

NAME: \_\_\_\_\_

# ROCKS AND MINERALS NOTES

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## MINERALS (Video 3.1 ESRT 16)

1. A student claimed that an object in his hand was a rock. The teacher said it was a mineral. What tests would have to be performed and what would the results be in order to settle this argument?
2. The minerals diamond and graphite are both composed of the element carbon, yet their physical properties are completely different. Why?
3. Does the mineral sample to the right show fracture or cleavage? How can you tell?



## ROCKS (Videos 3.2, 3.3, 3.4 ESRT 6a, 6b, 7a, 7b)

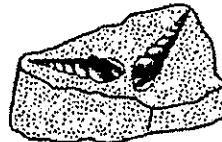
1. State if the rock is igneous, metamorphic, or sedimentary and write a sentence explaining how you made your decision:



Sample A



Sample B



Sample C



Sample D

- a. Is sample A an igneous, sedimentary, or metamorphic rock? How can you tell?
  - b. Is sample B an igneous, sedimentary, or metamorphic rock? How can you tell?
  - c. Is sample C an igneous, sedimentary, or metamorphic rock? How can you tell?
  - d. Is sample D an igneous, sedimentary, or metamorphic rock? How can you tell?
2. State and define the textures that are found in each rock type. (Be able to read pages 6 and 7 ESRT):
    - a. Which environment is below the Earth's surface?
    - b. What type of texture do intrusive igneous rocks have?
    - c. List all the minerals that can be found in granite.
    - d. Igneous rocks with a felsic composition contain which element?
    - e. What is the mineral composition of gneiss?
    - f. Shale undergoes metamorphism to become which rock?
    - g. Limestone undergoes metamorphism to become which rock?
    - h. What is the mineral composition of shale?
    - i. Which inorganic sedimentary rocks are made up of all different size sediments?
    - j. Which sedimentary rock can easily be split into thinner layers?
    - k. A particle 0.2 to 6.4 cm in diameter would be called what?
    - l. What is the smallest and largest diameter that a sand particle can be?
    - m. Which sedimentary rocks have a bioclastic texture?
    - n. Name three sedimentary rocks that form from the evaporation of water.

# Rocks and Minerals Facts

(ESRT pages are huge here, rocks pgs. on 6, 7, and minerals pg. 16)

- Video 3.1 ESRT 16
- 1.) Minerals are / solid, naturally occurring, inorganic (not living) substances
  - 2.) Minerals are **identified** on the basis of / well defined physical and chemical properties  
ex. hardness, cleavage, shape
  - 3.) Color is not a good way to ID a mineral because / some minerals come in lots of colors  
like quartz
  - 4.) Streak is / the powdered form of a mineral, as found by using a streak plate
  - 5.) Cleavage is / the flat sides on a mineral, mineral breaks along planes of weak bonding
  - 6.) The mineral and rock that react to acid are / calcite (rhombus-shaped) and limestone
  - 7.) **The physical properties of minerals depends upon / the internal arrangement of atoms**
  - 8.) The most abundant elements in Earth's crust are / oxygen and silicon = quartz (esrt p.1)
- Video 3.2 ESRT 7a & 6a
- 9.) Rocks are **classified** on the basis of / their origin (how they formed)
  - 10.) Rocks are **identified** by their / texture (physical appearance or size of grains)
  - 11.) Sedimentary rocks form from / sediments by compaction & cementation, evaporation,  
and organic remains
  - 12.) How can you tell a rock is sedimentary / its texture is clastic (pieces of rocks) and fossils
- Video 3.3 ESRT 6b
- 13.) Igneous rocks form by / the crystallization of molten magma or lava  
Large crystals / slow cooling (Intrusive)  
Small crystals / fast cooling (Extrusive)
  - 14.) Vesicular means / gas pockets (cooled fast, extrusive, volcanic)
  - 15.) How can you tell a rock is igneous / its texture is glassy, visible intergrown crystals or  
vesicular
- Video 3.4 ESRT 7b
- 16.) Metamorphic rocks form from / other rocks by heat and pressure (recrystallization)
  - 17.) How can you tell a rock is metamorphic / its texture is foliated or banded
  - 18.) Contact metamorphism / molten rock (igneous intrusions) coming in contact with other  
rocks
  - 19.) Regional metamorphism / over large areas and is associated with mountain building
  - 20.) According to ESRT pg. 7 shale turns into / slate, sandstone into / quartzite, limestone  
into / marble

