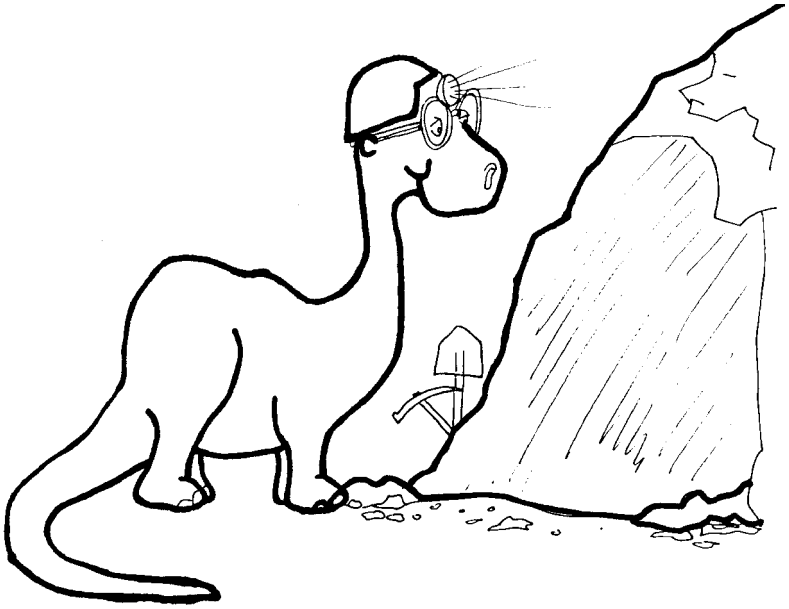
Rock Cycle

Understanding the Earth's Crust

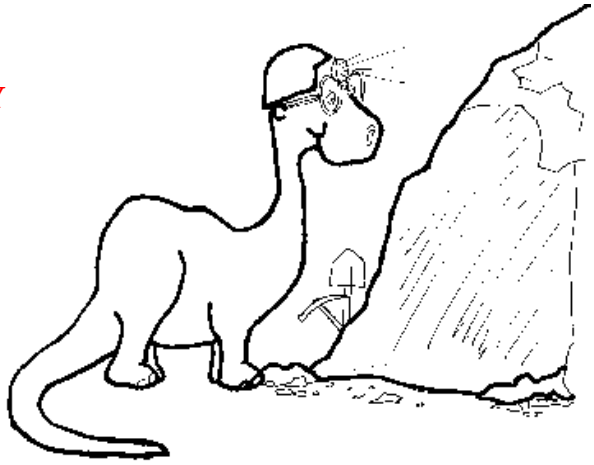
THIRD GRADE

CHEMISTRY



1 WEEK
LESSON PLANS AND
ACTIVITIES

ROCK CYCLE
OVERVIEW OF THIRD GRADE



CHEMISTRY

WEEK 1.
PRE: *Comparing elements of the periodic table.*
LAB: *Discovering properties of compounds.*
POST: *Exploring why elements combine.*

MINERALS

WEEK 2.
PRE: *Exploring the shapes of gems.*
LAB: *Comparing mineral shapes.*
POST: *Distinguishing the geometric shapes of minerals.*

WEEK 3.
PRE: *Distinguishing between crystalline and amorphous substances.*
LAB: *Discovering that all minerals are not crystalline.*
POST: *Exploring crystals.*

ROCKS

WEEK 4.
PRE: *Exploring the etymology of sedimentary, igneous, and metamorphic rocks.*
LAB: *Contrasting different types of rocks.*
POST: *Writing a creative essay on rocks.*

WEEK 5.
PRE: *Exploring agents of erosion.*
LAB: *Analyzing different types of sands.*
POST: *Comparing sand formed by wind and water.*

PAST LIFE

WEEK 6.
PRE: *Comparing different modes of fossilization.*
LAB: *Discovering information derived from organisms.*
POST: *Observing fossil and living organisms.*

ROCK CYCLE - CHEMISTRY (3)

