FOURTH GRADE
6 lessons

4

HELPING HANDS SCIENCE

Joint project
Fremont Unified School District
and Math Science Nucleus

Comments or correction please contact
msn@msnucleus.org

These are suggestions on how to use the materials with your students. The materials are set up so you can easily put out the materials. Make sure the students do not destroy materials. Many times the material can stay in the bag and a hand lens can be used for observation. Please put materials back the way you found them so all children at your school can enjoy them.

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Curriculum customized for FUSD by MSN

HELPING HANDS SCIENCE (FUSD) - FOURTH GRADE

4

LIFE

Chapter	***Lab description and/or box label***	***Materials***	***Storybooks (on http://msnucleus.org)***
Parts of Ecosystems	4.1 Owl Pellets – describing and identifying	5 sets of owl pellets, 5 forceps	*Owl Pellet Party* Owls
Interactions of Living Things	4.2 San Francisco Bay Mollusk fauna	5 sets of mollusk mixture from San Francisco Bay	*Murder in the Mud*
Energy in Ecosystems			*Through a Frog's Eye*
Matter in Ecosystems			

EARTH

Rocks and Minerals	4.3 Mineral Hardness – looking at minerals	3 sets of the following minerals: talc, gypsum, mica, calcite, fluorite, apatite, hematite, feldspar, olivine, quartz	*Ricky the Rapping Rocks* Minerals and Rocks
Rapid Changes on Earth	4.4 Rock Cycle - looking at characteristics of rocks	Igneous (obsidian, granite, scoria, basalt) Sedimentary (shale, sandstone, conglomerate, diatomite), Metamorphic (marble, schist, shale, gneiss	Rock Cycle
Slow Changes on Earth			

PHYSICAL

Electricity	4.5 Electricity - static versus current	2 sets for 4 stations: Balloons, fluorescent tube, combs, confetti, cloth, electric ball	*Night without Light Electricity* Electricity
Magnetism and Electromagnets	4.6 Magnetism – finding north and south, strength	2 sets of 4 stations: 1 – bar magnet with iron files; 2 – 3 ring magnets; 3 – 2 wand magnets with files; 4 – logo, marble, rectangle magnets, paper clips	*Electrons and Hairy Monster*

LIFE CYCLE - NATURAL ENVIRONMENT (4B)

4.1

OBJECTIVES:

Classifying organisms that live in the San Francisco Bay.
Creating a San Francisco Bay mud fauna food web.

VOCABULARY:

food web

food chain
primary
consumer
primary producer
secondary
consumer

MATERIALS:

Life Cycle - Natural Environment (4b)
Murder in the Mud by M. Doherty and J. Blueford

BACKGROUND:

The life of the San Francisco Bay is dominated by little critters. None of the organisms of the San Francisco Bay mud life are exceptionally beautiful nor unique, but all are part of a **food web**. The picture to the left was taken at Mud Slough which flows into the southern part of the San Francisco Bay in the City of Fremont.

In an ecosystem, organisms play different roles in the food web. There are **primary producers**, **primary consumers**, and then different levels of **secondary consumers**.

However before you determine the position of an organisms in a food web you need to identify the organisms first. In this lab, the students will first take a look at the different organisms of the mud (from the San Francisco Bay) and then they will analyze their positions in the food chain.

This lab can be customized to either a lake, pond, river, or marsh in your area. However, bays or along a coastline are preferable. Look for a place where the currents may concentrate shells. In lakes or ponds you may look at where some birds eat and find left over shells.

PROCEDURE:

1. Discuss with students how they can determine the role that an organism

plays in an ecosystem. Review that the plants are primary producers (produce their own food through photosynthesis) and the smaller animals like snail are primary consumers (first eat primary producers). A secondary consumer would be an animal that eats primary consumers. The food chain can have several layers, and several levels can be eaten by more than one organism.

2. Read "Murder in the Mud" to students. The story is just a fun way to point out which organisms eat one another. The carnivore, or Hannibal Radula, contains a tooth like structure called a **radula** that can actually bore through the shell of another organism that will be its next dinner.

3. Biologists classify organisms because it is easy to talk with other biologists if the name is standardized. When students select the different groups, have them name the organism as a class. The scientific name is fine, but naming their own organism can even be fun. Try to get them to name the organism to reflect what that shell looks like. Have them select two parts of the name (Genus + species). You can use the analog that people's names help identify them, so genus + species helps scientists identify the different organisms.

   Have the students draw and describe the samples of sea life by name and key characteristics. The students need not name the sea life by their scientific names. They can devise or invent names for the organisms. However, if you want them to use the correct scientific names which is described below.

4. In your kit you have 5 to 7 different types of organisms on the species level. You may have one or two organisms that are not in the following description. These mollusks represent only a fraction of the population. These shells were collected under the Dumbarton Bridge (between the cities of Fremont and Menlo Park, California). The proportion that is in your container reflects the ratio in which they were found, which changes seasonally. You can discuss with your students why some are more abundant than others. This has to do with which organisms are more abundant but also how they were transported after they died.

