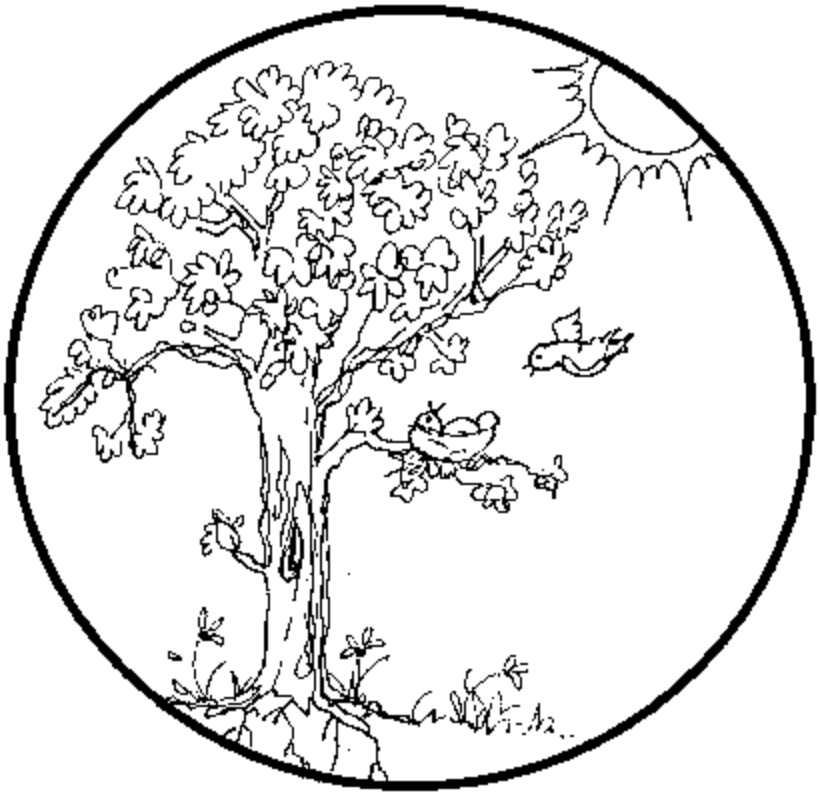
Life Cycle

Diversity in a Balance

SIXTH GRADE

NATURAL ENVIRONMENT



2 WEEKS
LESSON PLANS AND
ACTIVITIES

LIFE CYCLE
OVERVIEW OF SIXTH GRADE
ORGANISMS

WEEK 1.
PRE: *Defining classification.*
DURING: *Exploring characteristics of the lower kingdoms.*
POST: *Comparing classification and taxonomy.*
WEEK 2.
PRE: *Exploring how food gets rotten.*
DURING: *Discovering why food rots.*
POST: *Defining the parameters of the kingdom system.*

HUMAN BIOLOGY

WEEK 3.
PRE: *Exploring the endocrine system.*
DURING: *Analyzing the different stages of human growth.*
POST: *Comparing mitosis and meiosis.*
WEEK 4.
PRE: *Distinguishing bacteria, protozoa, and viruses.*
DURING: *Distinguishing bacteria and viruses.*
POST: *Comparing genetic disorders with diseases.*

PLANT LIFE

WEEK 5.
PRE: *Distinguishing land from aquatic plants.*
DURING: *Comparing growth factors of plants.*
POST: *Exploring uses of auxins.*
WEEK 6.
PRE: *Exploring the history of genetics.*
DURING: *Testing heredity models.*
POST: *Developing a mutation theory.*

NATURAL ENVIRONMENT

WEEK 7.
PRE: *Exploring ecosystem requirements.*
DURING: *Comparing the pH of different soils.*
POST: *Interpreting the results of soil pH.*
WEEK 8.
PRE: *Adapting to the local environment.*
DURING: *Researching factors on adaptation.*
POST: *Comparing different theories on evolution.*

LIFE CYCLE - NATURAL ENVIRONMENT (6A)

PRE LAB

Students compare the elements in minerals found in soil.

