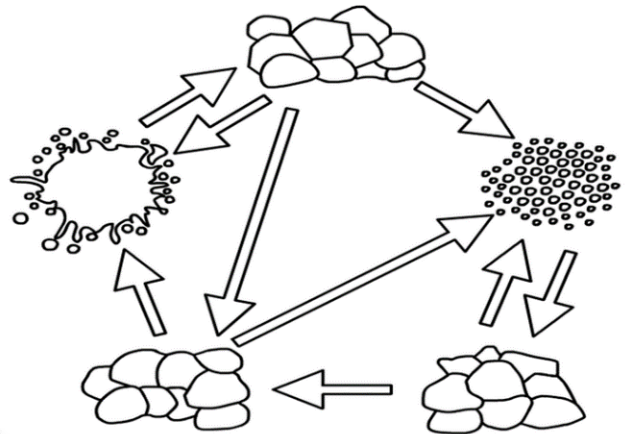
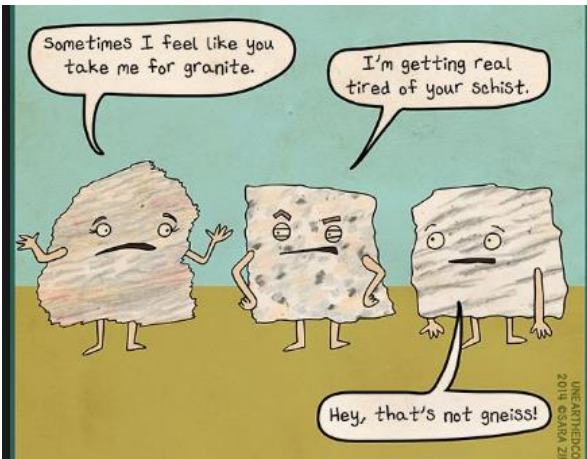


# Practice Packet

## Topic 3: Rocks & Minerals



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Vocabulary: \_\_\_\_\_

Lesson 1: \_\_\_\_\_

Lesson 2: \_\_\_\_\_

Lesson 3: \_\_\_\_\_

Lesson 4: \_\_\_\_\_

Lesson 5: \_\_\_\_\_

Name: \_\_\_\_\_

## PRACTICE PACKET: TOPIC 3 Minerals & Rocks

### VOCABULARY

For each word, provide a short but specific definition from YOUR OWN BRAIN! No boring textbook definitions. Write something to help you remember the word. Explain the word as if you were explaining it to an elementary school student. Give an example if you can. Don't use the words given in your definition!

Mineral: \_\_\_\_\_

Luster: \_\_\_\_\_

Non Metallic Luster: \_\_\_\_\_

Metallic Luster: \_\_\_\_\_

Fracture: \_\_\_\_\_

Cleavage: \_\_\_\_\_

Igneous: \_\_\_\_\_

Intrusive Igneous Rocks: \_\_\_\_\_

Extrusive Igneous Rocks: \_\_\_\_\_

Solidification: \_\_\_\_\_

Vesicular: \_\_\_\_\_

Sedimentary Rocks: \_\_\_\_\_

Cementation: \_\_\_\_\_

Compaction: \_\_\_\_\_

Metamorphic Rocks: \_\_\_\_\_

Contact Metamorphism: \_\_\_\_\_

Regional Metamorphism: \_\_\_\_\_

### Lesson 1 - Minerals

#### Objective:

- I can explain what a mineral is.
- I can explain why color is not a good test to identify minerals
- I can describe how to find streak
- I can describe how to find hardness
- I can explain the difference between cleavage and fracture
- I can describe what luster is & the two main categories

**Mixed-Up Minerals**

Cheryl Mason works for *Geotech, Inc.*, a geology laboratory. While moving the laboratory's rock and mineral collection to a new building, she discovered five mineral samples that did not have labels. Two samples were white, one was brown, and two were colorless.

Cheryl labeled the samples A, B, C, D, and E. The two white samples, A and B, looked very similar. They had the same texture and appeared to have the same density. However, sample A bubbled when a drop of dilute hydrochloric acid was placed on it. Sample B did not react with the dilute hydrochloric acid. Sample C, the brown mineral, attracted iron filings.

After making these observations, Cheryl found five labels that had no samples to go with them: Diamond, Quartz, Calcite, Halite, and Magnetite.

**Your Turn to Think**

1. Based on Cheryl's observations, which is the calcite sample? Explain your choice.
2. Which is the magnetite sample? Explain your choice.
3. What test could Cheryl perform to clearly identify the diamond sample?
4. What test should Cheryl use to clearly identify the quartz and halite samples?
5. What other test could Cheryl perform to further confirm that she had correctly identified the halite sample?

**Practice Questions:**

1. What are the two different types of luster? \_\_\_\_\_
2. What is the range of hardness found on the chart? \_\_\_\_\_
3. What type of breakage is more common: cleavage or fracture? \_\_\_\_\_
4. For the mineral quartz, identify the following:  
Luster: \_\_\_\_\_ Hardness: \_\_\_\_\_ Breakage: \_\_\_\_\_ Composition: \_\_\_\_\_
5. For the mineral galena, identify the following:  
Luster: \_\_\_\_\_ Hardness: \_\_\_\_\_ Breakage: \_\_\_\_\_ Composition: \_\_\_\_\_
6. Which minerals can scratch glass, has a non-metallic luster, has fracture and is a dark red color?
7. Which mineral can be easily scratched by a finger nail, has cleavage, a metallic luster and has a black streak?

## PRACTICE PACKET: TOPIC 3 Minerals & Rocks

### Minerals Regents Questions

8. The mineral mica breaks evenly along flat sheets mainly because of its
- a. density                      b. chemical composition      c. atomic arrangement      d. hardness
9. According to the ESRTs, which element is most abundant in the Earth's crust?
- a. silicon                      b. oxygen                      c. nitrogen                      d. hydrogen
10. Which property is most useful in mineral identification?
- a. Size                      b. color                      c. texture                      d. hardness
11. Certain minerals usually break along flat surfaces, while other minerals break unevenly. This characteristic is due to the
- a. luster of the mineral                      c. force with which the mineral is broken  
b. age of the mineral                      d. internal arrangement of the mineral's atoms

Base your answers to questions 12-15 on your knowledge of Earth Science and the Properties of Common Minerals chart in the ESRT.

12. A company decides to expand its business by manufacturing sandpaper. What mineral listed on the Common Properties of Common Minerals chart would be a good one to use? Explain why?
13. A student puts a drop of cold, dilute hydrochloric acid on a mineral. But no reaction occurs. When a piece of the same mineral is ground into a powder and a drop of the same acid is applied, a bubbling reaction occurs. What might this mineral be?
14. Describe two ways galena and pyrite are similar and two ways they are different?
15. A student with no special equipment to use is given two colorless crystals. One of the crystals is the mineral halite and the other is calcite. How could the student identify which mineral is which?

ASSESS YOURSELF ON THIS LESSON: \_\_\_\_\_/20

If you missed more than 3, do the Additional Practice. If not, go on to the next hw video!!!

