

CORNELL NOTES

Directions: You must create a minimum of **5 questions** in this column **per page** (average). Use these to study your notes and prepare for tests and quizzes. Notes will be turned in to your teacher at the end of the Unit for scoring.

UNIT 4: Earth Science Chapter 20: Earth Materials (pages 606-643)

I. Minerals

A. Common Elements

1. Of the first 92 elements on the periodic table, _____ **are found in Earth**

a. Only **small number** combine to make up most of common minerals in **Earth's** _____

b. Major _____ in Earth's crust includes:

Major Elements in Earth's Crust			
Element	Percent (by mass)	Element	Percent (by mass)
Oxygen	46.6%	Sodium	2.8%
Silicon	27.7%	Potassium	2.6%
Aluminum	8.1%	Magnesium	2.1%
Iron	5.0%	All others	1.5%
Calcium	3.6%		

2. Composition of Earth's Crust

a. _____ is outer most layer

b. Includes all **continental** material and _____ **bottom**

c. Extends down _____ **of kilometers**

3. Chemical Element Building Blocks- most minerals of the crust contain abundant _____ and **silicon**

B. What's a Mineral

1. **Mineral**- a naturally occurring _____ or _____ that is inorganic, solid, and has a crystalline structure

a. Have predictable _____ **compositions**

b. Can be indicated by single **elements** or **chemical** _____

C. Physical Properties

1. Each mineral has characteristic set of _____ properties

b. **Physical properties**- Any characteristic of a material that you can observe without _____ the identity of the substances that make up the material (**color, shape, size, density, melting point, boiling point**)

b. Care should be taken studying mineral properties, especially _____ (may be due to impurities)

2. **Atom arrangement**- Some physical properties controlled by the arrangement of _____ in mineral

a. **Orderly pattern** is what makes a mineral _____

b. Arrangement of _____ reflect way mineral **breaks, hardness**, and what type of **crystal shape** it has

3. How Minerals Break

a. _____ - when mineral breaks along planes creating **flat surface**

b. _____ - Do not split along well-defined flat surfaces- **breaks unevenly**

4. _____ - The physical property that measures resistance to scratching

Mohs Scale of Hardness	
1	Talc
2	Gypsum (fingernail)
3	Calcite (copper penny)
4	Flourite
5	Apatite (glass plate)
6	Feldspar
7	Quartz (streak plate)
8	Topaz
9	Corundum
10	Diamond

a. Determined by **strength of** _____ that connect atoms

b. Measured in scratching test called _____ **Scale**

1). When rub two objects together, the _____ of the two will **wear away**

2). **Mohs Scale of Hardness**

5. Luster and Streak-

- a. _____ - Physical property- way a mineral **reflects light**
- b. _____ - physical property- **color** mineral in **powdered form**
 - 1). May be same color as mineral or different
 - 2). Performed by rubbing on **white plate**

6. **Crystal shape**- Arrangement of atoms often indicated by its external _____ shape (Sorted by 6 crystal systems)

D. Mineral Formation

1. Mineral crystals _____ as atoms are added
 - a. Types of atoms added depends on atoms

 - b. _____ controlled by how fast atoms can **migrate** to crystal, **temperature**, and **pressure** conditions
2. **Minerals from water**- Some minerals produced from hot-water solutions rich in dissolved mineral matter
 - a. Occurs around edges of **hot** _____
 - b. Also formed when hot water passes through _____ in cooler rock (i.e. gold, silver, or copper)
3. **Minerals from** _____ - occurs when magma cools
4. **Minerals from Evaporation**- Also form from water on Earth's surface when water slowly _____

E. Mineral Groups

1. Over _____ **minerals** identified in nature
2. Only a **few** minerals needed to make up almost the entire _____ of Earth

3. _____ - The most important by volume of Earth's crust

a. Most minerals contain _____

b. Common term for compound containing **silicon** plus _____ or **silicon dioxide**

c. Forms tetrahedron shape

d. Other _____ **atoms** can attach to the oxygen atoms

4. Minerals of the Crust- **silicate** groups form most of Earth's _____

a. **Quartz** and **feldspar** make up most of _____ **crust**

b. _____ **crust** is **denser**

5. Important non-silicates- many important mineral groups are not silicates

a. Include **carbonates**, **oxides**, **halides**, **sulfides**, **sulfates**, and **native metals**

b. Source of many valuable ore minerals (I.e. _____ ore, **bauxite** (aluminum), **carbonate** (used to make _____))

F. Mineral Uses

1. Humans have relied on minerals for their everyday _____

2. Used minerals either directly as objects of _____, or as raw materials to **make things**.

II. Igneous Rocks

A. What is a Rock?

1. _____ - a naturally formed consolidated mixture containing **minerals**, **rock fragments**, or **volcanic glass**

2. Identified by their **composition** and _____

B. Intrusive Igneous Rocks

1. Rocks formed from **molten rock material** called _____

- a. Termed "**plutonic**" after Pluto, Greek god of the _____
- b. Called **intrusive** because form _____, or push into, regions of Earth's crust

2. Nature of Magma- As it passes through rock, magma might cause **partial** _____ of rock it intrudes

3. Intrusive Igneous Rock Composition

- a. **Composition** of intrusive igneous rocks gives clues to where in Earth they _____
- b. _____ rock settles toward bottom and **less dense** float to top of magma chamber

4. Intrusive Igneous Rock Texture

- a. Texture describes size and arrangement of rock components
- b. **Size** of individual **mineral crystals** tells you how quickly or slowly the **magma** _____

