Metamorphic Rocks and the Rock Cycle

NAME: _____

KICK OFF ACTIVITY	☐ Comparing the 3 Rock Types **(Pg. 2)**

MUST DO ALL

THE FOUNDATION	☐ Metamorphic Rocks Video with Questions **(Mr. White's Webpage)** ☐ ESRT: Metamorphic Rock Identification **(Pg. 3-5)** ☐ ESRT: Metamorphic Rock Identification Questions **(Pg. 6)** ☐ ESRT: Rock Cycle in Earth's Crust **(Pg. 7-8)** ☐ ESRT: Rock Cycle in Earth's Crust Questions **(Pg. 9-10)**
HANDS-ON	☐ Metamorphic Rock Identification Lab **(Pg. 11-12)** ☐ Rock Cycle and Density Lab **(Pg. 13-15)**

DO AT LEAST 2

TUNE-UP ACTIVITIES	☐ Metamorphic Rocks Review Sheet **(Pg. 16-17)** ☐ Additional ESRT Practice: Metamorphic Rocks **(Pg. 18-19)** ☐ Online ESRT Practice: Rock Cycle **(Mr. White's Webpage)** ☐ VIDEO: In-Depth Metamorphic Rock Review **(Mr. White's Webpage)** ☐ VIDEO: In-Depth ESRT page 7 Review **(Mr. White's Webpage)** ☐ VIDEO: In-Depth Rock Cycle Review **(Mr. White's Webpage)**

If you didn't get 100% do more tune-ups!!!

CHECK FOR UNDERSTANDING QUIZZES	SCORE: Quiz 1 _____ Quiz 2 _____ Quiz 3 _____ ***You must get a 100% on a quiz to move on to extension activities.** ***A 100% on a quiz will earn you a grade of 80% for the workbook.**

EXTENSION ACTIVITIES	☐ Online Metamorphic Rock ID **(Pg. 20)** **5 Pts.** ☐ Roger the Rock **(Pg. 21-22)** **10 Pts.** ☐ Virtual Coal Mine or VIDEO: How Do They Do It -Coal Mining **(Pg. 23)** **10 Pts.** ☐ Regents Diagrams- What are they telling me? **(Pg. 24-26)** **5 Pts.**

Comparing the 3 Rock Types
Kick-Off Activity

- Sort your container of rocks into 3 groups: Igneous, Sedimentary, and Metamorphic.
    - Use observable characteristics (what you see) to help you sort them.

Igneous *Record observable characteristics that help you identify these rocks as igneous.*	**Sedimentary** *Record observable characteristics that help you identify these rocks as sedimentary.*	**Metamorphic** *Record observable characteristics that could make these rocks metamorphic.*

ESRT: Metamorphic Rock Identification (Page 7)

Metamorphic rocks have been produced by the processes of **heat and/or pressure**. There are two main types of metamorphism: *Regional* and *Contact* metamorphism.

- **Regional metamorphism** is associated with a large area of metamorphism deep underground, caused by the heat and pressure that is produced when Earth's tectonic plate collide.

- **Contact metamorphism** happens when hot magma or lava comes into contact with rocks, causing a small area to change into a metamorphic rock. Contact metamorphism will be present on the outside edges of igneous intrusions. It is here where the heat of the molten material comes into contact with existing layers of rocks and recrystallizes them. In both types of metamorphism, a preexisting rock is changed to a new metamorphic rock that has different properties.

Materials Needed: Laminated copy of the Scheme for Metamorphic Rock Identification and a dry-erase marker

A. Texture Column: The first column on the chart is labeled **Texture**.

1) Draw a box around the texture column.

2) Notice that the column is divided into two sections based on texture type: **Foliated** and **Nonfoliated**.

3) Foliated texture is subdivided into: _____ and _____.

4) ***Erase the box you have drawn.***

Upper Chart:

B. Foliated Texture - Foliated texture is subdivided into Mineral Alignment and Banding. For **Mineral Alignment** texture, heat and pressure has caused the minerals to line up. **Banding** texture is where minerals are lined up in alternating light and dark mineral bands.

5) Draw a box around the section of the chart that contains foliated metamorphic rocks.

6) List the names of the 4 foliated metamorphic rocks: _____, _____

_____, _____

7) Draw a box that follows the row for **banding** all the way across the chart. What is the name of the metamorphic rock that shows banding? _____

8) ***Erase the boxes you have drawn.***

C. The Composition column - The shaded bars represent the different minerals found in the four metamorphic rocks shown on the right of the chart. For example, **slate** would have only **mica** in it.

9) Draw a box around the **row for phyllite**. What minerals are found in phyllite? _____, _____, _____, _____, _____

10) ***Erase the box you have drawn.***

D. Type of Metamorphism column

11) Draw a box around the column labeled "**Type of Metamorphism**". Notice that all of the rocks listed in this part of the chart were made by regional metamorphism.

12) The downward pointing arrow indicates that as pressure and heat **increases**, the rocks change from slate to phyllite to _____, and finally to _____.

E. Comments column -Use these comments to help you identify an unknown metamorphic rock. Notice that slate originated from shale, a sedimentary rock. Also, banding is described in the Gneiss Comments section.

13) What comments are listed for the rock phyllite that may help you to identify it?

_____

_____

F. Map Symbols -These are the designated diagrammed symbols for the given rocks.

14) Draw the map symbol for Schist. 

Lower Chart:

G. Nonfoljated Texture column -Nonfoliated texture is when the minerals have not lined up after metamorphism.

15) Draw a box around the section of the chart that contains **nonfoliated** metamorphic rocks.