1. According to the Properties of Common Minerals Earth Science reference table, which mineral scratches dolomite and is scratched by olivine?
- a. muscovite mica                      b. potassium feldspar                      c. quartz                      d. galena
2. The mineral mica breaks evenly along flat sheets mainly because of its
- a. atomic arrangement                      b. chemical composition                      c. hardness                      d. density

**PRACTICE PACKET: TOPIC 3 Minerals & Rocks**

3. Which two minerals are commercial sources of iron?
  - a. galena and graphite
  - b. garnet and fluorite
  - c. muscovite mica and biotite mica
  - d. hematite and magnetite
  
4. According to the Properties of Common Minerals Earth Science reference table, which mineral leaves a green-black powder when rubbed against an unglazed porcelain plate?
  - a. hematite
  - b. galena
  - c. graphite
  - d. pyrite

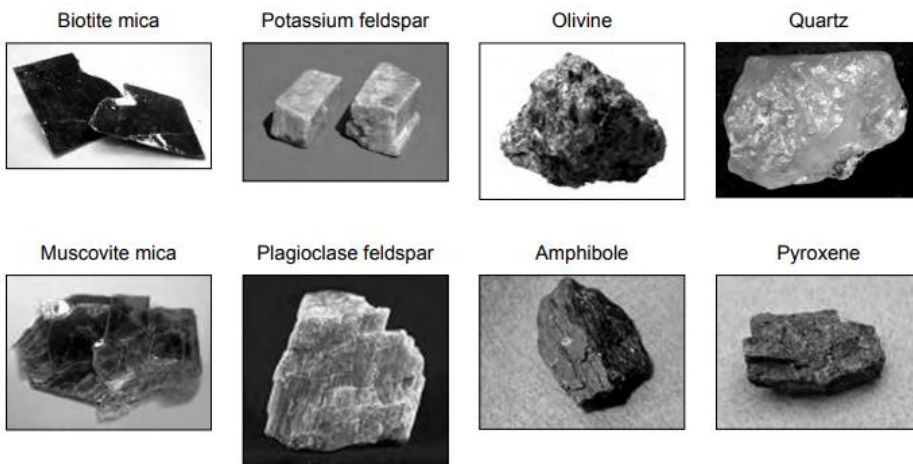
Base your answers to questions 5 through 7 on the mineral chart below and on your knowledge of Earth science. The mineral chart lists some properties of five minerals that are the major sources of the same metallic element that is used by many industries.

**Mineral Chart**

Mineral Name	Composition	Density (g/cm <sup>3</sup> )	Hardness	Streak	Nonmetallic Luster	Common Colors
brucite	Mg(OH) <sub>2</sub>	2.4	2.5-3	white	glassy to waxy	white
carnallite	KMgCl <sub>3</sub> •6H <sub>2</sub> O	1.6	2.5	white	greasy	white
dolomite	CaMg(CO <sub>3</sub> ) <sub>2</sub>	2.8	3.5-4	white	glassy to waxy	shades of pink
magnesite	MgCO <sub>3</sub>	3.1	3.5-4.5	white	glassy	white
olivine	(Fe,Mg) <sub>2</sub> SiO <sub>4</sub>	3.3	6.5	white	glassy	green

5. Which two minerals have compositions that are most similar to calcite?
  - a. brucite and carnallite
  - b. carnallite and dolomite
  - c. dolomite and magnesite
  - d. magnesite and olivine
  
6. Which mineral might scratch the mineral fluorite, but would not scratch the mineral amphibole?
  - a. brucite
  - b. carnallite
  - c. magnesite
  - d. olivine
  
7. Which mineral has a different common color from its color in powdered form?
  - a. brucite
  - b. magnesite
  - c. carnallite
  - d. olivine

Base your answers to questions 8 through 10 on the photographs below and on your knowledge of Earth science. The photographs show eight common rock-forming minerals.



8. Identify the mineral shown that can scratch all of the other minerals shown.
  
9. Identify the two most abundant elements, by mass, in Earth's crust that are part of the composition of all eight of these minerals.

10. Identify the two minerals shown that exhibit fracture as a dominant form of breakage.

ASSESS YOURSELF ON THIS ADDITIONAL PRACTICE: \_\_\_\_\_/10

If you missed more than 2 you should see me for extra help and/or re-watch the lesson video assignment and/or watch the podcast link on the ESRT page on the website.

# PRACTICE PACKET: TOPIC 3 Minerals & Rocks

## Lesson 2 - Igneous Rocks

### Objective:

- I can name the three different types of rocks
- I can explain how rocks are classified
- I can name how an Igneous rock formed
- I can explain the difference between intrusive & extrusive
- I can explain the difference between mafic & felsic
- I can describe the different textures
- I can use the Igneous Rock Chart

**Directions:** Using your *Igneous Rock Identification Scheme* from your ESRT's answer the following questions.

**Note:** An important key to classifying igneous rocks is their *Environment of Formation*. In other words, where did the rock originally solidified; from magma or lava.

1. What are the names of the 2 major classification groups for igneous rocks that are based on where the rock formed? Include the alternate name (in parenthesis) for each. **(highlight them)**  
\_\_\_\_\_ and \_\_\_\_\_
  - a. Which environment is far beneath Earth's surface? \_\_\_\_\_
  - b. Which environment is at or near Earth's surface? \_\_\_\_\_
  - c. With a gray color pencil, trace over and darken the line that separates intrusive and extrusive rocks.
  - d. What environment did Granite form in? \_\_\_\_\_
  - e. What environment did Basalt form in? \_\_\_\_\_
  - f. What environment did Obsidian form in? \_\_\_\_\_

**Note:** Cooling history of an igneous rock (i.e. the time it takes for the rock to solidify from magma or lava), determines the size of the crystals (minerals) in the rock.

- Rocks that cool underground cool more slowly and have larger crystals.
  - Rocks that cool above ground cool more quickly and have smaller crystals or no visible crystals.
2. Using a green color pencil, lightly shade in the first row, starting with obsidian and going all the way to the right of the row through the words "Non-vesicular".
  3. Using an orange color pencil, lightly shade in the next row, starting with pumice and going all the way to the right of the row through the word "vesicular".
    - a. What does vesicular contain? \_\_\_\_\_

### PRACTICE PACKET: TOPIC 3 Minerals & Rocks

4. Using a blue color pencil, lightly shade in the next row, starting with Vesicular Rhyolite and going all the way to the right of the row through the word "vesicular".
5. Using a pink color pencil, lightly shade in the next row, starting with Rhyolite and going all the way to the right of the row through the word "non-vesicular". Only shade in the top half for Diabase.
6. Using a light green color pencil, lightly shade in the next row, starting with Granite and going all the way to the right of the row through the word "non-vesicular". Only shade in the bottom half for Diabase.
7. Using a purple color pencil, lightly shade in the next row, starting with Pegmatite and going all the way to the right of the row through the word "non-vesicular".
8. Explain the relationship between environment of formation, texture, & crystal size.
  - a. Intrusive: \_\_\_\_\_
  - b. Extrusive: \_\_\_\_\_
9. Using a highlighter trace over the word "Lighter" through the entire line and the word "Color". Continue through the word "Darker". This line indicates the general color of the rocks.
10. Using a highlighter trace over the word "Lower" through the entire line and the word "Density" until you reach the end. Highlight the word "Higher". This line indicates the relative densities of the rocks.
11. Using a highlighter trace over the word "Felsic" through the entire line and the word "Composition" until you reach the end. Highlight the word "Mafic". This line indicates the relative composition of the rocks.
  - a. What two elements are Felsic rocks "rich in"? \_\_\_\_\_ and \_\_\_\_\_
  - b. State the color & density of Felsic rocks. \_\_\_\_\_ color & \_\_\_\_\_ density
  - c. What two elements are Mafic rocks "rich in"? \_\_\_\_\_ and \_\_\_\_\_
  - d. State the color & density of Mafic rocks. \_\_\_\_\_ color & \_\_\_\_\_ density

**Note:** The reason the color, density and composition are the same for rocks on the same side of the chart is that the minerals those rocks contain are also the same. Go to the last section at the bottom of the chart. This section lists the mineral composition of the igneous rocks above.

12. Highlight "Mineral Composition" on the left side of the bottom chart.
  - a. Using a pencil, darken in the line between Vesicular Rhyolite and Vesicular Andesite. Go all the way through the mineral composition portion of the chart.
  - b. Using a pencil, darken in the line between Obsidian and Basalt Glass. Go all the way through the mineral composition portion of the chart.
  - c. Using a pencil, darken in the line between Diabase and Peridotite. Go all the way through the mineral composition portion of the chart.