5. Using these specimens you can devise several activities with your students, not only the prescribed lab. Mix all the shells together and have them separate the different groups. Depending on the verbal and written skills of your students, you may want them to start writing a description of the little organisms. Direct their attention to size, shape, color, and ornamentation on the shell. You can also have them draw the different types, as drawing tends to really develop their observational skills.

SAN FRANCISCO BAY MOLLUSK FAUNA

On the information below, the position of each organism in the food chain is outlined, and a food web can be created.

BIVALVES *Gemma gemma* - Shell is no longer than high, slightly triangular; general color white with purple tinge, shell very thin, hinge and teeth very reduced. Introduced to the San Francisco Bay from the east coast. This bivalve is a filter feeder, meaning that it takes in water and "filters" the algae from it to digest. It is considered a primary consumer.

Macoma nasuta - Also called the bent-nosed macoma. Lives in shallow water with muddy bottoms. Some are 3-4 cm long, color grayish white. Anterior end broadly rounded; posterior end bluntly pointed, partially truncated and noiceably bent to one side and is a filter feed like *G. gemma*

I*scadium demissum* - Also known as the ribbed horse mussel has fine ribbed lines running lengthwise. This purple mussel grows to 3.5 inches. Pearly luster inside of shell.

Mytilus edulis - Shell elongated -triangular, rather plump, with scarcely noticeable beaks at the apex. Length about 3 inches on the average. Adult shells are deep bluish black with a shiny periostracum (outer covering); juveniles show various shades of gray, green and brown, often exhibiting rays of color. Also called the bay mussel, lives in rock areas in colonies. *M. edulis* is a filter feeder with very few natural enemies.

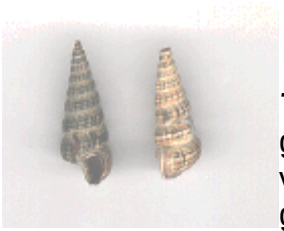
Ostrea lurida - No longer than 3-5 cm long, the shape quite irregular, depending on the surface of the object on which it grows. Shells are not especially thick or heavy. Lives in shallow waters with stony bottoms. This is a common native oyster along the west coast and is also a filter feeder.

GASTROPODS

Ocenebra interfossa - A spindle-shaped shell about 3/4 of an inch high. There are 5 whorls, high spiral, and a sharp apex. Lives in the shoreline or on rocks. Commonly called the sculptured rock shell, because of the large wavy ridges that revolve with the whorls. This little gastropod is top of the food chain in the mud, eating many of the bivalves and other gastropods.

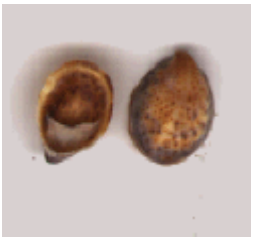
Nassarius tegulus - Commonly called the Mud Dog Whelk. Lives in the mudflats, about 3/4 of an inch high, a stocky shell of 5 or 6 whorls with a sharply pointed apex. Sculpture of weak revolving lines, sometimes faintly banded. Inner lip broadly expanded, outer lip thickened. This group eats similar to *N. obsoletus* and is hard to distinguish between the two.

Nassarius obsoletus - Black Dog Whelk; medium sized, surface blackish with obscure spiral and longitudinal lines, introduced and extremely abundant in the San Francisco Bay (mud snail), nearly one inch high, with about 6 whorls. Apex rather blunt, and commonly more or less eroded. The only sculpture consists of weak revolving lines, plus a few vertical folds on the early whorls. Inner lip deeply arched. Color deep purplish black. This is an east coast snail, probably introduced into California water with young oysters. It is a scavenger that eats dead fish or other organic debris.



***Turritella* sp**. - Greatly elongated, many whorled shells. A large group of organisms that live mainly in tropical waters. A few will venture into he San Francisco Bay, but this group is very rare. This groups eats food similar to that eaten by *N. obsoletus.*

***Acmaea* sp** - Limpet is the common name for this group. Shells conical, oval, and open at base, with no opening at the top. No spiral at any stage of growth and does not have the pearly look to its inside shell. These gastropods live on stones and grasses at the shoreline, generally between the tide limits. They are herbaceous which means they eat small algae or bacteria.



LIFE CYCLE - NATURAL ENVIRONMENT (4B)

NAME: _____

PROBLEM: How many different types of organisms live in a mudflat?

PREDICTION:

PROCEDURE: Using the bag of organisms from the San Francisco Bay mud, determine how many different organisms there are. Then discuss with your instructor the possible "food chain" of these organisms. You may use the back of this lab sheet if you need more room.

DRAW SPECIMEN AND NAME	DESCRIBE

CONCLUSION: Recreate the food chain of these organisms by stating who eats whom.

Sketch a food web of organisms in the San Francisco Bay mud by linking the food chains you've identified on the back of this lab sheet.

