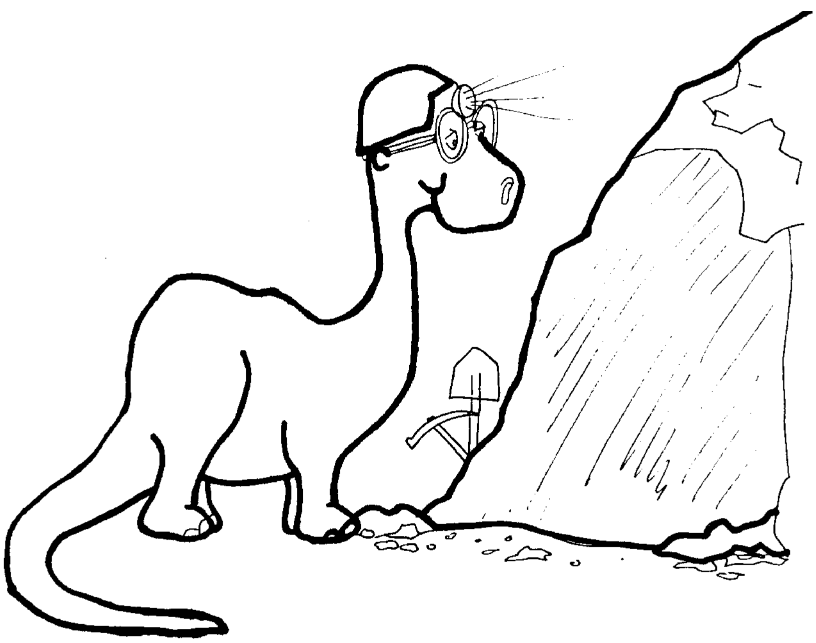
Rock Cycle

Understanding the Earth's Crust

SIXTH GRADE

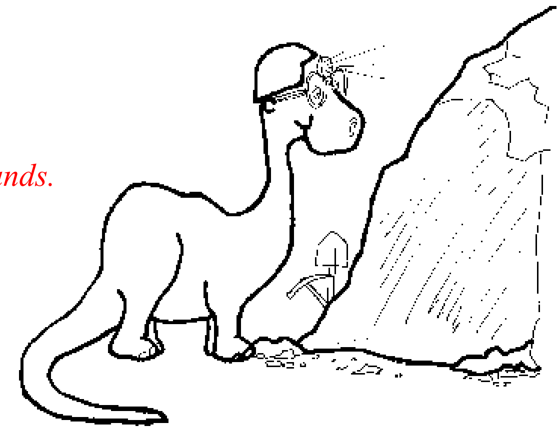
CHEMISTRY



1 WEEK
LESSON PLANS AND
ACTIVITIES

ROCK CYCLE
OVERVIEW OF SIXTH GRADE

CHEMISTRY



WEEK 1.
PRE: *Comparing different solutions.*
LAB: *Exploring how elements can be released from compounds.*
POST: *Analyzing the periodic table.*

MINERALS

WEEK 2.
PRE: *Exploring the composition of minerals.*
LAB: *Exploring the varieties of quartz.*
POST: *Exploring minerals made from silicon and oxygen.*

WEEK 3.
PRE: *Determining specific gravity.*
LAB: *Predicting the use of minerals.*
POST: *Comparing an ore with a mineral.*

ROCKS

WEEK 4.
PRE: *Discovering how rocks are formed by plate tectonics.*
LAB: *Distinguishing where rocks are located within the rock cycle.*
POST: *Writing a creative essay on rocks.*

WEEK 5.
PRE: *Discussing decorative uses of rocks.*
LAB: *Distinguishing between adhesives and cements.*
POST: *Comparing mined resources in the United States.*

PAST LIFE

WEEK 6.
PRE: *Exploring the importance of fossils.*
LAB: *Interpreting cores to understand stratigraphy.*
POST: *Discovering how paleontologists document evolution.*

ROCK CYCLE - CHEMISTRY (6)

PRE LAB

Students make a supersaturated solution and compare it to other solutions.

