Science Standard of Learning 5.7 a,b- Earth Science

The student will investigate and understand how Earth's surface is constantly changing. Key concepts include

a) identification of rock types;
b) the rock cycle and how transformations between rocks occur

Learning Targets

- The student will be able to describe the history of the earth as described through fossil evidence.
- Students will be able to identify rocks and describe how rock transformations occur in the rock cycle.

Hey! What's the BIG IDEA???

- The rock cycle has an impact on the physical characteristics of the Earth.

Essential Questions

- How does the rock cycle compare to other cycles found in nature?
- How do the physical characteristics of a rock help us understand the past?
- How do a rock's properties determine how it is used in everyday life?

GOALS: By the end of this section, I should be able to:

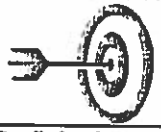
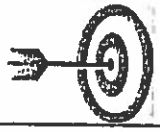
identify a variety of common rocks using a classification key based on distinguishing characteristics

describe the process a rock goes through during the rock cycle

Compare and contrast the origin of igneous, sedimentary, and metamorphic rocks.

Science Standard of Learning 5.7- a. identification of rock types

Learning Target- How will I know if I've met my goal?

5.5a The student will investigate and understand how Earth's surface is constantly changing. Key concepts include identification of rock types.	*Advanced Proficient* I can create a classification key to help identify rock types, and use it to identify unknown rocks.	***Proficient*** **I can identify an unknown rock based on its distinguishing characteristics.** 	*Intermediate* I can define sedimentary, igneous and metamorphic rock.	*Beginner* I can sort rocks according to common characteristics.
5.5a The student will investigate and understand how Earth's surface is constantly changing. Key concepts include identification of rock types.	*Advanced Proficient* Given a rock, I can determine where it would be found on the rock cycle, what type of rock it is, and what possible processes it has gone through to be the type it is now.	***Proficient*** **I can draw and label the rock cycle and describe the major processes and rock types involved.** 	*Intermediate* I can label the rock cycle.	*Beginner* I can identify cycles in nature and understand why it is a cycle.

Why should we learn about geology?

Also, by studying how the Earth and other planets worked in the past, we can better understand how they are working today. This helps us understand our effects on the environment and its potential effects on us. For example, by understanding where earthquakes have occurred in the past, we have a much better idea of where they are likely to occur in the future and can be prepared for them. Second, by gaining an understanding of how planets work, we can better predict how the Earth will react to changes.

So, why are rocks so important?

Rocks are important to our survival. Studying and understanding rocks gives us the capacity to use them for art, architecture, cement , ceramics, currency, defense, energy for light/heat/cooking/moving/making (uranium, coal, gas, petroleum), farming (tools & fertilizers), fire (flint & pyrites), hunting (spears, bolas), jewelry, making metals, making monuments, metals, music (metals strings for some string instruments), painting (pigments), road surfaces- the list goes on and on! All living things depend on nutrients from soil which is weathered rock.

How are Rocks Formed?

It really depends on which type of rock you are talking about... read on to find out more.

The Three Major Rock Types

There are three main types of ROCKS and all form differently:

Metamorphic- Rocks that are formed by heat and pressure usually while buried deep below Earth's surface.

Exposure to extreme heat and pressure change the mineral make-up, texture and chemical composition of other types of rocks (sedimentary, igneous, or even other metamorphic rocks) into metamorphic rocks.

Examples: Gneiss (pronounced "nice"), marble, slate

Igneous- Rocks that are formed from molten (melted) rock (magma) that has cooled.

Igneous rocks form when melted rock cools and hardens. Melted rock may come in the form of magma, when it is found underneath the Earth's surface. Lava, which is magma that has been released onto the Earth's surface during the eruption of a volcano, also forms igneous rocks after cooling.

Examples: Granite, obsidian

Sedimentary- Rocks that are formed by the cementation and compaction of sediments at the earth's surface or within bodies of water. As a result, many sedimentary rocks contain fossils, pieces of shells, etc.

Sedimentary rocks form when soil and other materials on Earth's surface are broken down into tiny bits, move to a new location, and settle in a new spot, forming a layer of sediments. Over time, more and more materials get broken down, move, and lay on the older layers. The layers and layers of sediments build up and the lower layers undergo intense pressure due to the weight of the upper layers, eventually turning into rocks.

Examples: Sandstone, coal, shale, limestone

The Rock Cycle

As you know, rocks can be formed in different ways. But once a certain type of rock is formed, can it change into another type of rock? Yes!