OWL PELLETS – FOURTH GRADE
LIFE CYCLE - NATURAL ENVIRONMENT (4B)

4.2

OBJECTIVES:

Exploring owl pellets.
Determining the eating habits of a great horned owl.

VOCABULARY:

owl pellet prey

MATERIALS:

owl pellet kit
forceps

SLIDESHOW: Owl Pellets
STORYBOOK: Owl Pellet Party

BACKGROUND:

Owls swallow their prey nearly whole, however, the fur and bones of their prey cannot be digested. The food goes into the proventriculus which is found just before the gizzard. (Owls do not have crops like many other birds.) As food starts to digest in the gizzard, the muscles separate the fur from the bones. The fur and bones are then pushed forward to the proventriculus. About 12 hours after eating their prey owls spit out a "pellet," an ellipsoidal to spherical glob. Owl pellets are clean of all flesh and odorless.

The pellets that your students have in the kit are mainly from a wild Great Horned owl. This owl hunts rabbits, rodents, and birds. The owl is about 18-25 inches in height. The ear tufts are set wide apart, and the owl has yellow eyes. The body feathers are a mottled gray brown in the upper body and a fine dark gray horizontal barring below. The Great Horned has a deep resonant hooting, "hoo, hoo-hoo, hoo." The materials for this kit are from the San Francisco Bay area, but Great Horned owls range in all of North America up to the northern tree limit. They build nests in trees, crevices or cliffs with 2 or 3 white eggs.

PROCEDURE:

1. Read the electronic storybook, Owl Pellet Party. Use portions of the Owl slideshow to show students what owls are and what they eat.

2. Each pair of students should get an owl pellet, a microscope or hand lens, a toothpick or tweezers or any other instrument that can separate the bones from

the pellets. Students may use their hands, but caution them that the bones are little and not to break them.

3. Instruct students to separate the fur from the bones and then have them look carefully at their contents. Instruct students to record the information on their lab sheet. Point out to students that on their lab sheet there are some clues to the type of mammal that they will find in their sample.

4. Have the students put the remains back in the bag, so they can be reused.

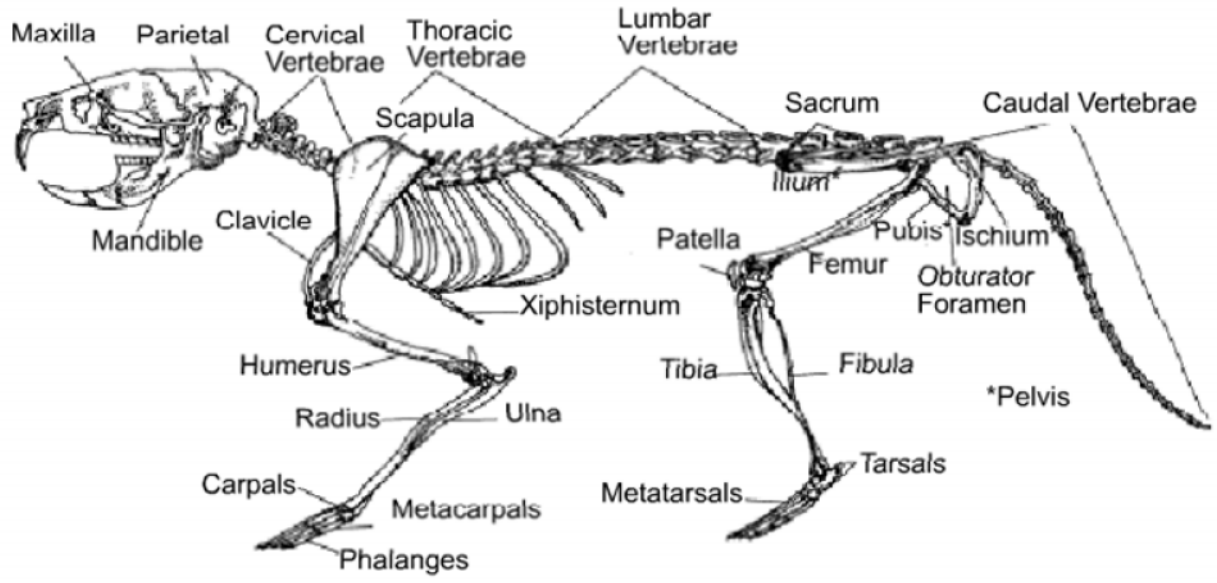
OWL PELLETS **NAME** _____

PROBLEM: Can one determine what the food chain of an owl is?

PREDICTION:

MATERIALS: owl pellets, forceps, hand lens

PROCEDURE: Look at the bones and see if you can identify what parts your team has. If they are not bones make a guess of what it might be. Draw them and try to identify them in the space below.



CONCLUSIONS: What is the food chain of this Great Horned Owl?