OBJECTIVES:

1. Comparing different solutions.
2. Distinguishing between a solute and solvent.

VOCABULARY:

saturated
solute
solution
solvent
supersaturated

MATERIALS:

Kool-Aid
sugar
hot plate

BACKGROUND:

A mixture is a combination of two or more materials in which each material is identifiable. For example salt combined with pepper is a mixture. A solution is a combination of two or more materials in which one is dissolved in the other; the materials cannot be recognized. In a solution of sugar and water you cannot distinguish between the water and the sugar.

A solution consists of a solute (the dissolved material) and a solvent (the substance in which the solute is dissolved). The solute is present in a smaller quantity than the solvent. The amount of solute in the solvent is called the concentration. As the amount of solute in a solution increases, the solution becomes more concentrated. At the point of maximum concentration, the solution is saturated. Any additional solute added to a saturated solution will precipitate and drop to the bottom of the container.

In general, increasing the temperature of a solution will increase how much solute can be dissolved in it (solubility). Once solvent temperature has been increased, more solute has been added, but no more will dissolve, the solution is termed supersaturated.

PROCEDURE:

1. Discuss the differences between mixtures and solutions.

2. Have the students experiment with saturated and supersaturated solutions. If the materials are not available, the exercise can be done as a homework assignment.

3. Have the students prepare a saturated solution of Kool-aid or an equivalent powdered drink mix. Have them follow these directions:

a. Make Kool-aid according to the package directions. Use a pan that can be heated on a stove top.

b .Add sugar to the Kool-aid, and dissolve it by stirring.

c. Keep adding sugar until no more will not dissolve, and instead it begins to settle at the bottom of the container. This produces a saturated solution.

d. Have the students experiment and see what happens if they swirl the mix around. Does more sugar dissolve? Ask them to carefully observe what happens as more sugar is added.

4. Heat the saturated solution and observe what happens. Make sure that the students are careful not to stick their hands in the hot solution. The students should see that sugar accumulated on the bottom of the container has dissolved. Ask the students where the sugar went, and why. Have them keep adding sugar again, until no more will dissolve. Explain that they have prepared a supersaturated solution. Have them taste the solution and determine if it is sweeter than the original or the saturated solution.

ROCK CYCLE - CHEMISTRY (6)

LAB

Students set up and use an electroplating apparatus.

OBJECTIVES:

1. Exploring how elements can be released from compounds.
2. Experimenting with electroplating.


Copper ore

VOCABULARY:

anode
cathode
electrode
ion
solute
solvent

MATERIALS:

beakers
copper sulfate ($CuSO_4$) (about 10 ml per set up)
wire
copper for (+) electrode
metal (zinc, steel, or other non-copper metal) for (-) electrode,
6 volt lantern battery for each set up
alligator clips

BACKGROUND:

An atom consists of three basic components: electrons, protons, and neutrons. An electron has a negative charge; a proton has a positive charge; a neutron has no charge. An atom that has a charge is called an "ion." If an ion has too many electrons, it has a negative charge. If an ion has too many protons (not enough electrons) it has a positive charge. Positive and negative ions will combine to form neutral substances.

When a solute is dissolved in a solvent, the compound is "broken" into its consistent atoms, which are almost always ions. These ions will easily be attracted to other ions if given the chance. Positively charged ions will be attracted to negatively charge ions.

In this lab, the students will experiment with the bonding behavior of elements through electroplating (the art of producing metallic coatings by using electric currents.) Economically, metallic coatings are used to improve appearance, resist corrosion, or improve hardness. Examples include plating steel with copper, nickel, or chromium in the automotive industry; tin plated steel for food cans; and the manufacture of silver or gold plated jewelry.

In this lab, the students will make a solution of copper sulfate in water. When water is added to the copper sulfate, the copper sulfate is broken into copper ions (Cu^{2+}) and sulfate ions (SO_4^{2-}). The copper ions roam around in the solution looking for a negatively charged with which to combine.

This process is facilitated by passing an electric current through the solution. In this lab, the power source is a battery. As directed below, a copper strip is wired to the battery's positive terminal (the cathode), while a zinc or iron strip is attached to the negative terminal (the anode). When electricity flows through the circuit, the positive copper ions in solution bond to the negatively charged metal. In addition, the copper strip loses Cu^{2+} ions, which replace the Cu^{2+} ions lost from the solution. Given time to experiment, any substance can eventually be electroplated. Students will see that elements can "move" around with just a small amount of energy from the battery.