**PRACTICE PACKET: TOPIC 3 Minerals & Rocks**

- d. Using a pencil, darken in the line between Peridotite and Dunite. Go all the way through the mineral composition portion of the chart.
- e. In the table below, list the seven minerals listed in the Mineral Composition section of the Igneous rock chart. Refer to the Earth Science Reference Tables, "Properties of Common Minerals" and place an "X" in the box to indicate the elements that are present in each mineral. All of the elements for each of the minerals are not listed, mark the ones that are.

Mineral Name	Silicon (Si)	Oxygen (O)	Magnesium (Mg)	Potassium (K)	Aluminum (Al)	Iron (Fe)
Potassium Feldspar	X	X	X	X	X	

- f. What two elements do each of the above minerals contain? \_\_\_\_\_ & \_\_\_\_\_
- i. Why? What is special about those elements?

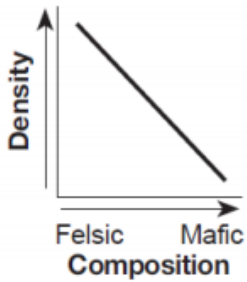
**Regents Questions:**

1. According to the *Earth Science Reference Tables*, which minerals could both be contained in the rocks gabbro and granite?
  - a. quartz and pyroxene
  - b. mica and amphibole
  - c. orthoclase and olivine
  - d. plagioclase and nepheline
2. According to the *Earth Science Reference Tables*, gabbro is composed mainly of
  - a. plagioclase feldspars and pyroxene
  - b. amphibole and nepheline
  - c. mica and olivine
  - d. orthoclase feldspar and quartz
3. Most igneous rocks form by which processes?
  - a. melting and solidification
  - b. heat and pressure
  - c. erosion and deposition
  - d. compaction and cementation
4. An igneous rock which has crystallized deep below the Earth's surface has the following approximate composition: 70% pyroxene, 15% plagioclase, and 15% olivine. According to the *Earth Science Reference Tables*, what is the name of this igneous rock?
  - a. granite
  - b. rhyolite
  - c. gabbro
  - d. basalt
5. Extremely small crystal grains in an igneous rock are an indication that the crystals formed
  - a. under high pressure
  - b. over a short period of time
  - c. from an iron-rich magma
  - d. deep below the surface of the Earth



**PRACTICE PACKET: TOPIC 3 Minerals & Rocks**

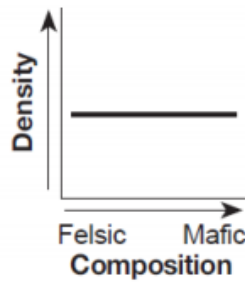
6. Which graph best shows the relationship between the compositions of different igneous rocks and their densities?



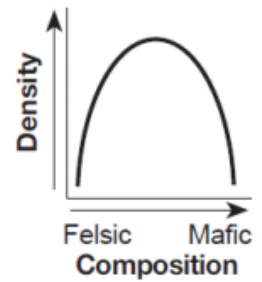
a.



b.



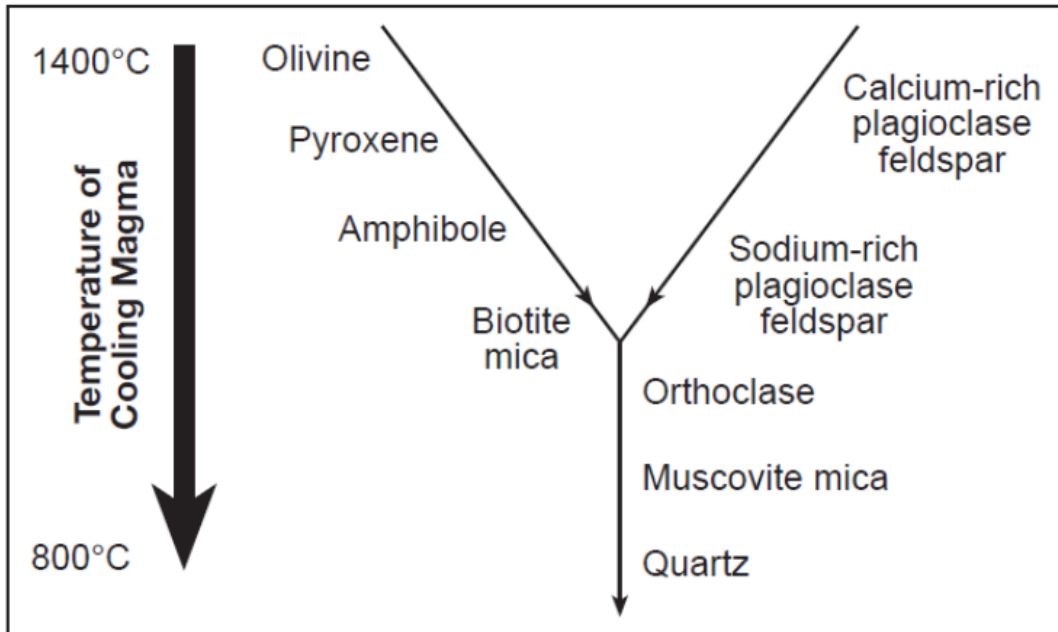
c.



d.

7. The diagram of Bowen's Reaction Series below indicates the relative temperatures at which specific minerals crystallize as magma cools.

**Bowen's Reaction Series**  
(Temperatures at which minerals crystallize)

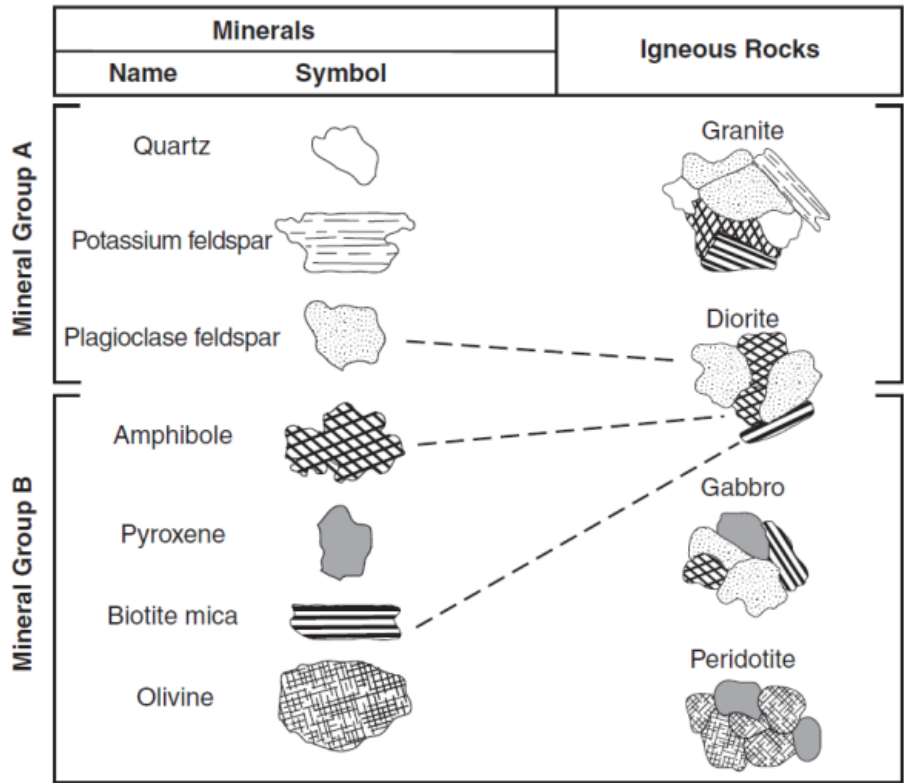


Which statement is best supported by Bowen's Reaction Series?

- (1) Most minerals crystallize at the same temperature.
  - (2) Most felsic minerals usually crystallize before most mafic minerals.
  - (3) Muscovite mica and quartz are the last minerals to crystallize as magma cools.
  - (4) Biotite mica is the first mineral to crystallize as magma cools.
8. Identify *one* dark-colored, mafic igneous rock with a vesicular texture that is likely to be found on the surface of Iceland.
9. Two rocks, scoria and basalt, have formed from the cooled lava that erupted from the volcano, Nyiragongo. Describe the texture of *each* rock.