MINERAL HARDNESS - FOURTH GRADE

4.3

OBJECTIVES:

Identifying mineral characteristics.
Determining the hardness of minerals

VOCABULARY:

cleavage
fracture
characteristic
hardness
mineral

MATERIALS: Mineral Hardness; Rock Cycle (slideshow)

BACKGROUND:

The obvious descriptive characteristics of a mineral such as size, shape, and color are not the only features that can identify that mineral. Geologists recognize a number of useful key characteristics for mineral identification. These include:

A. **CRYSTAL FORM** - The natural growth (shape) of a mineral.

B. **FRACTURE AND CLEAVAGE** -The way a mineral breaks. Fracture is irregular breakage. For example, quartz has a conchoidal fracture; it breaks along hollowed and rounded, uneven surfaces. Cleavage is a regular breakage that follows the atomic structure of a mineral. Cleavage results in smooth, planar surfaces. Different minerals may have one, two, three, four, or six cleavages.

C. **HARDNESS** - The mineral's resistance to scratching. It is controlled by the strength of atomic bonds within the mineral. Mineral hardness is rated from 1 (soft) to 10 (hard) on the Mohs hardness scale.

D. **SPECIFIC GRAVITY** - The density of a mineral relative to water.

E. **STREAK** - The color of a powdered mineral sample.

F. **LUSTER** - The way that a mineral reflects light. There are two types of luster. Metallic minerals look like shiny or rusted metal. Nonmetallic elements reflect light like glass or pearls or glue.

G. **TASTE** - Certain minerals like halite (salty) and sulfur (bitter) have characteristic "flavors."

H. **MAGNETISM** - The attraction of a mineral to a magnet.

I. **REACTION TO ACID** - The mineral reacts by "fizzing" with dilute HCl reacts with carbonate minerals.

This lab will deal with "hardness" which is one of the easiest characteristics to test. Hardness helps geologists determine the identity of some minerals when they are doing field work. For instance, if a steel knife cannot scratch a white or clear mineral, it is likely quartz. Hardness also can tell us something about the composition of minerals (how tightly the elements are bonded together). Formally, the hardness of a mineral is ranked by **Mohs Hardness Scale** (named after Austrian mineralogist Friedrich Mohs), which lists 10 reference minerals that are arranged in increasing order of hardness. Note that this is a relative hardness scale; diamond is actually over four hundred times harder than talc. Hardness is important to identify just a few minerals like talc and gypsum.

Mohs Hardness Scale

1 = talc	6 = microcline (feldspar)
2 = gypsum	7 = quartz
3 = calcite	8 = topaz
4 = fluorite	9 = corundum
5 = apatite	10 = diamond

PROCEDURE:

1. In order to make the mineral samples last longer, we are just asking students to use their fingernails to test the hardness. Most of the minerals they will not be able to scratch, but it gives them an idea of how a geologist would use the technique. A fingernail is a little less than 3 so the only pieces that students can scratch is talc and gypsum.

2. Students should look at the mineral specimen and describe or draw their mineral. There are many other characteristics that help to identify minerals, hardness is only one.

3. Information on minerals that might be helpful:
   talc - soft mineral that is used in making talcum or baby powder, the softness even applies when the mineral is ground up into powder
   gypsum – is harder than talc, but still can be scratched; used in making the walls of rooms (gypsum boards)
   mica – will not be scratched, but it is a relative softer mineral; however it is fire proof and has been used in fire places and even in fire proof clothing of fire fighters
   calcite – can easily be scratched by a steel nail and used in the production of cement
   fluorite – used in the manufacture of toothpaste to help prevent tooth decay
   apatite – is a 5 on the Moh's hardness scale, a nail would scratch it; used in the manufacture of fertilizers
   hematite – can be scratched by a nail, but used in jewelry (usually necklace or bracelet because of its metallic color)

feldspar – is not quite as hard as quartz, used in the manufacture of porcelain
olivine – is not as hard as quartz, but close… so used as a gemstone (peridot)
quartz – is easily recognized because it cannot be scratched by a steel knife, used in many applications from producing silicon to jewelry

4. **GENERAL ANSWER**: softness to hardest: talc, gypsum, mica, calcite, fluorite, apatite, hematite, feldspar, olivine, quartz

PROBLEM: How can you tell if a mineral is hard or not?

PREDICTION:

PROCEDURE: Let's try to figure out the hardness of the minerals in your collection

	Can you scratch with fingernail	Description or draw mineral on the back
fluorite		
gypsum		
feldspar		
olivine		
hematite		
apatite		
mica		
quartz		
talc		
calcite		

CONCLUSION:

ROCK CYCLE -FOURTH GRADE

OBJECTIVES:

Analyzing how different types of rocks are formed.
Interpreting the characteristics of the three types of rocks.

