



## WOW! on Wheels – STEM Labs


### EARTH SCIENCE ROCKS!

### Teacher Packet



Our website offers several DIY activities that can be used in the classroom or for further exploration at home. [http://wpafbstem.com/pages/wow\\_diy.html](http://wpafbstem.com/pages/wow_diy.html)

- Compost Challenge
- Erosion Experiment
- Filter Fix
- Making Observations
- Nature Adventure
- Rock Cycle Research
- Seismograph Simulation





### DIY Air Force Activities: Rock Cycle Research

**Materials:**

- empty egg carton
- cereal bowl
- vinegar
- nail
- magnet
- smooth cement
- rocks!
- pen or pencil
- small notebook or paper


\*You can use a magnifying glass to examine rocks if you have one!

Rocks come in all shapes and sizes! They are constantly changing. Scientists who study rocks are called geologists, and they can gain a lot of information about the history of the earth by looking at rock formations. Geologists study the earth, the structure of the materials that make it up, and the processes acting upon it that make it change. The following activity will introduce you to some basic geology! Geologists classify rocks by how they are made or formed. There are three major types: igneous, metamorphic, and sedimentary (see back of sheet for more details). These types are the foundation of the rock cycle. Rocks are constantly changing and moving through the cycle. This change happens very slowly, and can take millions of years. The rocks you find each day are really part of the earth's history! In today's activity we will go on an adventure to collect some rocks of our own, then take a look at the three main types of rocks and see if we can recognize them in our collection. You can also collect rocks when you visit different beaches, forests, lakes, rivers, and open fields. Compare these rocks to the ones in your notebook. You will also learn how to do a test for a specific type of sedimentary rock called limestone.


**Directions:**


1. Number the slots in your egg carton.
2. Have an adult help you explore outside to find rocks from different places in your neighborhood. If possible go for a hike! When you find a rock, place it in your egg carton in the lid above that space with the location you found it.
3. When you get home, clean your rocks off and look at each closely. What makes you scratch them with the nail? What happens when you rub them on the cement mark? Where did you find the rock? Are the edges smooth or jagged? Write down your location and record your observations on your paper or in your notebook.

To learn more about the types of rocks and how to classify them, look for information on fossils, minerals, and Mohs Scale. There are also awesome and affordable rock testing kits available.





**Air Force Associations:**  
Military geology is a branch of geology that studies the geological structure of terrain to evaluate the conditions for military purposes. These scientists will evaluate possibility of terrain, organization of troop water supply, and determine the requirements to fortify structures, create airfields, roads, and bridges. Although Napoleon Bonaparte was the first to employ geologists in military operations in 1798, military geologists were not deployed in the battle field until World War I.





### DIY Air Force Activities: Erosion Experiment

**Materials:**

- ¼ to ½ cup baking soda
- bowl or dish (preferably glass so you can see through it)
- teaspoon
- measuring cup
- rocks (small and large)
- water (about ½ cup total)
- vinegar
- straw or pipette

\*bonus experiment: sand and twigs


Erosion is the process of land, soil, or rock being gradually worn away by water, wind, and ice. This differs from weathering, which is the breaking down of materials into smaller pieces from exposure to things such as air, water, or organisms. New landforms can be created and destroyed by weathering and erosion! Sometimes this process can happen quickly, and sometimes it takes hundreds of years. These natural processes help to form the landscape around us. The following experiment will allow you to model the weathering and erosion processes to better understand these phenomena.