5. Classification of Intrusive Igneous Rocks

- a. _____ - rich in quartz and feldspar (dominant rock of continental crust)
- b. **Gabbro**- _____ quartz and abundant feldspar

C. Extrusive Igneous Rocks

1. Rocks that **cool from** _____ that has **erupted** at Earth's surface

- a. Have **same composition** as intrusive igneous rocks, but **different** _____
- b. Often _____ by rocks as it passes through them on way to surface

2. Extrusive Igneous Rock Textures

a. **Rapid cooling** results _____ or no crystals

b. _____ **eruptions** can result in many different textures and forms (**large blocks to ash**)

3. Effect of **Gases**

a. Can break apart lava to form _____

b. Can form lava with many **small holes** (_____ - can float on water)

III. Sedimentary Rocks

A. Rocks from Surface Materials

1. Surface Attack- exposed rocks attacked by

a. Action over **long time** breaks rocks down into _____ -sized pieces

b. Slow, constant **smashing, grinding, and dissolving** of **clasts** can take place in _____ and _____

_____ - small bits and pieces of rocks

2. Transportation and Deposition

a. Can be **eroded** or **removed** from original

b. When transported to new location, clasts often become _____

c. **Porosity**- _____ between clasts

1). **Porosity** can vary

2). Porosity is what can _____ **water**, **oil**, and **natural gas** stored in the Earth

3. Buried Clasts

a. Eventually, clasts can become consolidated into rock

1). Making of **clasts** by **weathering** is process

2). Making of **sedimentary rock** occurs
_____ the surface

4. Force of _____ (gravity) causes **clasts** to
stick together

a. _____ carries dissolved minerals that
can act like **cement**

b. **Cementation**- process where minerals fill
spaces between _____ to make
sedimentary rock

B. Detrital Sedimentary Rocks

1. **Detritus**, from Latin *deterere*, means “to lessen or wear away”

a. Sedimentary rock made mostly from _____
are **detrital sedimentary rocks**

b. In order of decreasing _____, **clasts** are
known as- **gravel**, **sand**, **silt**, or **clay**

2. Detrital Sedimentary Rock Textures-

a. Scientist use **size of clasts** as clue to the kind of
_____ in which a rock forms

b It takes **more** _____ (or energy) to move
gravel than **sand**

c. When water is **moving**, silt and clay particles
_____ up in water

d. When water is **calm**, most **clast** sizes
_____ out

3. Detrital Sedimentary Rock Compositions

a. Depends on **sources** of _____ material
that were **eroded**

b. Some _____ tend to be more
common in detrital sediments (i.e. quartz)

4. Detrital Rock Classification

a. Classified according to _____
and **texture**

b. Classified as follows

Common Clast Sizes Used to Name Sedimentary Rock	
Common Clast Size	Rock Name
Gravel or larger	Conglomerate
Sand	Sandstone
Silt	Siltstone
Clay	Shale

C. Chemical Sedimentary Rock

1. Formed through the activity of _____ dissolved in water

2. _____ settle our of water to build and form new rock

3. **Precipitation**- the **crystallization** of excess dissolved _____

4. **Evaporation**- _____ matter crystallizes when water evaporates

D. Biochemical Sedimentary Rocks

1. Contain the **remains** of _____ **organisms**

2. _____ contains remains of marine organisms that had body parts of calcium carbonate

3. Variety of limestone (Coquina) is made from _____ **fragments**

4. **Coal**- originates from remains of mostly _____ material

a. Composed of mostly _____

b. Usually develops from **peat** found in _____ or **bogs**

c. Transformed into coal by _____ after buried by sediments

IV. Metamorphic Rocks and the Rock Cycle

A. Metamorphic Rock

1. Rocks that have been changed by some combination of **thermal energy**, _____, and **chemical** activity

2. Atoms rearrange and sometimes form new minerals

a. The word **metamorphic** comes from “meta”- meaning **to change**, and “morph”- meaning _____

b. Occurs at _____ between that which forms **sedimentary** (low) and **igneous** (high)

B. Metamorphic Rock Composition

1. Changing Minerals

a. **Clay** minerals tend to form _____

b. _____ forms with increased temperature and **pressure**

2. Environments of Metamorphism

a. **Movements** of large parts of **Earth's crust** and uppermost _____

b. Contact of preexisting rock with _____

C. Metamorphic Rock Textures

1. _____ Rocks- most common sedimentary rocks in Earth's crust are **mudrocks** such as **shale** and **siltstone**

a. Contain abundant _____ minerals

b. **Metamorphizes** into minerals in the _____ group

c. When squeezed and heated, layers of mica line up in direction **perpendicular to direction** of _____

2. **Nonfoliated** Rocks

a. Tend to have random **crystal** orientation and uniform _____ **size**

b. Results in _____ (chemically equivalent to limestone)

D. Metamorphic Rock Classification

- 1. _____ based on **texture** and **composition** (Can be **foliated** or **nonfoliated**)
- 2. **Mineral composition**- can tell you clues about the _____ **rock type**

E. The Rock Cycle

1. Includes any **chemical** and **physical** conditions that continuously form and _____ rocks
2. Some happen at **Earth's surface**, while others happen _____ **below** the surface
3. All material is conserved through process
(_____ is conserved)
4. Can take many _____ **paths**
5. . Occur over **millions of years** or **suddenly**
(erupting _____)
- 6.. **No** _____ or _____ to rock cycle