4.4

VOCABULARY:

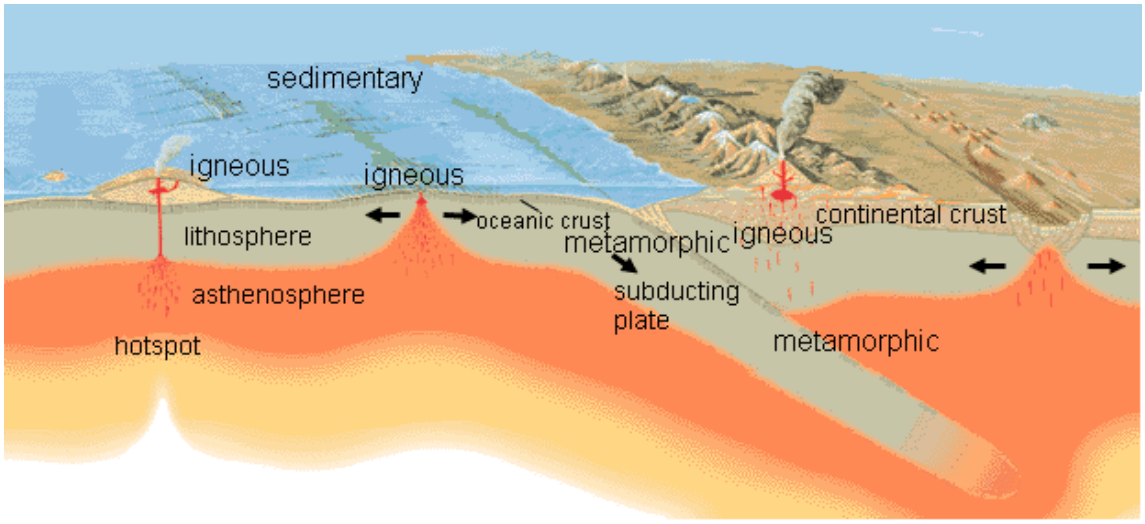
igneous
metamorphic
mineral
rock
sedimentary

MATERIALS:

Rocks
Minerals and Rocks (slideshow); Ricky the Rapping Rock (storybooks)

BACKGROUND:

Studying the **environments** where rocks form is a more creative way of teaching rocks than simply identifying rocks. Students should be able to visualize the different environments of rock formation. For example, if a child picks up granite, they should think that this rock cooled slowly inside the crust of the Earth. The pictures below can help you illustrate the different environments. Igneous is melted and hot; sedimentary is wet and cool; and metamorphic is full of pressure and heat. The distinct characteristics that separate igneous, sedimentary, and metamorphic rocks are not easily observed. The objective of this exercise is for the students to recognize common characteristics shared by rocks belonging to the same group. Some general characteristics that your students may observe include:



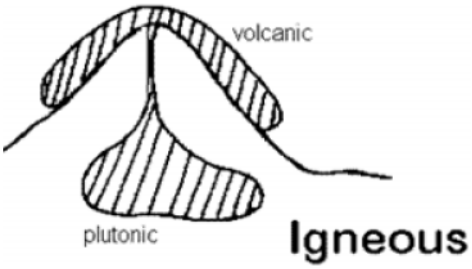
1. igneous rocks are often composed of minerals that are visible, especially rocks that have cooled slowly;

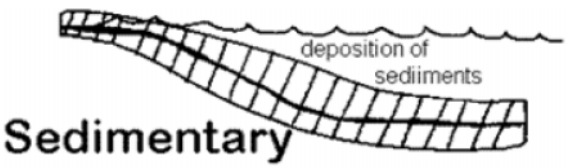
2. metamorphic rocks look squished, are very dense and sometimes shiny; and
3. sedimentary rocks usually are made up of pieces of rocks cemented together, resulting in a grainy texture.

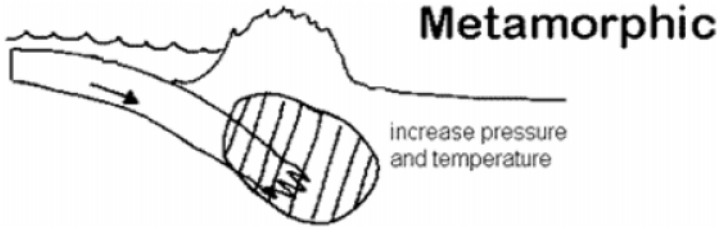
PROCEDURE:

1. Explain the three ways that rocks form.

2. Draw the three types of rock-forming environments on the board. Label each diagram with the appropriate name (igneous, metamorphic or sedimentary).







3. Instruct students to use the microscope or hand lens to look for details of each of different types of rocks. The following are suggested answers, but remember students can be more creative in their descriptions

IGNEOUS ROCKS (obsidian, granite, scoria, basalt) - all samples seem to be hard and not breakable.

GRANITE: Granite is an igneous rock that cooled very slowly. We know this because the minerals in granite are very large. It takes a long time (hundreds of thousands of years) for rocks to grow to visible size.
BASALT: Basalt cooled more quickly than granite. Geologists know this because the minerals are not visible with the naked eye, but are visible with a specialized microscope. The quicker an igneous rock cools the smaller the crystals.
OBSIDIAN: Obsidian, or volcanic glass, cooled very quickly giving minerals no time to form. Obsidian cooled faster than granite or basalt. The chemical composition is silicon dioxide (the same as quartz and glass).