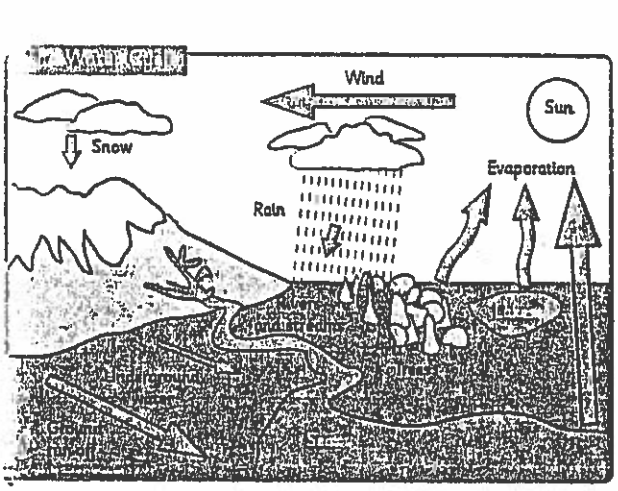
Rocks move and change over time due to heat and pressure within Earth and due to weathering, erosion, and deposition (more on these terms later) at the surface. These and other processes constantly change rock from one type to another.

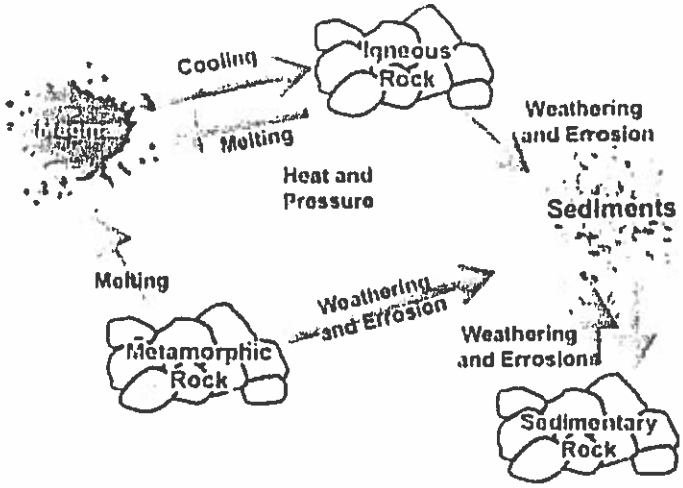
Cycles- The Water Cycle vs. The Rock Cycle

You know about the water cycle, but what about the rock cycle? Can knowing the water cycle help you to understand the rock cycle??? Yes!

What do they have in common?

They're similar in that they both take their elements (water or rocks) through a cycle that doesn't just occur in a cycle but also occasionally cuts across the cycle to get somewhere faster. Both of these cycles will (or can) eventually restart the cycle again.





The **water cycle** is a continuous cycle where water evaporates, travels into the air and becomes part of a cloud, falls down to earth as precipitation, and then evaporates again. This repeats again and again in a never-ending cycle. Water keeps moving and changing from a solid to a liquid to a gas, over and over again.

The **rock cycle** is a model that describes the formation, breakdown, and reformation of a rock as a result of sedimentary, igneous, and metamorphic processes.

From: http://www.cotf.edu/ete/modules/msese/earthsysflr/rock.html

The **Rock Cycle** is a group of changes. Igneous rock can change into sedimentary rock or into metamorphic rock. Sedimentary rock can change into metamorphic rock or into igneous rock. Metamorphic rock can change into igneous or sedimentary rock.

Igneous rock forms when **magma** cools and makes crystals. Magma is a hot liquid made of melted minerals. The minerals can form crystals when they cool. Igneous rock can form underground, where the magma cools slowly. Or, igneous rock can form above ground, where the magma cools quickly (when it pours out on Earth's surface, magma is called **lava**).

On Earth's surface, wind and water can break rock into pieces. They can also carry rock pieces to another place. Usually, the rock pieces, called **sediments**, drop from the wind or water to make a layer. The layer can be buried under other layers of sediments. After a long time the sediments can be cemented together to make sedimentary rock. In this way, igneous rock can become **sedimentary** rock.

All rock can be heated. But where does the heat come from? Inside Earth there is **heat** from **pressure** (push your hands together very hard and feel the heat). There is heat from friction (rub your hands together and feel the heat).

So, what does the heat do to the rock? It bakes the rock.

Baked rock does not melt, but it does change. It forms crystals. If it has crystals already, it forms larger crystals. Because this rock changes, it is called **metamorphic**. Remember that a caterpillar changes to become a butterfly. That change is called metamorphosis. Metamorphosis can occur in rock when they are heated to 300 to 700 degrees Celsius.

When Earth's tectonic plates move around, they produce heat. When they collide, they build mountains and change the rock.

