*Topics that you asked for, between 3rd/4th periods, HEE, Mr. Bischoff’s classes, Mar 21, 2019*

**Rock Classification Chart**

Rocks on earth are classified according to the way they were formed. [Igneous rocks](http://scienceviews.com/geology/igneous.html) come from magma or lava. [Sedimentary](http://scienceviews.com/geology/sedimentary.html) rocks are made from sediments. [Metamorphic rocks](http://scienceviews.com/geology/metamorphic.html) are the result of great heat and pressure that have changed existing rocks into new rocks. Together, these three rock types account for all the rocks on earth! The following chart is the basic classification of these three types of rock.

|  |  |  |
| --- | --- | --- |
| **Igneous**  **Igneous rocks form when molten rock (magma) originating from deep within the Earth solidifies. The chemical composition of the magma and its cooling rate determine the final igneous rock type.** | ***Intrusive  (plutonic)*** | Intrusive igneous rocks are formed from magma that cools and solidifies deep beneath the Earth’s surface. The insulating effect of the surrounding rock allows the magma to solidify very slowly. Slow cooling means the individual mineral grains have a long time to grow, so they grow to a relatively large size. Intrusive rocks have a characteristically coarse grain size. |
| ***Extrusive (volcanic)*** | Extrusive igneous rocks are formed from magma that cools and solidifies at or near the Earth’s surface. Exposure to the relatively cool temperature of the atmosphere or water makes the erupted magma solidify very quickly. Rapid cooling means the individual mineral grains have only a short time to grow, so their final size is very tiny, or fine-grained Sometimes the magma is quenched so rapidly that individual minerals have no time to grow. This is how volcanic glass forms. |
| **Sedimentary**  **Sedimentary rocks are formed from pre-existing rocks or pieces of once-living organisms. They form from deposits that accumulate on the Earth's surface.** | ***Clastic*** | Clastic sedimentary rocks are made up of pieces (clasts) of pre-existing rocks. Pieces of rock are loosened by weathering, then transported to some basin or depression where sediment is trapped. If the sediment is buried deeply, it becomes compacted and cemented, forming sedimentary rock.  Clastic sedimentary rocks may have particles ranging in size from microscopic clay to huge boulders. Their names are based on their grain size. |
| ***Chemical*** | Chemical sedimentary rocks are formed by chemical precipitation. This process begins when water traveling through rock dissolves some of the minerals, carrying them away from their source. Eventually these minerals are redeposited when the water evaporates away or when the water becomes over- saturated. |
| ***Biologic*** | Biologic sedimentary rocks form from once-living organisms. They may form from accumulated carbon-rich plant material or from deposits of animal shells. |
| **Metamorphic**  **Metamorphic rocks are rocks that have been substantially changed from their original igneous, sedimentary, or earlier metamorphic form. Metamorphic rocks form when rocks are subjected to high heat, high pressure, hot, mineral-rich fluids or, more commonly, some combination of these factors.** | ***Foliated*** | Foliation forms when pressure squeezes the flat or elongate minerals within a rock so they become aligned. These rocks develop a platy or sheet-like structure that reflects the direction that pressure was applied. |
| ***Non-foliated*** | Non-foliated metamorphic rocks do not have a platy or sheet-like structure. There are several ways that non-foliated rocks can be produced. Some rocks, such as limestone are made of minerals that are not flat or elongate. No matter how much pressure you apply, the grains will not align! Another type of metamorphism, contact metamorphism, occurs when hot igneous rock intrudes into some pre-existing rock. The pre-existing rock is essentially baked by the heat, changing the mineral structure of the rock without addition of pressure. |

