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## EARTH SCIENCE – UNIT 2 – CHAPTER 3 NOTES

### MINERALS

**\*\*\*MINERALS ARE NOT THE SAME AS ROCKS!\*\*\***

#### 3.1 Minerals

Mineral = a naturally occurring, inorganic solid with a definite structure and composition

- \* naturally occurring = cannot be man-made
- \* inorganic = not alive; cannot be made by animals or plants (EX: shell, bone, fossil)
- \* solid = cannot be a liquid or gas; have a specific size and shape that doesn't change
- \* definite structure = the atoms are arranged in a specific pattern or order
- \* composition = each mineral has a very specific chemical formula

#### 3.1 Crystals

Crystal = a solid in which the atoms are arranged in repeating patterns

- \* Square on both ends = cubic or tetragonal
  - \* all 6 sides are equal = cubic
  - \* the sides are not as long as the ends = tetragonal
- \* Rectangle on both ends = orthorhombic
- \* Hexagon on both ends = hexagonal
- \* sides are slanted = monoclinic or triclinic

#### 3.1 How Minerals Form

1. Minerals form when magma (melted rock material) cools.  
As it cools, molecules lose energy, slow down, move close together, and form repeating patterns.  
The type of compounds in the magma determine the type of minerals that form.  
Cools quickly → small crystal size  
Cools slowly → large crystal size
2. Crystals form when a solution of minerals slowly evaporates.  
As the water evaporates, the minerals are left behind and form crystals.  
This works best when the solution is "super-saturated".

#### 3.1 Most Common Elements on Earth

1. Oxygen
2. Silicon
3. Aluminum
4. Iron
5. Calcium
6. Sodium
7. Potassium
8. Magnesium

**\*\*DRAW ORBITAL DIAGRAM FOR SILICON\*\***

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### 3.1 Most Common Mineral Groups on Earth

NOTE: Minerals contain other elements than just the ones in parentheses.

1. Silicates (oxygen and silicon) – MOST COMMON!
2. Carbonates (carbon and oxygen)
3. Oxides (oxygen)
4. sulfides (sulfur)
5. sulfates (sulfur and oxygen)
6. hydroxide (oxygen and hydrogen)
7. phosphates (phosphorus and oxygen)
8. native elements (made of just 1 element)

HINT: The suffix “-ate” means that the mineral contains oxygen!

### 3.2 Physical Properties of Minerals

1. Color = a good starting point for mineral identification  
not usually a helpful property
2. Hardness = a measure of how easily the mineral can be scratched  
Mohs Hardness Scale – page 69
3. Luster = how light is reflected from the surface of a mineral  
EX: metallic, nonmetallic (dull, pearly, silky, vitreous/glassy, Earthy, waxy, etc.)
4. Streak Test = the color of a mineral’s powder when it is rubbed across an unglazed porcelain tile
5. Break Pattern = whether a mineral breaks unevenly or along even planes  
EX: cleavage = breaks along smooth, flat, even surfaces (atoms have strong bonds)  
EX: fracture = breaks along rough, jagged, uneven surfaces (atoms have weak bonds)
6. Crystal System = the basic shape of the crystals found in a mineral  
EX: cubic, tetragonal, orthorhombic, hexagonal, monoclinic, triclinic
7. Density = how much matter (mass) is found in a specific amount of space (volume)  
EX: high density (feels heavy), low density (feels light)

### 3.2 Chemical Properties of Minerals

1. Magnetism = the ability of a mineral to act like a magnet (EX: Magnetite)
2. Acid Test = the ability of a mineral to fizz when acid is placed on it (EX: Calcite)

### 3.2 Optical Properties of Minerals

1. Opaque = cannot see through the mineral at all  
EX: when looking through a mineral, you cannot see any images
2. Double Refraction = when light passes through the mineral, it bends in 2 directions  
EX: when looking through a mineral, you see a double image
3. Fiber Optic = when light passes through the mineral, it bends in such a way that it speeds up  
EX: when looking through a mineral, an image looks closer
4. Translucent = when light passes through the mineral, but is scattered  
EX: you can see through the mineral, but image is not clear
5. Transparent = when light passes through the mineral, producing a clear image  
EX: you can see through the mineral, and the image is very clear
6. Prism = when light passes through the mineral, light splits into all colors of the spectrum  
EX: when you hold the mineral in front of a bright light, you see a rainbow of colors

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### 3.3 Uses of Minerals

1. Gem = a mineral that is considered valuable because it is rare and beautiful
  - usually contains traces of certain minerals
  - usually is polished
  - usually is cut into a particular shape
2. Ore = a mineral that is considered valuable because it can be mined for a profit
  - can be refined or processed into a useful product
  - is worth more as a final product than as a raw material

### 3.3 Uses of Titanium

\*SILENT READING: MAKE A LIST OF PROS AND CONS\*

### 3.X Phosphates – Help or Hazard?

\*SILENT READING: MAKE A LIST OF PROS AND CONS\*