OBJECTIVE:

1. Exploring ecosystem requirements.
2. Determining if chemicals can be found in the environment.

VOCABULARY:

ecosystem
environment

MATERIALS:

worksheet
Periodic Table Placemats

BACKGROUND:

Although the media talks about chemicals being harmful to our environment they fail to point out that chemicals make-up everything. There are naturally good chemicals and naturally bad chemicals in the world depending on how specific organisms react to them. The key to this unit on natural environment if for students to recognize that chemicals can "control" an environment, and can also influence organisms that live in a specific environment.

An environment refers to the surroundings of an area. Environments are different from place to place, and change with time. Within environments you have different parameters that allow ecosystems to maintain themselves. Major land and aquatic ecosystems require the following components in order to be maintained.

1. Sunlight - the ultimate source of energy for primary producers, controls a photochemical process
2. Inorganic substances - carbon, nitrogen, oxygen, minerals, and water
3. Organic compounds - fats, proteins, carbohydrates
4. Climate or weather - wind, water currents, temperature, rain, snow, and humidity
5. Producers - autotrophic organisms for most part green plants, that capture sunlight, convert energy into organic nutrients, and release oxygen
6. Macroconsumers - heterotrophic organisms, animals for the most part that eat other organisms or organic matter
7. Microconsumers - decomposer organisms, largely bacteria and fungi that break down the organic components of dead organisms

Notice that all the components are ultimately composed of chemicals. However, there are inorganic components that are "given" or specific to an area. The ecosystem has to build

itself on earth (organic matter + rock). Organic matter is carbon based, but rocks can be made of a variety of chemical compounds which add character to a particular soil. Remember, minerals make-up rocks, and minerals can be composed of elements or compounds.

PROCEDURE:

1. The worksheet is designed for students to look at minerals. The students should use a periodic table if they are not sure what the symbols stand for.

2. ANSWERS: 1. Mg,Si,O,H; Cu; Ca,C,O; 2. Si,O; Pb, S; Ca, F; Al; Ca, K, Si, O; 3. Ba, S, O; Si, O; Ca, C, O; Hg, S. 4. The soil in #3 because mercury is toxic to many organisms, especially humans.

LIFE CYCLE - NATURAL ENVIRONMENT (6A)

PRE

MINERAL	COMPOSITION
CALCITE	$CaCO_3$
BARITE	$BaSO_4$
COPPER	Cu
FLUORITE	CaF_2
GALENA	PbS
QUARTZ	SiO_2
SERPENTINE	$Mg_6(Si_4O_{10})(OH)_8$
FELDSPAR	$CaK(AlSi_3O_8)$
CINNABAR	HgS

1. Which elements are in soil that has the following minerals in the parent rock: serpentine, copper, and calcite.

_____
_____

2. Which elements are in soil that has the following minerals in the parent rock: quartz, galena, fluorite, and feldspar.

_____
_____

3. Which elements are in soil that has the following minerals in the parent rock: barite, quartz, calcite, and cinnabar.

_____
_____

4. Which of the soils may be dangerous for humans and why?

_____
_____

LIFE CYCLE - NATURAL ENVIRONMENT (6A)

LAB

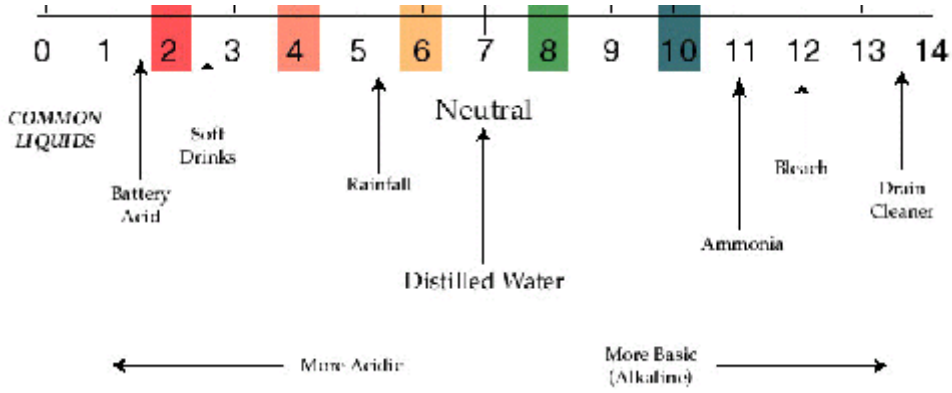
Students experiment with pH and soils.

