

LESSON 1: MINERALS AND ROCKS

Conserving
Our
Resources

Chapter 6

LESSON 1: MINERALS AND ROCKS

■ Objectives

- Identify minerals by their properties.
- Discuss the formation of igneous, sedimentary, and metamorphic rocks.

- **Main Idea**

- **Earth's crust is made of minerals that have different properties.**

VOCABULARY

mineral – any of the naturally occurring solid materials of Earth’s crust

crystal – a solid that has a structure arranged in orderly, fixed patterns

igneous rock – rock that forms when melted rock in the form of lava or magma cools and turns into a solid

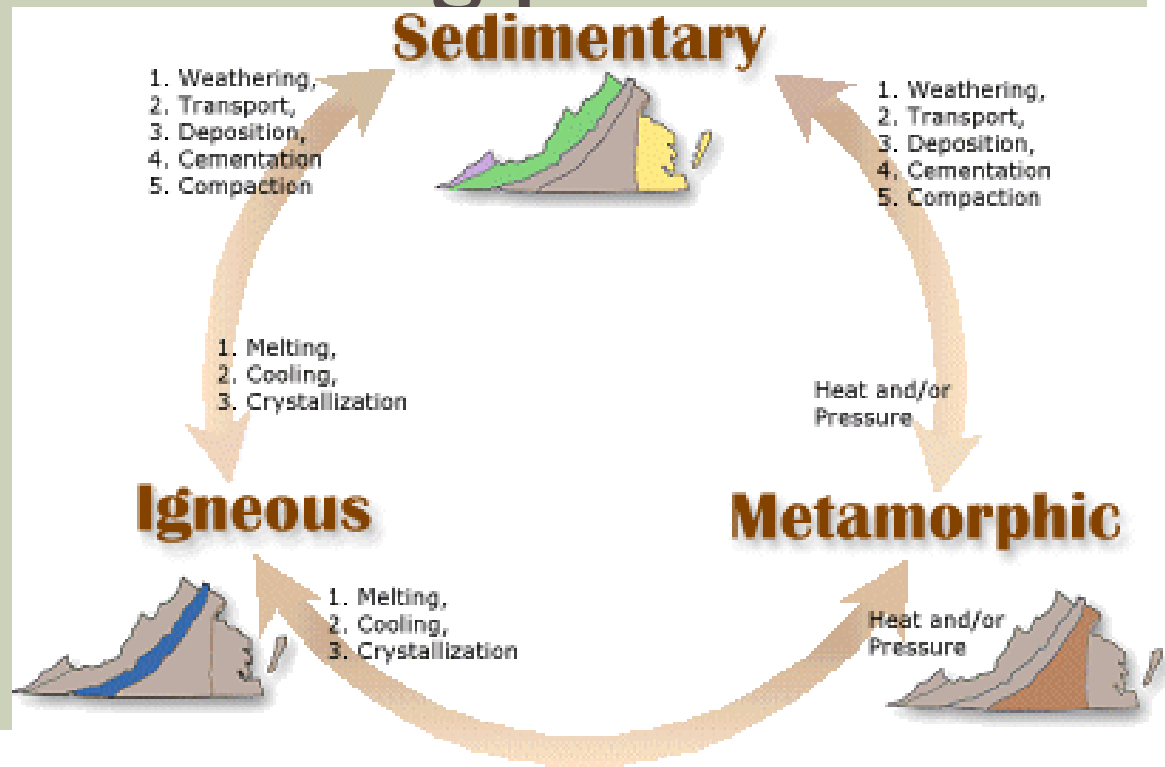
VOCABULARY

sedimentary rock – a rock that forms when small pieces of rocks, minerals, and shells are deposited, buried, and are squeezed and cemented together

metamorphic rock – a rock that forms from other rocks which have changed from heat, pressure, or a chemical reaction

VOCABULARY

rock cycle - the process in which rocks continuously change from one kind into another over long periods of time



WHAT ARE MINERALS?

Minerals like all kinds of matter are made up of elements.

