag and pour in small cups.
8. Top with graham crackers.
9. Dig holes for seeds and gummy worms.

Recommended Reading
Mud by Mary Lyn Ray
A Handful of Dirt by Raymond Bial
Dirt the Scoop on Soil by Natalie Rosinsky

References
Lesson adapted from Alabama Agriculture in the Classroom.

Nature's Recyclers

Standards of Learning
Science: 3.7, 4.8, 5.6

Objective
Students will:
- Explore how organic material decomposes and becomes part of the soil.

Materials
- *Composting* by Robin Koontz
- Materials to create a classroom compost:
  - Heavy duty plastic bag
  - Twist tie
  - 1 cup of dirt
  - ½ cup of green or colored materials
    - Coffee grounds, fruit peels, grass clippings
  - ½ cup of shredded brown materials
    - Pine needles, dry leaves
  - 30 mL of water

Background Knowledge
Composting happens naturally. Materials decay and turn into bits of soil, or humus. The nutrients from the dead plants are recycled and reused by growing plants. Decomposers live in compost and help break down the particles even further, making it easier for plants to use. As the pile heats up, the compost decays even faster. The heap turns into humus, which is spread over plants to help them grow.

Composting does not occur over night. This activity takes several weeks to change organic materials into humus.

Procedure
1. Teacher reads *Composting* by Robin Koontz to students.
2. Discuss the purpose of composting with students. List examples of things that may be used for composting (examples: dry leaves, food scraps, grass clippings, coffee grounds). Explain that it is a form of recycling.
3. Tell students that they will be creating their own compost.
4. In the plastic bag, pour in 1 cup of dirt.
5. Add in the colored materials and the brown materials listed above.
6. Add 30 mL of water.
7. Seal the bag with the twist tie and shake.
8. Over the next several weeks (approximately 6 weeks):
   a. Squeeze the bag once a day to mix up the materials.
   b. Open the bag every other day. This will help decrease the potential for stinky smells.
9. Discuss what the compost can be used for and what other materials can be added to it.

Extension
Use the compost in the school garden.

Measure the weight of the material as it changes. Keep track of the recordings and graph the changes.

Discuss the physical and chemical changes occurring inside the bag.

Pick-a-Path

Standards of Learning
Science 3.1, 3.7, 4.9

Objective
Students will:
- Identify the three main types of soil
- Model the different properties of soil

Materials
- Student volunteers

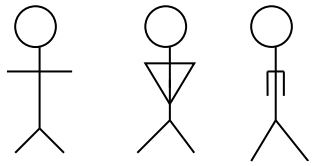
Background Information
Soil is one of our most valuable natural resources – useful to both plants and animals. Plants, which provide us with food, clothing, and other materials, live in the soil. Additionally, animals graze in fields and eat feed produced from various plants. Plants grow in the top layer of soil, which is called topsoil. Topsoil is a product of the two lower layers of soil – subsoil and bedrock. Topsoil is best for plant growth because it contains nutrients deposited by humus. Humus is decayed organic matter in soil. In addition to nutrients, topsoil is where plants absorb water and air. However, it takes an average of 100-500 years for an inch of topsoil to form. It is important to take measures to conserve topsoil and prevent erosion because plants grow poorly in subsoil.

There are three main types of topsoil – sand, silt and clay. When all three are mixed together, they create loam. Humus, anything in the process of decaying, is the organic matter found in soil. In this activity, the students will pretend to be the different soil types. Sand, being the largest and heaviest soil particle, allows water to flow through the easiest and fastest. Plants that like fairly dry roots, such as cotton and peanuts, do well in sandy soil. The coastal plain has the highest concentration of sandy soil. Silt, a fine textured soil that feels like talcum powder, is the next smallest particle. Water can flow through silt but it takes more time. None of Virginia's regions have a major portion of silty soil. Most of the silt can be found in the rivers and tributaries of Virginia. Clay, the final soil type, is the smallest soil particle. Clay packs together very tightly. It is difficult to dig and very clumpy. Most clay-based soils are west of Virginia's fall line. Water has a difficult time flowing through clay. In fact, often the water sits on top of the clay creating mud. When all three soil types are mixed together, loam is created. Loam is the best growing soil.