The rock cycle continues. Mountains made of metamorphic rocks can be broken up and washed away by streams. New sediments from these mountains can make new sedimentary rock.

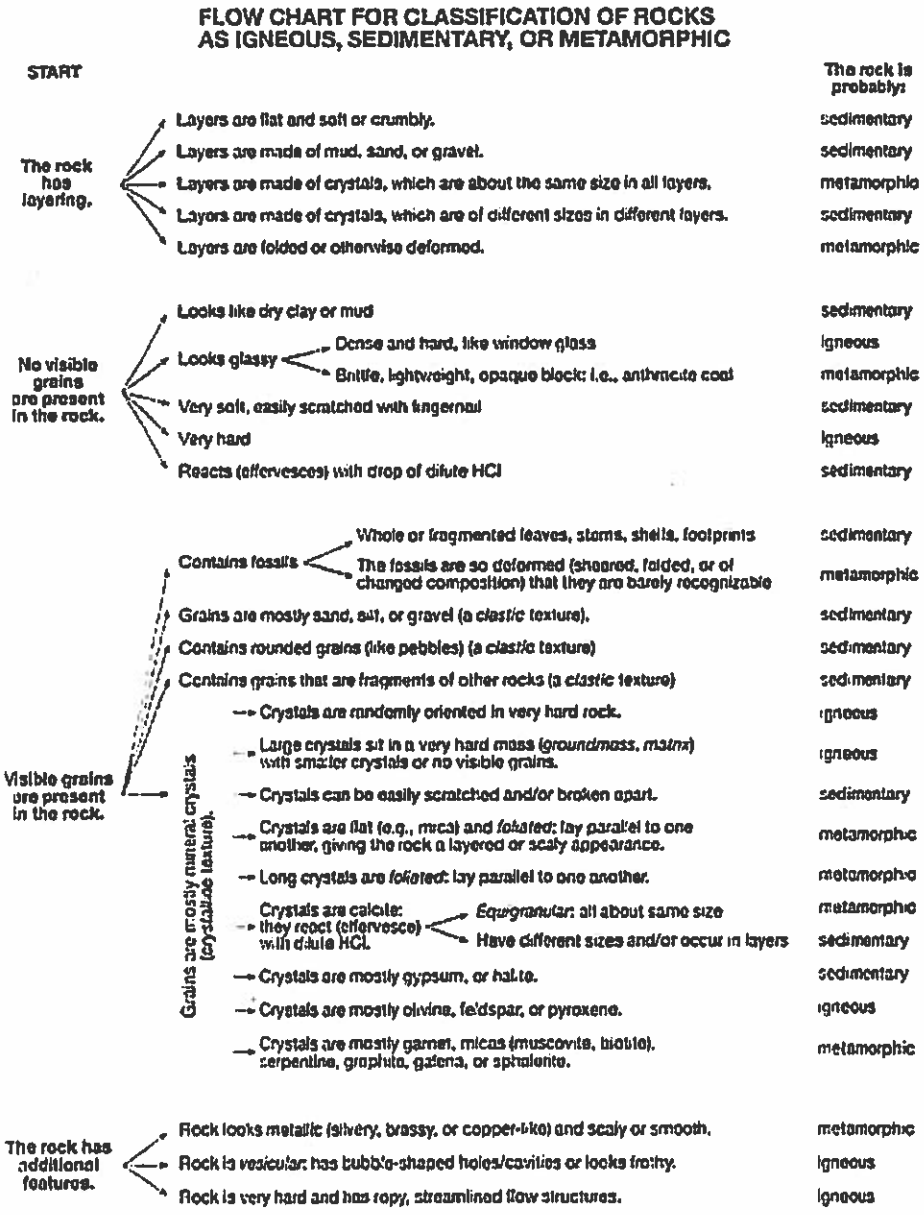
The rock cycle never stops.

So how do I tell the difference between the three types of rocks?

Rocks have properties that can be observed, tested, and described.

Properties of Rocks

- **Composition-** what "ingredients" make up, or "compose" a rock
- **Grain size-** super tiny, like in silt or clay; small like sand; pebbles; gravel, etc.
- **Textural features-** description of the grains in a rock like their size (coarse-grained, glassy (no crystals or grains), fine-grained, or a combination of the two)
- **Shape-**round or crystal-shaped
- **Arrangement-** random grains throughout rock or layers of similar types of minerals
- **Color-** rocks can be different colors based on the minerals that compose it
- **Presence of fossils-** Sedimentary rocks often contain bits of fossils and other organic (meaning "derived from living matter") material as these rocks are formed by sediments that have been moved by water. There is also little or no heat to destroy the fossils