An element is a substance that cannot be changed into a simpler substance.

Periodic Table of the Elements

1 IA 11A		2 IIA 2A												13 IIIA 3A	14 IVA 4A	15 VA 5A	16 VIA 6A	17 VIIA 7A	18 VIIIA 8A
1 H Hydrogen 1.008																			2 He Helium 4.003
3 Li Lithium 6.941	4 Be Beryllium 9.012												5 B Boron 10.811	6 C Carbon 12.011	7 N Nitrogen 14.007	8 O Oxygen 15.999	9 F Fluorine 18.998	10 Ne Neon 20.180	
11 Na Sodium 22.990	12 Mg Magnesium 24.305												13 Al Aluminum 26.982	14 Si Silicon 28.086	15 P Phosphorus 30.974	16 S Sulfur 32.066	17 Cl Chlorine 35.453	18 Ar Argon 39.948	
19 K Potassium 39.098	20 Ca Calcium 40.078	21 Sc Scandium 44.956	22 Ti Titanium 47.88	23 V Vanadium 50.942	24 Cr Chromium 51.996	25 Mn Manganese 54.938	26 Fe Iron 55.933	27 Co Cobalt 58.933	28 Ni Nickel 58.693	29 Cu Copper 63.546	30 Zn Zinc 65.39	31 Ga Gallium 69.732	32 Ge Germanium 72.61	33 As Arsenic 74.922	34 Se Selenium 78.09	35 Br Bromine 79.904	36 Kr Krypton 84.80		
37 Rb Rubidium 84.468	38 Sr Strontium 87.62	39 Y Yttrium 88.906	40 Zr Zirconium 91.224	41 Nb Niobium 92.906	42 Mo Molybdenum 95.94	43 Tc Technetium 98.907	44 Ru Ruthenium 101.07	45 Rh Rhodium 102.906	46 Pd Palladium 106.42	47 Ag Silver 107.868	48 Cd Cadmium 112.411	49 In Indium 114.818	50 Sn Tin 118.71	51 Sb Antimony 121.760	52 Te Tellurium 127.6	53 I Iodine 126.904	54 Xe Xenon 131.29		
55 Cs Cesium 132.905	56 Ba Barium 137.327	57-71 Lanthanide Series	72 Hf Hafnium 178.49	73 Ta Tantalum 180.948	74 W Tungsten 183.85	75 Re Rhenium 186.207	76 Os Osmium 190.23	77 Ir Iridium 192.22	78 Pt Platinum 195.08	79 Au Gold 196.967	80 Hg Mercury 200.59	81 Tl Thallium 204.383	82 Pb Lead 207.2	83 Bi Bismuth 208.980	84 Po Polonium [208.982]	85 At Astatine 209.987	86 Rn Radon 222.018		
87 Fr Francium 223.020	88 Ra Radium 226.025	89-103 Actinide Series	104 Rf Rutherfordium [261]	105 Db Dubnium [262]	106 Sg Seaborgium [266]	107 Bh Bohrium [264]	108 Hs Hassium [269]	109 Mt Meitnerium [268]	110 Ds Darmstadtium [269]	111 Rg Roentgenium [272]	112 Cn Copernicium [277]	113 Uut Ununtrium unknown	114 Fl Flerovium [289]	115 Uup Ununpentium unknown	116 Lv Livermorium [293]	117 Uus Ununseptium unknown	118 Uuo Ununoctium unknown		

57 La Lanthanum 138.906	58 Ce Cerium 140.115	59 Pr Praseodymium 140.908	60 Nd Neodymium 144.24	61 Pm Promethium 144.913	62 Sm Samarium 150.36	63 Eu Europium 151.966	64 Gd Gadolinium 157.25	65 Tb Terbium 158.925	66 Dy Dysprosium 162.50	67 Ho Holmium 164.930	68 Er Erbium 167.26	69 Tm Thulium 168.934	70 Yb Ytterbium 173.04	71 Lu Lutetium 174.967
89 Ac Actinium 227.028	90 Th Thorium 232.038	91 Pa Protactinium 231.036	92 U Uranium 238.029	93 Np Neptunium 237.048	94 Pu Plutonium 244.064	95 Am Americium 243.061	96 Cm Curium 247.070	97 Bk Berkelium 247.070	98 Cf Californium 251.080	99 Es Einsteinium [254]	100 Fm Fermium 257.095	101 Md Mendelevium 258.1	102 No Nobelium 259.101	103 Lr Lawrencium [262]