# Minerals



5 Characteristics:


A. Minerals are classified according to their \_\_\_\_\_ and \_\_\_\_\_ properties.

Physical Properties:

1) Color - \_\_\_\_\_  
\_\_\_\_\_

Example: quartz - \_\_\_\_\_  
\_\_\_\_\_ calcite and halite - \_\_\_\_\_  
\_\_\_\_\_

2) Streak - \_\_\_\_\_  
Test: \_\_\_\_\_  
\_\_\_\_\_

3) Luster - \_\_\_\_\_  
Metallic - \_\_\_\_\_  
Non-Metallic - \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

4) Hardness - \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
Test: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
Moh's hardness scale - \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Moh's hardness scale:

1. Talc
2. Gypsum
3. Calcite
4. Fluorite
5. Apatite
6. Feldspar
7. Quartz
8. Topaz
9. Corundum
10. Diamond

5.5 – approximate  
hardness of a glass plate

5) Cleavage - \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
Test: \_\_\_\_\_  
\_\_\_\_\_

6) Fracture - \_\_\_\_\_  
\_\_\_\_\_

7) Composition - \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

8) Special Properties - \_\_\_\_\_  
\_\_\_\_\_  
Examples - \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

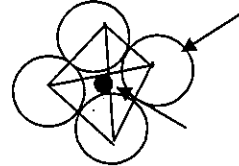
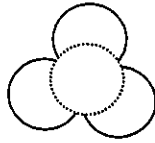
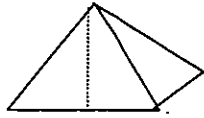


B. Minerals are grouped according to their \_\_\_\_\_

1. The elements \_\_\_\_\_ and \_\_\_\_\_ combine to form tetrahedral units.

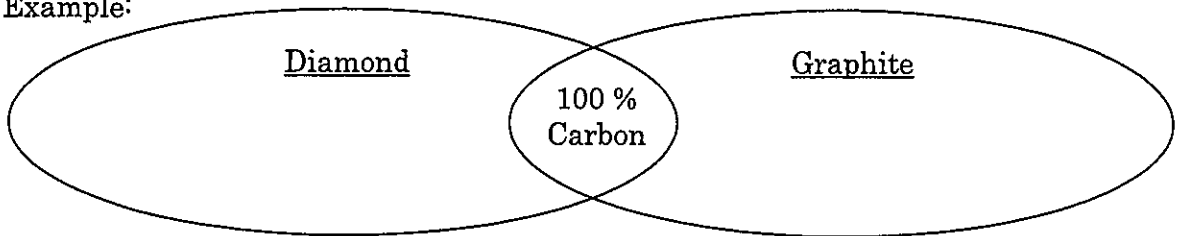
Together, the mass of these two elements are most abundant in the Earth's crust.

Silicates - any mineral composed of silicon and oxygen



2. The physical properties of minerals depend upon the \_\_\_\_\_

Example:



3. Of the thousands of known minerals, only a few are found almost \_\_\_\_\_
4. If you know how to identify about a \_\_\_\_\_ of the most common minerals you will be able to identify minerals in most rocks you are likely to find.
5. Nearly all rocks are composed of one or more \_\_\_\_\_
6. Minerals are the \_\_\_\_\_ of most rocks.  
Some exceptions include: \_\_\_\_\_ and \_\_\_\_\_

Fill in the missing information in the chart below by using the "Properties of Common Minerals" in the *Earth Science Reference Tables* page 16

Luster	Hardness	Composition	Color	Mineral Name
Nonmetallic	6		white to pink	
	2	S		
	4		colorless/variable	
Metallic	2.5		metallic silver	
		$Mg_3Si_4O_{10}(OH)_2$		Talc
	1-6.5	$Fe_2O_3$		
Nonmetallic	2	$CaSO_4 \cdot 2H_2O$	white to pink	
Nonmetallic		$CaF_2$		
			brassy yellow	
		$Fe_3Al_2Si_3O_{12}$	dark red	
		C		
Nonmetallic	3		colorless/variable	
Metallic	5.5-6.5		black to silver	
	6.5	$(Fe, Mg)_2SiO_4$		

Which mineral has the following characteristics?