OBJECTIVE:

1. Exploring the chemical make-up of soil.
2. Comparing the pH of different soils.

VOCABULARY:

acid
base
ion
pH



MATERIALS:

magnet
glass beaker
pH Indicator paper
spoons
Life Cycle - Natural Environment (6A)
mortar and pestle (optional)

BACKGROUND:

The "H" in pH stands for hydrogen. The more reactive hydrogen in a liquid the more acidic it is. The more hydroxide ions (hydrogen + oxygen) the more basic it is. Water is neutral because it has one H^+ ion and one OH^- ion, so they balance out and are neutral. It is not important that the students really understand what pH is, but that they understand what the numbers refer to. Advertisers refer to pH all the time, especially in soap and shampoo products.

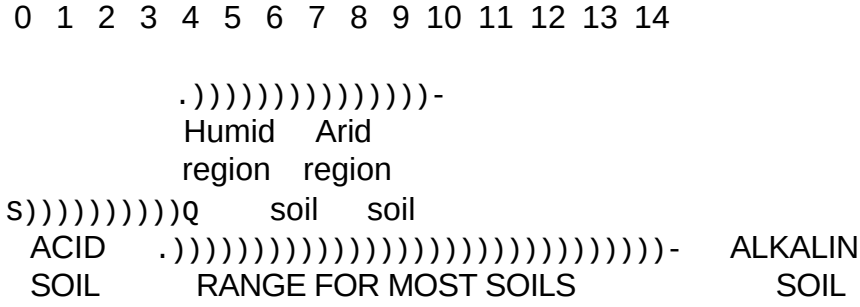
Measuring whether a substance is an acid or a base is not difficult using litmus paper. However, litmus paper is not quantitative. Chemists use a pH scale from 0-14 to measure the intensity of being an acid or base. Water, which is neutral is a 7, 0 is a strong acid and 14 a strong base. Lye is 13, bleach is 12, ammonia is 11, milk of magnesia is 10, borax is 9, baking soda is 8, blood and milk are 7, orange juice is 4, vinegar is 3, lemon juice is 2, and battery acid is 1. These numbers refer to the concentration of hydrogen ions in a solution. In this lab, students will use the pH indicator or litmus paper on solutions of soil to try to figure if the acidity or basicity of a soil will affect the plant growth on that soil. The pH of mineral soils varies from values of 3 or less in very acidic soil to more than 10 in alkali soils

of some arid and semiarid areas. In order for a soil to be productive in humid areas it must have a pH between 5-7 and arid regions must have a soil pH between 7-9. An indicator is a substance that can determine the presence of an acid or base. Indicators change color when they come in contact with an acid or base. Litmus is red (pink) in acid and blue in base. Citrus fruits and vinegar are examples of acids; bleach and ammonia are examples of bases. In this lab, the students will determine the actual pH of a soil by using indicator solutions and comparing the color of the indicator with a pH scale. Litmus paper can also be used but the samples must be cleaner than what is needed for an indicator solution.

PROCEDURE:

1. Students will look at two types of soil; soil from a granitic area and soil from a serpentinite area. They will determine whether each of the solutions from the soil is either basic or acidic. They will examine the vegetation on each of the soils in the next lab to determine if there are any differences between the vegetation that occurs in each of the two different soils. Climatic conditions are the same, so they will have to determine why there is such a difference. The key point to emphasize is that there is some kind of chemical difference which makes one soil much better for growth than another.

2. The following diagram may help you explain the range of pH in soils.



3. This lab has students actually do a chemical determination. Sometimes impurities can make the experiment produce different results. If the beakers or spoons are not clean, the results may be different.

4. Have the students follow their lab sheet. The granitic solid is more acid than the serpentinite, but not dramatic. Granitic soil can be from 7 to 6, while serpentinite ranges from 7 to 8. The pH of your local soil will vary. The key objective is for students to realize that there are chemicals in soil which makes soils different. If you have a mortar and pestle you may want to crush the samples first. Students only need about ½ ml of soil to perform the test.

5. You need to collect soil from your local area to be used in lab.

LIFE CYCLE - NATURAL ENVIRONMENT (6A)

PROBLEM: Can pH be used to detect differences in soil?