Soil conservation is the wise use of soil. Many farmers have to follow conservation laws and guidelines depending on where they live. Some soils are designated as suitable for annual crops and other areas are designated for perennials, such as grass and legumes, or for use as grazing or forestry. Another conservation method involves the use of soil-building plants in crop rotations. Such crops hold and protect the soil during growth and, when plowed under, supply much-needed organic matter to the soil. Special methods for erosion control include contour farming, in which cultivation follows the contours of sloping lands and ditches and terraces are constructed to diminish the runoff of water. Another soil-conservation method is the use of strip-cropping, that is, alternate strips of crop and fallow land. This method is valuable for control of wind erosion on semiarid lands.

Procedure

1. Divide the class into 4 groups. Assign each group one of the following titles: water, sand, silt, and clay.
2. Soil particles should position their arms like the examples illustrated in this lesson plan.
3. Group the sand particles together so that each particle is touching another (fingertip to fingertip). Tell students in the water group to try and carefully flow through the sand group. They should be able to flow through with little difficulty.
4. Repeat the above step for silt and clay. Silt particles should be touching elbows, and clay particles should be touching shoulders. Discuss the results of water trying to get through the different soil types.
5. Mix up the sand, silt, and clay particles (students) to make loam. Ask the water group to flow through. Discuss the results.



Sand Silt Clay

Acknowledgements

Lesson adapted from Utah Agriculture in the Classroom.

Reading Climate Maps

Standards of Learning
Science: 4.1, 4.6

Objective
The student will

- Read and interpret maps to determine the most suitable plants for their area as well as the optimal planting time.

Materials

- USDA Plant Hardiness Zone Map, http://planthardiness.ars.usda.gov/PHZMWeb/Maps.aspx
- Average First and Last Frost Maps, https://bonnieplants.com/library/first-and-last-frost-dates/
- Worksheet, attached
- Interactive Virginia Agriculture Map, http://www.agintheclass.org/Teachers/InteractiveVirginiaMap.aspx

Background Knowledge
An understanding of climate and weather patterns is essential to farmers and gardeners as it tells him or her when to plant, when to harvest and guides their choice of what to plant. Weather refers to the temperature and conditions at any given time for a location while climate refers to the pattern of weather for a location over a period of years. The USDA Plant Hardiness Zone Map is based on the average annual winter low temperature and is divided into 10 degree Fahrenheit zones. Landscapers and growers will often use this chart to determine the correct plants for their area. Many plants are labeled with their zone either on the packaging or in the catalogue. Virginia is a geographically diverse state with coastline to the east and mountains to the west, this results in several different climate zones within the state. The diverse climate and geography also means that a wide variety of crops are grown throughout the state.

This lesson uses The USDA Plant Hardiness Map as well as maps of the average first and last frosts. You may choose to download and print each of these maps for students or students may access the maps digitally.

Procedure

1. Begin by reviewing with students the elements that plants need in order to grow – sunlight, space, nutrients from the soil, water. Explain that they also need the appropriate weather and climate in order to flourish. Some plants, such as citrus, like a very warm and humid climate. While others, such as apples, prefer warm days and cool nights. For this reason, you would not expect to find oranges growing with the apples in the Shenandoah Valley.
2. Display the Interactive Virginia Agriculture Map, point out that different crops are grown in different regions and that climate and geography play a very large role in determining which crops are planted where.
3. Instruct students to use the Plant Hardiness and Frost maps to answer the worksheet questions.

Reading Climate Maps

Directions: Use the maps below to correctly answer each question.

USDA Plant Hardiness Zone Map,
http://planthardiness.ars.usda.gov/PHZMWeb/Maps.aspx

Average First and Last Frost Maps,
https://bonnieplants.com/library/first-and-last-frost-dates/

1. How many different hardiness zones does Virginia have? _____
2. In which zone do you live? _____
3. What can you tell about the climate of Virginia by looking at the map? Where is it warmest? Where is it coolest?

   _____

   _____
4. Using what you know about Virginia's geography, why do you think the temperatures and zones change from east to west in the state?

   _____

   _____
5. Using the frost maps, when is the best time for gardeners in your area to plant their gardens? _____
6. Why do you think the first and last frost dates are important to farmers?