Mineral Characteristics	Mineral Name
Bubbles with acid when powdered	
Cleaves at $56^\circ$ and $124^\circ$	
Food additive and melts ice	
Easily scratched by a fingernail	
Red-brown streak	
Feels greasy	
Used in glass, jewelry and electronics	
NYS Gemstone	

Use the diagram to the below to answer questions 1-4.

Table 1

Gemstone Mineral	Composition	Hardness	Average Density (g/cm <sup>3</sup> )
emerald	Be <sub>3</sub> Al <sub>2</sub> (Si <sub>6</sub> O <sub>18</sub> )	7.5-8	2.7
sapphire	Al <sub>2</sub> O <sub>3</sub>	9	4.0
spinel	MgAl <sub>2</sub> O <sub>4</sub>	8	3.8
zircon	ZrSiO <sub>4</sub>	7.5	4.7

KEY	
Al = aluminum	O = oxygen
Be = beryllium	Si = silicon
Mg = magnesium	Zr = zirconium

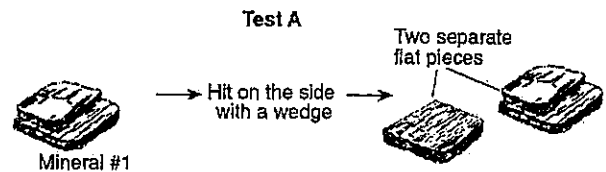
Table 2

Moh's Scale of Hardness
1 talc
2 gypsum
3 calcite
4 fluorite
5 apatite
6 feldspar
7 quartz
8 topaz
9 corundum
10 diamond

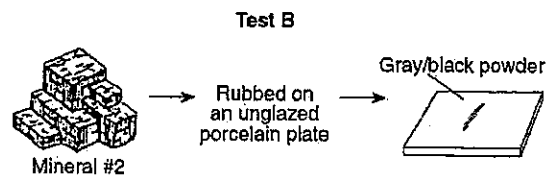
1. What element is found in all four of the above samples?
2. How many minerals will sapphires scratch on page 16 of your ESRT?
3. Using Table 2 and your ESRT, between which two minerals will Dolomite go between?
4. What happens when acid is applied to Calcite?

Use the diagram to the right to answer questions 5-8.

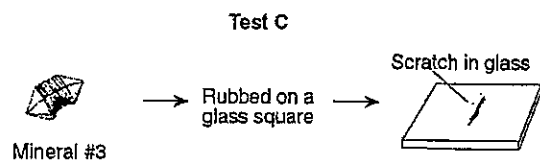
5. Mineral test A is testing....



6. Mineral test B is testing...



7. Mineral test C is testing...



8. Which of the following tests is the most reliable?

9. Which mineral test is the least reliable?



# Sedimentary Rocks

**Key Concept #1:** Most sedimentary rocks are made of pieces ( ) of other rocks.

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

a. \_\_\_\_\_  
\_\_\_\_\_

b. \_\_\_\_\_  
\_\_\_\_\_

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

\_\_\_\_\_

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

a. Strata \_\_\_\_\_  
\_\_\_\_\_

b Clasts \_\_\_\_\_  
\_\_\_\_\_

c. Fossils \_\_\_\_\_  
\_\_\_\_\_

## Sedimentary Rock ESRT Questions

1. \_\_\_\_\_ Name a non-clastic sedimentary rock which is composed of calcite.
2. \_\_\_\_\_ Name a clastic sedimentary rock which has mixed, angular particle sizes.
3. \_\_\_\_\_ Name a non-clastic sedimentary rock composed of marine shell fragments.
4. \_\_\_\_\_ Name a dark-colored, organically formed sedimentary rock composed mostly of carbon.
5. \_\_\_\_\_ Name the sedimentary rock formed by the process of evaporation and composed mostly of gypsum.