**Directions: Be sure to ask an adult for permission before beginning the experiment!**

1. Fill your rocks in a formation in your dish or bowl.
2. Measure out ¼ - ½ cup of baking soda.
3. Add water 1 teaspoon at a time to the baking soda and mix with your spoon. Continue until you form a smooth paste. You do not want it to be too runny or too thick!
4. Pour your paste over your rock formation to "glue" it together. Feel free to sculpt shapes!
5. Place the bowl with your creation in the fridge for about 2 hours to set.
6. Once it is ready, pour a little less than ¼ cup vinegar in a clean measuring cup. Use your pipette to drop it on your rock formation and observe what happens! If you do not have a pipette, you can take a straw, submerge it in the vinegar and cap the other end with your thumb (see picture on back). Then remove your thumb once the straw is over your formation to drop the vinegar on!
7. After you have "weathered" your formation with some vinegar, slowly pour ¼ cup warm water over the formation to erode it away!

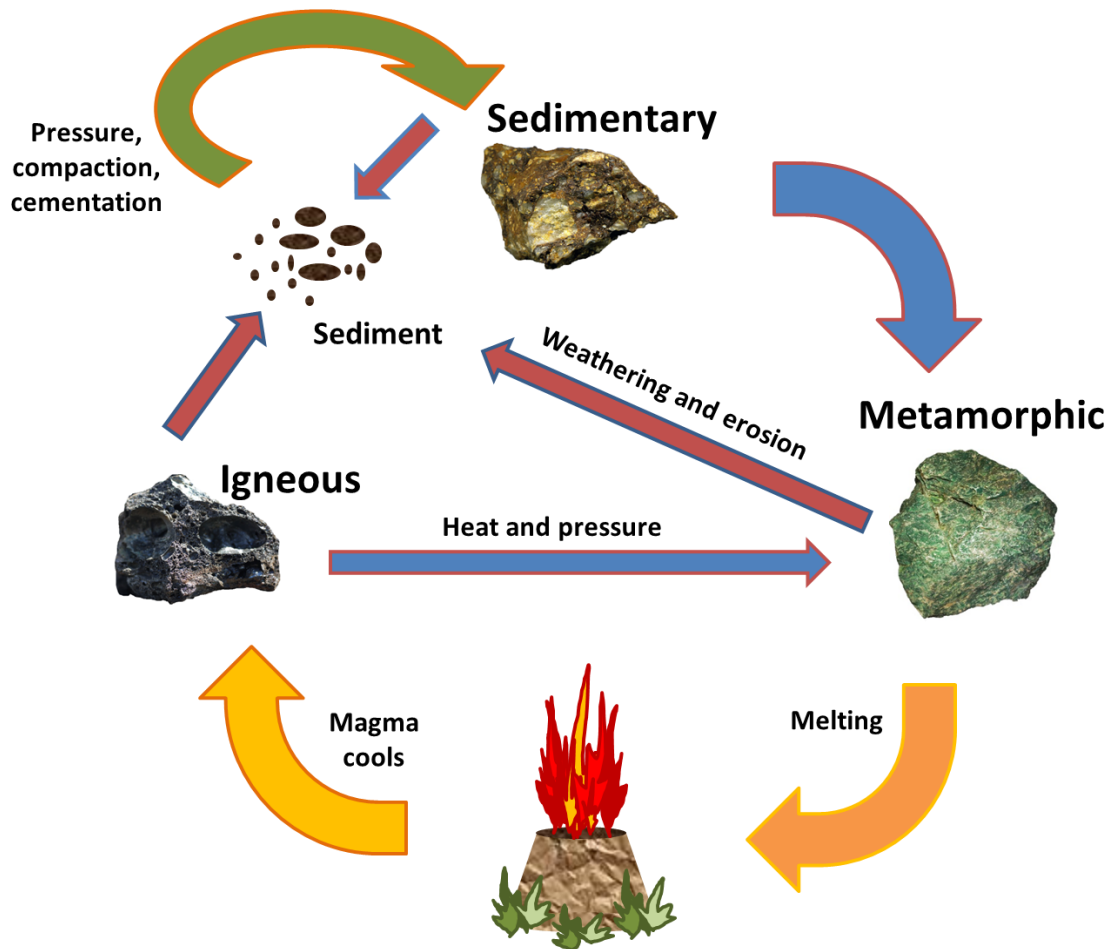
What did you observe during your experiment? Did you notice any interesting shapes and patterns? Have you seen similar results in nature after a storm or by a river bank? Now repeat the experiment but add sand and twigs when you build your structure up. Does this alter your results?