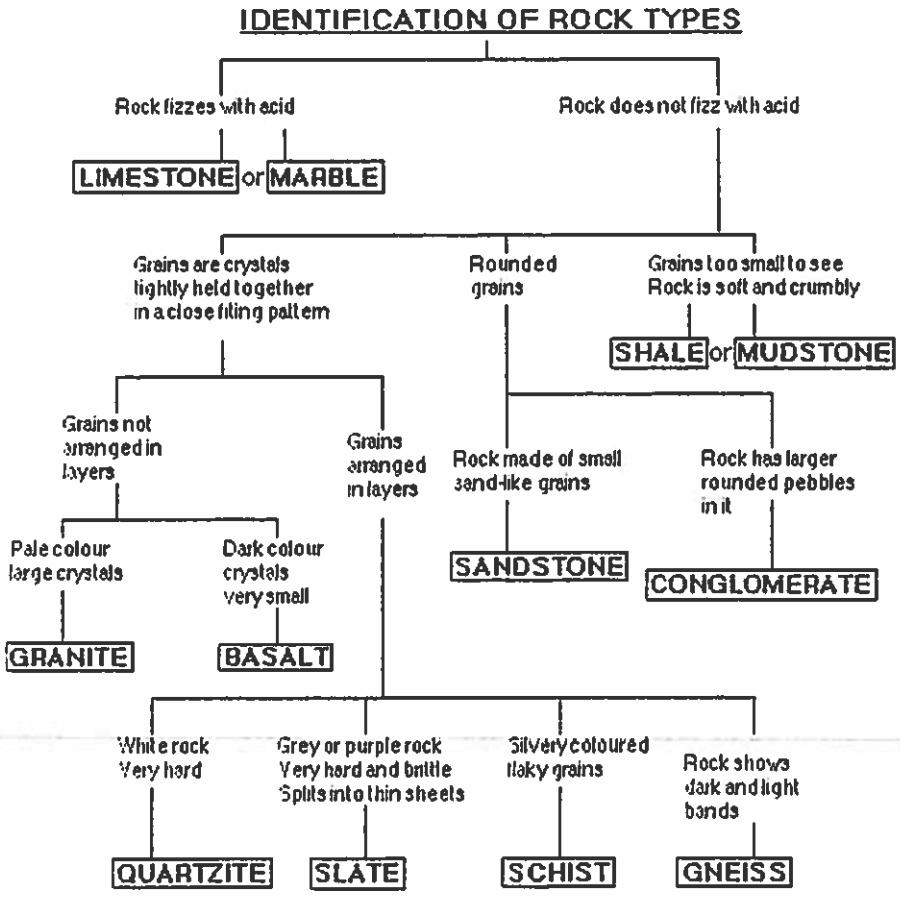
Okay, so I know what properties to look for in rocks. How do I use this information to identify the rocks?

Classification keys, like the one below, can help with this process.

How to Use a Dichotomous Key

- Begin by looking at the rock you want to identify.
- Then, look for distinguishing features based on the properties of rocks listed on the previous page.
- Next, look at a dichotomous key for rocks. Follow the directions on the key step by step to identify the rock-or- determine which characteristic your rock fits at the top of the key, then work your way downward.

So, for example, if your rock does not fizz with acid, you go would move down to the next "branch" on the dichotomous key. In the key below, since we know that the rock does not fizz with acid, we follow the line down and have to determine if the grains are crystals, rounded, or too small to see. If the rock is soft and crumbly with grains too small to see, it is shale or mudstone.



Use the classification key below to identify the rocks.

1a. Rock has holes. Go to 2.

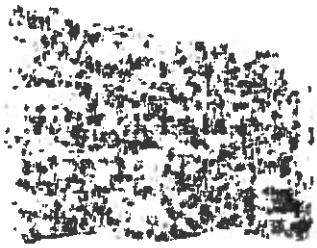
1b. Rock does not have holes. Go to 3.