Alkali Metal	Alkaline Earth	Transition Metal	Basic Metal	Semimetal	Nonmetal	Halogen	Noble Gas	Lanthanide	Actinide
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Most minerals are compounds made up of two or more elements.



Some examples of minerals are aluminum foil, copper wire, and table salt.

PROPERTIES OF MINERALS

Color

Color is useful in identifying what type of mineral you have.

But many minerals can have the same color.

One way to determine the true color of a mineral is scratching the surface.



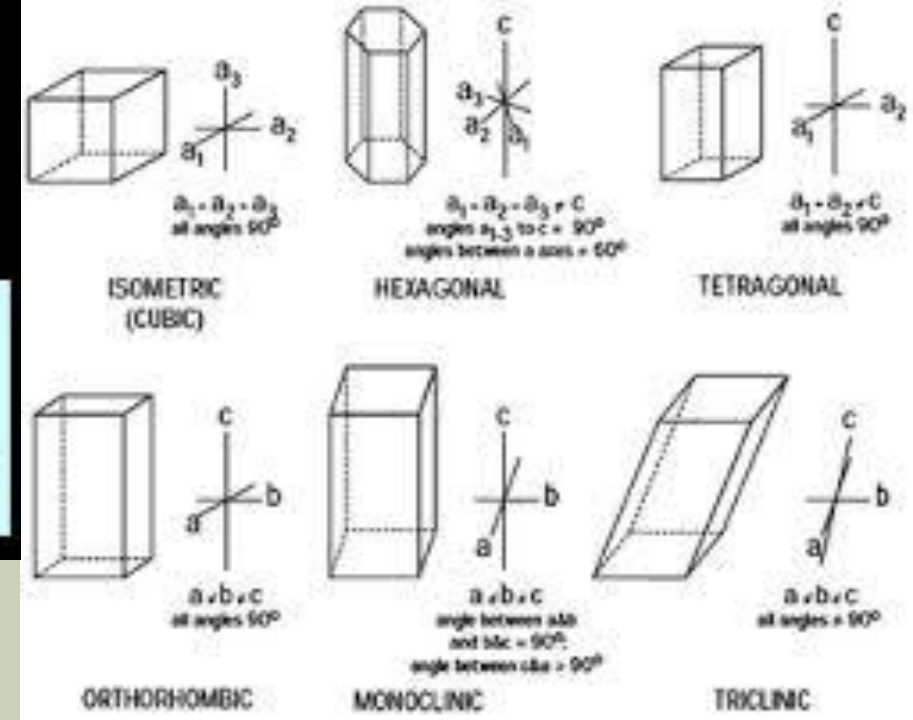
Texture

The texture of the mineral is based on the shapes and sizes of the substances in it.

In a coarse mineral, the pieces are large enough to see and feel.

In a smooth one, the pieces are quite small and may sometimes be difficult to see.

A *glassy* mineral feels and looks smooth.



■ Crystal Structure

- A crystal is a solid that has a structure arranged in orderly, fixed patterns.
- A crystal's shape depends on the way its structure is arranged.

■ Cleavage

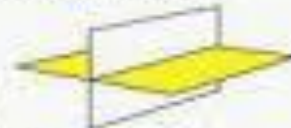
- Cleavage is described by the number of planes, or directions, along which the mineral breaks.
- Cleavage of the mineral depend on its structure.
- Some minerals break smoothly.
- Some have rough or uneven surfaces.



