KEY CONCEPT #1:

What is a mineral?

It is a _______ naturally occurring _______. _______ inorganic _______ substance which has a _______ definite chemical composition

What would be the opposite of this?

man-made, organic, random chemical composition

KEY CONCEPT #2:

What causes minerals to have different physical properties?

***THEIR INTERNAL ARRANGEMENT OF ATOMS***

Give an example of two minerals which have the same chemical composition but different physical properties.

graphite and diamond

KEY CONCEPT #3:

The Main Physical Properties Used to Identify Minerals

1. Color _______ a poor indicator
   many minerals are the same color, one mineral can be multiple colors

2. Streak _______ the powder form of a mineral
   more reliable than color

3. Luster _______ how light reflects off a mineral
   metallic: _______ looks like a metal
   nonmetallic: _______ looks earthy, waxy, greasy, or brilliant

5. Fracture: The mineral breaks randomly.

6. Hardness: Resistance to being scratched. It is not the same as breaking!

MOH'S SCALE OF HARDNESS

<table>
<thead>
<tr>
<th>Hardness</th>
<th>Mineral</th>
<th>Hardness</th>
<th>Mineral</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (softest)</td>
<td>talc</td>
<td>6</td>
<td>orthoclase</td>
</tr>
<tr>
<td>2</td>
<td>gypsum</td>
<td>7</td>
<td>quartz</td>
</tr>
<tr>
<td>3</td>
<td>calcite</td>
<td>8</td>
<td>topaz</td>
</tr>
<tr>
<td>4</td>
<td>fluorite</td>
<td>9</td>
<td>corundum</td>
</tr>
<tr>
<td>5</td>
<td>apatite</td>
<td>10 (hardest)</td>
<td>diamond</td>
</tr>
</tbody>
</table>

KEY CONCEPT #4: Minerals have a definite chemical composition

What two elements, by mass, make up the greatest percentage of the Earth’s crust?

a. Oxygen

b. Silicon

These two elements combine to form compounds called silicates.

They combine in a specific structure called a:

Oxygen - Silicon - Tetrahedra

Draw this structure below.
MONO-MINERALIC  MADE FROM ONE MINERAL

POLY-MINERALIC  MADE OF TWO OR MORE MINERALS

Most rocks are **POLY** - MINERALIC

**Three classifications of rocks are:**

Sedimentary

Igneous

Metamorphic

Draw the rock cycle below.

Refer to Page 6 of the Earth Science Reference Tables
**Key Concept #1:** Most sedimentary rocks are made of pieces (clasts) of other rocks.

**Key Concept #2:** Name two processes that form sedimentary rocks.

a. cementation—the pieces are held together by minerals (cement)

b. compaction—the weight of the overlying sediments forces the particles together

**Key Concept #3:** In what type of environment are most sedimentary rocks formed? [watery]

**Key Concept #4:** Key Identifying Features of Sedimentary Rocks

a. Strata—a clear layering of sediments

b. Clasts—pieces of other rocks

c. Fossils—the remains of once-living organisms

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**Sedimentary Rock ESRT Questions**

1. **limestone** Name a non-clastic sedimentary rock which is composed of calcite.

2. **breccia** Name a clastic sedimentary rock which has mixed, angular particle sizes.

3. **limestone** Name a non-clastic sedimentary rock composed of marine shell fragments.

4. **coal** Name a dark-colored, organically formed sedimentary rock composed mostly of carbon.

5. **rock gypsum** Name the sedimentary rock formed by the process of evaporation and composed mostly of gypsum.
1. According to the Earth Science Reference Tables, which characteristic determines whether a rock is classified as a shale, a siltstone, a sandstone, or a conglomerate?

   (a) the mineral composition of the sediments within the rock
   (b) the density of the sediments in the rock
   (c) the absolute age of the sediments within the rock
   (d) the particle size of the sediments within the rock

2. According to the Earth Science Reference Tables, some sedimentary rocks form as the direct result of

   (a) freezing of the material
   (b) cementation of rock fragments
   (c) melting of minerals
   (d) solidification of molten magma

3. According to the Earth Science Reference Tables, which is a sedimentary rock that forms as a result of precipitation from seawater?