PROCEDURE:

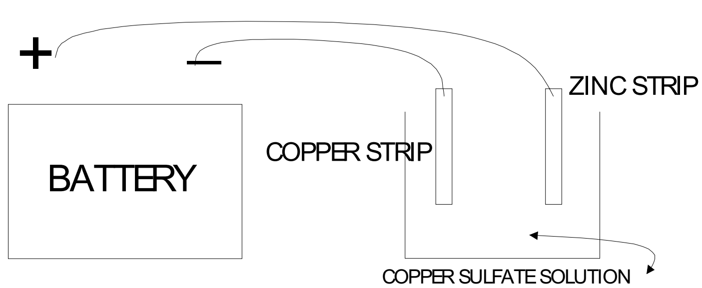
1. Reinforce to students that chemical compounds are made of elements, which are composed of atoms. This lab will demonstrate how elements by becoming ions can be manipulated and moved from one area and deposited in another. Emphasize that it is not magic when the elements move around, but their response to the electrical current.

2. Perform the electroplating experiment, following the directions below.

a. Mix the solution. Use 250, 500, or 1000 ml glass beakers. For every 250 ml of water, use approximately 5 ml of copper sulfate. You can purchase copper sulfate at a chemical supply place or contact us at the Math/Science Nucleus..

Note: After the experiment, you can safely dispose of the solution down the sink. However, the solution is reusable for a few years. If you keep it, store in it safe place, correctly marked as copper sulfate solution.

b. Place the electroplating materials on a table. Make sure that the beakers and wires are clean. Cut two 6" sections of wire. Wrap a piece of copper around the end of one wire and a piece of another metal (Zn or Fe) around the end of the other wire. Use alligator clips on the other ends of both wires, so you can easily attach them to the battery.



c. Using the alligator clip, connect the wire wrapped to the piece of copper to the POSITIVE battery terminal (see the diagram). Connect the other wire to the NEGATIVE battery terminal. You should now have one wire from the positive terminal connected to the copper electrode and one wire from the negative terminal connected to the iron or zinc electrode.

d. Place the electrodes in the solution and let the experiment stand. You should begin to see little bubbles form on the copper electrode very soon. If you wire the electrodes backwards, a different reaction will occur; a black film will coat the electrode. If this happens, clean all the metal by wiping it with a tissue, and try the experiment again.

e. Let the electrodes stay in solution for about 5 minutes. When removed, the anode should be coated with copper.

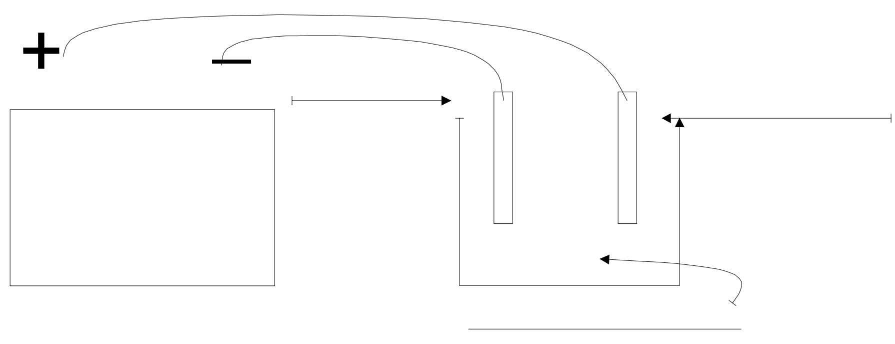
ROCK CYCLE - CHEMISTRY (6) LAB

PROBLEM: Can atoms and molecules move?
PREDICTION:____
PROCEDURE:

MATERIALS: beaker, 2 electrodes (one copper), items to plate, wire, battery, copper sulfate ($CuSO_4$) solution

EXERCISE I. Set up the equipment as noted in the diagram. When dissolved in water, the copper sulfate ($CuSO_4$) breaks down into copper ions (Cu^{2+}) and sulfate ions (SO_4^{2-}). When an electric current is applied to the solution, the Cu^{2+} ions in solution will travel to the negative (-) electrode. Label the diagram below.

+ hook up copper **-** hook up zinc or whatever you want to plate



What is the chemical formula for copper sulfate?

____

What does the copper sulfate break into when it is in the water?

Exercise II. Experiment with electroplating other items and record your observations.

item	observation - what happens?