Cleavage in one direction. Example: MUSCOVITE



Cleavage in two directions. Example: FELDSPAR



Cleavage in three directions. Example: HALITE



Cleavage in two directions. Example: CALCITE



QUICK CHECK

Compare and Contrast

What can be seen when a mineral breaks with cleavage?

Without cleavage?

A mineral with cleavage tends to break smoothly along flat surfaces in a predictable manner.

A mineral without cleavage will not break in a predictable manner and will have rough, uneven surfaces.

Critical Thinking

Why is it useful to examine the crystal structure of an unfamiliar mineral?

The structure of a crystal is arranged in an orderly, fixed pattern that can help to identify the mineral.

WHAT ARE SOME OTHER PROPERTIES OF MINERALS?

Hardness is another important property of minerals; some minerals scratch easily and others do not.

Hardness is a measure of how well a mineral resists scratching.

- **Friedrich Mohs, a German scientist, devised a scale of hardness to compare minerals to one another.**
 - **This has come to be known as Mohs' scale.**
 - **The scale's lowest number is 1 and the highest number is 10.**
 - **Minerals higher on Mohs' scale can be used to scratch minerals lower on the scale.**

STREAK AND LUSTER

- If you rub a mineral on a porcelain plate, the color left is called the streak.
- During the California Gold Rush, some people found what they believed to be gold was actually iron pyrite.
 - The streak test showed that iron pyrite has a greenish-black streak, not a yellow streak like gold.

- **Luster refers to the way that minerals reflect light.**
 - **Minerals with a metallic luster appear shiny like metal.**
 - **Graphite has a metallic luster.**
 - **Minerals with a nonmetallic luster appear oily, slick, glassy, or silky.**
 - **Quartz has a glassy luster.**
 - **Talc has an oily luster.**

- **Some other materials have special properties that can be used to identify what they are.**
 - **Arsenic gives off a garlicky odor when it is heated.**
 - **Copper is a good conductor of electricity.**
 - **Magnetite attracts elements such as iron, nickel, and cobalt and is a naturally formed magnet.**

QUICK CHECK

Compare and Contrast

Compare the properties of galena and hornblende shown in the table of mineral properties.

	galena	hornblende
color	steel gray	green to black
streak test	gray to black	gray to white
hardness	2.5	5 - 6
density	7.5	3.4

They are alike in that they both have luster and cleavage.

Critical Thinking

Why should you test several properties when identifying minerals?

- Two different minerals can share one or more properties, but they cannot share them all.
- Each mineral has its own special set of properties.
 - By studying the properties, you can often find enough information to identify minerals.

HOW DO ROCKS DIFFER?

- Rock is formed from solid material made up of one or more minerals.
- Types of rocks are identified by the minerals they contain and the conditions under which they were formed.

- **Properties identify types of rock which include features such as texture and structure.**
 - **Texture depends on the size, shape, and arrangement of the minerals in the rock.**
 - **Structure is how the minerals fit together.**

IGNEOUS ROCK

- Igneous rock forms when the melted rock cools down and hardens into a solid.
- Sometimes igneous rock is below the surface.
 - *Intrusive rock occurs* when magma is flowing and seeping into cracks, it sometimes gets trapped.
 - While the rock cools, the crystals in the minerals grow larger and more coarse.
 - Gabbro and granite are examples of intrusive rock.

QUICK CHECK

Compare and Contrast

How does an igneous rock that has cooled quickly differ from one that has cooled slowly?

An igneous rock that cooled quickly has a smoother, finer texture, and its crystals are smaller.

An igneous rock that cooled slowly has a rougher, more coarse texture, and its crystals are larger.

Critical Thinking

What might explain the presence of coarse textured igneous rock exposed on the surface of Earth?

The rocks formed underground, cooling slowly, allowing large crystals to form.

The lower layers were pushed up; the upper layers were eroded; plates shifted and moved the layers.

WHAT ARE SEDIMENTARY AND METAMORPHIC ROCK?

- Sedimentary rock is pebbles and bits of rock, squeezed, and cemented together when deposited.