SCORIA: Scoria is partly composed of pre-existing rock and new lava being cooled. It usually is reddish brown, with many gas pockets throughout the rock. Scoria is denser than pumice, but still relatively light in weight.

SEDIMENTARY ROCKS (shale, sandstone, conglomerate, diatomite). These samples are soft and more breakable than igneous or metamorphic rocks. These also seem to be less dense than the other types.

CONGLOMERATE: Conglomerate is composed of fairly large rock fragments and minerals. Students will identify these as "pebbles" or "rocks". The composition of these particles varies quite a lot between samples.

SANDSTONE: The gritty feel of the surface of sandstone hints that this rock was once sand that has been cemented together. Depending on the specimen, individual sand grains may be visible. Sandstones have quite varied compositions; some are composed entirely of quartz, and others are mixtures of rocks, crystals and fossils. Almost any combination is possible. Sandstones thus come in a wide array of colors.

SHALE: Shale is composed of very small particles of mud, which have been compacted and cemented together. Individual mud grains are very small; they will rarely be visible. Shales are quite variable in color.

DIATOMITE: Grains are very fine, smaller than sand size. In the case of diatomaceous shale many of the grains are skeletons of one celled plants called diatoms other grains are clays. The particles are so small that they rub off easily. It can be used as chalk to write on the board. Diatomaceous shale (sometimes called diatomite) is used for many purposes because of its fine grained nature. It is used in filters, fertilizers and many manufacturing items.

METAMORPHIC ROCKS (marble, schist, shale, gneiss) these samples are dense, but all of them seem to have different characteristics

SCHIST: Schist is composed of visible minerals, mostly micas. Schists form under moderately high pressure conditions; this causes the naturally platy mica crystals to line up, giving the rock a platy look. This is a good example for illustrating the characteristic "squished" look of metamorphic rocks to your students. This is called a *foliated* texture. This It is a new word for most students, so it is important that you have a good sample when illustrating schist.

MARBLE: Marble is composed exclusively of large commonly visible crystals of calcite. The gray/white bands in some of the samples are due to impurities within the calcite. Marble actually comes in a variety of colors, including black, gray, white, and pink. Marble, like all rocks that have calcite in them, fizz if you put a weak acid on it (usually 10% solution of hydrochloric acid). Marble forms when a rock containing calcite in it (such as limestone) was put under high temperature and pressure conditions.

GNEISS: Gneiss is composed of visible minerals that have a "layered" look. They are unusually formed under high pressures. The minerals separate into layers.

SLATE: Slate used to be a mudstone or shale before it was put under high temperature and pressure. Slate is denser than mudstone or shale and has a characteristic "ting" sound when it hits a hard surface. Mudstone and shale will have a "thud" type of sound. This illustrates how geologists use other than their sense of sight, they can also use their hearing sense.

PROBLEM: What characteristics are useful in identifying the major types of rocks?

PREDICTION:

EXERCISE Try to determine which characteristics are common to each group. List these characteristics [Hint: hard, soft, breakable, flat, sandy, heavy, crystals, color, etc.].

IGNEOUS	CHARACTERISTICS
GRANITE	
OBSIDIAN	
BASALT	
SCORIA	

SEDIMENTARY	
SHALE	
SANDSTONE	
CONGLOMERATE	
DIATOMITE	

METAMORPHIC	
MARBLE	
SLATE	
GNEISS	
SCHIST	

CONCLUSION: What are some identifying characteristics of igneous rocks?

ELECTRICITY - FOURTH GRADE

4.5

OBJECTIVES:

Investigating electricity.
Comparing static and current electricity.

VOCABULARY:

current
electricity
electrons
static

MATERIALS:

fluorescent tube
plastic comb
confetti
plastic rod
balloons
Electricity (slideshow); Electricity (Storybook), Night without Light (Storybook)

BACKGROUND:

There are 2 basic kinds of electricity: static electricity and current electricity. Static electricity is uncontrolled electrons passing from one body to another in sudden, momentary movements. Examples include clothes from the dryer that stick together; or getting a shock after walking on a carpet and then touching something. Static electricity is usually a nuisance and a hazard that can cause fires.

Current electricity is when the electrons are controlled by moving along a path together. The path is usually a conductor of electricity. A copper wire can move electricity from a power plant to a house.

PROCEDURE:

1. Use the slideshow to show static and current electricity. You may want to read Night without Light, to look at where electricity comes from. You may also want to use the Electricity Song to illustrate how important electricity is.

2. Current electricity is controlled; the electrons all move in one direction. Wire can transmit electricity so it becomes a very useful energy source. When its movement along a wire is controlled, it is current electricity. Remember,

CONTROLLED	UNCONTROLLED
electric circuit electric oven electric can opener	when clothes get stuck when socks stick to clothes when confetti gets stuck on items

electricity is a flow of electrons in one direction.

3. On the board, have students make a list of their experience with electricity. Put it in 2 columns - CONTROLLED (CURRENT) and UNCONTROLLED (STATIC), as illustrated below. Students are sure to bring up lightning which is a visible discharge of electricity. This will be explained in the post lab.