**PRACTICE PACKET: TOPIC 3 Minerals & Rocks**

Base your answers to questions 10 through 12 on the diagram and on your knowledge of Earth science. The diagram represents several common rock-forming minerals and some of the igneous rocks in which they commonly occur. The minerals are divided into two groups, *A* and *B*. Dashed lines connect the diagram of diorite to the three minerals that are commonly part of diorite's composition.



- On the diagram, draw *five* lines to connect the diagram of granite to the symbols of the minerals that are commonly part of granite's composition.
- Describe *one* characteristic of the minerals in group *A* that makes them different from the minerals in group *B*.
- Based on the *Earth Science Reference Tables*, identify *one* other mineral found in some samples of diorite that is *not* shown in the diorite sample in the diagram.

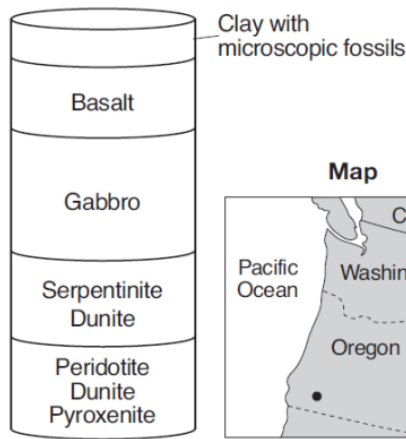
**ASSESS YOURSELF ON THIS LESSON: \_\_\_\_\_/12**  
 If you missed more than 3, do the Additional Practice. If not, go on to the next hw video!!!

- A fine-grained igneous rock contains 11% plagioclase, 72% pyroxene, 15% olivine, and 2% amphibole. This rock would be classified as
  - Granite
  - rhyolite
  - gabbro
  - Basalt
- List *three* minerals that are likely present in granite rock.
- According to the "Scheme for Igneous Rock Identification" in the *Earth Science Reference Tables*, basalt contains the greatest quantity of which mineral?
  - pyroxene
  - Mica
  - orthoclase
  - quartz

## PRACTICE PACKET: TOPIC 3 Minerals & Rocks

Base your answers to questions 16 through 17 on the passage, diagram of an ophiolite drill-core sample, and map below and on your knowledge of Earth science. The dot on the map represents the location where the ophiolite drill-core sample was taken.

Oregon Ophiolite Drill-Core Sample



(Not drawn to scale)

### Ophiolites

In some places, segments of oceanic crust, sediment, upper mantle, and rock have been heaved up by tectonic movements onto the edges of continents, where they often become part of mountains. These displaced oceanic lithosphere segments are called ophiolites. They provide an opportunity to study the composition of oceanic lithosphere and are a key feature in recognizing past tectonic plate convergence along subduction zones. Drill-core samples of ophiolites typically have the layering pattern shown in the drill-core sample at left.

16. What are the approximate crystal sizes in basalt and gabbro found in the Oregon drill-core sample?
17. Describe how the mineral composition of dunite is different from the mineral composition of peridotite.
18. The igneous rock gabbro most likely formed from molten material that cooled
- rapidly at Earth's surface
  - slowly at Earth's surface
  - rapidly, deep underground
  - slowly, deep underground
19. The photograph shows an outcrop where a light-colored, igneous rock is cross cut by a dark-colored, igneous rock.
- This fine-grained, dark-colored, igneous rock is most likely
- rhyolite
  - basalt
  - diorite
  - gabbro
20. The best evidence for determining the cooling rate of an igneous rock during its solidification is provided by
- index fossils
  - the crystal size of its minerals
  - faults in the rock
  - the disintegration of radioactive substances



ASSESS YOURSELF ON THIS ADDITIONAL PRACTICE: \_\_\_\_\_/8

If you missed more than 2 you should see me for extra help and/or re-watch the lesson video assignment and/or watch the podcast link on the ESRT page on the website.

# PRACTICE PACKET: TOPIC 3 Minerals & Rocks

## Lesson 3 - Sedimentary Rocks

### Objective:

- I can name how a sedimentary rocks form
- I can describe the three different types of sedimentary rocks
- I can describe characteristics of sedimentary rocks
- I can use the Sedimentary Rock Chart

**Directions:** Using your *Sedimentary Rock Identification Scheme* from your ESRT's answer the following questions.

1. What are the two major groups of sedimentary rocks?
  2. Which of these 2 groups is broken down into smaller groups by grain size?
  3. Using a purple colored pencil, color in the column for "grain size" on the top section ONLY
  4. Which of these 2 groups is broken into smaller groups by composition?
  5. Color in the column for "composition" purple on the bottom section ONLY
  6. Two clastic textured rocks have mixed size pieces from clay to boulders. Which has rounded fragments? \_\_\_\_\_
  7. Which clastic rock is made of clay? \_\_\_\_\_
  8. What is the grain size range of siltstone? \_\_\_\_\_
  9. What size particles which make up shale? \_\_\_\_\_
  10. What does **composition** mean? \_\_\_\_\_
  11. What mineral is rock salt composed of? \_\_\_\_\_
  12. What mineral is limestone composed of? \_\_\_\_\_
  13. What four rocks form from chemical precipitates and evaporites? \_\_\_\_\_,  
\_\_\_\_\_, \_\_\_\_\_ and  
\_\_\_\_\_.
  14. What rock has a map symbol that looks like graph paper? \_\_\_\_\_
  15. Draw the map symbol for limestone here.
- ✓ Check Point
- a. What is another name for Clastic rocks? \_\_\_\_\_

## PRACTICE PACKET: TOPIC 3 Minerals & Rocks

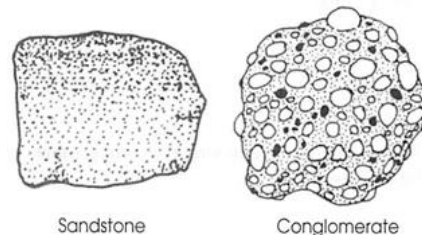
- b. How are Clastic sedimentary rocks classified? \_\_\_\_\_
- c. By what process did Clastic rocks form? \_\_\_\_\_
- d. How are Crystalline and Bioclastic sedimentary rocks classified? \_\_\_\_\_
- e. By what process do crystalline rocks form? \_\_\_\_\_
- f. Name the sedimentary rock that bubbles if HCl is placed on it. \_\_\_\_\_
  - i. Explain why \_\_\_\_\_

### Regents Questions:

1. One difference between a breccia rock and a conglomerate rock is that the particles in a breccia rock are
  - a. more aligned
  - b. more angular
  - c. harder
  - d. land derived
2. Indicate the range of grain sizes in bedrock composed of sandstone. \_\_\_\_\_
3. A limestone layer is composed mostly of what mineral? \_\_\_\_\_
4. Which rock is composed of the mineral halite that formed when seawater evaporated?
  - a. limestone
  - b. dolostone
  - c. rock gypsum
  - d. rock salt
5. Which sedimentary rock is composed of fragmented skeletons and shells of sea organisms compacted and cemented together?
  - a. shale
  - b. limestone
  - c. sandstone
  - d. gypsum
6. Rock layers showing ripple marks, cross-bedding, and fossil shells indicate that these layers were formed
  - a. from solidification of molten material
  - b. from deposits left by a continental ice sheet
  - c. by high temperature and pressure
  - d. by deposition of sediments in a shallow sea
7. Which rock most likely formed as a result of biologic processes?
  - a. granite
  - b. basalt
  - c. sandstone
  - d. limestone
8. Which characteristic determines whether a rock is classified as a shale, a siltstone, a sandstone, or a conglomerate?
  - a. the absolute age of the sediments within the rock
  - b. the mineral composition of the sediments within the rock
  - c. the particle size of the sediments within the rock
  - d. the density of the sediments within the rock
9. According to the *Scheme for Sedimentary Rock Identification*, particles of which size could have formed shale?
  - a. 0.2 cm
  - b. 0.02 cm
  - c. 0.002 cm
  - d. 0.0002 cm

**PRACTICE PACKET: TOPIC 3 Minerals & Rocks**

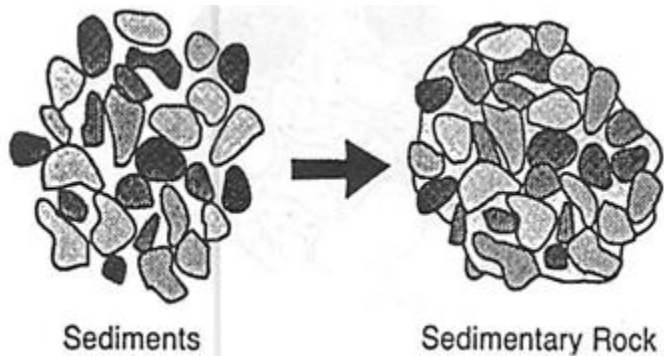
10. In one or more sentences state one way the rock types pictured are similar and one way they differ.