- **As layers of sediment build up, the layers above press down upon the fine particles beneath them.**
- **The particles beneath are squeezed and cemented into various layers of rock.**
- **Some of the rock layers are dense and solid, and others are porous.**

METAMORPHIC ROCK

Metamorphic rock are rocks deep underground that have been changed and formed by high temperatures, pressure from overlying rock layers, or a chemical re-action, beginning as igneous rock, sedimentary rock, or other metamorphic rock. It changes the structure and texture of the older rock, normally making it hard and nonporous.

The high heat and pressure needed to produce metamorphic rock are generated in two basic ways.

- **One way is regional metamorphism which is when rock in a large area may be exposed to high heat and pressure that changes the rock's structure and texture.**

Another way is contact metamorphism which is when magma rises through the crust and can change the structure and texture of the rock it touches.

QUICK CHECK

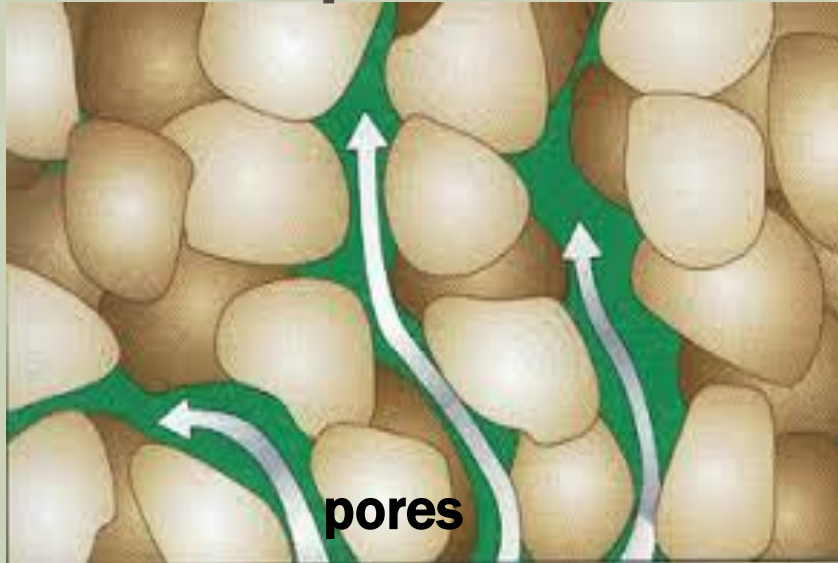
Compare and Contrast

How do the characteristics of sedimentary rock differ from those of metamorphic rock?

Sedimentary rocks are formed when loose pieces of rocks and minerals are squeezed and cemented together; metamorphic rocks develop from other rocks when great heat and pressure change the original structure, texture, and composition.

Critical Thinking

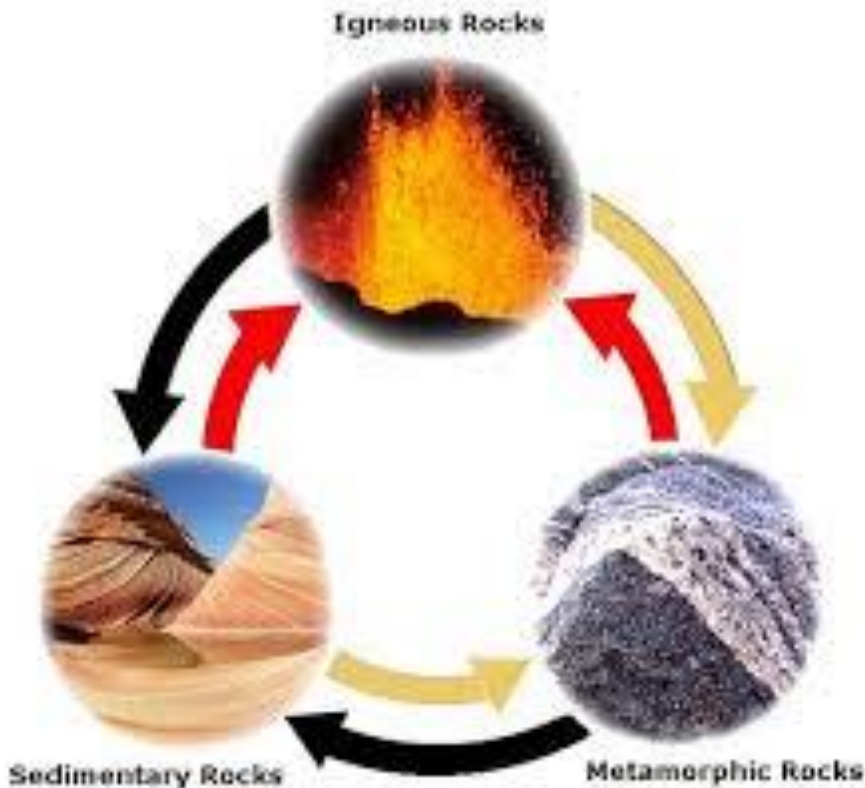
Explain why petroleum is not found in metamorphic rock.