2a. Rock is dark colored. Scoria

2b. Rock is light colored. Pumice

3a. Rock is speckled with crystal structures. Granite

3b. Rock has a glassy surface. Obsidian



Weathering

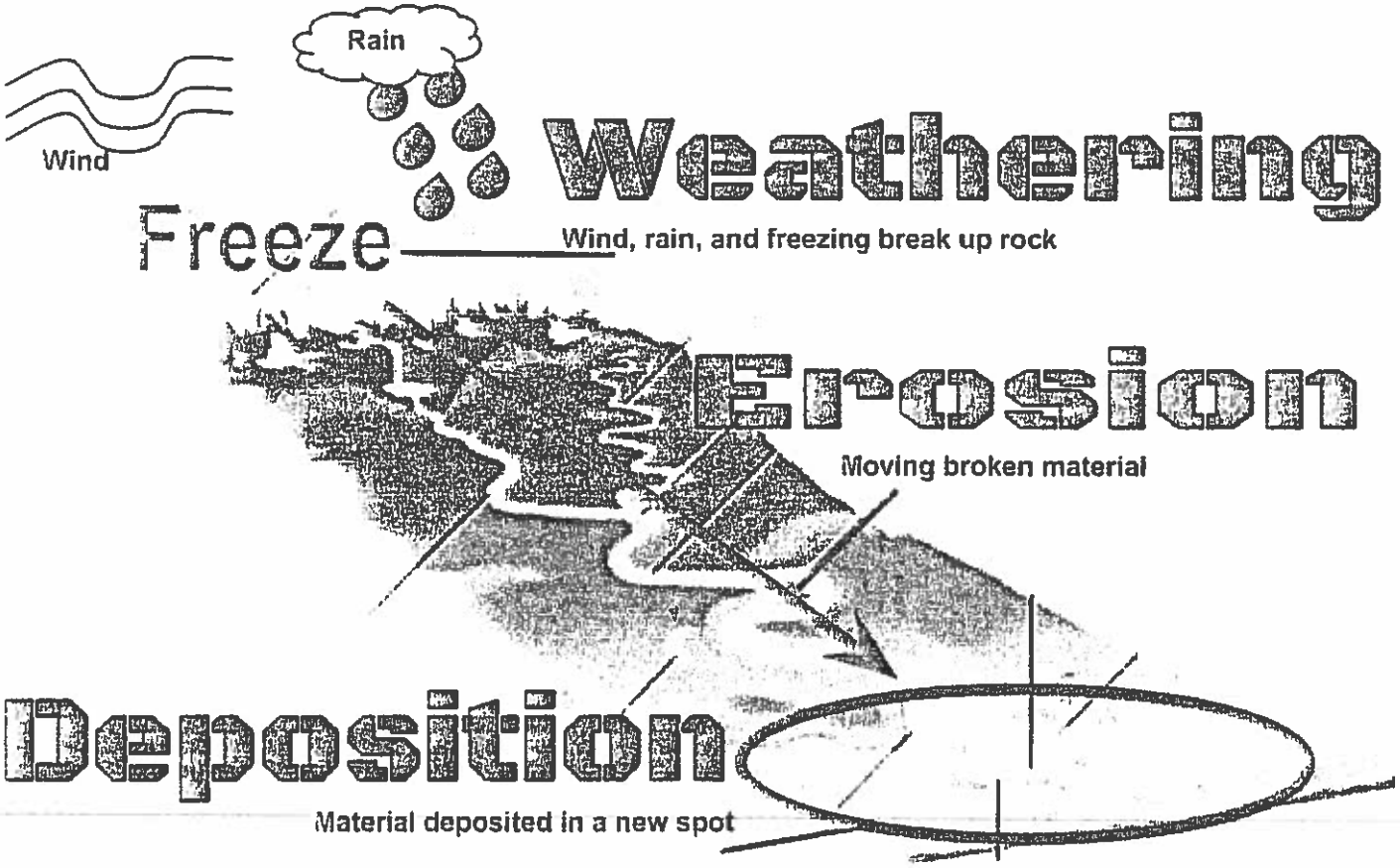
A chemical or physical process in which rocks exposed to the weather are worn down