PREDICTION:_____

MATERIALS: 3 soil samples, pH indicator paper, magnet, beaker

PROCEDURE:

1. Describe each of the samples that you have. Use a magnifying glass and magnet to see if you can find any differences.
2. Put about 2 ml of the soil in 2.5 ml of water and mix thoroughly.
3. Use the pH indicator paper to determine the pH of the soil by putting the paper into the mixture and comparing it with the colors in the kit.

	DESCRIPTION OF SOIL
SERPENTINITE SOIL pH _____	
GRANITIC SOIL pH _____	
SCHOOL SOIL pH _____	

CONCLUSIONS: How are the soils different?

_____

_____

LIFE CYCLE - NATURAL ENVIRONMENT (6A)

POST LAB

Students compare pH of two different soils.

OBJECTIVE:

1. Interpreting the results of soil pH.
2. Exploring environmental differences in soil.

VOCABULARY:

granitic
requirement
serpentinite

MATERIALS:

worksheet

BACKGROUND:

The soil specimens that the students have looked at come from two sides of the San Andreas fault in California. The San Andreas fault has moved one side relative to the other and has allowed different types of rocks to abut right next to each other. On the worksheet you can see that west of the San Andreas and Pilarcitos Faults, there are granitic rocks. East of the Pilarcitos Fault you have rocks composed of serpentinite.

The parent rock material weathers, releasing the elements that compose the minerals of the rocks. These elements provide nutrients for the plants to grow. Students will see in Life Cycle - Natural Environment (6B) that the plants are very different. The rock serpentinite is composed mainly of the mineral serpentine. The main minerals of the serpentine group all have the approximate composition $H_4Mg_3Si_2O_9$. The principle minerals in a granitic soil are quartz, feldspar, hornblende, and mica (SiO_2).

The factors that influence soil formation include climates (particularly temperature and precipitation), living organisms (especially native vegetation and human beings), the nature of parent material (including texture and structure, and chemical and mineralogical composition), topography of area, and time that the parent materials were subjected to soil formation.

The process of disintegration of solid rock makes possible a “foothold” for living organisms. Decomposing minerals release nutrients that nourish simple plant and animal forms. Rocks are broken down by mechanical or chemical mechanisms. Mechanical weathering or disintegration is affected by temperature (differential expansion of minerals, frost action), erosion and deposition (mainly by water, ice and wind), and activity from

organisms. Chemical weathering or decomposition can be accomplished by the chemical processes of hydrolysis, hydration, acidification, oxidation, and dissolution. It is the chemical weathering that frees elements into an ionic state that makes them available for plants to use.

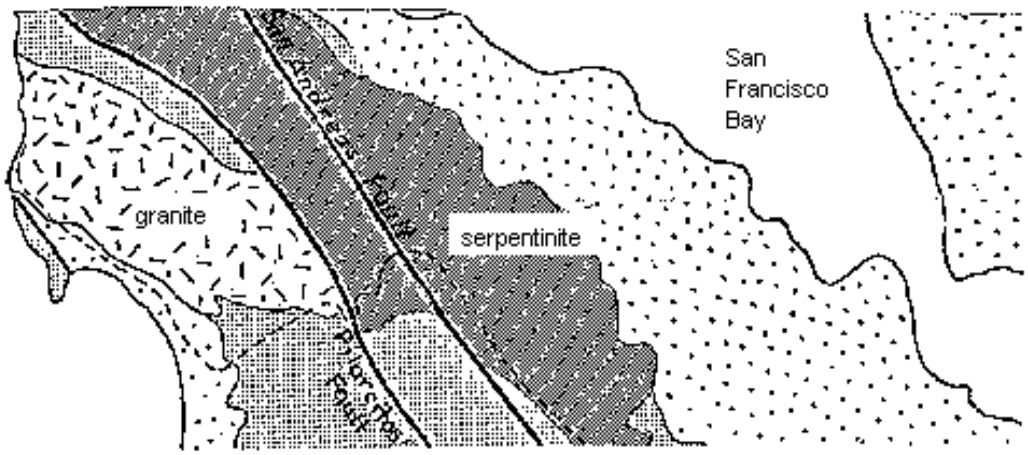
PROCEDURE:

1. As the students complete their worksheet, have them refer to Life Cycle - Natural Environment 6A Pre for the chemical composition of the minerals.