From: <http://scienceviews.com/geology/rockclassificationchart.html>

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| [**General Rock Type**](http://jersey.uoregon.edu/~mstrick/AskGeoMan/geoQuerry13.html) | [**Texture**](http://jersey.uoregon.edu/~mstrick/AskGeoMan/geoQuerry14.html)**- ave. size of minerals** | | **General color and/or**[**composition**](http://jersey.uoregon.edu/~mstrick/AskGeoMan/geoQuerry14.html)**- Miscellaneous observations** | **Rock Name** |
| [IGNEOUS ROCKS](http://jersey.uoregon.edu/~mstrick/MinRockID/RockID/Igneous.html) **Interlocking homogenous crystalline texture - no preferred orientation to the mineral grains** | Fine grained  Extrusive, volcanic | | Felsic - Light colored | **Rhyolite** |
| Intermediate | **Andesite** |
| Mafic - Dark colored | **Basalt** |
| Medium grained  Dikes, sills, etc. | | Felsic - Light colored | **- - - - - -** |
| Intermediate | **Dacite** |
| Mafic - Dark colored | **Diabase** |
| Coarse grained  Generally intrusive | | Felsic - Light colored | **Granite** |
| Intermediate | **Diorite** |
| Mafic - Dark colored | **Gabbro** |
| Ultramafic | **Peridotite** |
| Glassy | | Dark to black - felsic (DOES NOT follow normal color index) | **Obsidian** |
| Frothy | | Felsic - Light colored | **Pumice** |
| Mafic - Dark colored | **Scoria** |
| [SEDIMENTARY ROCKS](http://jersey.uoregon.edu/~mstrick/MinRockID/RockID/Sedimentary.html) **Consolidated detrital clasts, chemical precipitates, and/or biological residue** | Coarse Fragments | | Rounded clasts | **Conglomerate** |
| Angular clasts | **Breccia** |
| Sand sized fragments | | Clean quartz (w/feldspar?) | **Sandstone** |
| Dirty w/rock fragments & clay | **Graywacke** |
| Fine grained - cannot see individual clasts | | Nonfoliated, "clay the size" | **Siltstone** |
| Foliated, "clay the mineral" | **Shale** |
| Chemical - fine grain | | Soft - passes fizz test | **Limestone** |
| Hard - fails fizz test | **Chert** |
| Fossiliferous | | Mostly shell fragments | **Coquina** |
| [METAMORPHIC ROCKS](http://jersey.uoregon.edu/~mstrick/MinRockID/RockID/MetaClass.html) **Interlocking non- homogenous crystalline texture - commonly with a preferred orientation to the mineral grains** | F  O  L  I  A  T  E  D | Very fine grained-no visible minerals | Dull - passes "tink test" | **Slate** |
| Foliated, shiny due to increased size of micaceous minerals (almost see them) | **Phyllite** |
| Medium to coarse grain | Individual mineral grains visible. Major mineral(s) included as name modifiers | **Schist (ex. Mica Schist)** |
| [Color banded](http://jersey.uoregon.edu/~mstrick/GraphicPages/ColorBanding.html) | Alternating layers of light (felsic) and dark (mafic) minerals | **Gneiss** |
| Distinct layering - often highly folded and contorted | Alternating layers of felsic igneous rock (light) and mafic gneiss (dark) | **Migmatite** |
| Non-foliated,  with non-oriented grains | | Soft - passes fizz test | **Marble** |
| Hard - fails fizz test | **Quartzite** |
| Interlocking **hornblende**crystals | **Amphibolite** |

From: <http://jersey.uoregon.edu/~mstrick/MinRockID/RockID/RockIDChart.html>

**Minerals**

## What Makes a Mineral a Mineral? In order for something to be a mineral, it must first meet four criteria:

1. First, all minerals are **solid**. So, while water may contain minerals, water itself can't be a mineral because it's liquid.
2. Minerals are all **naturally formed**. This means they can't be manufactured in a lab. Synthetic gems, like cubic zirconia, are not minerals.
3. All minerals have a unique and specific **chemical composition**.
4. Lastly, all minerals have a [**crystalline structure**](http://www.geologyin.com/2014/12/what-are-crystals.html). Minerals are always arranged in an orderly geometric pattern. Minerals of the same type always have the same geometric arrangement of their atoms.

**Properties of Minerals**

Minerals are classified by their chemical composition and crystal structure. These two features occur on a microscopic level, but we can see them in other ways because they determine a mineral's **observable physical properties**.

**Crystal form** is the outward expression of the orderly arrangement of atoms inside the mineral. What you are seeing is the actual arrangement and structure of the atoms in that mineral. For example, look at some everyday table salt, which is a combination of sodium and chlorine. Normally, what you see is a salt cube, but if you were to break this cube down into smaller parts, it would simply break into smaller and smaller cubes because that is how the atoms are arranged.  
**Hardness** is how resistant a mineral is to scratching, not how easily it breaks. Hardness depends on the bonds within the mineral, the stronger the bonds, the harder the mineral.

Diamond is considered the hardest mineral, so it's a 10 on the Mohs scale of hardness. Talc has a very weak bond between its atoms, and so it's a 1 on the Mohs scale of hardness. If it helps, you can think of the hardness of talc in relation to the hardness of your fingernail, which is about a 2.5.

**Fracture and cleavage** describe how a mineral breaks. Some minerals break very nicely along smooth planes, and this is called **cleavage**. Minerals that break this way do so because their atoms are arranged so that they break apart from each other along these planes. Mica is an example of a mineral that has cleavage. If a mineral **fractures**, it breaks in uneven ways that are not flat or parallel.

**Luster** is how reflective a mineral is. Minerals are usually either classified as having **metallic luster**, which is very shiny or reflective, or **non-metallic luster**, which is dull.