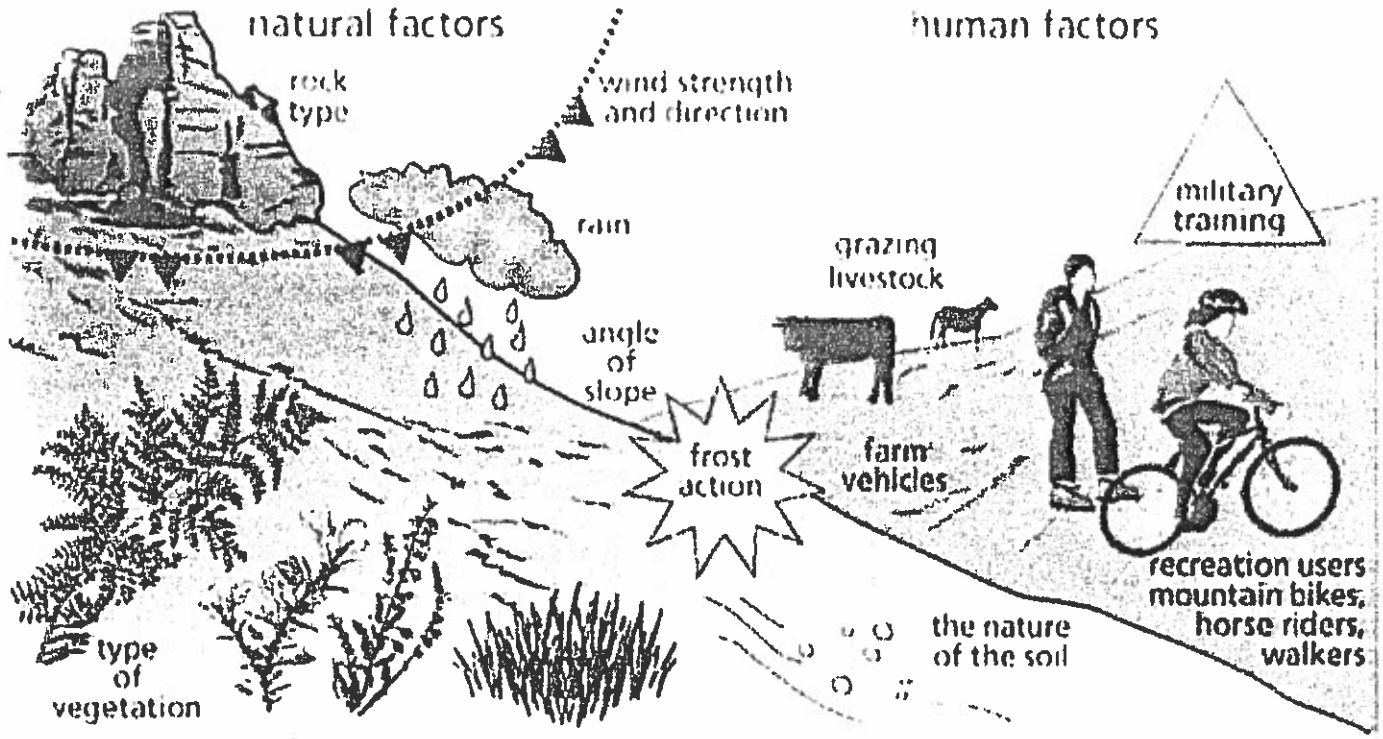
- water
- wind
- ice

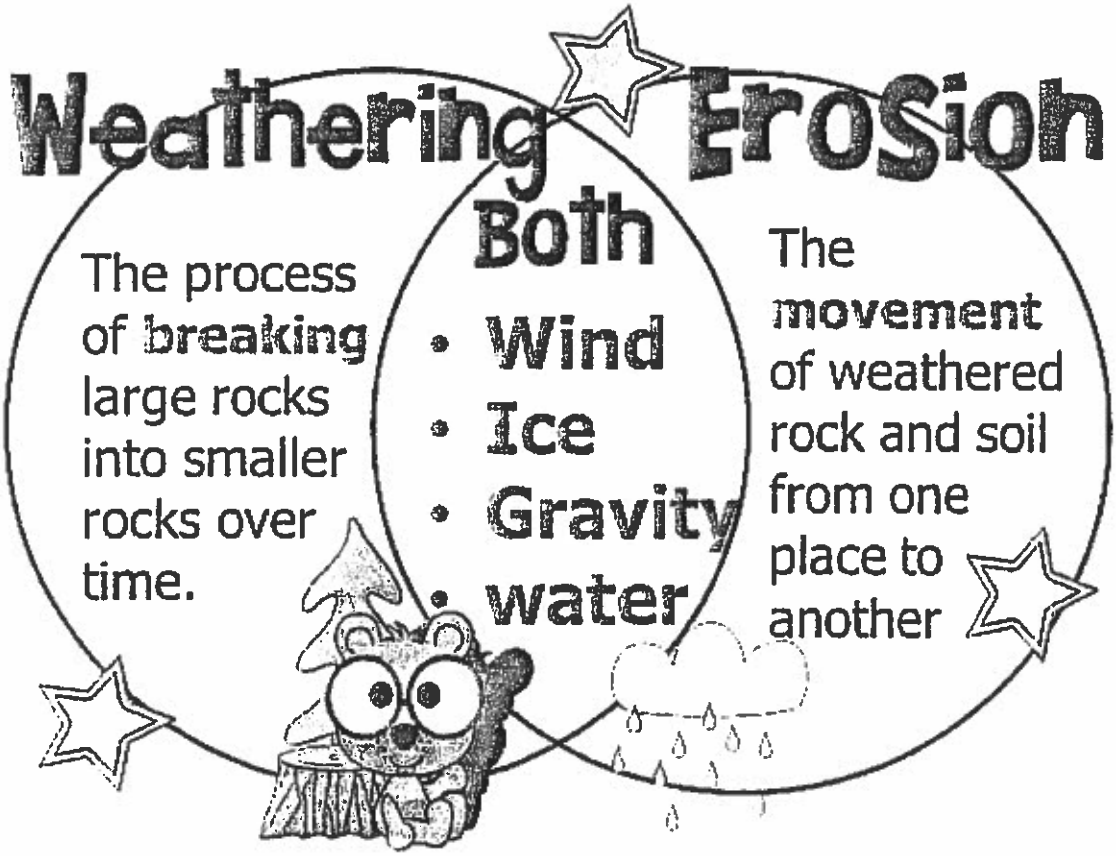
Erosion

The carrying away of weathered soil, rock, and other materials on the Earth's surface by