A. Clastic Sedimentary Rocks: Fill in the chart below.

Rock name	Grain size (name)	Grain size (cm)	Comments
Conglomerate	Mixed	Variable	Rounded fragments
Breccia			
Sandstone			
Siltstone			
Shale			

1. What is another name for Clastic rocks? \_\_\_\_\_
2. How are Clastic sedimentary rocks classified? \_\_\_\_\_
3. By what process did Clastic rocks form? \_\_\_\_\_

B. Crystalline & Bioclastic Sedimentary rocks: Fill in the chart below

Rock Name	Composition	Crystalline (or) Bioclastic?	Grain size
Rock Salt			
Rock Gypsum			
Dolostone			
Limestone			
Coal			

1. How are Crystalline and Bioclastic sedimentary rocks classified? \_\_\_\_\_
2. By what process do crystalline rocks form? \_\_\_\_\_
3. Where does coal come from? \_\_\_\_\_
4. What is limestone sometimes made up of? \_\_\_\_\_

C. Fill in the following chart using the Earth Science Reference Tables page 6:  
*Relationship of Transported Particle Size to Water Velocity*

Grain size	Name of the	Rock name
0.00001	Clay	Shale
0.1		
0.002		
0.007		
0.9 (round)		
0.5 (angular)		
0.00004		
0.005		

Regents Questions:

1. Which rock is formed when rock fragments are deposited and cemented together  
(1) dolostone                      (2) sandstone                      (3) rhyolite                      (4) gabbro
  
2. Which rock type most likely would contain fossils?  
(1) intrusive igneous rock                      (3) sedimentary rock  
(2) extrusive igneous rock                      (4) metamorphic rock
  
3. Some sedimentary rocks are composed of rock fragments that had different origins. Which statement best explains why this could occur?  
(1) Fossils are often found in sedimentary rocks.  
(2) Sedimentary rocks form from the weathered products of any type of rock.  
(3) When molten lava solidifies to form sedimentary rock it often contains foreign particles.  
(4) Under high heat and pressure, recrystallization results in the formation of many minerals.
  
4. Which rocks form relatively thin layers, compared to the thickness of the continent, over large areas of the continents?  
(1) granite and gabbro                      (3) metamorphic rocks  
(2) sandstone and shale                      (4) intrusive igneous rocks
  
5. One similarity between a sand pile and sandstone is that they  
(1) contain a cementing agent                      (3) have a crystalline structure  
(2) always contain fossils                      (4) are composed of sediments
  
6. Which kind of bedrock would most likely contain fossils?  
(1) A mass of granite in the core of a mountain  
(2) A series of alternating layers of shale and sandstone  
(3) A basalt lava flow from an ancient volcano  
(4) A high-grade metamorphic rock layer made from mixed igneous and sedimentary layers
  
7. Which statement correctly describes the distribution of sedimentary rocks on the Earth?  
(1) Sedimentary rock layers are the thickest in the middle of the oceans.  
(2) Sedimentary rocks extend down into the earth's crust as far as the inner core.  
(3) Sedimentary rocks are usually located in volcanic regions.  
(4) Sedimentary rocks usually form a thin layer over large areas of the continents.
  
8. The thick sedimentary rocks of central and western New York State, which were formed from shallow water deposits, were most probably produced by  
(1) glaciation                      (3) deposition  
(2) the uplift of this region                      (4) volcanic eruption



# Igneous Rocks

*Earth Science Reference Tables, page 6*

Intrusive	Environment of Formation	Extrusive
	Also known as	
	Rate of cooling	
	Size of crystals	
	Texture	

1. The two extrusive glassy textured rocks that are non-vesicular are \_\_\_\_\_
  
2. The two extrusive glassy textured rocks that are vesicular are \_\_\_\_\_
  
3. What is the grain size of an extrusive rock with a glassy texture? \_\_\_\_\_
4. What is the cooling rate for extrusive rocks with a glassy texture? \_\_\_\_\_
5. Where are extrusive rocks formed? \_\_\_\_\_
  
6. The three extrusive fine textured rocks that are vesicular are \_\_\_\_\_
  
7. The four extrusive fine textured rocks that are non-vesicular are \_\_\_\_\_
  
8. What is the grain size of an extrusive rock with a fine texture? \_\_\_\_\_
9. What is the cooling rate for extrusive rocks with a fine texture? \_\_\_\_\_
10. Where are extrusive rocks formed? \_\_\_\_\_
  
11. What is another word for extrusive? \_\_\_\_\_
12. What does vesicular mean? \_\_\_\_\_

13. List the five intrusive, coarse textured rocks listed in the Reference Tables.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