**Air Force Associations:**  
The US Air Force's Rain Erosion Test Facility at Wright Patterson Air Force Base is part of the Air Force Research Laboratory's material degradation test facility. It has an 8 ft diameter rotating arm and 96 calibrated nozzles that simulate 1 inch of rainfall per hour at speeds up to 650 mph! Real time video is monitored and recorded for "time to failure" testing. Another facility tests particle erosion on a "dust rig" to simulate the effects on air craft surfaces in dust laden environments!





## Teaching About Rocks and Minerals (Student Packet)



**Igneous:** These types of rocks are formed when the molten magma (underground) from the core of the earth cools and hardens. When the magma comes to the surface it is called lava. When it cools slowly, sometimes small crystals are formed and the rock glitters. When it cools quickly, the surface is shiny and smooth (glassy). Gas bubbles may also become trapped, leaving tiny spaces or holes in the rock.



**Metamorphic:** These rocks are formed under the earth's surface over hundreds of years. Intense pressure and heat squeeze particles and fuse them together. You may observe layers in the rock, or crystals formed by minerals growing over time on the surface. The layers are the result of heat and pressure pushing and fusing the material together. Different grains, or textures, may be present. Metamorphic rocks have been changed from one form, the parent rock, to another by heat and pressure. For example, shale (sedimentary) is the parent rock of slate.

**Sedimentary:** These rocks are formed when sediment (small particles, mud, sand, shells, and bone) accumulate in layers and become cemented, or stuck, together. This often happens when the material settles at the bottom of a body of water. These rocks are usually softer and break apart and scratch more easily. You may even find fossils in sedimentary rocks! Wavy horizontal lines, layers, grains, or a dusty texture may be present in these rocks.

### **Minerals vs Rocks:**

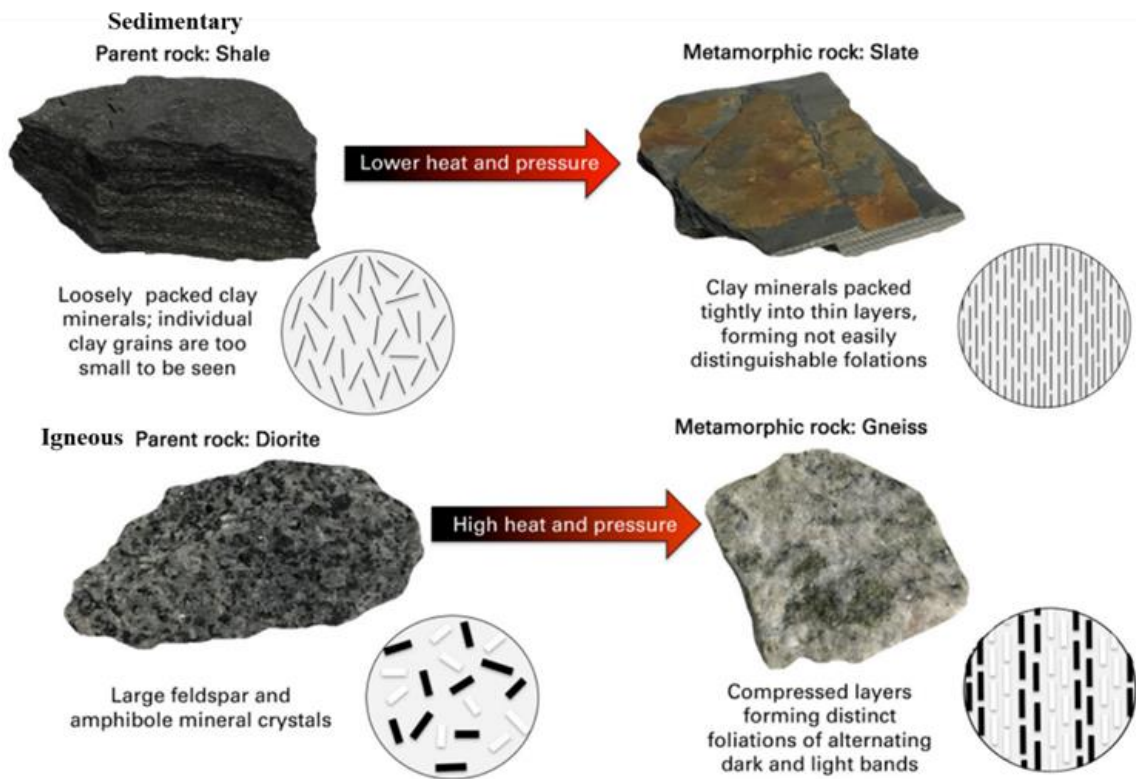
A **mineral** is a naturally occurring inorganic element or compound. It has its own well-ordered internal structure and a characteristic chemical composition, crystal form, and properties.