CONCLUSION: How do the copper ions move?
____
____

ROCK CYCLE - CHEMISTRY (6)

POST LAB

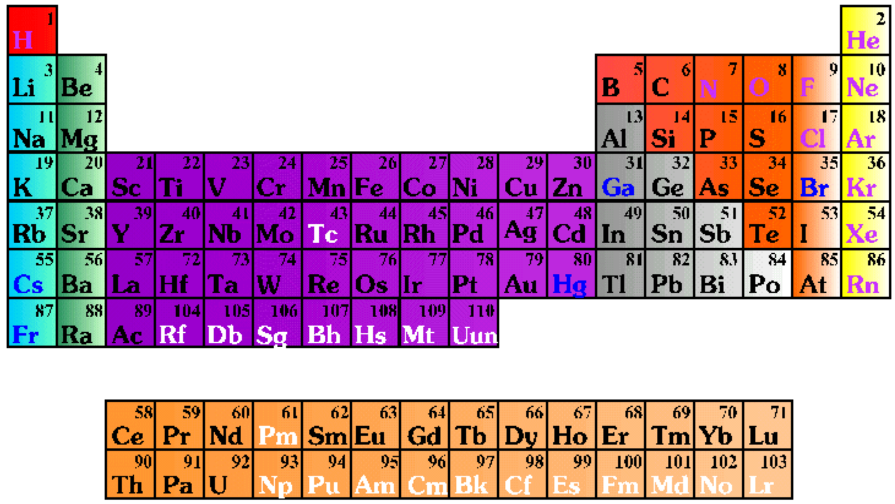
OBJECTIVE:

Students classify elements on periodic table of elements.

1. Analyzing the periodic table.
2. Learning the components of an element.

VOCABULARY:

electron
neutron
proton



MATERIALS:

Periodic Table Placemats
Internet

BACKGROUND:

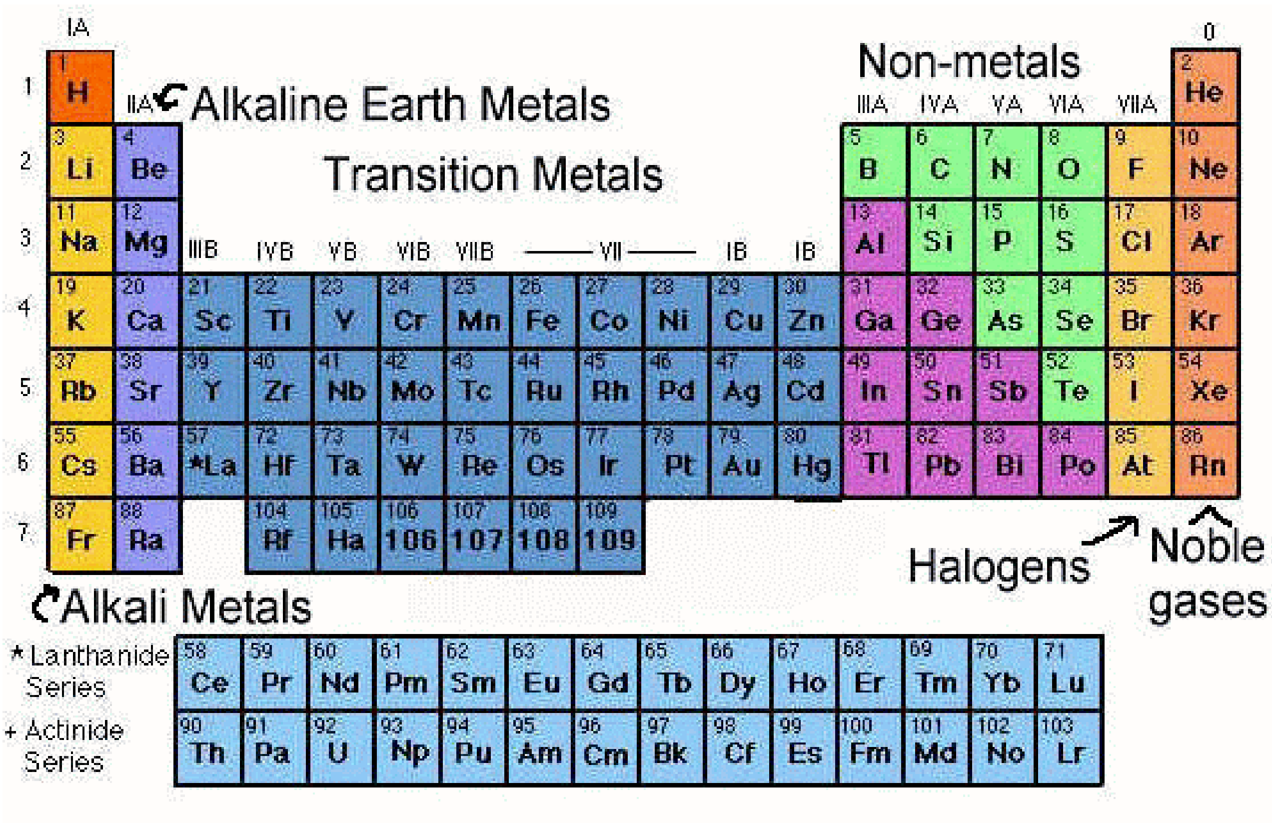
The periodic table has taken a long time to develop and continues to grow as new elements are discovered through experiments in nuclear chemistry. You can give your students the following example to show how the arrangement of the elements means something.