PRE LAB

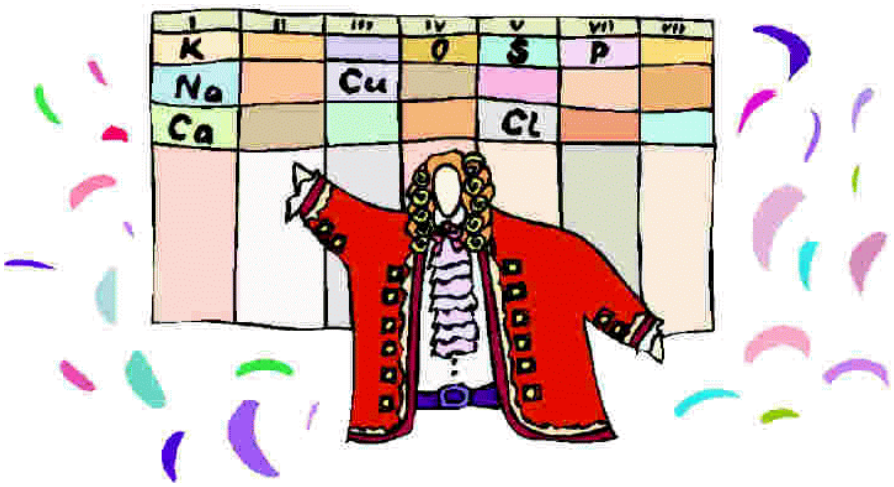
Students compare elements with compounds.

OBJECTIVE:

1. Exploring elements and compounds
2. Comparing elements on the periodic table.

VOCABULARY:

element
compound
matter
periodic table



MATERIALS:

Periodic Table Placemats

BACKGROUND:

All known substances can be classified as solids, liquids, gases, or plasma. In addition, a fifth state of matter, the Bose-Einstein condensate has been discovered recently. However, it is not stable at normal earth conditions. Likewise, although plasma is the most abundant state of matter in the Universe, it is not common on the Earth under normal conditions, except for lightning. Most matter that students are familiar with will therefore be in a solid, liquid, or gaseous state.

An element is a pure substance that cannot be decomposed into simpler substances by normal chemical means. There are 109 different elements. Ninety of these are naturally occurring; the rest have been created in laboratories. Elements 110 and 118 are still being researched on. There will be more elements as technology can identify them. A symbol is used to represent the full name of an element. For example, H represents hydrogen; O represents oxygen, and Al represents aluminum. Sometimes the Latin name for an element is used as the basis for its symbol, for instance K represents potassium (kalium in Latin).

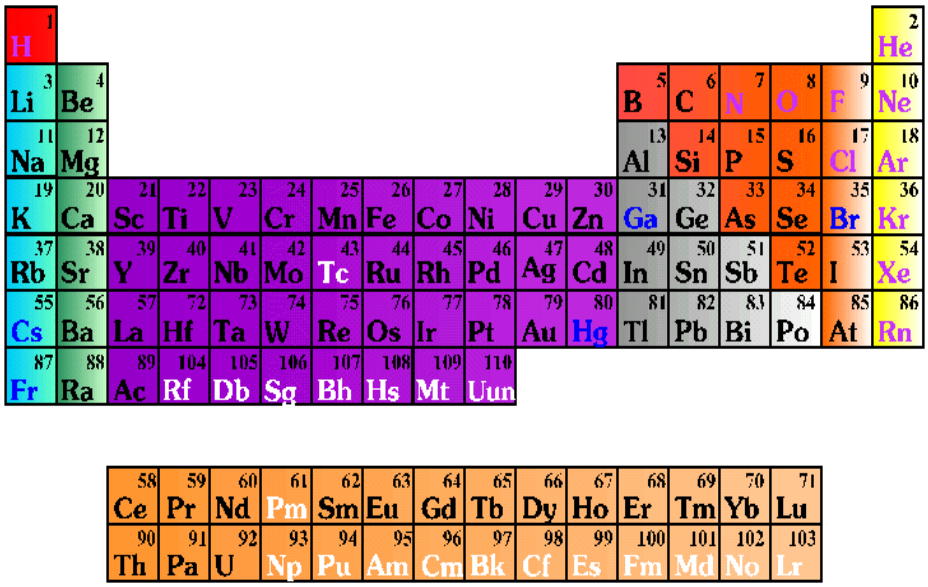
Three subatomic particles compose elements: protons, neutrons, and electrons. Protons, which have an electrical charge of +1, and neutrons, which have a neutral charge, make up the nucleus of an element. This nucleus is surrounded by a “cloud” of electrons, each of which as a charge of -1. The electrons spin around the nucleus in what are called orbits or shells. Each of the orbits can contain a set number of electrons. For instance, the first orbital from the nucleus has 2 electrons, the second has 8, the third has 8, the 4th

has 16 and the fifth has 32, and so on. Each shell may not be full, depending on the number of electrons in the element, and the inner shells fill before the outer shells fill. Sodium, for example, has 11 electrons, which are located in the first, second, and third shells (2+8+1.)