   _____

   _____
7. What similarities do you see between the hardiness map and the frost maps?

   _____

   _____

Soil Cereal

Standards of Learning
Science 3.7

Objective
Students will:
- Demonstrate understanding of the soil profile

Materials
- Three different types of cereal
- Milk
- Clear plastic cups, one per student
- Bowls, one per group
- Resealable plastic baggies, at least three per group
- Dried fruit (ex: raisins, cranberries)
- Spoons, one per student

Background Knowledge
Soil is one of our most valuable natural resources – useful to both plants and animals. Plants, which provide us with food, clothing, and other materials live in the soil. Additionally, animals graze in fields and each feed produced from various plants. Plants grow in the top layer of soil, which is called topsoil. Topsoil is a product of the two lower layers of soil – subsoil and bedrock. Topsoil is best for plant growth because it contains nutrients deposited by humus. Humus is decayed organic matter in soil. In addition to nutrients, topsoil is where plants absorb water and air. It is important to take measures to conserve topsoil and prevent erosion because plants grow poorly in subsoil.

Procedure
1. Ask students if they have ever heard of the phrase "Digging all the way to China?" What would happen if you began digging a hole and kept digging? Would you run out of soil? What it all look the same?
2. Explain to students that there are 3 basic layers of soil; this is called the soil profile. If you dug deep enough you would hit solid rock, which is known as the bedrock. Above the bedrock is the subsoil, and the top layer is topsoil. Topsoil contains the most nutrients and is where plants grow.
3. Organize students into small groups. Give each group a sampling of each cereal and dried fruit. The cereal will be the layers of soil and the dried fruit will represent the humus in the topsoil (or the living plants).
4. Have them crush up the cereal in the plastic baggies.
5. Give each student a plastic cup. Instruct them to use the crushed up cereal to create their own soil profile in their cup. Mix some of the dried fruit into the topsoil layer to represent humus.
6. Give each group a small cup of milk. Have them take turns pouring a little bit into their cups to represent rain.
7. Eat and enjoy!

Extension
Bring in extra cereal to represent the different soil particles – sand, silt, and clay. Crush it to appropriately represent the particle size.

References
Lesson adapted from Utah Agriculture in the Classroom

There's *What* in My Watershed?

Standards of Learning
Science: 3.6, 3.9, 3.10, 4.5, 4.9, 6.5, 6.7, LS.12

Objective
The students will:
- define "watershed" and identify the effect of runoff on watersheds.
- identify ways to prevent pollution.

Materials
- white computer paper
- washable markers
- spray bottles with water

Background Knowledge
Sometimes the ground is too wet to soak up more water. So when it rains or snow melts, the water moves until it meets or creates a stream. The area of land that drains the water into the stream is called a watershed. The Chesapeake Bay watershed covers approximately half of Virginia's land area.

Watershed pollution is caused by point source as well as non-point source pollution. Point source pollution is when you know exactly where the pollution entered the water system, such as when motor oil goes down a storm drain. Non-point source pollution is when the pollutant enters the water system over a large area, such as when heavy rains wash grass fertilizer, soil, and trash from a neighborhood into the river.

Farmers work to reduce water pollution several ways, as good management of natural resources increases the value and productivity of their land. Conservation tillage allows the farmer to dramatically reduce soil erosion as well as the amount of pesticides used. Additionally, farmers may leave buffer zones around their crops and use cover crops to reduce the movement of pollutants. Finally, farmers avoid spraying their crops before a heavy rain.

Procedure
1. Ask students to describe what happens when we get a lot of rain. Point out that the water must go somewhere, and when the ground has absorbed all that it can, the water then runs into drains and or streams.
2. Define the term "watershed." Point out that they just because they might not live alongside a river does not mean that they are not part of a watershed.
3. Take a piece of white computer paper and draw several medium sized dots on it using a washable marker. Tell students that the dots represent pollution
4. Have students brainstorm and give examples of pollution as well as its different sources. Define point source and non-point source pollution and give examples of each.
5. Tightly crumble the paper into a ball.
6. Unfold the paper and lay on a table or desk. Point out that the paper now resembles the Earth's terrain, with hills, ridges, and valleys.
7. Use a water spray bottle to spray the paper to simulate rain.
8. Ask students to describe their observations.
9. Debrief by discussing how watersheds were created where the water ran together and eventually pooled. Additionally, discuss how the ink bled into the water. Explain that this is similar to what happens when rain washes away soil, trash, and chemicals.
10. Divide students into small groups; assign each group a different topic, such as farms, factories, and homes. Have each group research ways that their segment of the population can reduce water pollution. Have them present their findings in the form of a public service announcement.