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 has 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.)

There are 109 different elements. Ninety of these are naturally occurring; the rest have been created in laboratories. More elements are created every year. The elements are grouped on the periodic table of the elements. The periodic table was developed by the Russian scientist Dmitri Mendeleyev in the 1850's. He based the table on the regular reoccurrence of elemental properties, arranged by increasing atomic weight.

The elements are placed in boxes in the periodic table. 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). The number above each element symbol is the atomic number (the number of protons in the element); the number below it is the atomic weight (essentially the number of protons and neutrons).

The periodic table consists of two major divisions: the metals and the non-metals.



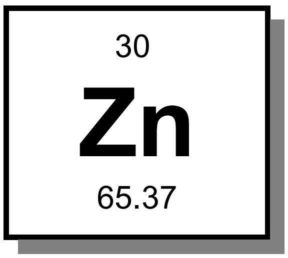
The metals lie to the left of the zig-zag line (i.e., transition, alkali, and alkaline earth-metals.) The non-metals lie to the right of the zig-zag line (i.e., noble gases, halogens.) The Lanthanoid and Actinoid series elements belong to the transition metals, but they are placed out of sequence below the main part of the periodic table. The vertical columns on the table are called *families*; these elements share similar chemical properties. The horizontal rows are called *periods*; every period begins with an alkali metal and ends with a noble gas.

Starting from the left, the *alkali metals* are the first family encountered. The alkali metals are all similar because they characteristically donate or give up one electron when forming compounds. The next family is the *alkaline earth metals*. The alkaline earth metals donate or give up two electrons when forming compounds. Both the alkali and alkaline earth metals react readily with the non-metals and form ionic compounds, and the electrons involved come from outer electron shells.

The third through twelfth columns are the *transition metals*. The electrons from these elements that are involved in chemical reactions vary in both the number and energy level (i.e., the electron shell from which the electrons come). The transition metals tend to form multiple series of compounds. The transition metals form covalent bonds.

The *halogens* are similar in that they accept an electron during a chemical reaction. The *noble gases* are unique due to their low tendency to react with other elements.

PROCEDURE:



1. Explain the general arrangement of elements in the periodic table. Next, explain the information contained in each box. You may need to review protons, electrons, and neutrons. Use zinc as an example.

atomic number = 30
atomic symbol = Zn
chemical name = zinc
atomic weight = 65.37

protons = 30 (# of protons = atomic number)
electrons = 30 (since # of protons = # of electrons)
neutrons = (65 (atomic wt) - 30 (atomic number)) = 35

2. Go over as many examples as needed until you are sure that the students understand how to read the periodic table.

3. Many government and educational facilities have scientific information on the Internet. Instruct your students to use a search engine to look up Periodic Table of the elements. Have them look at the different websites, and determine which one would be helpful to a sixth grader. Websites for periodic tables seem to change frequently, so every year you do this exercise, you may be surprised! Below are a few suggested sites.

http://pearl1.lanl.gov/periodic/
Los Alamos National Laboratory site on Periodic Table

http://www.shef.ac.uk/~chem/web-elements/
Web Elements

http://www.chemicalelements.com/
Chemical Elements