**Streak:** the color of the powdered mineral, from rubbing on an unglazed white tile.  
Read more at <http://www.geologyin.com/2015/02/what-are-minerals-types-properties.html#Mj76s24EvQL4QyDr.99>

From: <http://www.geologyin.com/2015/02/what-are-minerals-types-properties.html>

**Types of Minerals**

Minerals are grouped by their chemical composition.  Silicates, oxides, sulfates, sulfides, carbonates, native elements, and halides are all major mineral groups.

1. [Silicates](https://www.radford.edu/jtso/GeologyofVirginia/Minerals/GeologyOfVAMinerals1-3a.html)

• Silicate minerals contain silicon (Si) and oxygen (O), the two most abundant elements in the earth’s crust.

* Over 90% of the common rock-forming minerals are silicates.

1. [Oxides](https://www.radford.edu/jtso/GeologyofVirginia/Minerals/GeologyOfVAMinerals1-3f.html)

• Oxide minerals are made up of oxygen and one or more metals.

1. [Sulfates](https://www.radford.edu/jtso/GeologyofVirginia/Minerals/GeologyOfVAMinerals1-3g.html)

• Sulfate minerals contain sulfur and oxygen (SO4) combined with other elements.

1. [Sulfides](https://www.radford.edu/jtso/GeologyofVirginia/Minerals/GeologyOfVAMinerals1-3h.html)

• Sulfide minerals contain sulfur and a metal.

1. [Carbonates](https://www.radford.edu/jtso/GeologyofVirginia/Minerals/GeologyOfVAMinerals1-3i.html)

• Carbonate minerals contain carbonate (CO3), a combination of carbon and oxygen, combined with other elements.

1. [Native Elements](https://www.radford.edu/jtso/GeologyofVirginia/Minerals/GeologyOfVAMinerals1-3j.html)

• Native elements are minerals that form as individual elements.  Gold and copper are examples of metallic native elements.

• Diamonds are a type of non-metallic native element.

1. [Halides](https://www.radford.edu/jtso/GeologyofVirginia/Minerals/GeologyOfVAMinerals1-3j.html#Halides)

• Halides include such elements as chlorine and fluorine.

From: <https://www.radford.edu/jtso/GeologyofVirginia/Minerals/GeologyOfVAMinerals1-3.html>

**Isotopes:**

### Key Takeaways: Isotopes

* Isotopes are samples of an element with different numbers of neutrons in their atoms.
* The number of protons for different isotopes of an element does not change.
* Not all isotopes are radioactive. Stable isotopes either never decay or else decay very slowly. Radioactive isotopes undergo decay.
* When an isotope decays, the starting material is the parent isotope. The resulting material is the daughter isotope.

From: <https://www.thoughtco.com/definition-of-isotopes-and-examples-604541>

<https://quizlet.com/233726746/counting-subatomic-particles-protons-neutrons-electrons-flash-cards/>

(handout for practice: “Subatomic Particles Worksheet”)

**Reading the periodic table**

* Rows, aka periods: sequences of increasing protons/electrons for a given energy level
* Groups, aka columns: groups of elements with the same number of valence (outermost occupied energy level) electrons; expect very similar chemical behavior
* Note staircase from B/Al downward to lower right: metalloids act sometimes as metals, sometimes as nonmetals, are along this staircase
  + Metals to the left; all tend to lose their valence electrons to become stable
  + Nonmetals to the right: all tend to gain or share electrons for stability

**Soil Types**

* Pedalfer: forest soils based on deciduous leaves, most common in eastern US; name comes from aluminum and iron; typically are very fertile, dark colored soils, rich in aluminum clays and iron oxides
* Pedocal: formed in drier, temperate grasslands and brush areas, moderate rainfalls, named from calcite enriched layer begins to form, can form a hard layer called caliche.
* Laterite: leached soils from intense tropical rainforest regions, high in least soluble materials, such as aluminum and iron oxides…tend to bake brick-like in sun. Nutrient poor material.

All soils are formed from a variety of actions, including deposition from higher altitude sources, weathering of available bedrock and surface formations, and, potentially, deposition from glacial or aeolian (wind-blown) sources

**Clouds**

Visit: <https://scied.ucar.edu/webweather/clouds/cloud-types> click on hyperlinks for clouds, below graphic.

**Weather**

Visit: <https://www.metoffice.gov.uk/weather/learn-about/weather/types-of-weather> Source is British, so many references to phenomena that are local, but good pictures and explanations.

**Mineral Resources**

Visit: <https://www.americangeosciences.org/critical-issues/mineral-resources>

**Wind Turbines**

Visit: <https://www.awea.org/wind-101/basics-of-wind-energy> , <http://windeis.anl.gov/guide/basics/>