An element has a uniform composition. Different elements may join together; these combinations are called compounds. A compound can be separated into its component elements by chemical means. For example, common table salt is a compound made of two elements: sodium and chlorine. Table salt can be broken down into sodium and chlorine by mixing it with water. However, sodium and chlorine cannot be easily broken down into any simpler forms.

PROCEDURE:

1. Discuss the properties of elements with the students. Review the structure of the periodic table. Ask students questions about the different elements and see if they can locate them on the periodic table.



2. Review the difference between an element and a compound. The students should realize that an element cannot be broken down, whereas a compound can be subdivided into elements. You may wish to explain that in many instances, forming or breaking down a compound requires energy. For example, if you place a mixture of iron and sulfur in a bowl, they will not react. No compound will form. However, if iron and sulfur are mixed and then heated, they will combine and form a compound.

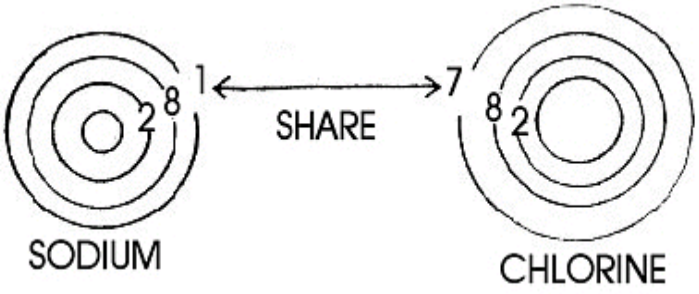
3. Write the following examples of compounds and their constituent elements on the

board. At this point, do not be concerned with explaining the "endings" to the chemical words, such as chlorine versus chloride. These endings reflect the molecular structure of the compound.

ELEMENTS	COMPOUNDS
Na-sodium	**NaCl** (sodium chloride)
Cl-chlorine	**AgCl** (silver chloride)
K-potassium	**KCl** (potassium chloride)
Ag-silver	**KClO** (potassium perchlorate)
O-oxygen	**H_2O** (water)

4. Use the Periodic Table placemats to explore elements with the students. When they examine the chart, the students may ask the meaning of the numbers surrounding the element symbols. The number in the upper left corner is the *atomic* number, i.e., the number of protons inside the nucleus of the element. The number in the lower left is the atomic mass or atomic weight, which is essentially a measurement of how heavy the element is.

5. Explain the basic subatomic structure of elements. Tell the students that protons and neutrons reside inside the nucleus. The electrons spin around the nucleus in what are called orbits or shells. Each of the orbits represents a set number of electrons. For instance, the first orbit from the nucleus has 2 electrons, the second has 8, the third has 8, the 4th has 16 and the fifth has 32, and so on. Sodium for instance, has 11 electrons located in the first, second, and third shells (2+8+1.)



The Na and Cl atoms in this drawing share the electrons in their outer shells, giving each element an overall neutral charge.

ROCK CYCLE - CHEMISTRY (3)

LAB

Students explore the elements that make up minerals.

OBJECTIVE:

1. Comparing the properties of different elements.
2. Discovering properties of compounds.

VOCABULARY:

compound
element

MATERIALS:

Rock Cycle - Chemistry (3)
Periodic Table Placemats

BACKGROUND:

Minerals are either composed of one type of element (a native mineral) or two or more elements (a compound). The characteristics of minerals depend on their constituent elements and compounds. Table salt (the mineral halite) would not have the same properties if either sodium or chlorine were replaced with another element such as silver or potassium. However, the characteristics of elements are not always expressed in minerals; for example, quartz, a hard, glassy mineral, is composed of silicon, which is a lightweight, metallic element, and oxygen, a clear gas.

In this exercise, the students will be given the characteristics of several elements, and will then identify those characteristics in a group of minerals. They will learn that elements cannot always be recognized in minerals.

PROCEDURE:

1. Pass out the Periodic Table Placemats Instruct students to find the following elements on the placemats: iron (Fe), sulfur (S), copper (Cu), silicon (Si), and titanium (Ti). Ask the students to say the atomic symbol of each element. Review the characteristics of each element as outlined below. Have students record the names of the elements in their workbooks.

IRON: heavy, metal
SULFUR: yellow, bad “rotten egg” smell
COPPER: blue-green as a compound with oxygen, copper color as a native metal

SILICON: gray, glassy, metallic, light weight
TITANIUM: dark gray or silvery, metallic

2. Explain the lab. The students should try to determine if the characteristics of the elements described in class are recognizable in the specimens. In other words, the students should try to decide if the individual pieces provide clues to which element they are examining.