Sandstone

Conglomerate

Base your answers to questions to 11 & 12 on the diagram below which represents the formation of a sedimentary rock. [actual size]



11. The formation of which sedimentary rock is shown in the diagram?

- a. Conglomerate
- b. Sandstone
- c. Siltstone
- d. Shale

12. Which two processes formed this rock?

- a. Folding and faulting
- b. melting and solidification
- c. Compaction and cementation
- d. heating and application of pressure

13. According to the ESRT, which sedimentary rock most likely formed as an evaporate?

- a. Siltstone
- b. Gypsum
- c. Conglomerate
- d. Shale

14. What rock is formed by the compression and cementation of sediments with particle size ranging from 0.08 to 0.1 centimeter?

- a. Basalt
- b. Conglomerate
- c. Granite
- d. Sandstone

15. Which of the following is **not** chemically or organically formed?

- a. Limestone
- b. Coal
- c. Siltstone
- d. rock salt

ASSESS YOURSELF ON THIS LESSON: \_\_\_\_\_/15

If you missed more than 3, do the Additional Practice. If not, go on to the next hw video!!!

16. Which rock type most often contains fossils?

- a. gabbro
- b. quartzite
- c. limestone
- d. Metaconglomerate

17. Which process most likely formed a layer of the sedimentary rock, gypsum?

- a. precipitation from seawater
- b. folding of clay-sized particles
- c. solidification of magma
- d. melting of sand-sized particles

18. A sedimentary rock sample has the same basic mineral composition as granite. Describe *one* observable characteristic of the sedimentary rock that is different from granite.

19. Which kind of sedimentary rock may be formed both chemically and organically?

- a. limestone
- b. rock gypsum
- c. rock salt
- d. bituminous coal

**PRACTICE PACKET: TOPIC 3 Minerals & Rocks**

20. Which group lists rocks in order of grain size from smallest to largest?
- a. conglomerate, sandstone, shale
  - b. shale, sandstone, conglomerate
  - c. sandstone, shale, conglomerate
  - d. shale, conglomerate, sandstone
21. Which process most likely formed a layer of sedimentary rock gypsum?
- a. precipitation from seawater
  - b. solidification of magma
  - c. folding of clay-sized particles
  - d. melting of sand-sized particles

ASSESS YOURSELF ON THIS ADDITIONAL PRACTICE: \_\_\_\_\_/6

If you missed more than 2 you should see me for extra help and/or re-watch the lesson video assignment and/or watch the podcast link on the ESRT page on the website.

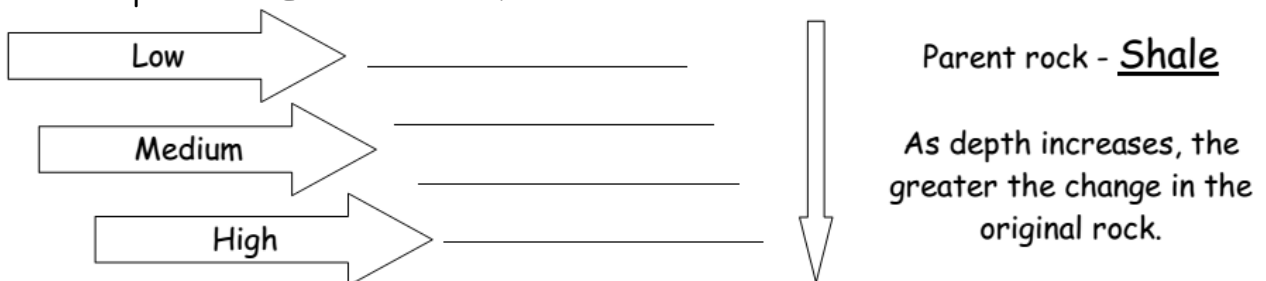
**Lesson 4 - Metamorphic Rocks**

**Objective:**

- I can name how a metamorphic rocks form
- I can describe the two types of metamorphic rocks
- I can describe metamorphic rock textures
- I can use the Metamorphic Rock Chart

**Directions:** Using your *Metamorphic Rock Identification Scheme* from your ESRT's answer the following questions.

1. This table is divided into two basic sections. Name the two main categories for metamorphic rocks (listed under texture).
2. The foliated section is broken up into two additional categories, what are they?
3. What type of metamorphism do these foliated rocks go through?
4. Looking at the comments, as heat and pressure increases what happens to the "grade" of metamorphism?
5. Referring to the comment section again, name the rock that is formed from "Low-grade metamorphism" of Slate. This rock is considered the "parent" rock for Slate.
6. The deeper underground, the more heat and pressure and the greater the change. There are four rocks listed on the top section of the Metamorphic Rock Chart. Place the rock names in order in the blanks below. This illustrates the amount change that occurred to the original (parent) rock Shale as depth within Earth increased.



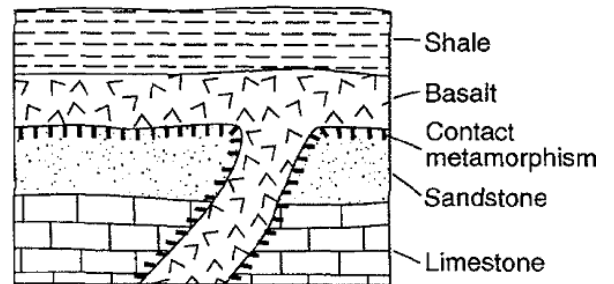
**PRACTICE PACKET: TOPIC 3 Minerals & Rocks**

- 7. What is the composition of Anthracite coal? \_\_\_\_\_
- 8. Name the parent rock of Anthracite coal. \_\_\_\_\_
- 9. What is the composition of Quartzite? \_\_\_\_\_
- 10. What is the parent rock for Quartzite? \_\_\_\_\_
- 11. What is the composition of Marble? \_\_\_\_\_ and/or \_\_\_\_\_
- 12. What is the parent rock of Marble? \_\_\_\_\_ or \_\_\_\_\_
- 13. Name the mineral in marble that bubbles in acid. \_\_\_\_\_
- 14. Name the mineral in marble that bubbles in acid when powdered. \_\_\_\_\_
- 15. What is the composition of Metaconglomerate? \_\_\_\_\_
- 16. What is the parent rock of a Metaconglomerate? \_\_\_\_\_
- 17. Name the Metamorphic rock that is formed only by contact metamorphism. \_\_\_\_\_

There are two types of metamorphism. The first type is regional metamorphism that occurs when large areas of rock are under intense heat and pressure. This is associated with mountain building. The second type is contact metamorphism. This occurs when molten rock comes in contact with surrounding rock. Heat alters the rock it comes in contact with (but does not melt it). Contact metamorphism is usually found between Igneous and Sedimentary Rocks.

- 18. The diagram below illustrates where contact metamorphism takes place. Color the Basalt red to show that it came from solidification of magma.
- 19. Highlight the "hasher" marks that indicate the contact metamorphism.

- 20. What type of rock is Basalt? \_\_\_\_\_
- 21. What type of rock is Shale, Sandstone and Limestone?