16) List the names of the 5 **nonfoliated** metamorphic rocks: _____, _____, _____, _____, _____

17) ***Erase the box you have drawn.***

H. Composition column – This column lists the minerals found in each **nonfoliated** metamorphic rock. For example, **quartz** is the dominant mineral found in quartzite.

18) What is the composition of marble? _____

19) Would you expect marble to bubble with acid? _____

I. Types of Metamorphism – Both types are listed here (Contact and Regional Metamorphism).

20) Place a box around the Type of Metamorphism column in the lower portion of the chart. Notice that **hornfels** is associated only with **contact metamorphism**.

21) What type of metamorphism does anthracite coal have? _____

22) What type of metamorphism creates quartzite, marble, and metaconglomerate?

_____

23) ***Erase the box you have made.***

J. Comments -In the comment section for **hornfels**, a simple definition of contact metamorphism is given, "Various rocks changed by heat from nearby magma/lava." Sandstone, having a lot of quartz, changes to quartzite. Limestone or dolostone changes to marble during metamorphism.

24) Place a box around the "**Comments**" column in the lower portion of the chart.

25) What metamorphic rock contains pebbles that may be distorted or stretched?

_____

Check Your Understanding:

1. Draw a box around the row for **SLATE.** Answer the following questions:
   - Mineral composition: _____
   - Type of metamorphism: _____
   - Texture: _____ and _____
   - How does slate form? _____
2. What is the difference between PHYLLITE and SCHIST? _____

   _____
3. Which rock is nonfoliated, contains carbon, and is formed by regional metamorphism? _____
4. Which rock is produced by the metamorphism of sandstone? _____

ESRT: Metamorphic Rock Identification Questions (Page 7)

1. Wavy bands of light and dark minerals visible in gneiss bedrock probably formed from the

   (1) cementing together of individual mineral grains
   (2) cooling and crystallization of magma
   (3) evaporation of an ancient ocean
   (4) heat and pressure during metamorphism 1 _____

2. Which physical characteristic best describes the rock phyllite?

   (1) glassy texture with gas pockets
   (2) clastic texture with angular fragments
   (3) bioclastic texture with cemented shell fragments
   (4) foliated texture with microscopic mica crystals 2 _____

3. Which rock is foliated, shows mineral alignment but not banding, and contains medium-sized grains of quartz and pyroxene?

   (1) phyllite (3) gneiss
   (2) schist (4) quartzite 3 _____

4. Which rock can form in a contact metamorphic zone?

   (1) slate (3) gneiss
   (2) hornfels (4) phyllite 4 _____

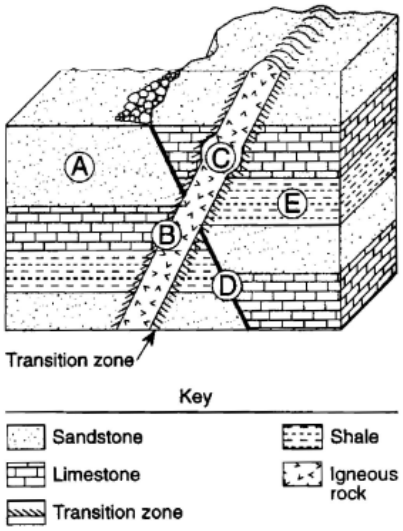
5. How do the metamorphic rocks schist and quartzite differ?

   (1) Quartzite contains the mineral quartz and schist does not.
   (2) Quartzite forms from regional metamorphism and schist does not.
   (3) Schist is organically formed and quartzite is not.
   (4) Schist is foliated and quartzite is not 5 _____

6. Which rock would most likely be produced by the metamorphism of the grey limestone?

   (1) quartzite (3) marble
   (2) slate (4) gneiss 6 _____

7. The diagram below shows a portion of the Earth's crust. Letters *A*, *B*, *C*, and *D* indicate different types of rock.



   At which location is metamorphic rock most likely to be found?

   (1) *A* (3) *C*
   (2) *B* (4) *D* 7 _____

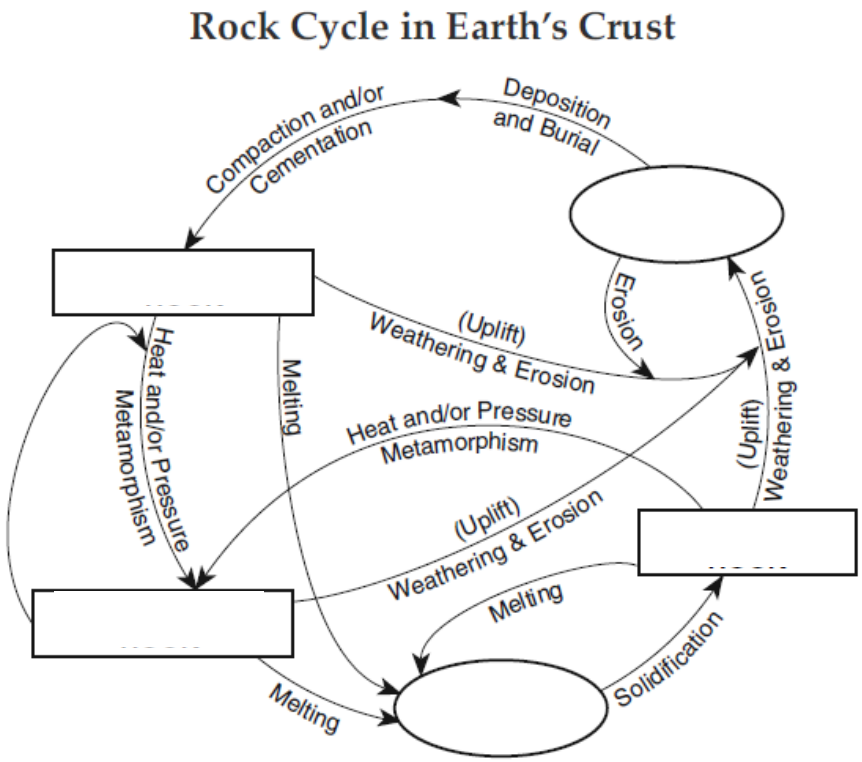
ESRT: Rock Cycle in Earth's Crust (Page 6)