The heat and high pressure that produce metamorphic rocks do not leave any openings or pores in which petroleum can collect.

WHAT IS THE ROCK CYCLE?

Magma and lava are molten rock made from rock that already existed.



In a process known as the rock cycle, rock can continually change from one kind of rock into another over a long period of time.

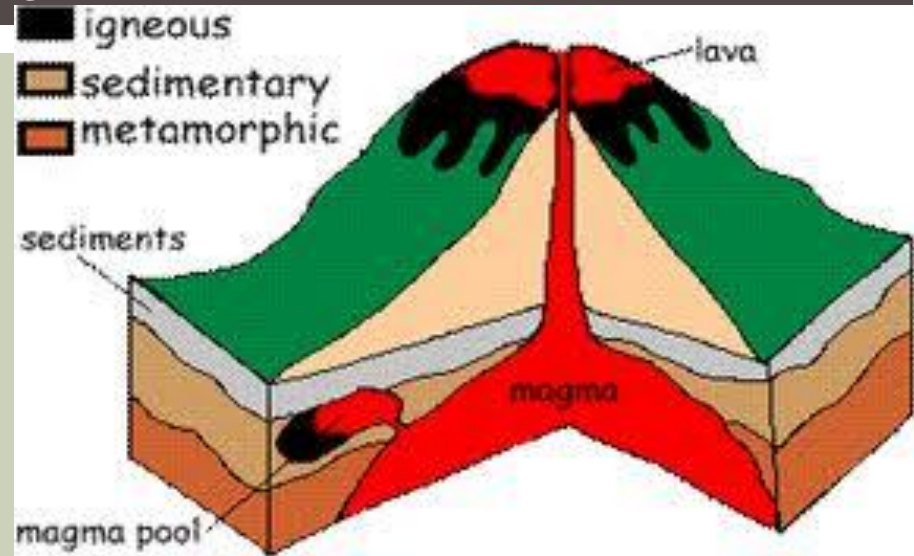
- **Magma cools, crystallizes, and becomes igneous rock.**
- **Weathering can break down any rock into sediment.**
 - **The sediment may turn into sedimentary rock.**

- Under heat and pressure, sedimentary or igneous rock can become metamorphic rock.
- Any type of rock that is pushed back into the mantle can melt and turn into magma once again.

QUICK CHECK

Compare and Contrast

How does igneous rock differ from metamorphic rock?



Metamorphic rock deep underground can melt into magma, which becomes igneous rock when it cools and hardens. Under extreme heat and pressure, igneous rock can change into metamorphic rock.

Critical Thinking

Why is it so difficult to find out which kind of rock came first?

- Scientists have no evidence of which formed first. Scientists simply know that all kinds of rock are part of the rock cycle and all rocks come from other rocks.

WORKSHEET PACKET # 17

You can describe a type of rock by its physical properties, such as size, color, shape, texture, and luster. You can also discuss its hardness, its crystal structure, and the color it leaves when it is rubbed against a rough surface. These properties can tell you what the rock is made of and how it was formed.