- 22. Between which two rock types is the contact metamorphism located?
- 23. What metamorphic rock was created in the zone of contact metamorphism?

**Regents Questions:**

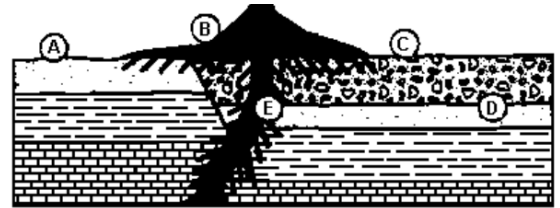
- 1. If granite were subjected to intense heat and pressure, it would most likely change to
  - a. conglomerate
  - b. sandstone
  - c. gneiss
  - d. Basalt
- 2. Which rock is foliated, shows mineral alignment but not banding, and contains medium-sized grains of quartz and pyroxene?
  - a. phyllite
  - b. schist
  - c. gneiss
  - d. quartzite



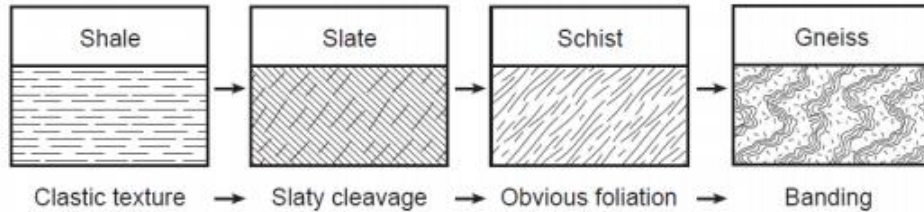
**PRACTICE PACKET: TOPIC 3 Minerals & Rocks**

3. Where are metamorphic rocks frequently found?
  - a. on mountain tops that have horizontal layers containing marine fossils
  - b. within large lava flows
  - c. as a thin surface layer covering huge areas of the continents
  - d. along the interface between igneous intrusions and sedimentary rocks
  
4. Which mineral is commonly found in the three metamorphic rocks slate, schist, and gneiss?
  - a. pyroxene
  - b. feldspar
  - c. quartz
  - d. mica

5. The diagram represents a geologic cross-section. At which location would quartzite most likely be found?
  - a. A
  - b. B
  - c. E
  - d. D

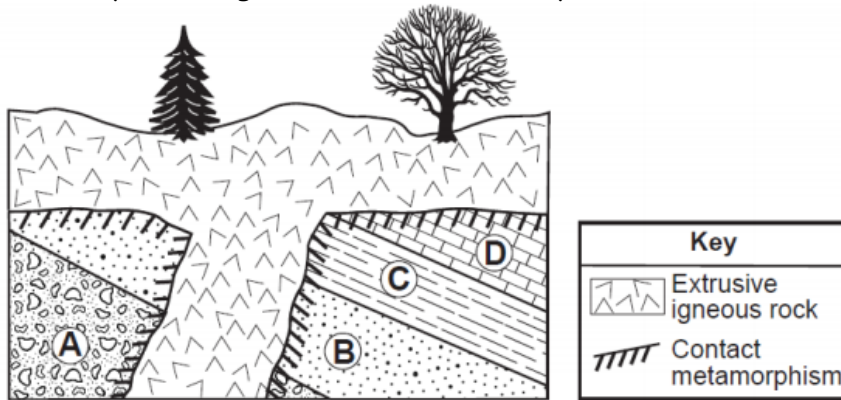


6. The diagram below indicates physical changes that accompany the conversion of shale to gneiss.



Which geologic process is occurring to cause this conversion?

7. In the diagram below, identify the name of the contact metamorphic rock formed at the boundary of the igneous rock and rock layer A, B, C, & D.



(Not drawn to scale)

- A: \_\_\_\_\_  
 B: \_\_\_\_\_  
 C: \_\_\_\_\_  
 D: \_\_\_\_\_

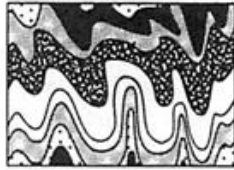
8. Slate is formed by the
  - a. deposition of chlorite and mica
  - b. metamorphism of shale
  - c. foliation of schist
  - d. folding and faulting of gneiss
  
9. If schist had been exposed to greater heat and pressure during metamorphism, it could have formed
  - a. Gneiss
  - b. marble
  - c. quartzite
  - d. phyllite

**PRACTICE PACKET: TOPIC 3 Minerals & Rocks**

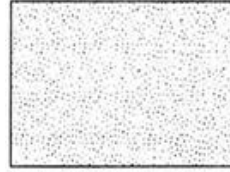
10. Which diagram best represents a sample of the metamorphic rock gneiss?



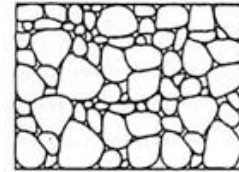
a.



b.



c.

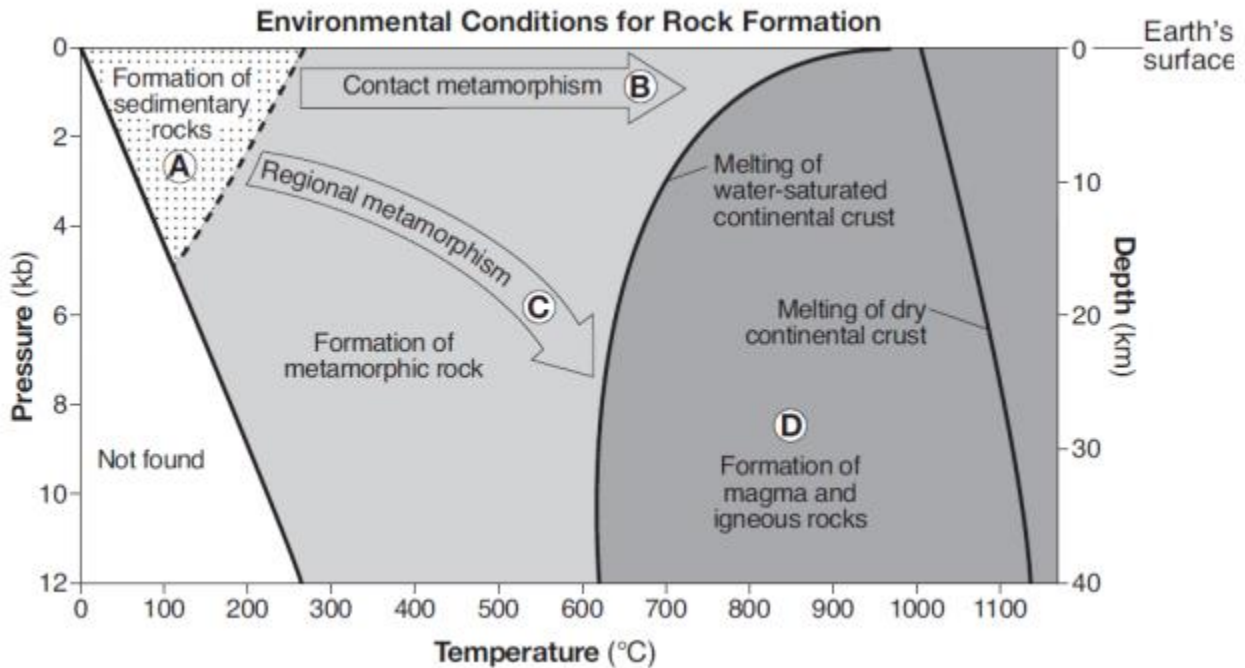


d.

11. Metamorphic rocks result from the

- a. Erosion of rocks
- b. Recrystallization of rocks
- c. Cooling & solidification of molten magma
- d. Compression and cementation of soil particles

Base your answers to questions 12 through 14 on the graph below and on your knowledge of Earth science. The graph shows the temperature, pressure, and depth environments for the formation of the three major rock types. Pressure is shown in kilobars (kb). Letters A through D identify different environmental conditions for rock formation.