References
Lesson adapted from Illinois Agriculture in the Classroom.

Water Cycle in a Bag

Standards of Learning
Science: K.1, K.3, 1.1, 1.3, 2.1, 2.3b, 3.1, 3.9, 3.11
Language Arts: 2.10, 2.11, 3.9

Objective
The students will:
- Correctly identify and label the steps of the water cycle.

Materials
- sandwich size plastic bags
- various colored permanent markers
- small aquarium rocks (optional)
- water
- picture of the water cycle (attached)

Background Knowledge
Water is used by many people in many ways. But people are not the only ones who need water; it is also critical resource for crops and animals. The earth, however, has a limited amount of water. The water that the earth has constantly keeps going around and around and around in a cycle. This is called the water cycle, which is made up of five steps: sunlight, condensation, precipitation, evaporation, and accumulation. The sunlight is important because it gives the water cycle the energy it needs to keep going around and around. The sunlight starts the cycle. Evaporation happens when the sunlight heats up the water from the lakes, rivers, and oceans and turns it into vapor or steam. This water leaves the lakes and rivers and goes up into the air. Condensation happens when the water in the air as vapor gets cold and changes back into a liquid for rain or a solid for snow. Clouds are formed during condensation and when the cloud lets the rain or snow go precipitation happens. The cloud is not able to hold the water anymore because so much has condensed so the water falls back to earth. As the water falls to the earth it collects in various lakes, rivers, streams, and oceans in a process called accumulation. Some of the water will remain on the ground and soak into the earth for plants to use. Now that the water is back in the rivers and lakes the cycle can start all over again.

Because water is so important for farmers there are several things that they can do to conserve it and keep it clean. For example, they might utilize watering systems that put water directly at the plants' roots – this allows more water to get straight to the plant instead of evaporating. They may also employ vegetative or conservation buffers, which are trees or grasses that are planted in between fields and waterways. These act as a barrier, helping keep pollutants out of the water. Additionally, cover crops are a way that farmers take care of the land and water. Cover crops, such as rye grass or clover, protect the soil from wind and water erosion. Additionally, cover crops help keep nutrients in the soil and out of the waterways.

