7th Grade

Earth's Structure
Chapter 2: Minerals and Rocks

Lesson 1 (Properties of Minerals)

Mineral – a mineral must meet all four of the following requirements:

1. **must be naturally-occurring** (formed by nature)
2. **must be an inorganic solid**

organic – formed from living things or the materials of once-living things and containing the element **carbon**.

inorganic – not formed from living things or the remains of living things

3. **must have a crystal structure** (the particles line up in a pattern that repeats over and over again)
4. **must have a definite chemical composition.** (A mineral always contains the same elements in the same proportions)

Examples: A crystal of quartz (SiO_2) always has one atom of silicon for every two atoms of oxygen.

Some minerals consist of only one type of atom and are elements on the Periodic Table (gold, silver, copper)

Tests Used to Identify Minerals:

1. **Color** – the least reliable test
2. **Streak** – the color of a mineral in powdered form
   – A streak test is done by rubbing the mineral on a piece of unglazed porcelain tile.
   – A mineral's streak can be the same as its color, or may be completely different.

3. **Luster** – the way light is reflected off a mineral's surface
4. **Density** – the amount of mass in a given space (how tightly packed the particles are)
   – The density of a mineral is the same regardless of the size of the piece or where it was found.

$$\text{density} = \frac{\text{Mass of the sample}}{\text{volume of the sample}}$$

5. **Hardness** – use the **Mohs Hardness Scale** and a scratch test
6. **Cleavage and fracture test** – test the way a mineral breaks apart

Cleavage – the ability to split easily along flat surfaces.

Fracture – does not split easily, but breaks apart in an irregular way.

Whether a mineral has cleavage or some type of fracture depends on how the atoms in its crystals are arranged.

7. Test for special properties:

magnetism – test with a magnet

fluorescence – glows under an ultraviolet (UV) light

radioactivity – test with a **Geiger counter** (instrument that tests radioactivity)

reactivity – undergoes changes when exposed to certain chemicals

8. Type of crystal system

– Look at the shape of the crystals.

– Sometimes you need a microscope to tell crystal structure.

Geode – a rounded rock that is lined with mineral crystals (Iowa's state rock)

– Formed by water containing dissolved materials seeping into a crack or hollow in a rock

– When the water cools or evaporates, the materials group together in a repeating pattern.

Crystallization – the process by which atoms are arranged in a repeating pattern to form crystal structure

Minerals Can Form in Two Ways:

1. Crystallization of molten material.
2. Crystallization of materials dissolved in water (solutions)

Minerals from magma and lava:

Magma – molten material beneath Earth's surface

Lava – magma that has risen above Earth's surface

Both form rock when they cool and harden.

The size of crystals formed depends on the cooling rate.

Large crystals – from very slow cooling of magma deep in the Earth

Small crystals – from quick cooling of magma near Earth's surface or lava on the surface.

Minerals from solutions:

Solution – a mixture in which one substance is dissolved in another substance, usually water.

1. minerals formed by **evaporation** – when water with dissolved elements and compounds evaporates, the compounds may bond together in a repeating pattern.
2. minerals formed from **hot water solutions** – When magma-heated water pockets inside Earth cool, dissolved elements and compound leave the solution and crystallize as minerals. (**Gold** is formed this way.)

Vein – a narrow channel or slab of mineral beneath the surface that is different from the surrounding rock.

Some common minerals and their uses:

Quartz – used in making glass, and for watch crystals

Pyrite – known as "fool's gold" and is used as novelties at gift shops

magnetite – an important ore from which we get iron

hematite – most important ore of iron, also used as a paint pigment (red)

copper – metal used in making electrical wires, coins, and water pipes

graphite – used as pencil lead, and as a powdered lubricant

bauxite – an ore of aluminum

halite (rock salt) – used as road salt, or dissolved in water and evaporated for table salt

gypsum – very soft mineral used in plaster and wallboard

talc (soapstone) – very soft mineral used in talcum powder

Lesson 2 (Classifying Rocks**)**

Rocks – most are mixtures of different minerals

Some rocks contain only a single mineral.

Classifying (Identifying) Rocks:

1. Look at the **mineral composition**.(What minerals are in it?)
2. Look at the **color**.(This may give clues as to the minerals in it.)
3. Look at the **texture**.

Texture – the look and feel of a rock's surface because of the size, shape, and pattern of the **grains** (or particles in the rock).

Determining Texture:

1. Look at the grain **size**.
   - **coarse grain** – easy to see without magnification
   - **fine grain** – very small, usually cannot be seen without magnification
   - **glassy –** grain cannot be seen even with a microscope
     - very hard with no crystal structure
   - **porous** – very fine texture and filled with air spaces

2. Look at the grain **shape**.
   - **rounded** grain
   - **jagged** grain

3. Look at the grain **pattern**.
   - **banded** – the grains lie in flat, stacked layers
   - **nonbanded** – grains are arranged randomly or in swirling patterns

Three Groups of Rocks: (grouped by how they form)

1. **Igneous rock** – forms from the cooling of magma or lava.
2. **Sedimentary rock** – forms when particles of other rocks or the remains of plants and animals settle into an area and are pressed and cemented together.
   - forms in layers that are buried below the surface
3. **Metamorphic rock** – forms when existing rock (igneous, sedimentary, or other metamorphic rock) is changed by heat, pressure, or chemical reactions.
   - mainly forms deep underground

Lesson 3 (Igneous Rocks**)**

Igneous rocks are classified according to:

1. their **origin** (where they formed)
2. their **texture** (how they look and feel)
3. their **mineral composition** (how much **silica** is in them)

Origin:

Extrusive igneous rock – formed by **lava** that cools and hardens on Earth's surface

Example: **basalt** (the most common extrusive rock)

Intrusive igneous rock – formed by **magma** cooling and hardening beneath the surface

Example: **granite** (the most common intrusive rock)

Texture:

– Depends on the size and shape of its mineral crystals

– Size and shape of crystals depends on cooling rate of magma or lava.