All rocks can be classified as igneous, metamorphic, or sedimentary. As permanent as rocks appear, eventually geologic forces act on them, causing major changes. These changes may cause a rock to turn into a different rock type. Even rocks that have been melted within the mantle forming magma may one day surface as lava, solidifying only to be exposed to the forces of the **"Rock Cycle."** So the real question is: *"Are rocks ever really destroyed?"*

The Chart:

The outside circle shows the processes and steps that change rocks from one type into another. This path is not a one-way route. The rock cycle shows many other paths represented by inner lines. Let's look at each type of rock and how it fits in the rock cycle.

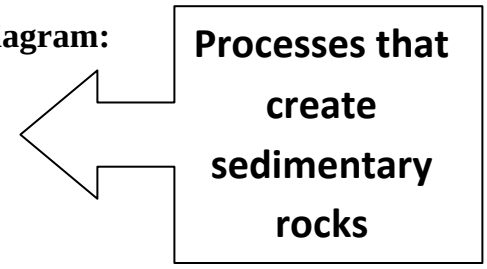
1) **Turn to page 6 of your ESRT and fill in the missing terms in the Rock Cycle diagram below.**



Sedimentary Rocks:

Sediments are smaller pieces of rocks that are easily moved by water and most eventually settle in a lake, shallow sea, along a shoreline, or in the deep ocean. Locate **Sediments** in the Rock Cycle diagram. The path shows that these sediments are **deposited** and **buried,** becoming compacted (*compaction*) from the weight above them. Dissolved minerals slowly cement (*cementation*) the sediments together, producing a sedimentary rock. If these rocks are **uplifted**, emerging from underground, **weathering** forces will reduce them to smaller sediments and **erosion** will transport them away to start another sedimentary cycle.

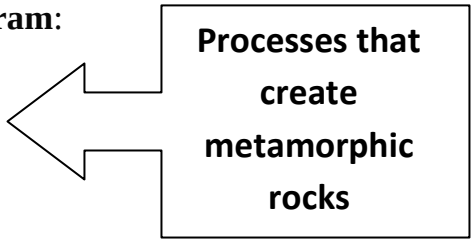
2) **Color the following arrows GREEN on the Rock Cycle diagram:**
   - **Weathering and Erosion**
   - **Deposition and Burial**
   - **Compaction and Cementation**



Metamorphic Rocks

Heat and/or pressure applied to rocks may cause them to change into metamorphic rocks. Notice all arrows heading to metamorphic rocks have this process of heat and/or pressure as a requirement. The arrows (paths) show that all types of rocks can undergo metamorphism, including a metamorphic rock.

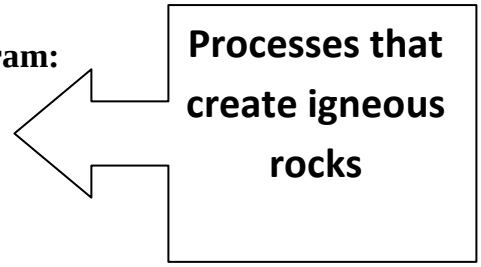
3) **Color the following arrows BLUE on the Rock Cycle Diagram**:
   - **Heat and/or Pressure**



Igneous Rocks

The initial process for creating an igneous rock is melting, which produces magma. As this magma cools, it undergoes the process of solidification, changing the molten material to a solid igneous rock. The igneous rock may be re-melted and recycled back to magma. Or it may be subjected to heat and/or pressure, changing it to a metamorphic rock; or in time, weathering and erosion can break down the igneous rock into sediments for future sedimentary rocks.

4) **Color the following arrows RED on the Rock Cycle Diagram:**
   - **Melting**
   - **Solidification**



ESRT: Rock Cycle in Earth's Crust Questions (Page 6)

1. Rocks are classified as igneous, sedimentary, or metamorphic based primarily on their

   (1) texture
   (2) crystal or grain size
   (3) method of formation
   (4) mineral composition 1_____

2. Which statement about the rock cycle is not true?

   (1) Cementation is a process that leads to sedimentary rocks.
   (2) When heat is applied to a rock and it melts, it may form a metamorphic rock.
   (3) A sedimentary rock in the future may change into another type of sedimentary rock.
   (4) Solidification is always needed to form an igneous rock. 2_____

3. The burial process involving sedimentary rocks is usually

   (1) deep within the Earth.
   (2) at the surface of the Earth.
   (3) within a water environment.
   (4) at an ocean ridge. 3_____

4. The solidification of magma produces

   (1) igneous and metamorphic rocks.
   (2) sedimentary rocks and igneous rocks.
   (3) only igneous rocks.
   (4) only metamorphic rocks. 4_____