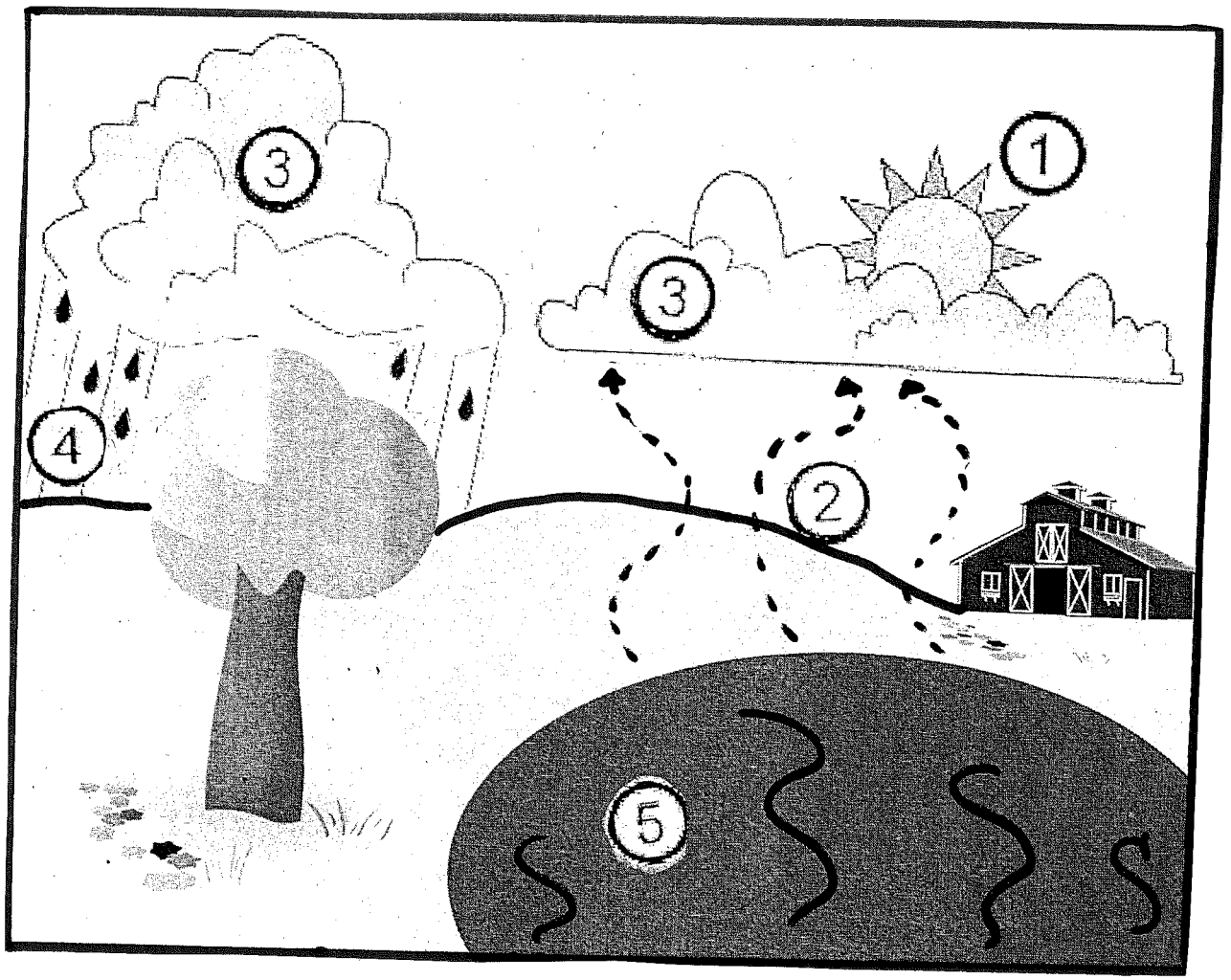
Procedure
1. Hand out the picture of the water cycle to your students.
2. It is best to explain the water cycle to them first and go over it as a class before your students complete the activity.
3. Make sure students have access to permanent markers.
4. Now hand out a plastic bag to each of your students.
5. Tell them to place the picture of the water cycle inside the bag and close the bag.

6. Using the permanent markers, have your students trace over the picture including the numbers.
7. After they trace everything, they can remove the picture from the bag.
8. Next have students number 1-5 on a sheet of paper. Have them correctly identify the numbers from the water cycle picture with the steps of the water cycle.
9. Make sure to remind them that the water cycle steps need to be in order.
10. Instruct your students to add 2 tablespoons of aquarium rocks to the bottom of their bag.
11. Next they need to add ¼ cup of water to their bag.
12. Lastly, using wide, clear packing tape, affix the bag to a window in direct sunlight.
13. Explain to your students how they will be able to watch the water cycle work as the sunlight heats up the water in the bag.

Extension

Challenge students to brainstorm ways in which farmers need water.

Research the effects of severe drought.


1
2
3
3
4
5

Water, Water…*Everywhere*?

Standards of Learning
Science: 1.8, 3.9, 4.9

Objective
The student will:
- identify the major uses of water and understand the limited amount of water available.
- discuss the importance of water conservation.

Materials
- 1 gallon jug of water (can recycle an old milk jug)
- measuring cup
- tablespoon
- eye dropper
- clear plastic cup

Background Knowledge
Water travels in a cycle. It comes down as precipitation; the sun causes evaporation; and then forms clouds through condensation. In this cycle, water is neither gained nor lost, it simply continues through the cycle.

Although the Earth's surface is about 75% water, only 3% of that is fresh, drinkable, water. Of that 3%, three-fourths is found in polar ice caps and glaciers. That means that less than 1% of the water on the earth is drinkable. Water is vital for humans, animals, and plants.

