Salt and Sand

Grade: 5

Subject Areas:
Physical science, Life Science, Geometry

Skills: describing, drawing, modeling, observing, sensing

Duration: 1 hour

Connections:
chemistry, geology, reading, oceanography

Vocabulary
atom
bond
chemistry
compound
element
matter
mineral mixture
salinity
sediment

Objective:
Students will compare the characteristics of salt and sand and will make an atomic model of a salt crystal.

Materials
- table salt
- clean beach or river sand
- hand lenses or magnifying glasses
- film canisters or small cups
- brightly colored paper
- worksheet 1 and pencils (see attached)
- toothpicks (24 or more per student)
- two different colors of miniature marshmallows
- an overhead model of sodium chloride (or other picture)
- cups for each table
- examples of salt crystals especially halite
- colored paper plates?? for modeling activity (optional)

Standards

Strands: Excellence in Environmental Education Guidelines
Strand 1 —Questioning and Analysis:
B) Questioning: Learners are able to design simple investigations.
Strand 2.1 —The Earth as a Physical System:
A) Processes that shape the Earth: Learners are able to identify changes and differences in the physical environment.
B) Changes in Matter: Learners are able to identify basic characteristics of and changes in matter.
Strand 2.4 — Environment and Society: B) Places: Learners understand that places differ in their physical and human characteristics.

California State Educational Standards:
Physical Sciences (PS): 1g: Students know that when two or more substances are combined, a new substance may be formed with properties that are different from those of the original materials.
PS1h. Students know all matter is made of small particles called atoms, too small to see with the naked eye.

Background

Sand's History

A rock is a mixture of minerals that has a history defined by how it was created. Rocks can be heated, cooled, re-heated, melted, twisted, compacted, eroded, re-compacted, and so on. Within every rock there is a story. This lesson will attempt to connect rocks to the basic chemistry of matter by looking closely at salt.

Rocks are made of minerals. Sometimes the individual minerals making up a rock can be seen easily with the unaided eye. Individual minerals become large enough when they are given adequate space and time to grow. All minerals are naturally occurring solids and under the right conditions have a crystal structure. Crystals can form into a variety of geometric shapes such as hexagons, octagons, and cubes. Minerals can be metals or non-metals.

As rock weathers it is broken down into smaller and smaller pieces called **sediments**. Small **sediments** are classified as sand and silt. Small particles are easily carried by water. **Salts** become dissolved in water and the left over sediments become suspended solids in the water. These suspended solids are carried along in waterways and often end up in the ocean. Sand on a beach is made of little pieces of resistant rock along with shells and whatever else gets ground down by natural forces. The sand on a beach is the accumulation of the nearby geology. In the King Range National Conservation Area (NCA), the beaches are dominated by the types of local rocks that are resistant to erosion along with bits of animals and wood.

Salts are particles that dissolve in water. Common salts areEpsom salt, or magnesium sulfate and sea salt or sodium chloride. Salts can be thought of as compounds. A **compound** differs from a pure element because one ore more elements are chemically bonded together. Once two elements join together more often than not the properties of those elements are very different. There are two types of **chemical bonds**: covalent and ionic. Ionic bonds happen between oppositely charged ions. An **ion** is an atom with an electrical charge. Covalent bonds are when atoms share electrons. Covalent bonds tend to be more stable. Minerals with these bonds include sulfur and diamond.

Salts have ionic bonds. This type of bond partly explains why they dissolve in water so readily. Because of this few water sources are salt free. Rivers and lakes are less salty than the ocean. Mineral water, spring water and tap water all have salts in them. It is understandable why the ocean is more salty than rivers and lakes because ultimately this is where most rivers drain to. **Salinity** is the number of grams of salt per kilogram of water. Different parts of the ocean have different degrees of salinity.

Adapting to Salt

Salts help preserve food and bring out flavor in food, but it is a part of living things too. Salt in the body forms ions. Ions like sodium and potassium

Local Connection

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come from salts and have important roles in cellular communication and metabolic functions. But, too much salt is not good for you. Many things live in asalty environment like the ocean and salt marshes, however, these organisms come from salts and have important roles in cellular communication and metabolic functions. But, too much salt is not good for you. Many things live in a salty environment like the ocean and salt marshes, however, these organisms need ways of dealing with the excess salt. Many salt tolerant plants move salt up to their tips where they break off. Many animals have special glands and extremely concentrated urine to get rid of excess salt.

Getting Chemical

Chemistry is the study of matter. All matter is made of elements. There are six main elements that make up life: carbon, oxygen, hydrogen, nitrogen, sulfur and phosphorous. The simplest form of an element is an **atom** which is way too small for us to see with the naked eye. In simple **atomic models**, dots or circles often represent atoms of different elements. A combination of atoms bonded together forms a molecule or a compound. **Bonds** which form compounds and molecules are often represented by using lines. Models are good ways to help us learn about the structure of matter. Table salt is often used as an introduction into ionic bonds. It has a ratio of one atom of sodium to one atom of chlorine. Its chemical formula is NaCl or sodium chloride. Students will make an atomic model of table salt using marshmallows and toothpicks in this lesson. The marshmallows represent the atoms and the toothpicks represent the chemical bonds holding the atoms together. When the students put their models together properly, they will make a cube of alternating sodium and chlorine atoms.