Rapid cooling – forms very fine grain or very small crystals (cools too fast for crystals to grow very large)

– may cool so fast that no crystals form (glassy texture, such as in **obsidian**)

Example: **extrusive** igneous rocks (Lava cools fast when exposed to air or water)

Slow cooling – forms coarse grain or large crystals (cools slowly enough for large crystals to form)

Example: **intrusive** igneous rocks (Magma under the crust cools very slowly.)

Mineral composition:

Silica – a material found in magma that is formed from the elements oxygen and silicon

– The amount of silica in magma or lava affects the type of rock that forms during cooling.

magma high in silica – forms light-colored rock

magma low in silica – forms dark-colored rock

Common igneous rocks to know:(You will get a handout.)

Rock	Texture	Type	Color	Other
Granite	Coarse grain	Intrusive	Light	Can be converted to **gneiss**, common building material
Obsidian	Glassy	Extrusive	Dark	Called "natural glass", used by natives for tools
Basalt	Fine grain	Extrusive	Dark	Makes up the black sands of Hawaii
Pumice	Porous	Extrusive	Light	Very rough, used in hand cleaners

Lesson 4 (Sedimentary Rocks)

Sediment – small, solid pieces of material that come from rocks or organisms (includes sand, gravel, mud, shells, bones, leaves, stems and other remains)

Sediment sizes (from smallest to largest):

clay – smaller than the tiniest pencil dot, less than $\frac{1}{256}$ *mm*

silt – less than $\frac{1}{16}$ *mm*

sand – less than 2 *mm*

gravel – 2 *mm and larger*

Processes that form sedimentary rocks: (in order)

1. **weathering** – breaking down of rock over time by wind, water, moving ice, freezing/thawing, and plant roots
2. **erosion** – movement of sediments to new locations by running water, wind, ice, and gravity
3. **deposition** – process in which sediment is laid down in new locations
4. **compaction** – the process by which sediment layers are pressed together by the weight of other sediments on top of them
   – Layers are often visible in sedimentary rocks.
5. **Cementation** – the process by which minerals dissolved in water seep into spaces between the sediments, then crystallize and glue particles of sediment into one mass.

Types of Sedimentary Rocks:

1. **clastic rocks** – a sedimentary rock that forms when rock fragments are squeezed together under high pressure

   Examples: **shale** – tiny clay particles squeezed together

   sandstone – sand squeezed together

   conglomerates – round rock fragments squeezed together

2. **organic rocks** – sedimentary rocks that form from remains of organisms deposited in thick layers that are squeezed together

   Example: **coal** – from layers of swamp plants buried in water

3. **chemical rocks** – sedimentary rock that forms when minerals dissolved in water crystallize.

   Examples: **limestone** – often contains fossils from plant and animal remains that get trapped as dissolved **calcite** crystallizes

   halite – rock salt

Common sedimentary rocks to know: (You will get a handout.)

Rock	Type	Other
Limestone	Chemical **or** organic	Often contains fossils
Sandstone	Clastic	Formed from compacted sand particles
Shale	Clastic	Compressed clay particles: can be converted to **slate**
Coal	Organic	Compressed plant remains

Lesson 5 (Metamorphic Rocks)

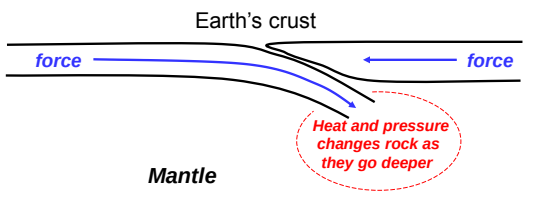
How metamorphic rock forms:

– **Heat** and **pressure** deep beneath Earth's surface can change any rock into metamorphic rock.

– When this happens, its appearance, texture, crystal structure, and mineral content changes.

– Forces inside Earth can push surface rocks down toward the very hot mantle and can melt rock.

– The deeper a rock is buried, the more pressure put on that rock.



Types of Metamorphic Rock:

1. **foliated rock** – a metamorphic rock that has it grains arranged in parallel layers or bands (They split into layers.)

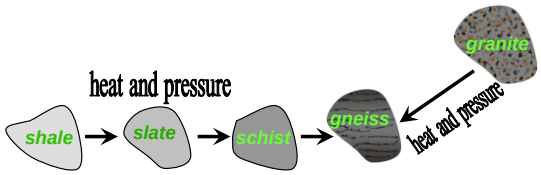
   Examples: **slate** – formed when heat and pressure changes shale (a sedimentary rock)

   schist – formed when additional heat and pressure changes slate (larger mineral grains form in slate to make schist)

   gneiss – formed when heat and pressure flattens the grains in granite (an igneous rock)

   – Also formed when heat and pressure changes schist (creating even larger mineral grains in schist to form distinct layers)

Two ways gneiss can form:



2. **nonfoliated rock** – a metamorphic rock in which the grains are arranged randomly

– They do not split into layers.

Example: **marble** – when heat and pressure changes **limestone**

Common metamorphic rocks to know: (You will get a handout.)

Rock	Type	Other
gneiss	foliated	Made from converted granite. Also from converted shale to slate to schist to gneiss.
slate	foliated	Made from converted shale
schist	foliated	Made from converted slate
marble	nonfoliated	Formed from limestone.

Lesson 6 (The Rock Cycle)

Rock cycle – a series of events on the surface and inside Earth that slowly changes rocks from one kind to another