5. Which statement about a metamorphic rock is not supported by the rock cycle?

   (1) A metamorphic rock may become sediments.
   (2) Metamorphic rocks may one day undergo melting.
   (3) A metamorphic rock has undergone cementation.
   (4) A metamorphic rock may eventually become another type of metamorphic rock. 5_____

6. The process of uplift is essential to the rock cycle for

(1) increasing the weight necessary for compaction.
(2) forming ocean trenches where erosion is dominant.
(3) exposing rocks to the forces of weathering and erosion producing sediments.
(4) increase the temperature needed to produce magma. 6_____

7. The crystals of many metamorphic rocks are aligned in bands as a result of

(1) earthquake faulting
(2) cooling and solidification
(3) mechanical weathering
(4) heat and pressure 7_____

8. Which statement about an igneous rock is not supported by the rock cycle?

(1) All igneous rocks eventually become sedimentary rocks.
(2) An igneous rock may be remelted and solidified into another type of igneous rock.
(3) All igneous rocks must have been a liquid at one time.
(4) An igneous rock can undergo metamorphism. 8_____

9. Uplift, weathering and erosion leads to the formation of

(1) magma
(2) sediments
(3) cementation
(4) igneous rocks 9_____

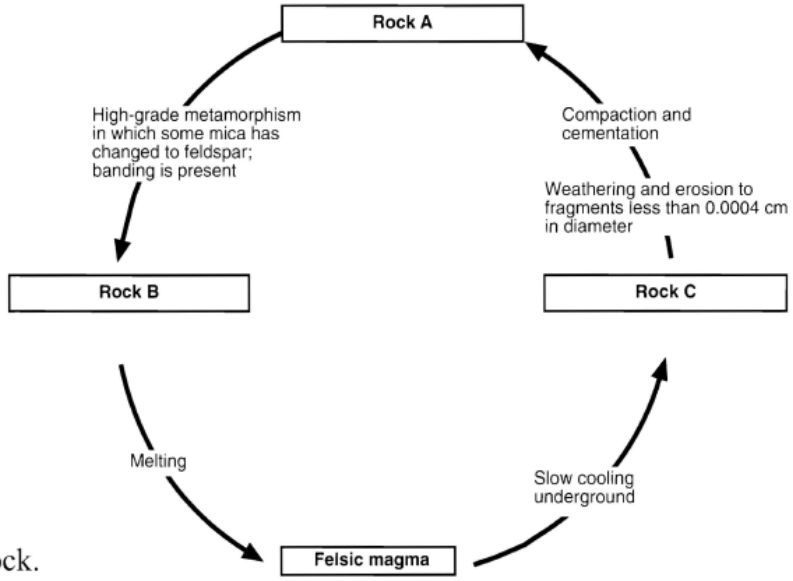
---

10. State the rock family that should be listed in the rectangle for:

Rock *A* _____

Rock *B* _____

Rock *C* _____



11. Give the processes to form an igneous rock.

_____

12. Give the processes to form a sedimentary rock.

_____

Metamorphic Rock Identification Lab

Introduction: Metamorphic rocks start out as igneous or sedimentary rocks (or even metamorphic) and are altered or changed by a combination of heat and pressure (**RECRYSTALIZATION)**. Simply put, metamorphism occurs when a previously existing rock, the parent rock, is buried in the Earth under layers of other rock. The deeper the rock is buried, the hotter it gets and the higher the pressure becomes. Eventually the rock must adjust to the conditions of this new environment. You might think of the rock as being baked, squeezed, or both, to form a metamorphic rock.

Questions: *1.) What makes a rock a metamorphic rock?*
2.) How do the characteristics of a metamorphic rock help you to determine its grade of metamorphism?

Materials: ESRT, Metamorphic rocks

Procedure:

1. You will be identifying 6 different metamorphic rocks in this lab.
2. You must have your *EARTH SCIENCE REFERENCE TABLES* ready before you can get your rock samples.
3. You will use a check list to help you identify the 6 metamorphic rocks.
4. Answer all questions.

The following is a list of ways that you can **improve** your science lab write-ups:

- □ I used complete sentences when appropriate.
- □ I answered all questions with complete ideas.
- □ I am neat, including using a pencil to erase mistakes.
- □ I reviewed the lab to make sure all questions are answered correctly.

LAB WORK: Locate a box of metamorphic rocks and then fill in or check the spaces in the following chart for each of the rock samples.

Rock	Texture	Grain size	Composition	Rock Name
Sample 1	☐ Foliated (☐ banding or ☐ mineral alignment) ☐ Nonfoliated	☐ Fine ☐ Medium ☐ Coarse		

Rock	Texture	Grain size	Composition	Rock Name
Sample 2	☐ Foliated (☐ banding or ☐ mineral alignment) ☐ Nonfoliated	☐ Fine ☐ Medium ☐ Coarse		

Rock	Texture	Grain size	Composition	Rock Name
Sample 3	☐ Foliated (☐ banding or ☐ mineral alignment) ☐ Nonfoliated	☐ Fine ☐ Medium ☐ Coarse		

Rock	Texture	Grain size	Composition	Rock Name
Sample 4	☐ Foliated (☐ banding or ☐ mineral alignment) ☐ Nonfoliated	☐ Fine ☐ Medium ☐ Coarse		

Rock	Texture	Grain size	Composition	Rock Name
Sample 5	☐ Foliated (☐ banding or ☐ mineral alignment) ☐ Nonfoliated	☐ Fine ☐ Medium ☐ Coarse		

Rock	Texture	Grain size	Composition	Rock Name
Sample 6	☐ Foliated (☐ banding or ☐ mineral alignment) ☐ Nonfoliated	☐ Fine ☐ Medium ☐ Coarse		

The Rock Cycle and Density Lab

Introduction: Rocks are continually changing from one type to another and back again. Tectonic forces inside the Earth bring rocks closer to the surface where they are weathered, eroded, compacted, and cemented. These forces also bury rocks where they are heated, compressed, and melted. So the elements that make up rocks are never created nor destroyed; instead, they are constantly being recycled. The rock cycle helps us to see that the Earth is like a giant rock-recycling machine!