A **rock** are aggregates (collections) of one or more different minerals.

Think of minerals as the ingredients for a rock! To make a sandwich, you would layer many ingredients together, but those ingredients alone are not a sandwich. The type of sandwich (rock) you have depends on the ingredients (minerals) used to build it. Further, the "mineral" bread is made up of specific elements. While a sandwich (our rock) can have many variations, the bread (our mineral) has specific elements that make it up. So the same minerals can make different rocks, but the minerals themselves have a set composition (make-up), although some can come in different forms (think hamburger bun vs sliced bread; see gypsum and mica).



This is the precursor, or what another rock is formed from. This can be the soil, sand, or other material (sedimentary) or a different type of rock that has undergone another process. For example, when limestone (sedimentary) undergoes intense heat and pressure it becomes marble.



<https://www.oogeep.org/wp-content/uploads/2019/05/Geology-4.5-May-2019.pdf>



**Igneous Rocks:**

Extrusive (volcanic) rocks form when magma flows out to the surface (extrudes) and becomes lava that cools into rock or explodes out into the atmosphere and falls to the earth as rock. The cooling time for these types of rock may be seconds to months.

Extrusive: Obsidian



Intrusive: Dolerite



Intrusive (plutonic) rocks cool slowly without ever reaching the earth's surface first. These rocks often have a coarse, crystal like texture. The cooling time may take thousands of years for intrusive rocks and millions of years for the plutonic varieties.

**Sedimentary Rocks:**

Clastic rocks are composed of fragments (clasts/ broken pieces) of preexisting minerals and rock.

Clastic: Conglomerate



Intrusive: Dolerite

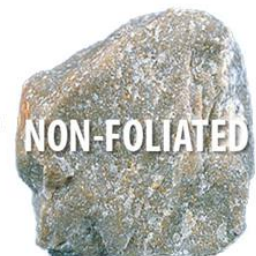


Non-clastic (chemical) rocks are formed through chemical reactions, such as the evaporation of water from sediment or precipitation and accumulation in water. They are also created from the remains of plants and animals, so may contain fossils.

**Metamorphic Rocks:**

Foliated rocks have identifiable layers, textures, or patterns.

Non-foliated don't have layers or patterns and are classified based on composition.





## Activity Ideas

### **Activity 1: Investigating Minerals**

Materials Needed:

[Introductory Information Packet](#) (can be used as reference during activities)

[Mineral Study Kit](#)

[Magnifying glass](#)

[Ceramic streak plate](#)

[Mineral Worksheet](#)

Students can examine the Mineral Study kit. They should use the magnifying glass and ceramic streak plate (directions found in the kit) to observe the minerals, then record their observations on their worksheet.

The idea of crystal structure can be introduced, but not beyond the fact it is how the atoms arrange themselves.