Almost Ready!

In this lesson, sand and salt will be compared. Upon close inspection, it will be obvious that sand is a mixture of assorted colors and shapes. The sand from local beaches will be a mixture of rocks, animal parts, and wood mostly. Salt by contrast will appear white in color and will be blocky or cubic. It is not a mixture, it is a compound. This particular compound forms a cubic crystal shape. The mineral name for table salt is **halite**. Salt crystals are fun and fascinating and in this case a good connection to rocks and their chemistry because they are a type of mineral .

Activity 1: Sand or Salt?

Preparation

Fill half of the canisters with salt and half with local sand from a beach. Assume that students will work in pairs. Have the magnifyers handy.

Materials

- table salt
- clean beach or river sand
- hand lenses or magnifying glasses
- film canisters or small cups
- brightly colored paper
- Worksheet 5.1 and pencils

Procedure

1. Ask the students some questions to gain understanding of what they already know.

- *Who likes the taste of salt?*
- *Where can we find salt?*
- *Is ocean water made of salt?*
- *Does your body have salt in it?*
- *What types of things live in salt?*
- *Does anybody know what minerals are?*
- *Does any body know what rocks are made of?*
- *What can sand be made of?*
- *Where does the sand from a beach come from?*
- *Is sand made of minerals?*

2. Explain to them that they are going to compare sand and salt. Sand is a mixture and salt is not. Tell them where the sand came from. They are to gather information about the physical nature of both.

3. Have the students pour a small sample of salt on one side of their paper and sand on the other side. Have them look closely at the size and shape of the particles. Have them close their eyes and see if the can feel the difference between the two. Using magnification, have them study the two samples up close.

4. They should draw a picture of both. After a few minutes, give them time to share what they observed. Allow them to finish their drawings. Proceed to Activity 2.

Activity 2: Making a Salt Crystal Model

Procedure

1. Review the basic vocabulary with the students: atom, element, bond, and compound. Explain to them that atoms are very small and they make up all matter. Tell them that atoms are so tiny we need models to help us understand their shape and behavior. Continue to explain that when atoms are bonded together they behave differently. Remind them that they are made mostly of carbon, hydrogen, oxygen and nitrogen, but today we are focusing on rocks and minerals. Salt is made of sodium and chlorine.

- *What are you made of?*
- *What are rocks made of?*
- *Does your body have minerals in it?*
- *What is the name of a type of mineral?*
- *What shape does salt come in?*
- *What two elements is salt made of?*

Materials

- toothpicks (24 or more/ student)
- two different colors of miniature marshmallows
- an overhead model of sodium chloride (or other picture)
- cups for each table
- examples of salt crystals, especially halite
- colored paper plates for modelling activity (optional)

Activity 2 Continued

2. After showing the model of sodium chloride to the class, hold up a halite crystal. They will be able to see clearly the cubic shape of it. Remind them that they saw smaller versions of the same thing in their last activity. Explain to the students that they will be making a model of salt using toothpicks to represent bonds and marshmallows to represent atoms.

3. Each table should have cups of different marshmallows and toothpicks out for assembling models together. Model this activity first as you explain the directions to them orally. Begin with one toothpick two different colored marshmallows on either end. Repeat and add two more toothpicks to make a box. Connect vertically with toothpicks. Students can keep adding atoms onto their model once they have a basic cube. It is important to make sure that when the toothpicks are brought together no two of the same colored atom should be next to each other.
Note: It would be best to have a complete model done and in a visible place so students can see it as they make their own.

Modeling the Activity
To better illustrate a salt crystal have the students join together to make this compound. You will need 9 (3x3) or 16 (4x4) students. Half of the students should receive one color plate while the other half gets another color of paper plate. Each color represents a different element (i.e. sodium and chlorine). Have them stand in an alternating pattern while holding up their plate. They need to form 3 lines of 3 students to form a 3x3 cube. Students should stand really close together to form a cube of alternating colors. Ask the students what compound they are modeling. Have them say: "Compounds behave differently than the elements they are made of."

Extensions

- Sing songs about scientific concepts. Some songs about molecules are available at Singing' Songs of Science
- Connect minerals to mining and important mineral uses
- Conduct experiments around evaporation. This ties into energy and states of matter
- Grow salt crystals
- Use atoms and molecules as an introduction into health topics
- Compare the different environments in which animals live: saltwater vs. freshwater.

References

Westley, Joan, Windows on Beginning Science, Active Learning for Young Children, Window 13: Same or Different? Pg. 28, Creative Publications, 1988.
Why is the Ocean Salty? http://www.palomar.edu/oceanography/salty_ocean.htm, Oceanography: http://courses.washington.edu
How to Make a Model of a Salt Crystal, eHow.com
Salinty: http://science.nasa.gov

Name: _____ **Date:** _____

Write down your observation of salt and sand below.

Salt	Sand