Directions: In this lab, you will study different groups of rock samples – groups A, B, and C. For each group, identify the samples as igneous, metamorphic or sedimentary, explain how you identified the rock types, and then list **ALL** the steps needed to transform rock 1 into rock 2.

GROUP A

Type of Rock #1(circle): Igneous Metamorphic Sedimentary

How do you know? _____

Type of Rock #2 (circle): Igneous Metamorphic Sedimentary

How do you know? _____

Steps for Rock #1 to change to Rock #2

_____

_____

GROUP B

Type of Rock #1(circle): Igneous Metamorphic Sedimentary

How do you know? _____

Type of Rock #2 (circle): Igneous Metamorphic Sedimentary

How do you know? _____

Steps for Rock #1 to change to Rock #2

_____

_____

GROUP C

Type of Rock #1(circle): Igneous Metamorphic Sedimentary

How do you know? _____

Type of Rock #2 (circle): Igneous Metamorphic Sedimentary

How do you know? _____

Steps for Rock #1 to change to Rock #2

_____

_____

Does the Size of a Rock Affect its Density?

From your ESRT's (page 1), what is the formula for density? **Copy it here.**

DENSITY =

Remember: *Density is the amount of matter (mass) that is in a certain amount of space (volume).*

What to do:

1. Calculate the density of the medium granite sample. Next, measure the **mass** and **volume** of the small granite sample. Record your measurements. Use a silver **OVERFLOW CAN** and a graduated cylinder to get the volume. Don't know how? Ask for help. Calculate the small granite sample's density.
2. Calculate the **average density** of all three samples with the correct units!

SIZE	MASS	VOLUME	CALCULATED DENSITY
Large	**194.0 g**	**73 ml**	**2.7 g/ml**
Medium	**86.4 g**	**32 ml**	
Small			

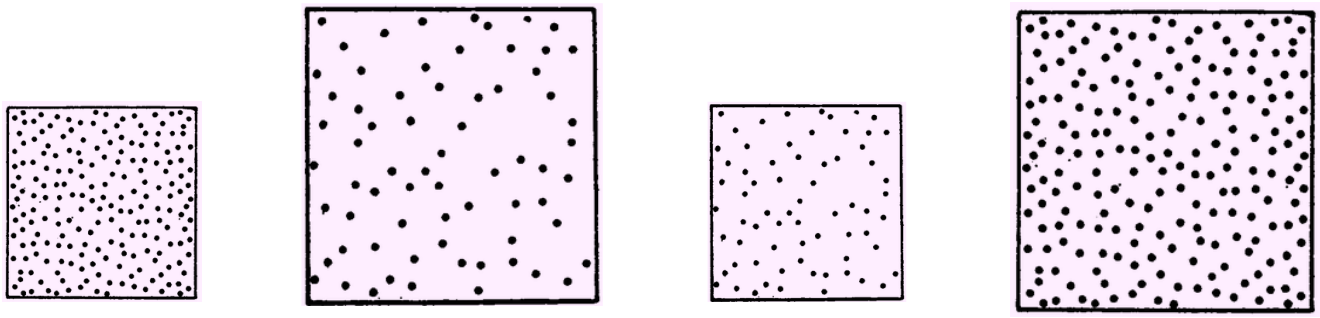
Mass = g, Volume = mL or cm^3, Density = g/mL or g/cm^3

Record your answers to the nearest tenth place!

CALCULATE AVERAGE DENSITY

Density Lab Summary Questions

1. Which image below would represent a sample "rock" with the **greatest density**? The dots represent atoms in each sample. Provide evidence supporting your selection.



1 **2** **3** **4**

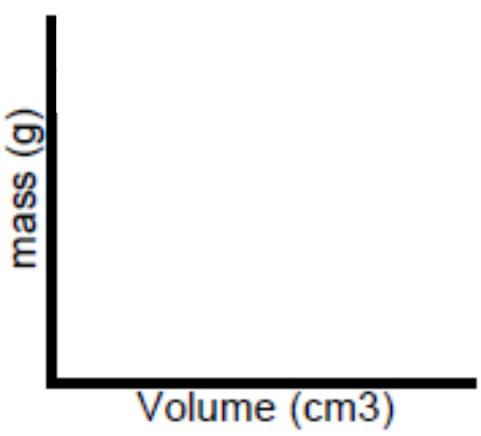
Supporting Evidence: _____

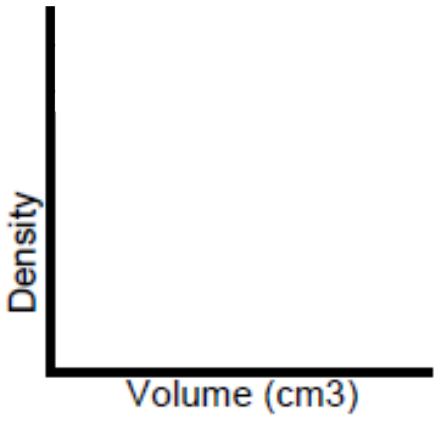
_____

_____

2. Does picking a larger or smaller sample of granite affect its density? **Explain.**

3. **Draw a line** in each graph below to show how the **variables are related** for one type of rock or mineral.