2. ANSWERS: 3. serpentine; 4. quartz, feldspar (mainly) could include biotite, hornblende, pyroxene; 5. Mg,Si,O,OH; 6. Ca,K,Al,Si,O; 7. Ca,K,Al; 8. Yes, plants have different requirements.

LIFE CYCLE - NATURAL ENVIRONMENT (6A) POST

SAN ANDREAS FAULT, NEAR HALF MOON BAY, CALIFORNIA



1. Color the areas that are primarily made of serpentinite. Color them blue.

2. Color the areas that are primarily granitic and sedimentary. Color them red.

3. Serpentinite is made of which minerals?

_____

4. Granite is made of which minerals?

_____

5. List the elements that are available in serpentinite soil.

_____

6. List the elements that are available in granitic soil.

_____

7. Which elements are only in granitic soil?

_____

8. Do you think there are enough differences in the soil to cause such a difference on the surface vegetation? Explain.

_____

LIFE CYCLE - NATURAL ENVIRONMENT (6B)

PRE LAB

Students interpret a worksheet to observe organisms' adaptation.

OBJECTIVE:

1. Adapting to the local environment.
2. Exploring consequences of competition.

VOCABULARY:

adaptation
niche

MATERIALS:

worksheet

BACKGROUND:

There is much stress in communities, and it is this stress that continues to push better adapted species to be successful in the community. There are many factors that govern competition between species which may result in extinction or separation of that species from its original areas. Species are associated with a particular and unique set of biological and physical influences which are known as niches. The term "niche" is used in ecology with a variety of meanings, but all of them have to do with a habitat that is filled by species within an entire ecosystem.

Students will take a closer look at how populations can become stressed in an ecosystem by interpreting scientific data. There are many chemical interactions between populations. It is known that there are many chemical secretions released by a particular plant population that will prevent other plants to grow around them. A classic experiment deals with the California chaparral. It had been known for many years that chaparral plants have a characteristic pungent and aromatic odor, and that this is due to the presence of volatile substances released from the shoots of the plants. These chemicals (known as terpenes and phenolic compounds) are absorbed onto surrounding soil surfaces and in turn suppress the growth of the seedlings of many species in the area.

This chemical interaction may provide clues on how ecosystems evolve through time. Chemicals are used to prevent predators from attacking a plant. Chemicals are emitted from plants and are used to protect the plants from their "enemies." However, it is known that insects can develop mutants that can successfully attack these plants, and if a plant cannot develop a stronger plant, than it will go extinct because the insects will eat the plant into extinction.

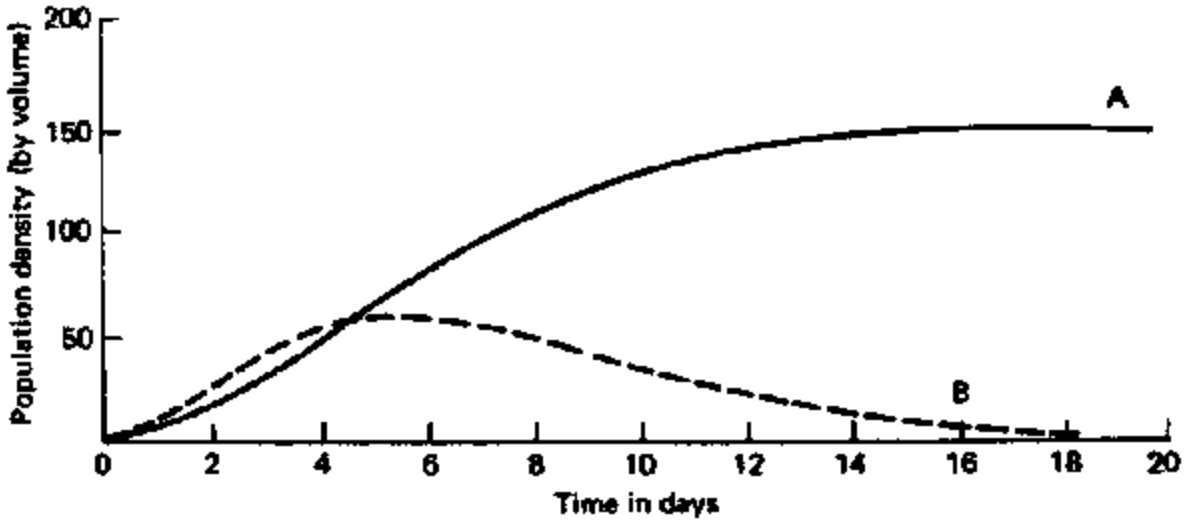
PROCEDURE:

1. The worksheet asks students questions on what happens when there is competition

between various populations. This graph illustrates the "Rule of Gause." If two species are utilizing the same resource, one will most probably reach this position where its growth rate is zero before the other. The graph illustrates competition between two species populations of *Paramecium* in a closed culture. One species, *Paramecium caudatum* (B), declines to extinction as the result of its inability to compete with *Paramecium aurelia* (A) for the same food sources. This exercise helps students to interpret data. This is an example of what happens when a population is stressed. There are many examples of this in nature.

2. ANSWERS: 1. time in days; 2. population density (by volume); 3.(2); 4.(50); 5. rapidly increases until about 9-10th day in which it levels off, decreases slightly after 18th day; 6. increase at about same rate as A until the 4th day, then it slowly decreases until the population dies at 18; 7. A and B are competing, B begins to lose on 4th day until it dies, A continues to survive.

RULE OF GAUSE COMPETITION



Looking at the graph, answer the following questions.

1. What is the horizontal (x)axis? _____

2. What is the vertical (y) axis? _____

3. What are the increments on the x axis? _____

4. What are the increments on the y axis? _____

5. Describe what happens to species A over time? Describe in detail.

_____
_____
_____

6. Describe what happens to species B over time? Describe in detail.

_____
_____
_____

7. Can you explain what is going on and what will happen to both species?

_____
_____

LIFE CYCLE - NATURAL ENVIRONMENT (6B)

LAB

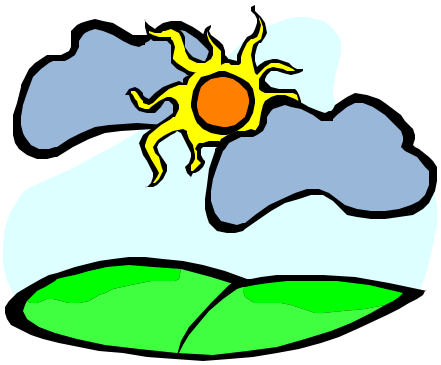
Students compare vegetation from different areas.

OBJECTIVE:

1. Researching factors on adaption.
2. Exploring why ecosystems are different.

VOCABULARY:

adaptation
ecosystem



MATERIALS:

Life Cycle - Natural Environment (6B)

BACKGROUND:

In the previous lab students looked at soils from granite and serpentinite parent rocks. In this lab students look at the resulting natural vegetation that grows on each of the soils. They will see that serpentinite soil does not have much vegetation other than shrub bushes and grass. Granitic soil, however, can support large trees. This lab illustrates how important soils are to developing communities. Granitic soil can support the most diverse ecosystems because it supports vegetation that in turn supports the most organisms. The soil, in a way, selects the ecosystem that it can support.

PROCEDURE:

1. Students should look carefully at the specimens in their packet. They should describe what they see and state how many different items they see and then have them draw an ecosystem for each type. In the picture, make sure that they draw more animals that live on vegetation on the granitic soil, especially more birds, rodents, larger mammals, fungi, and more grasses. The serpentinite soil should have just grass and shrub vegetation with gophers, small rodents, and a few birds. Tell students to use their imagination.

2. Students should also think back to the previous lab and try to figure out what type of soil is more suitable for gymnosperms (pines). They should be able to realize that gymnosperms prefer acidic soil. The serpentinite soil produces basic soil, which does not support lush vegetation.

3. Make sure students realize that the climates in these two areas are the same, but that sometimes the climate is a delineating factor for what can live on a given area. In this lab, soil is the dominant factor in selecting the ecosystem.

LIFE CYCLE - NATURAL ENVIRONMENT (6B)

PROBLEM: What influences the type of vegetation in an area?

PREDICTION:_____

MATERIALS: Life Cycle- Natural Environment (6B), Microscope

PROCEDURE:
How many different types of vegetation do you see evidence for in the granitic material? Name them and list the evidence.

_____
_____
_____
_____

How many different types of vegetation do you see evidence for in the serpentinite soil. Name them and list the evidence.