14. Name the intrusive, very coarse textured rock listed in the Reference Tables.

\_\_\_\_\_

15. What is another word for intrusive? \_\_\_\_\_

16. What is the grain size of coarse textured rocks? \_\_\_\_\_

17. What is the grain size of the very coarse textured rocks? \_\_\_\_\_

18. Are these rocks vesicular or non-vesicular? \_\_\_\_\_

19. What is the cooling rate for intrusive rocks? \_\_\_\_\_

20. Where were these rocks formed? \_\_\_\_\_

\_\_\_\_\_

21. Complete the chart below using your Earth Science Reference Tables:

	Color Light / Dark	Density High / Low	Composition Felsic / Mafic
Pegmatite			
Granite			
Gabbro			
Pumice			
Basalt Glass			
Scoria / Vesicular Basalt			
Rhyolite			
Basalt			
Vesicular Rhyolite			

22. Complete the following sentences.

a. Mafic rocks are \_\_\_\_\_ in color, have a \_\_\_\_\_ density and contain \_\_\_\_\_ and \_\_\_\_\_.

b. Felsic rocks are \_\_\_\_\_ in color, have a \_\_\_\_\_ density and contain \_\_\_\_\_.

**Regents Questions:**

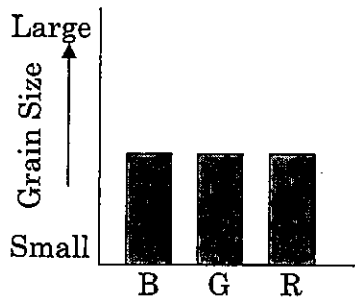
- Which is usually a characteristic of igneous rocks with a high density?
  - They are light in color
  - They are felsic.
  - They have a high aluminum content.
  - They contain iron.
- As the percentage of mafic minerals in an igneous rock increases, the rocks color becomes
  - lighter and its grain size decreases
  - lighter and its grain size increases
  - darker and its density decreases
  - darker and its density increases
- Which rock is of felsic composition, low in density, light in color, and coarse grained?
  - Rhyolite
  - Basalt
  - Granite
  - Gabbro
- Which statement is true of granite and gabbro?
  - they are both intrusive
  - they both contain potassium feldspar
  - they have different grain sizes
  - they are both extrusive
- Which characteristic of an igneous rock would provide the most information about the environment in which the rock solidified?
  - color
  - texture
  - hardness
  - streak
- Which graph best represents the comparison of the average grain sizes in basalt, granite, and rhyolite?

Key to Graph Abbreviations:

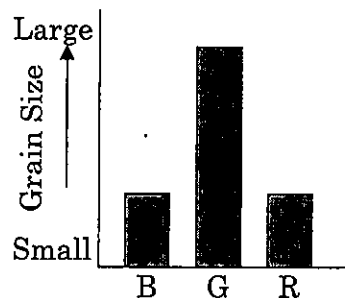
*B – Basalt*

*G – Granite*

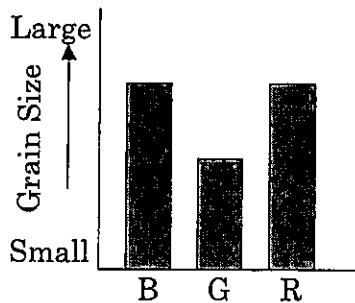
*R – Rhyolite*



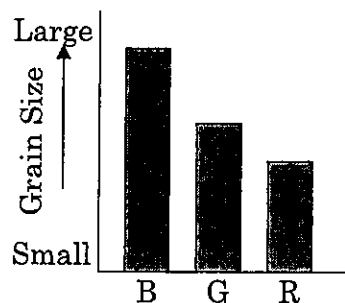
(1)



(3)



(2)



(4)



# Metamorphic Rocks

*Key Concept #1:* How are metamorphic rocks formed?

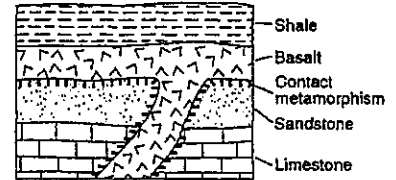
*Key Concept #2:* Melting **DOES NOT** occur.

If melting does occur, it is classified as a(n) \_\_\_\_\_ rock.