Metamorphic Rocks Review Sheet

Directions: Use the Earth Science Reference Tables to answer the following questions about metamorphic rocks. Refer to the Metamorphic, Igneous, and Sedimentary tables on pages 6 and 7.

1. What two major groups are metamorphic rocks divided into (based on texture)?

   _____ and _____

2. "Foliation" refers to the layered or banded structure common to metamorphic rocks. Look at the map symbol for gneiss. How would the texture of gneiss support its classification as a foliated rock?

   _____

   _____

3. Answer "a" and "b" below.
   a. What does conglomerate become when it changes to a metamorphic rock?

      _____

   b. Using the map symbols, describe the change in the rock's appearance.

      _____

      _____

4. What does limestone become when it is metamorphosed? _____

5. Which degree of metamorphism causes the most crystal realignment and change to the minerals in a rock? Circle answer below.

Low-Grade Metamorphism	Medium-Grade Metamorphism	High-Grade Metamorphism

6. What was slate before being changed by heat and pressure? _____

7. How is the metamorphic rock HORNFELS formed? _____

8. In schist, what minerals are chemically changed to become mica crystals?

   _____

9. What mineral can be found in gneiss but **NOT** in phyllite? _____

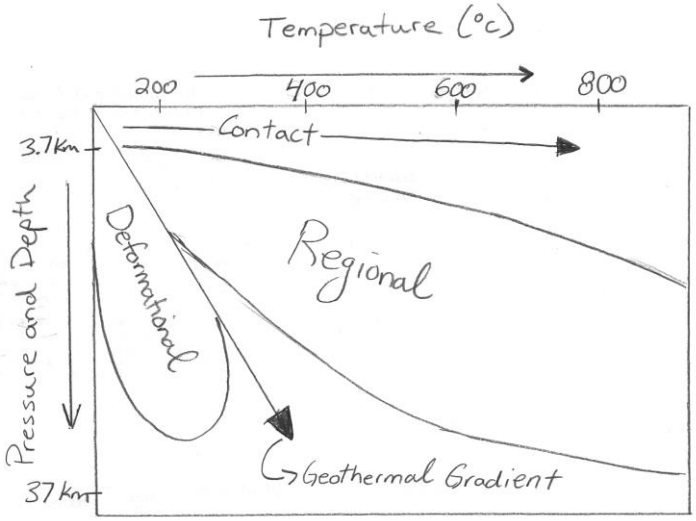
10. What mineral can be found in all **foliated** metamorphic rocks? _____

11. What minerals do igneous granite and metamorphic gneiss have in common?

_____

Use the diagram below to answer questions 12 -14.

Temperature and Pressure Graph for Types of Metamorphism



12. Describe the temperatures and pressures that are associated with regional metamorphism?

_____

_____

13. Describe the temperatures and pressures needed for contact metamorphism.

_____

_____

14. Do metamorphic rocks form when heat and pressure melt pre-existing rocks? *Explain*

_____

_____

Additional ESRT Practice: Metamorphic Rocks

8. Which rock forms by the recrystallization of unmelted rock material under conditions of high temperature and pressure?

   (1) granite
   (2) gneiss
   (3) rock gypsum
   (4) bituminous coal 8 _____

9. The crystals of many metamorphic rocks are aligned in bands as a result of

   (1) earthquake faulting
   (2) cooling and solidification
   (3) mechanical weathering
   (4) heat and pressure 9_____

10. Slate is formed by the

    (1) deposition of chlorite and mica
    (2) foliation of schist
    (3) metamorphism of shale
    (4) folding and faulting of gneiss 10_____

11. What metamorphic rock would react with hydrochloric acid?

    (1) slate
    (2) quartzite
    (3) marble
    (4) phyllite 11_____

---

12. Which rock sample is most likely metamorphic rock?


(1)


(2)


(3)

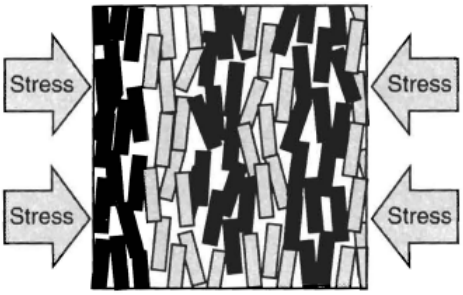

(4)

12_____

13. The accompanying diagram represents two magnified views showing the arrangement of minerals before and after metamorphism of a rock. State the name of Rock C.