12. 40 Which rock is most likely to form directly from rock material at a depth of 30 km and a temperature of 1000°C?

- a. quartzite
- b. scoria
- c. shale
- d. granite

13. Which letter represents the environmental conditions necessary to form gneiss?

- a. A
- b. B
- c. C
- d. D

14. At what pressure and temperature is sand most likely to be compacted into sandstone?

- a. 2 kb and 150°C
- b. 10 kb and 400°C
- c. 6 kb and 200°C
- d. 12 kb and 900°C

ASSESS YOURSELF ON THIS LESSON: \_\_\_\_\_/14

If you missed more than 3, do the Additional Practice. If not, go on to the next hw video!!! 18

## PRACTICE PACKET: TOPIC 3 Minerals & Rocks

15. While a geology student was walking along several outcrops, she found a rock specimen that showed the following characteristics:

**Grain Size** - coarse

**Texture** - foliated

**Composition** - quartz, feldspar, amphibole, garnet, and pyroxene

This specimen should be identified as

- a. hornfels                      b. slate                      c. gneiss                      d. Anthracite
16. The metamorphism of a sandstone rock will cause the rock to
- a. Be melted                      c. become more dense  
b. Contain more fossils                      d. occupy a greater volume

17. The photograph shows a large outcrop of rock composed primarily of visible crystals of mica, quartz, and feldspar. Based on the composition and foliated texture, this rock can best be identified as

- a. marble                      c. schist  
b. slate                      d. anthracite



## Lesson 5 - Rock Cycle

### Objective:

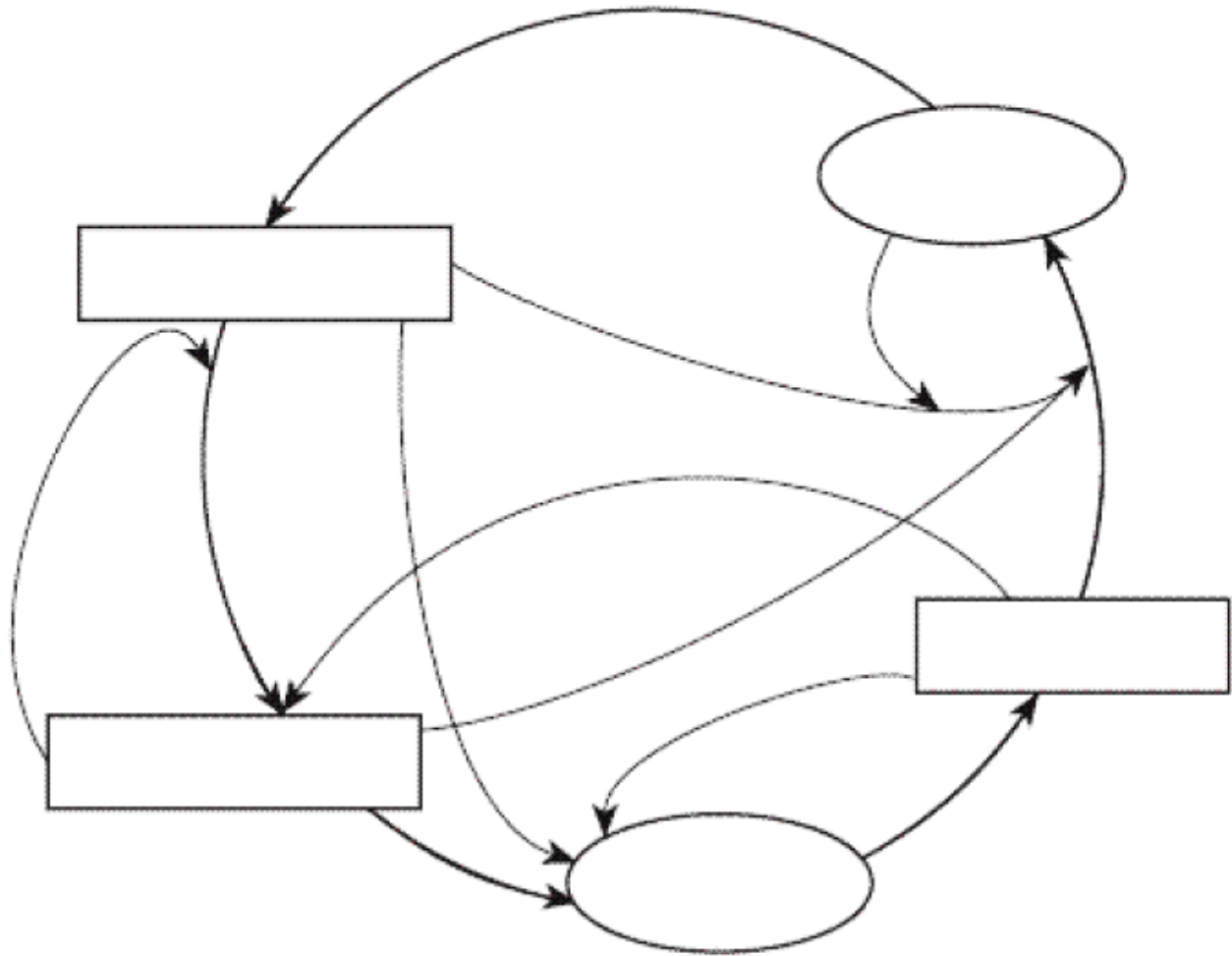
- I can name how the three different rock types formed
- I can use the Rock Cycle chart in the ESRT

1. Rocks are classified as igneous, sedimentary, or metamorphic based primarily on their:
- a. texture      b. crystal or grain size      c. method of formation      d. mineral composition
2. When granite melts and then solidifies, it becomes:
- a. a sedimentary rock      b. an igneous rock      c. a metamorphic rock      d. sediments
3. Some nonsedimentary rocks are formed as a result of:
- a. solidification of molten material                      c. evaporation and precipitation  
b. cementation of particles                      d. deposition of particles
4. Which statement is best supported by the information provided in the reference diagram of the *Rock Cycle in Earth's Crust*?
- a. Igneous rocks are formed from eroded sediments of metamorphic rocks.  
b. Sedimentary rocks are composed of intergrown crystals.  
c. Metamorphic rocks are formed by the complete melting of any other rock.  
d. Rocks may be formed from other rocks by various processes.

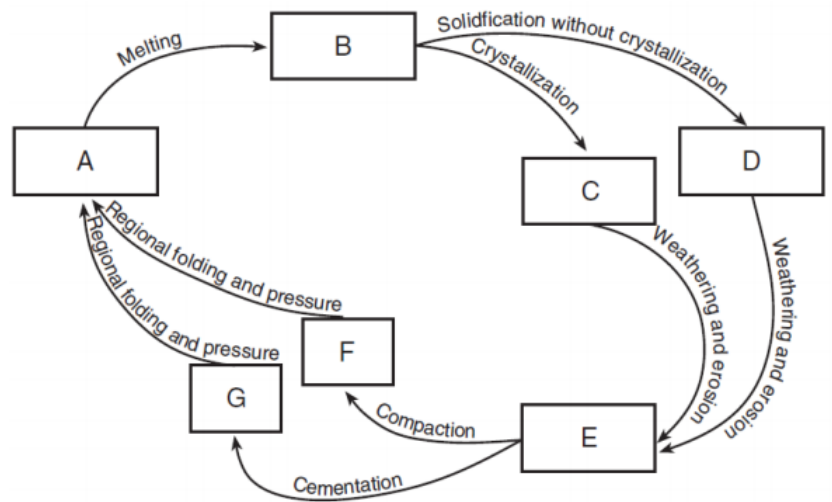
**PRACTICE PACKET: TOPIC 3 Minerals & Rocks**

**Directions:** Using your *Rock Cycle in Earth's Crust Diagram* from your ESRT's, COMPLETELY fill in the blank diagram below.