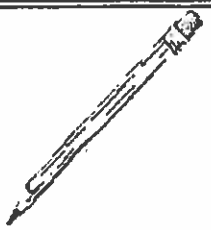
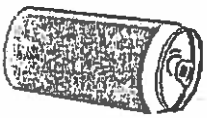
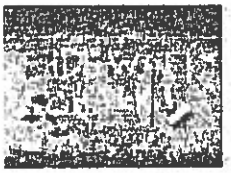
- wind
- water
- gravity



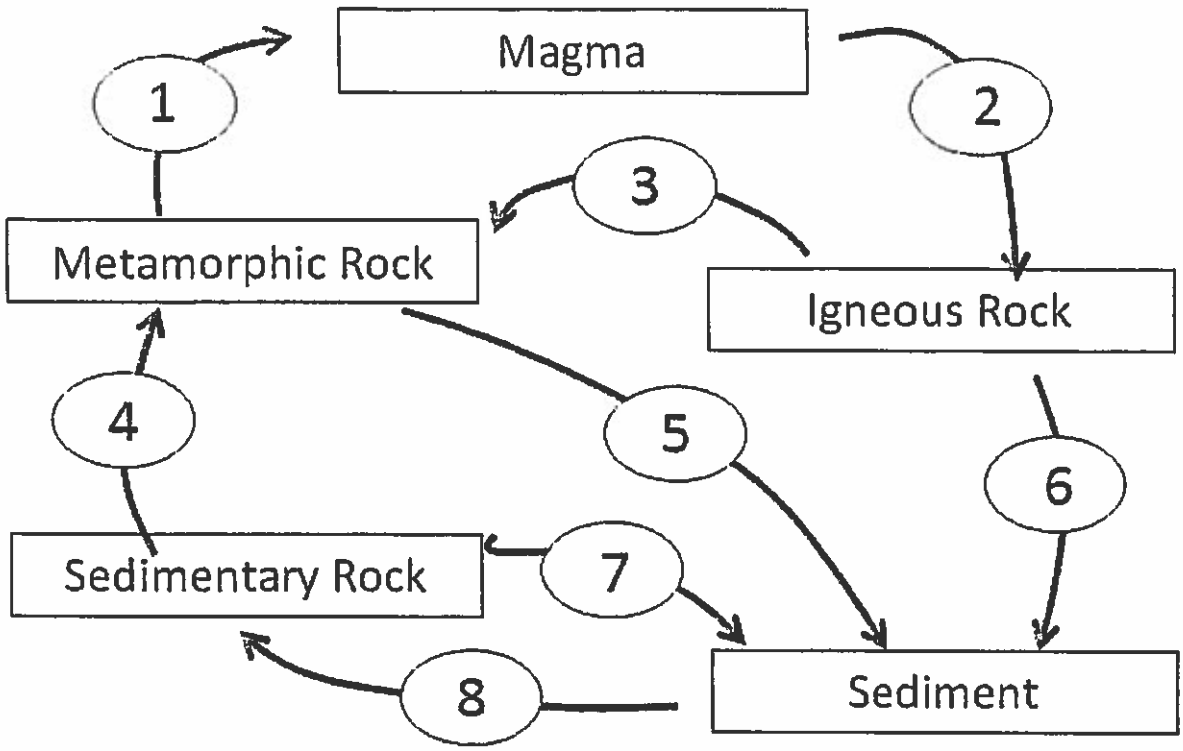

natural factors
human factors
rock type
wind strength and direction
rain
grazing livestock
military training
angle of slope
frost action
farm vehicles
recreation users mountain bikes, horse riders, walkers
type of vegetation
the nature of the soil


Weathering
Erosion
Both
• Wind
• Ice
• Gravity
• water
The process of breaking large rocks into smaller rocks over time.
The movement of weathered rock and soil from one place to another

Did you know that every person in the United States will use more than a million pounds of rocks, minerals and metals during their lifetime? How do we use rocks and minerals in our daily lives? Here are some examples. How many more can you think of?