_____


Mineral Arrangement Before Metamorohism



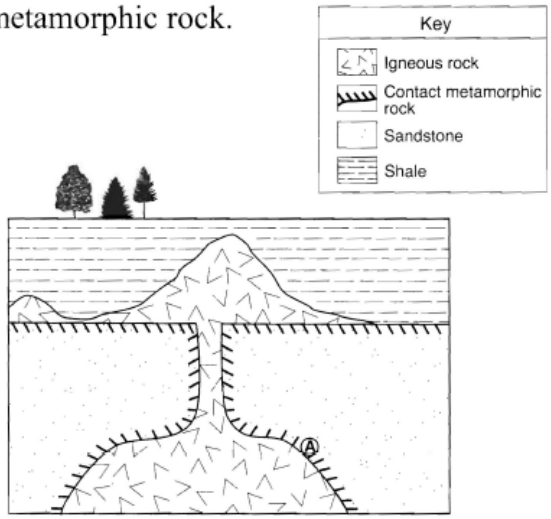
Rock C Showing Banding After Metamorohism

14. Name the processes needed to cause the banding of minerals as shown in the second diagram.

_____

15. An igneous intrusion entered a layer of sandstone. The contact metamorphism of the sandstone would produce what metamorphic rock? _____

16. The diagram below shows the geologic cross section. Location *A* is within the metamorphic rock.



The metamorphic rock at location *A* is most likely

(1) marble
(2) quartzite
(3) phyllite
(4) slate 16_____

17. The heat and pressure of regional metamorphism might effect a conglomerate layer by distorting or stretching the pebbles. The resulting rock would be

(1) hornfels
(2) granite
(3) phyllite
(4) metaconglomerate 17_____

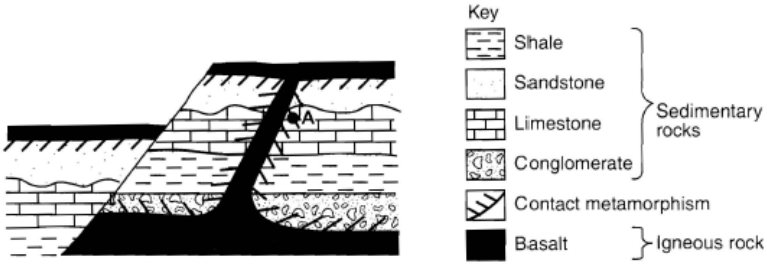
18. Which rock is foliated, shows mineral alignment but not banding, and contains shiny microscopic mica crystals?

(1) phyllite
(2) schist
(3) gneiss
(4) quartzite 18_____

19. Which sequence of change in rock type occurs as shale is subjected to increasing heat and pressure?

(1) shale → schist → phyllite → slate → gneiss
(2) shale → slate → phyllite → schist → gneiss
(3) shale → gneiss → phyllite → slate → schist
(4) shale → gneiss → phyllite → schist → slate 19_____

20. State the name of the rock, formed by contact metamorphism, located at *A*.



20_____

Online Metamorphic Rock Identification

How to access the activity…

Go to the teacher's Earth Science website. Under "Metamorphic Rocks Online Resources" click on **Online Metamorphic Rock Identification.**

When you get the webpage open…

When you get to the webpage, read through the introduction paragraphs. Clicking on the underlined words will take you to pictures showing the different textures of metamorphic rocks. These pictures will help you later when you try to identify the different metamorphic rocks.

Identifying the metamorphic rocks…

At the bottom of the main webpage you will find samples rocks 1 through 8 to identify. After examining each sample, write the correct rock name in the spaces provided below.

Rock Names
(rock names can repeat)

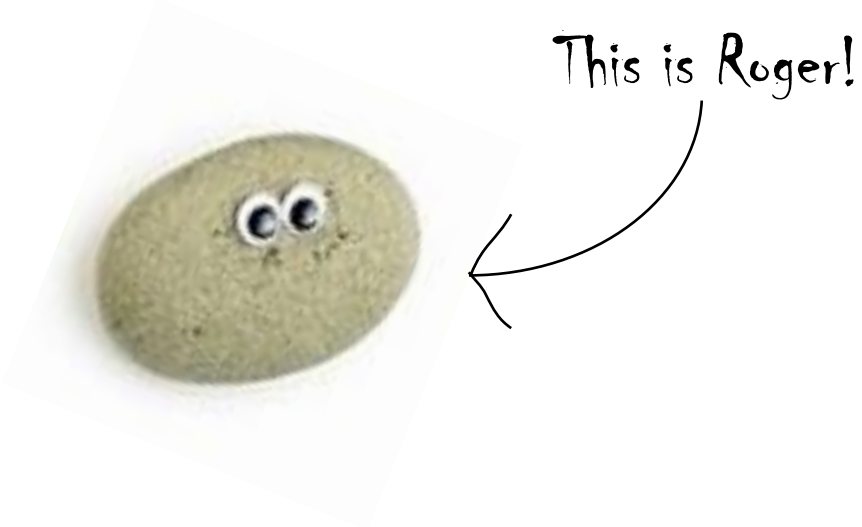
1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____

ROGER THE ROCK

The Assignment: Create a children's story book about Roger the Rock.

- Roger is a rock that has been a part of the **rock cycle** for millions of years. Your job is to tell Roger's story. You must describe how Roger was "born" and at least three transitions that occurred during Roger's life. (For example, changing from igneous to sedimentary, sedimentary to metamorphic and so on.)

- Your book must have both words and pictures (drawn and colored). Remember to use the proper vocabulary terms such as weathering, erosion, foliation, solidification, etc…



Write the story of Roger on the next page or create your own story book on separate paper!