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

**REGIONAL:**

**CONTACT:**



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

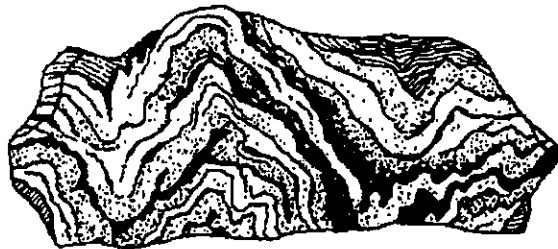
a. **Foliation:** \_\_\_\_\_  
\_\_\_\_\_

b. **Distorted Structure:** \_\_\_\_\_  
\_\_\_\_\_

c. **Key Identifier Minerals:**

\_\_\_\_\_ **Dark Red Color**

\_\_\_\_\_ **Shiny, flaky mineral**



Name the metamorphic rock that is

a. Foliated, fine-grained , low-grade metamorphism of shale	
b. Nonfoliated , Fine-grained	
c. Foliated, High grade metamorphism, Contains pyroxene, and quartz	
d. Nonfoliated, Contains quartz, Contact metamorphism	
e. Coarse grained, Parent rock is conglomerate, Pebbles may be distorted	
f. Parent rock is dolostone.	
g. Contains only mica	
h. Fine to medium grain size, contains clay minerals, but never contains pyroxene	
i. Has banding	
j. Contact metamorphism – due to extreme heat from nearby lava	
k. Metamorphism of sandstone	
l. Its minerals are aligned and it has visible platy mica crystals	

Use the table on page 7 – Scheme for Metamorphic Rock Identification - to determine the following.

1. Name the parent rock of each of the following metamorphic rocks.

Slate _____	Quartzite _____
Phyllite _____	Marble _____
Schist _____	Anthracite Coal _____
Gneiss _____	Metaconglomerate _____

2. Name the minerals that may be found in Phyllite \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

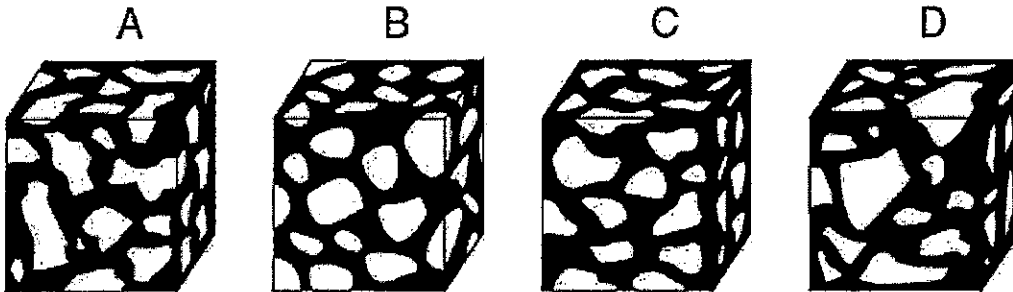
3. What mineral may or may not appear in a sample of schist? \_\_\_\_\_

4. Name the rock type that is produced when various rocks are changed by nearby magma or lava. \_\_\_\_\_

## Rock Review

Use the picture to the right to answer questions 1-2.

1. What caused the banding in this rock sample?
2. What is the name of this rock?

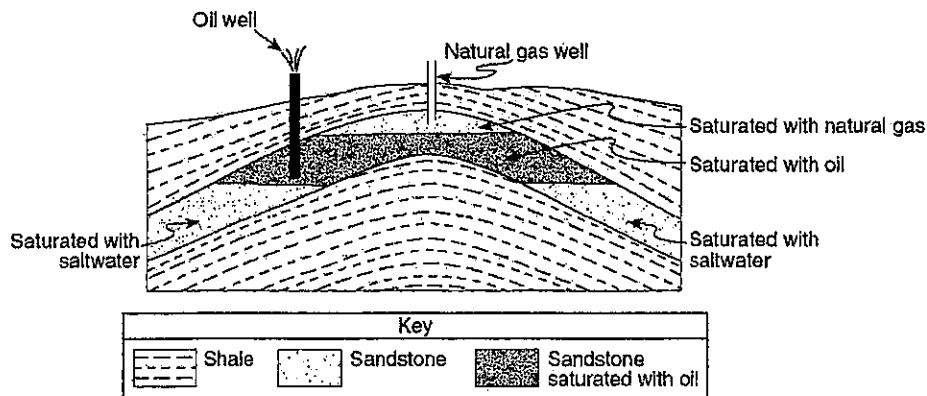


Use the picture below to answer questions 3-5.