4. In lab, students will experience static electricity. On damp days, static electricity sometimes doesn't do what it is suppose to. The best days are when it is warm and dry. Make sure to follow the instructions on the sheet. The best type of cloth to use is wool or nylon. To explore more with your students, find out which cloth has the most "static" by rubbing different types of cloths on the comb and see which one is the quickest to pick up the confetti.

5. Have students blow up the balloon. Direct them to put the balloon on the wall. The more the students rub the balloon, the longer it will stay on the wall. This activity can be extended by having students use different types of cloth.

6. Students should also rub the balloon and put a fluorescent tube end on the balloon. Rub the balloon rapidly and then barely touch the side of the tube to the balloon. Do this rapidly. If enough static electricity is built up, the electrons will go through the tube and allow it to glow. Darken the room so students can see the image better. They will become very excited about the bulb glowing. It sometimes takes many attempts for this to work.

ELECTRICITY - FOURTH GRADE

PROBLEM: What is the difference between static and current electricity?

PREDICTION:

Station 1.

1. Hold a plastic comb over confetti without rubbing the comb. What happens?

2. Rub a plastic comb with a piece of cloth. Hold the comb over a small pile of confetti. Did the comb "attract" or "repel" the confetti?

3. Rub the plastic rods, put it on the confetti. What happens?

Station 2.

1. Blow up a balloon. Without rubbing it, try and put the balloon on the wall. Does it work? YES NO

2. Blow up two balloons. Using a piece of cloth, both partners simultaneously rub their own balloon; one for 15 seconds and the other for 30 seconds. Quickly place both balloons on the wall and time how long each one stays up.

   Which balloon stayed up the longest?

   Why?

Station 3.

1. Rub a balloon to produce static electricity. Place one end of a fluorescent tube to the balloon. Describe what happens.

Station 4.

1. Try and make the electricity ball use your body to conduct electricity? Can you make a series circuit using several students? Describe

CONCLUSION: How can you create static electricity? Current electricity?

MAGNETISM - FOURTH GRADE

4.6

OBJECTIVES:

Exploring magnetism.
Comparing how a magnet repels and attracts.

VOCABULARY:

Attract
magnet
magnetism
negative
positive
repel

MATERIALS:

magnets
Periodic Table Placemats
Electrons and the Hairy Monster by J.R. Blueford

BACKGROUND:

Physics is the study of physical events on Earth and in the Universe. It is an attempt to explain why and how certain events occur. Physics occurs whether we understand it or not. For instance, when you pick up a book and drop it, the force of gravity pulls it toward the Earth. (Illustrate this with your students.) How does this happen? In part, this is still a mystery because we know that larger objects attract smaller objects. Exactly how they attract is not known. Whether you know why the book will fall or not, the book will still fall.

There are 4 major ways in which matter interacts on our planet. There are strong interactions and weak interactions, which involve the use ways atoms operate. Gravity is another interaction, which is mysterious, because we don't feel a force, but its impact is widespread. Electromagnetism is also an interaction, whose mysteries have been realized in the early part of the 1900's.

Electricity and magnetism are related and are the components of electromagnetism. Light is a subset of the electromagnetic wave spectrum. The electromagnetic wave spectrum also includes radio waves, microwaves, ultra violet rays, x-rays, and gamma rays. Magnets exhibit both attractive and repulsive forces. North attracts south, north repels north, and south repels south.

Magnetism and electricity are related. Both magnetism and electricity have opposites. In magnets north repels north and south repels south, but north attracts south. In electricity when you hook up positive and negative electrodes can the electrons flow creating current electricity.

Magnetism is a force generated by the motion of spinning electrons all going in the same direction. Students will go over this in more detail in the post lab. However, this lab will have them experience the direction of **magnetic force** and the power of magnets. The

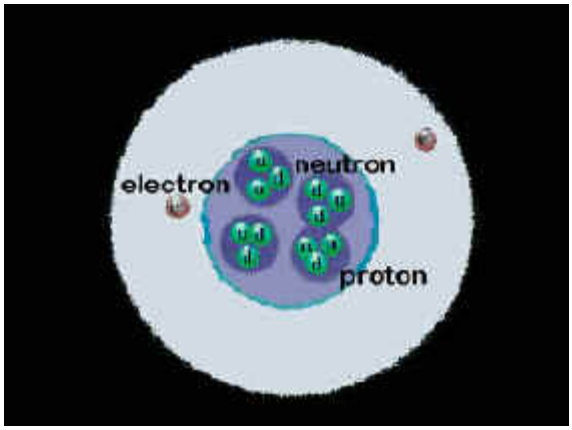
magnets you are using are ALNICO, which are permanent magnets. These magnets never demagnetize due to the combination of nickel, cobalt and aluminum.

It is very important for students to experience magnetism and spend time on feeling the "force."

PROCEDURE:

1. Discuss with students that the study of "physics" includes topics such as gravity, electricity, magnetism, light and friction.