Procedure
1. Begin the lesson by asking students how they use water each day. Discuss answers and record on the board.
2. Brainstorm other uses of water, industrial and agricultural. Record on the board as well.
3. Ask students where fresh water comes from. (rain/snow, rivers, lakes)
4. Hold up a gallon jug filled with water. Tell students that this represents all of the water on the Earth.
5. Use the measuring cup and pour out ¼ cup of water from the jug.
6. The water in the measuring cup represents the Earth's supply of fresh water. The water remaining in the jug represents ocean/salt water.
7. Take 3 tablespoons of water out of the measuring cup and dump into a clear plastic cup. The 3 tablespoons represents the water locked away in glaciers and polar ice caps.
8. Ask for a volunteer. Take the eyedropper and place 2 drops (taken out of the measuring cup) into his/her hand. These 2 drops represent all of the fresh water available for use on Earth.
9. Revisit the list of water uses on the board. Why is it important to conserve water? Why is water pollution and contamination so harmful? Discuss.

Extension
Break students into groups of 3-4. Have groups brainstorm ways to conserve water. Next, each group should create a Public Service Announcement skit or poster advertisement encouraging people to conserve water. Skits/posters should include conservation tips as well as explain the importance of doing so.

References
Lesson adapted from Space Agriculture in the Classroom, www.spaceag.org.

What's the Dirt on Virginia?

Standards of Learning
Science: 3.7, 4.9
Social Studies: VS.2

Objective
The student will be able to:
- Describe the different types of soil
- Identify the soil type(s) found in each region of Virginia

Materials
- large copies of the state of Virginia with regions outlined (recommended 11x17 paper)
- school glue
- water
- plastic cups
- paint brushes
- newspaper
- samples of sand, silt, and clay (about 2 cups of each)
- small aquarium rocks

Background Knowledge
There are three main types of soil – sand, silt and clay. When all three are mixed together, they create loam. Humus, anything in the process of decaying, is the organic matter found in soil. In this activity, the students will pretend to be the different soil types. Sand, being the largest and heaviest soil particle, allows water to flow through the easiest and fastest. Plants that like fairly dry roots do well in sandy soil. The Coastal Plain has the highest concentration of sandy soil. Silt, a fine textured soil that feels like talcum powder, is the next smallest particle. Water can flow through silt but it takes more time. None of Virginia's regions have a major portion of silty soil. Most of the silt can be found in the rivers and tributaries of Virginia. Clay, the final soil type, is the smallest soil particle. Clay packs together very tightly. It is difficult to dig and very clumpy. Most clay-based soils are west of Virginia's fall line. The Piedmont tends to have red clay, while the Valley and Ridge and Appalachian Plateau have a darker clay because of the high mineral content. Water has a difficult time flowing through clay. In fact, often the water sits on top of the clay creating mud. When all three soil types are mixed together, loam is created. Loam is the best growing soil.

For this lesson you will need finely ground samples of sand, silt, clay, and a mix of clay and topsoil (which will be the darker clay of the Valley and Ridge and Appalachian Plateau). You may dig samples outside or order online. If you choose to dig your own soil you need to be sure to dry it out completely and then ground it up very fine. An old coffee grinder or food processor work very well for this.

Procedure
1. Review with students the different types of soil. Point out that different plants thrive in different types of soil. For example, peanuts love the sandy soil of the Coastal Plain.
2. Pass out copies of Virginia map. Identify the different regions and discuss the soil composition of each.
3. Organize students into small groups. Lay out newspaper to protect desks. Give each student a half sheet of construction paper. Each group needs 4 paint brushes, a plastic

cup with a rounded tablespoon of soil, a water bottle, and a bottle of school glue.

4. Add approximately a teaspoon of glue and 5 spritzes of water (equal to the amount of glue) to the soil cups. Stir. Add more water until the mixture becomes soupy.
5. Have students paint the regions with the correct soil (red clay for the Piedmont and Blue Ridge Mountains, darker clay for the Valley and Ridge and Appalachian Plateau). Next go back and trace along the water ways with the silt.
6. Lastly, glue the aquarium rocks to represent the Blue Ridge Mountains and Appalachian Plateau.