3. Allow the students to look at the mineral samples and try to determine which elements are in which sample. Students should record their guesses in the squares provided on the worksheet.

4. Here are answers to guide their observations:

quartz (rose) Si + O, a trace of Ti (gives it the pink color) even though titanium is gray
sulfur S, is naturally yellow and if scratched gives a bad smell (rotten egg)
pyrite Fe + S, called fools' gold; heavy from Fe and yellow from S
hematite Fe + O, heavy from Fe
chrysocolla Cu + Si + O, blue from copper tarnish
copper Cu, color is natural copper
bornite Cu + Fe + O, color from copper, heavy from iron

5. Have the students write an answer to the conclusion. Make sure they understand that elements are not always identifiable in minerals.

ROCK CYCLE - CHEMISTRY (3)

PROBLEM: Can you identify the elements that are in a mineral if you know the characteristics of the elements?
PREDICTION: _____
MATERIALS: periodic table, mineral specimens
PROCEDURE: Look on the periodic table and identify the names of the following elements:

ELEMENT SYMBOL:	NAME:	CHARACTERISTICS
Fe		heavy
S		yellow
Cu		copper, tarnishes to green-blue color
Si		clear
Ti		dark gray, silvery

Try to figure out what elements might be in the following specimens.

SPECIMEN	ELEMENTS AND REASONS
ROSE QUARTZ	
HEMATITE	
PYRITE	
SULFUR	
COPPER	
CHRYSOCOLLA	
BORNITE	

CONCLUSION: Which minerals show the elements that make them up?

_____

ROCK CYCLE - CHEMISTRY (3)

POST LAB

Students explore why elements join together to form compounds.

OBJECTIVE:

1. Examining the periodic table.
2. Determining why elements combine.

Hematite

VOCABULARY:

element
negative
periodic table
positive

MATERIALS:

Periodic Table placemats

BACKGROUND:

The more exposure students have to the Periodic Table the more familiar they will become with the elements. The Periodic Table is arranged so that nonmetals are on the right side of the chart and metals on the center and to the left. The color coding on the chart indicates this classification. Note the right-descending "staircase line" separating nonmetal and metals. The elements to the immediate left of the "staircase line" are called "semi-metals" or "metalloids" because they can behave chemically as both metals or nonmetals. The metallic elements are characterized by a metallic luster and high electrical and thermal conductivity. The nonmetals may be gases, liquids or crystalline solids.

An element that has a charge is called an "ion." Generally, the metals have a positive charge (a positive ion) and the nonmetals a negative charge (a negative ion). There are several exceptions to this rule but there is no need to point this out to the students at this time. A chemical reaction can take place when a positively charged element meets a negatively charged element.

Minerals are compounds made of elements that have both negative and positive charges, which combine so that the overall charge equals zero, making the compound electrically neutral. For example table salt (the mineral halite) is composed of sodium, which has a +1 charge, and chlorine, which has a charge of -1. Since there are equal numbers of sodium and chlorine atoms in halite, the overall charge is zero. We will not be concerned with balancing charges in this activity, because the main point is to illustrate that positive and negative elements come together.

PROCEDURE:

1. Pass out the Periodic Table placemats. Explain the metals vs. nonmetals arrangement of the elements on the table to the students. Point out the staircase line. On the right of the line are the nonmetals. These can be liquids, gasses or crystalline elements. On the left of the line are the metals. The elements right beside the staircase line are "strange" elements that are called 'metalloids' or 'semi-metals'. They can act as both metals and nonmetals.

2. Tell the students that those elements to the left of the staircase line are attracted to those elements on the right. The metals have a positive (+) charge and the nonmetals have a negative (-) charge. This causes them to want to stick together so they can become neutral. A positive plus a negative produces a neutral compound.

3. Tell the students that when elements join together they form a new material called a compound. Compounds can look and act very differently from the elements that made them.

4. Write the following on the board:

table salt = NaCl	*quartz = SiO_2*	*hematite = Fe_2O_3*
pyrite = FeS	*galena = PbS*	*fluorite = CaF*

5. With the class determine which is the positive and negative part of the minerals (as in chart below). Use NaCl (halite) as your example, by asking students to find Na and Cl on the periodic table. Have them identify whether the element is positive or negative by looking at its location on the periodic table.

POSITIVE	NEGATIVE	MINERAL
Fe	O	hematite
Na	Cl	halite
Si	O	quartz
Fe	S	pyrite
Pb	S	galena
Ca	F	fluorite