**The Rock Cycle**



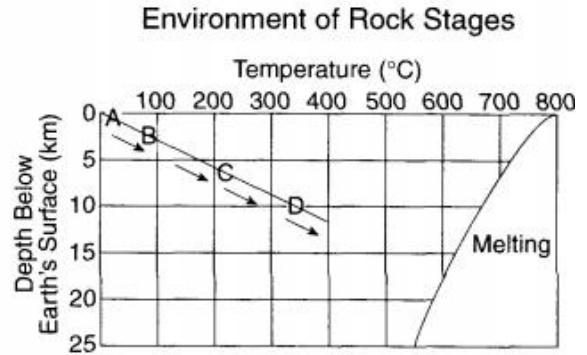
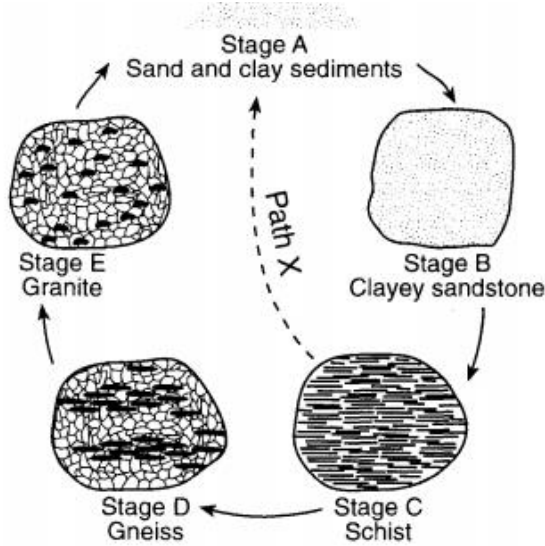
Base your answers to questions 5 and 6 on the flowchart below and on your knowledge of Earth science. The boxes labeled A through G represent rocks and rock materials. Arrows represent the processes of the rock cycle.



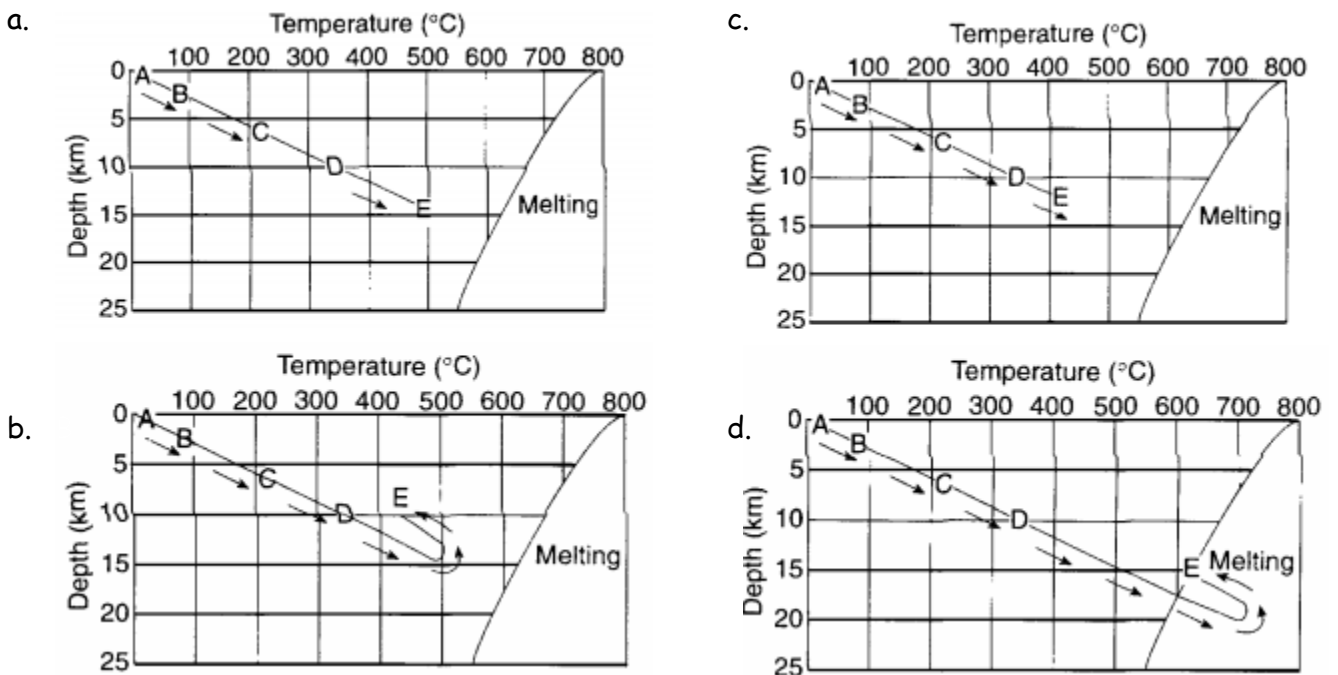
5. Which lettered box could represent the rock conglomerate?
  - a. E
  - b. G
  - c. C
  - d. D
  
6. Metamorphic rocks are represented by which lettered box in the flowchart?
  - a. A
  - b. B
  - c. E
  - d. F

**PRACTICE PACKET: TOPIC 3 Minerals & Rocks**

7. Base your answer to the following question on the diagrams below which represents the same rock material at five stages of development. The graph below shows the temperature and depth of burial at which stages A through D develop. Stage E has intentionally been omitted from the graph.



Which graph correctly shows where magma would begin to crystallize into granite (stage E)?



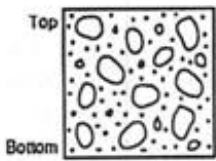
8. Which statement about the formation of a rock is best supported by the rock cycle?
- Magma must be weathered before it can change to metamorphic rock.
  - Sediment must be compacted and cemented before it can change to sedimentary rock.
  - Sedimentary rock must melt before it can change to metamorphic rock.
  - Metamorphic rock must melt before it can change to sedimentary rock.

ASSESS YOURSELF ON THIS LESSON: \_\_\_\_\_/23

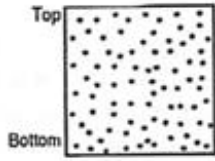
If you missed more than 4, do the Additional Practice. If not, go on to the next hw video!!!

**PRACTICE PACKET: TOPIC 3 Minerals & Rocks**

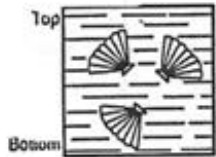
Base your answers to questions 9 & 10 on the six illustrations below which represent six different rock types.



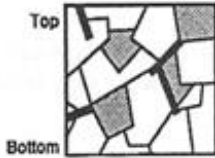
ROCK A: cemented sand and rounded pebbles



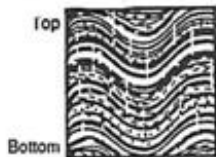
ROCK B: uniform smooth sand grains firmly cemented together



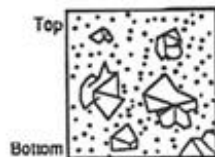
ROCK C: a matrix of fine colloidal-sized particles with shell fossils



ROCK D: large intergrown mineral crystals



ROCK E: crumpled, distorted bands of different minerals



ROCK F: cemented sand and angular rock fragments

9. Classify each rock sample as igneous, sedimentary, or metamorphic.

Rock A: \_\_\_\_\_

Rock B: \_\_\_\_\_

Rock C: \_\_\_\_\_

Rock D: \_\_\_\_\_

Rock E: \_\_\_\_\_

Rock F: \_\_\_\_\_

10. Explain what characteristic(s) of the rock led to your classification.

Rock A: \_\_\_\_\_

Rock B: \_\_\_\_\_

Rock C: \_\_\_\_\_

Rock D: \_\_\_\_\_

Rock E: \_\_\_\_\_

Rock F: \_\_\_\_\_

ASSESS YOURSELF ON THIS ADDITIONAL PRACTICE: \_\_\_\_\_/12

If you missed more than 3 you should see me for extra help and/or re-watch the lesson video assignment and/or watch the podcast link on the ESRT page on the website.