 Buildings	 Art	 Jewelry	 Pencil
 Bathtub	 Fireplaces	 Mirror	 Soda Can
 Stone Walls	 Walkways	 Cars	 Make Up
 Gravestones	 Counter Tops	 Chalk	 Curbs
 Medicine	 Electronics	 Jets	 Glasses

From http://www2.needham.k12.ma.us/mitchell/technology/lessons/rocks/use.htm



Using the diagram above, label the numbers below to show what is happening at each number.

1.

2.

3.

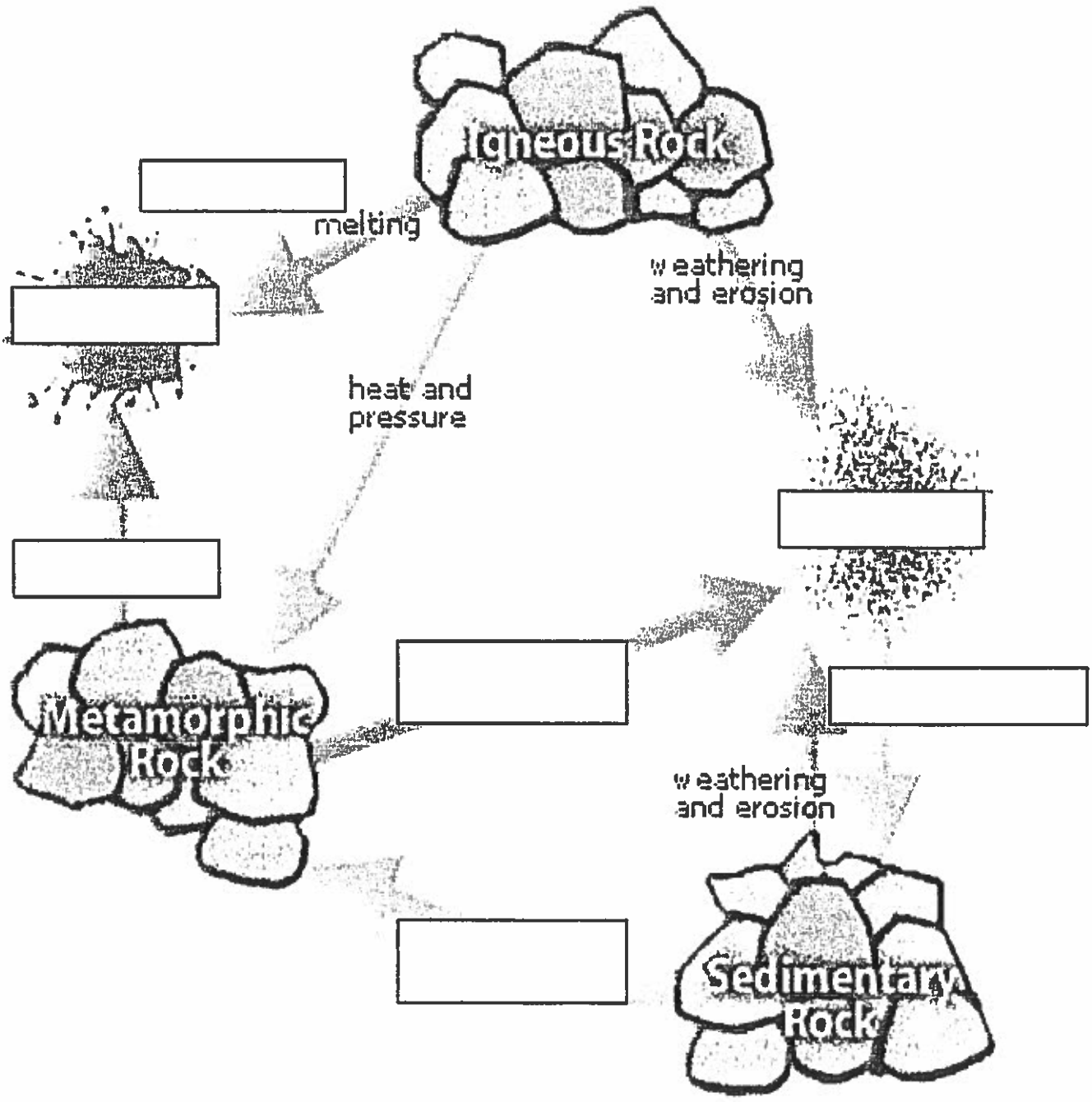
4.

5.

6.

7.

8.



Label the diagram above with the following terms.

- Weathering and erosion
- Sediment
- Heat and pressure
- Compaction and cementation
- Melting
- Magma
- Cooling