_____
_____
_____

Look at your samples of granite and serpentinite, describe what each looks like by using color, texture, mineral content, or any other descriptive terms in the space provided. Draw what you see.

GRANITE	SERPENTINITE

Draw a picture of the ecosystems that you think each of the soils can support on the back of the sheet. Be specific, especially with the type of animals that you would see.

CONCLUSION: What are some possible reasons for a species to be different in a given area?

_____
_____

LIFE CYCLE - NATURAL ENVIRONMENT (6B)

POST LAB:

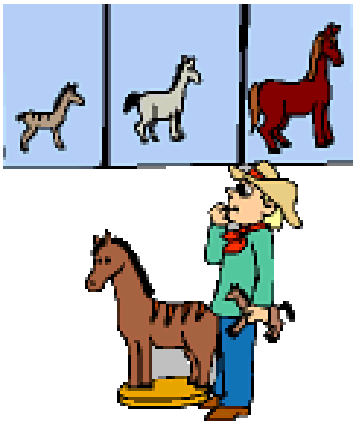
Students complete a worksheet comparing science and religion.

OBJECTIVE:

1. Comparing different theories on evolution.
2. Exploring religious influence on theories.

VOCABULARY:

adaptation
diversity
evolution
extinction
natural selection



MATERIALS:

worksheet

BACKGROUND:

Organisms are what they are because of their genetic codes, otherwise known as their genotypes. However, there are variations that may result because of limiting factors during the development of individuals with a particular genotype. The visible traits of an organism (its appearance) make up the phenotype of the organism.

There are many different organisms on this planet, representing many phenotypes and genotypes. There is certainly something called extinction, because we see it today through fossils and by actual organisms that disappear. We see how some organisms adapt to a new situation and are able to prosper because of the advantages they have. There are certainly some problems with understanding how all the mechanisms work, but there are certain events that are documented that lead us to begin understanding how we develop.

All philosophies, including all religions, have attempted to explain the diversity of life on this planet. The creation of all beings is difficult, if impossible, to explain. Religion has held a part in developing the early concepts of creation. Most religions believe in a being of higher order that created the diversity of life. One cannot dispute or prove the existence of a higher being, there is little evidence for or against this. Whether you have faith in a higher order or whether you do not is a personal decision.

There is not a disparity between religion and science when it comes to evolution. Scientists that deal with evolution use specimens that indicate evolution have happened through time. Scientists however cannot dictate what a person believes created life. This is an individual belief that one has to come to terms with.

PROCEDURE:

1. In this exercise we quote a few examples of natural selection, extinction, adaptation,

evolution, and religion. Students are to determine what type of example the questions illustrate.

2. ANSWERS: 1,2. Adaptation; 3. Natural selection; 4. Extinction; 5. Religion; 6. Evolution; 7. Extinction, 8. Religion.

LIFE CYCLE - NATURAL ENVIRONMENT (6B) POST

Determine if the following examples are evolution, extinction, adaptation, natural selection, or religion.

1. A scientist grew plants under the same conditions in a greenhouse. He then transplanted the plants to different locations in an east-west transect of California. He then observed the variation of his population of plants and was able to determine how the plants varied in different locations. The scientist used two species of plants, *Achillea lanulosa* and *Achilles borealis.*

_____

2. If water is added continually to desert land, the vegetation will change in into vegetation typical of a river valley.

_____

3. During the Industrial Revolution in England, dark moths began to increase in number in the urbanized area, while in non-polluted areas the white moth count was higher. The color keeps moths hidden on the bark of trees. In the urbanized areas the trees became dark because of the pollution.

_____

4. The dodo bird formerly lived in Mauritius but has been gone since 1681.

_____

5. The Christian Bible said that the Earth was created in 7 days.

_____

6. Scientists can trace a radiolarian species (one celled protozoa that makes a skeleton of glass) that changed its shape over the last 10 million years.

_____

7. The great auk was the first species on the coast of North America that man eliminated. This flightless bird was readily accessible to sailors and fishermen who took its eggs for food and slaughtered it for meat, feathers, oil, and cod fish bait. The last two specimens were killed June 8, 1884.

_____

8. Buddhism is an Asian religion based on the teachings of Buddha.

_____