2. Go over the structure of an atom with students. Remember all matter is made up of elements, which are made up of atoms. Go over electrons, protons, and neutrons. On the picture below point out that the nucleus is the center of the atom with the neutrons (neutral) and protons (positive charge) are located. The electrons (negative charge) are revolving around the nucleus. Electrons are important in understanding electricity and magnetism



3. Show students the periodic table of the elements. Remember all elements are made up of atoms. Quiz them on their knowledge. For instance, "The gas we need to live is called _____(students answer oxygen. What is the symbol?"

   What is salt made up of? Sodium (Na) and Chlorine (Cl)
   What are several metals? Iron (Fe), Nickel (Ni)
   What metal is a character from the Wizard of Oz made of? Tin (Sn)
   What are rings made of? Gold (Au), Silver (Ag)

4. Ask students how many elements are naturally magnetic. The only three naturally magnetic elements are nickel, cobalt, and iron.

   Notice that the three of them are very close on the Periodic Table. The periodic table is designed so that elements with similar properties are near each other. Iron is the weakest of all the elements; nickel and cobalt are the strongest and keep their magnetism longer. The magnets we use in this

program are called ALNICO, which stands for aluminum, nickel and cobalt.

5. Use the magnets to illustrate the basic principles of magnetism, like repel and attract. If students are unfamiliar with magnets, they may need to play with the magnets before the lab.

6. Either read or have students read *Electrons and the Hairy Monster*. This book allows students to look at the similarities of magnetism and electricity. You may want to read the book as a class to make sure that students are following the connection. Key concept is both electricity and magnetism have opposites

PROCEDURE:

This lab is divided into 4 stations. Have students spend about 5-8 minutes per station.

1. **Station #1.** Make sure the students put a sheet of paper over the magnet. If the iron filings are put directly on the magnet, the magnet will get "dirty" and the iron files are difficult to remove. Students should gently sprinkle the iron filings over the entire magnet. (Do not pour them out.) If a student gets any of the iron filings in their eye, wash it out immediately with water and don't rub their eyes. Demonstrate the procedure before students go to their stations.

   An alternative way is to put some iron files in a zip lock bag and put the magnet on the outside.

   The North and South poles create a pattern of strength of the magnet. There is a line of force between the attraction. Technically the force is generated in the north and seeks south.

2. **Station #2.** The students are asked to make the magnets "float." Let them experiment with the rings to see if they can find the right combination. Assure them that they can float but don't give any clues how. Let them discover for themselves. When the magnetic rings float, they are positioned north/north or south/south.

3. **Station #3.** These 2 magnets have iron filings on them. Have students try and find north and south. Remember, with these magnetic wands, north is on one of the large faces, south is on the opposite side. It will be difficult to decide which is north and which is south. They look very similar. Ask students to flip the direction of one of the magnets. The magnets will be in a north/north or south/south position and the iron filings will repel.

4. **Station #4.** How many paper clips can the students pick up. Who can hold the most? See if all the students come up with a similar number. If the strength of the magnet is the same, they should be able to pick up the same number. North is on one face, south is the opposite face.

In conclusion, go over the four different stations and discuss students' answers.

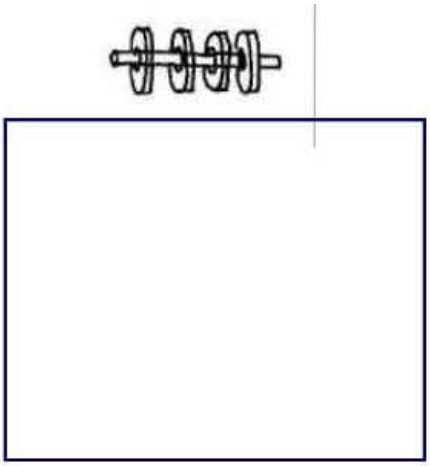
MAGNETISM - FOURTH GRADE

PROBLEM: How can you find the North and South Pole of a magnet?

PREDICTION:

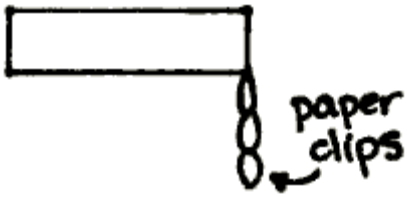
PROCEDURE: Go to 4 different stations and complete the assignment. Listen to your teacher give instructions.

Station #1. Do not take the iron files out of the bag. Put the bar magnet on the outside of the baggy and draw the pattern that you see below. Be careful not to put the iron filings on the magnet (very difficult to remove)



Station #2. There are 3 ring magnets. Experiment with them and arrange them so they "float." See diagram. Explain why this occurs.

Station #3. There are 2 magnets with iron files all over them. Draw what happens when you slowly pull them apart. What causes this? Next try to take 1 magnet and slowly turn it to the opposite face. What happens?



Station #4.

How many paper clips can you pick up?

How many paper clips can you line up (see diagram above)?

Where is north and south?

CONCLUSIONS: How were you able to distinguish north and south?