Materials Needed:

[Fluorescent Mineral Kit](#)

Students can use the LED flashlight to examine the fluorescent minerals.

- *Many of the stickers identifying these minerals have been lost.*
- *Please only take out one at a time, and put it back in its' original spot before examining another one.*



### **Activity 2: Investigating Rocks**

Materials Needed:

- Rock Study Kit
- Magnifying glass
- Magnet
- Rock Types - Sorting Sheet
- Rock Worksheet

Students can examine the Rock Study kit. They should use the magnifying glass to notice the observable properties of the rocks. Then record their observations on their worksheet.

They can sort their rocks by type, and taking note of similarities and differences. (Possibly discussing parent material mentioned in the introductory information packet).

Materials Needed:

- Fossil Kit

There is a fossil kit for students to examine as well.

### **Activity 3: Sort It Out**

Materials Needed:

- Educational Innovations Direction Sheet (orange sheet)
- List of samples (blue sheet)
- Sorting Key/Flow Chart
- Rock and Mineral Samples

Students can use the sorting key/flow chart to classify and separate a set of rocks and minerals.



#### **Activity 4: Unknown Answer Key**

Materials Needed:

A set of 12 unknown rock samples

Large sheet of paper and markers

Answer Key

Teams can work together to examine the rocks.

They can then attempt to make a flow chart similar to the one from Activity 3.

If you'd like, they can switch charts with another team and test it out!

#### **Activity 5: Earth Science Rocks! Booklet**

Materials Needed:

Template of booklet

Booklet Answer Key

Students can fill in the blanks to create their own booklet.

#### **Rock Tumbler Time**

To add to your study of rocks, you can borrow our Rock Tumbler to set up in your classroom. Prior to placing the raw rock into the tumbler, have the students attempt to classify them. Students can take notes on particularly notable rocks and log the changes that they observe during the polishing process.

This activity runs for several weeks, and observations should be made at each step. The process is similar to the natural weathering process, at a much faster rate.

At the end, you can discuss examples of this process in nature.





### Standards:

- 4.ESS.1: Earth's surface has specific characteristics and landforms that can be identified.
- 4.ESS.2: The surface of Earth changes due to weathering.
- 4.ESS.3: The surface of Earth changes due to erosion and deposition.
- 6.ESS.1 Minerals have specific, quantifiable properties.
- 6.ESS.2 Igneous, metamorphic and sedimentary rocks have unique characteristics that can be used for identification and/or classification.
- 6.ESS.3 Igneous, metamorphic and sedimentary rocks form in different ways.
- 6.ESS.4 Soil is unconsolidated material that contains nutrient matter and weathered rock.
- 6.ESS.5 Rocks, mineral and soils have common and practical uses.

### Suggested Sources:

- <https://www.geologypage.com/2019/07/rock-forming-minerals.html>
- <https://geologycafe.com/class/chapter3.html>
- [https://www.asec.purdue.edu/natural\\_resources/Soil,Health/Activities/SoilFormation,SWS2.pdf](https://www.asec.purdue.edu/natural_resources/Soil,Health/Activities/SoilFormation,SWS2.pdf)
- <https://safe.menlosecurity.com/doc/docview/viewer/docN623EA52E3D49332186bb1501afb0acb9f2107e15c7ee61a0d8696e41c39a054dc21500747471>
- [https://www.geocaching.com/geocache/GC80RVT\\_serpentinite-d-leslie-a-139?guid=23847a7d-9ef6-4b72-bd2d-2ea4be066ae8](https://www.geocaching.com/geocache/GC80RVT_serpentinite-d-leslie-a-139?guid=23847a7d-9ef6-4b72-bd2d-2ea4be066ae8)
- <https://mjksciteachingideas.com/minerals.html>
- <https://www.usgs.gov/science-support/osqi/yes/resources-teachers/grade-6-8-geology>
- <https://geology.com/teacher/>