Title: _____

Picture or Illustration #1

Picture or Illustration #2

Picture or Illustration #3

Virtual Nevada Mine Tour OR How Do They Do It?: Coal Mining

How to access…

Go to the teacher's Earth Science website. Go to "Metamorphic Rocks Online Resource." Next, under extensions click on one of the links: ***Virtual Nevada Mine Tour*** *OR* ***How Do They Do It?: Coal Mining.***

What to do now…

- ***Virtual Nevada Mine Tour*** *– Explore the Nevada Mine by clicking on the different locations and videos.* ***When you are done exploring, write a 10 sentence summary on the different processes that are part of this mine.***

OR

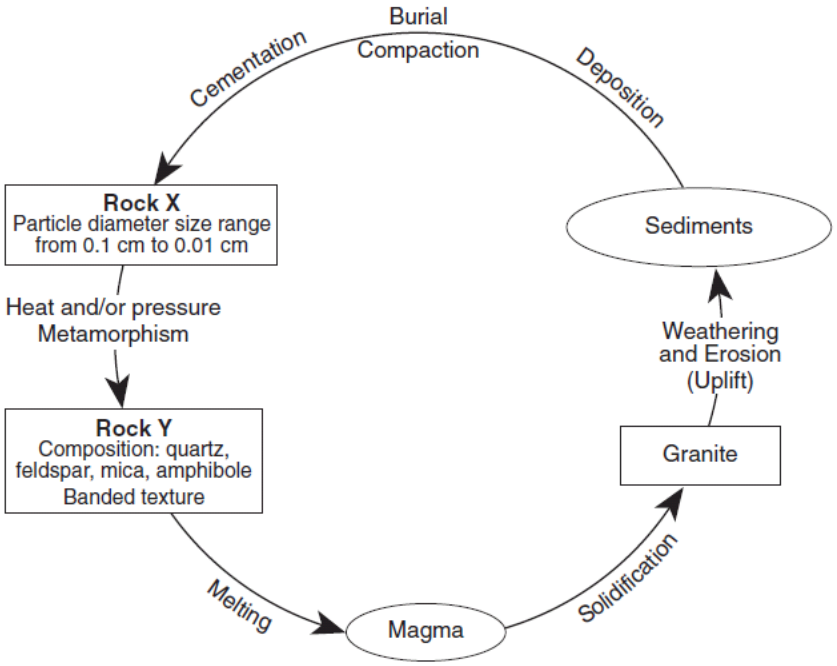
- ***How Do They Do It?: Coal Mining*** *– This is a six minute video on how coal is mined. Watch the video and take notes if needed.* ***When you are done watching the video, write a 10 sentence summary on how a coal mine works.***

SUMMARY

Regents Diagrams – What are they telling me?

For each of the following diagrams, give an explanation of what you think the diagram is showing. Then write one question the regents exam might ask you based on the diagram.

Diagram #1



Explanation:_____

_____

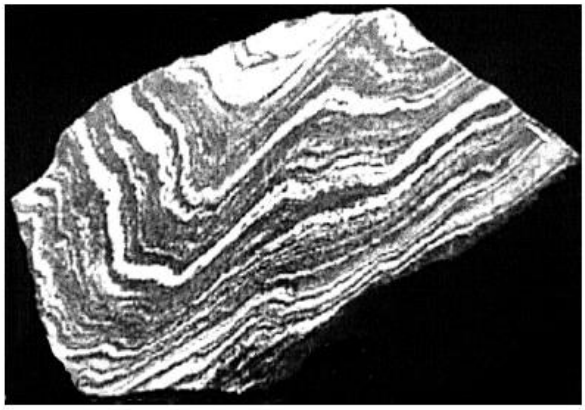
_____

Question:

_____

_____

Diagram #2



Explanation:_____

_____

_____

Question:

_____

_____

Diagram #3

Data Table

Rock Sample Number	Composition	Grain Size	Texture	Rock Name
1	mostly clay minerals		clastic	shale
2	all mica	microscopic, fine	foliated with mineral alignment	
3	mica, quartz, feldspar, amphibole, garnet, pyroxene	medium to coarse	foliated with banding	gneiss
4	potassium feldspar, quartz, biotite, plagioclase feldspar, amphibole	5 mm		granite

Explanation:_____

_____

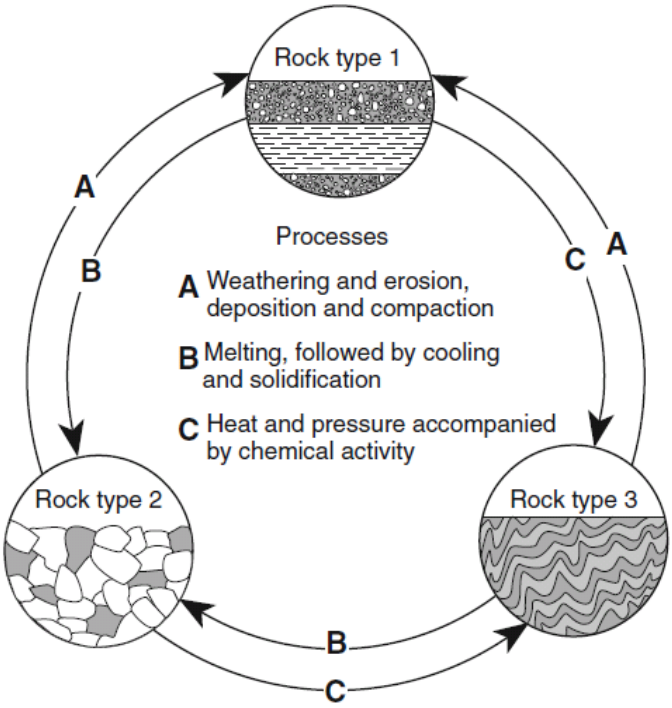
_____

Question:

_____

_____

Diagram #4



Explanation:_____

_____

_____

Question:

_____

_____