   (a) shale
   (b) basalt
   (c) conglomerate
   (d) gypsum

4. Which property best describes a rock which has formed from sediments?

   (a) distorted structure
   (b) crystalline structure
   (c) banding or zoning of minerals
   (d) fragmented particles arranged in layers

5. Which is most likely a nonsedimentary rock?

   (a) a rock composed of layers of gravel cemented together
   (b) a rock consisting of large intergrown crystals
   (c) a rock containing fossil shells
   (d) a rock showing ripple marks and mud cracks
**Key Concept #1:** How are igneous rocks formed?

by the melting and solidification of magma

**Key Concept #2:** Name two places where igneous rocks form.

a. _____ volcanoes ________________________________

b. _____ rifts/ridges ________________________________

**Key Concept #3:** What determines the crystal size in igneous rocks?

cooling time ________________

<table>
<thead>
<tr>
<th>Crystal Size</th>
<th>Cooling Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large crystals indicate a _____ long cooling time ____________________________</td>
<td></td>
</tr>
<tr>
<td>Small crystals indicate a _____ short cooling time ____________________________</td>
<td></td>
</tr>
</tbody>
</table>

**Key Concept #4:** What is the difference between extrusive and intrusive igneous rocks?

Extrusive form on or near the Earth’s surface (small crystals)  
Intrusive form below the Earth’s surface (large crystals)
**Key Concept #5:** Characteristics used to classify igneous rocks.

a. Texture
   - glassy
   - fine
   - coarse
   - very coarse

EXTRUSIVE

INTRUSIVE

b. Color
   - light
   - dark

c. Density
   - for its size, low or high mass

d. Composition
   - mafic
   - felsic

contains Fe and Mg

contains Al

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**Key Concept #6:** Key Identifying Features of Igneous Rocks

a. Glassy texture: will usually appear black in color

b. Interlocked grains: the grains have been melted are now physically connected

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**Igneous Rock ESRT Questions**

1. **basaltic glass**
   - An extrusive, dark-colored, glassy textured igneous rock composed mostly of pyroxene.

2. **granite**
   - A coarse-grained, felsic igneous rock, composed of 50% quartz, 25% potassium feldspar, and 25% plagioclase feldspar.

3. **basalt**
   - A fine-grained igneous rock containing 25% olivine.
1. What observation about an igneous rock would support the inference that the rock cooled slowly underground?
   a. The rock is light in color and low in density
   b. The rock is about 50% plagioclase feldspar.
   c. The rock has large crystals.
   d. The rock has fossils.

2. Which two igneous rocks could have the same mineral composition?
   a. pumice and scoria
   b. peridotite and andesite
   c. rhyolite and diorite
   d. gabbro and basalt

3. Rhyolite and granite are alike in that they both are:
   a. fine grained
   b. mafic
   c. felsic
   d. dark-colored

4. Most igneous rocks contain
   a. fossils
   b. sediments
   c. intergrown crystals
   d. recrystallized minerals

5. An igneous rock that has a glassy texture, mostly likely solidified
   a. quickly on/near the Earth’s surface
   b. quickly deep under the Earth’s surface
   c. slowly on/near the Earth’s surface
   d. slowly deep under the Earth’s surface

6. Most igneous rocks form by which processes?
   a. heat and pressure
   b. melting and solidification
   c. erosion and deposition
   d. compaction and cementation
**Key Concept #1:** How are metamorphic rocks formed?
by heat and pressure

**Key Concept #2:** Melting **DOES NOT** occur.
If melting does occur, it is classified as a(n) **igneous** rock.

**Key Concept #3:** What is the difference between Regional and Contact Metamorphism?

**REGIONAL:** large geographic area (mountains)

**CONTACT:** small geographic area---when rocks come in contact with magma

**Key Concept #4:** Key Identifying Features of Metamorphic Rocks

a. **Foliation:** banding of minerals usually black and white

b. **Distorted Structure:** folded layers

c. **Key Identifier Minerals:**

□ ______ garnet__________ Dark Red Color

□ ______ mica________ Shiny, flaky mineral
1. **gneiss**
   A foliated, coarse-grained metamorphic rock with distinct banding.

2. **quartzite**
   A non-foliated metamorphic rock formed from the metamorphism of quartz.

3. Identify the sedimentary rock each of the following metamorphic rocks started as:

<table>
<thead>
<tr>
<th>Metamorphic Rock Name</th>
<th>Sedimentary Rock Formed From</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quartzite</td>
<td>sandstone</td>
</tr>
<tr>
<td>Slate</td>
<td>shale</td>
</tr>
<tr>
<td>Marble</td>
<td>limestone</td>
</tr>
</tbody>
</table>