3. Which two samples could be BRECCIA?
4. Which two samples could be CONGLOMERATE?
5. What observational information did you use to make your decision?

Use the diagram below to answer questions 6-8.

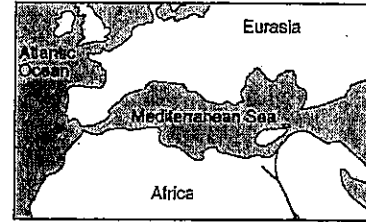
6. How is it possible that SANDSTONE could be saturated with liquid oil or water?
7. Why is the natural gas above the oil and the saltwater?
8. What is the grain size of the sandstone layer?





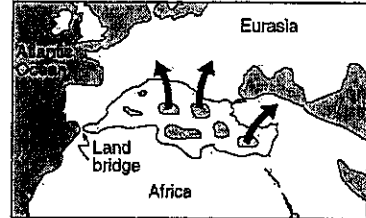
Use the picture to the right to answer questions 9-10.

9. What happened to the Mediterranean Sea about 6 million years ago?

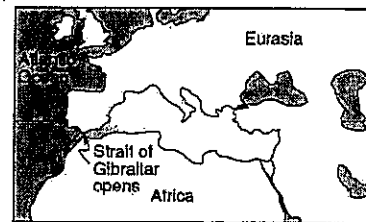


About 10 Million Years Ago

10. Name three sedimentary rocks that could have formed when the water evaporated.



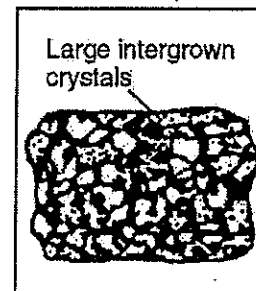
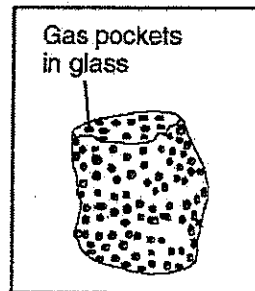
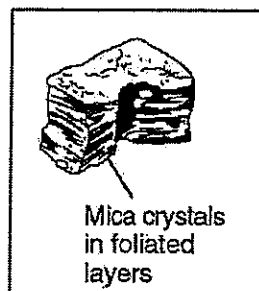
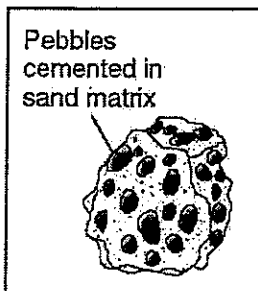
About 8 to 5.5 Million Years Ago  
Evaporation from Mediterranean Sea



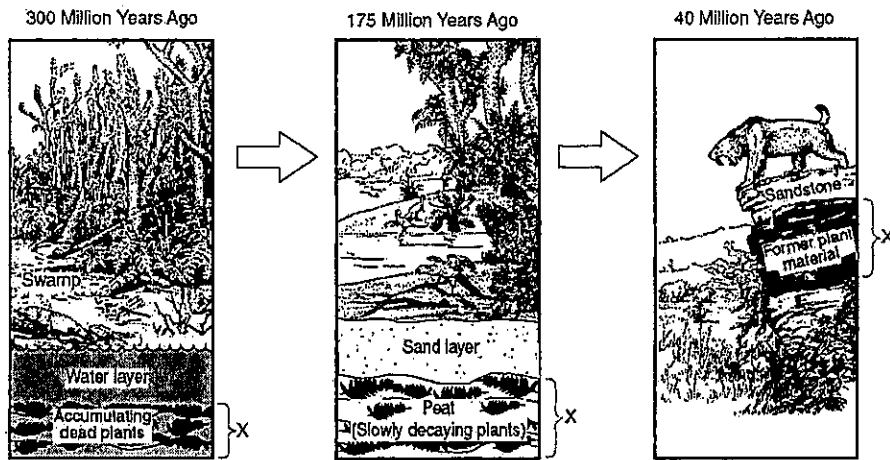
About 4 Million Years Ago  
Mediterranean Sea Refills  
with Atlantic Ocean Water

Use the pictures below to answer questions 11-15.

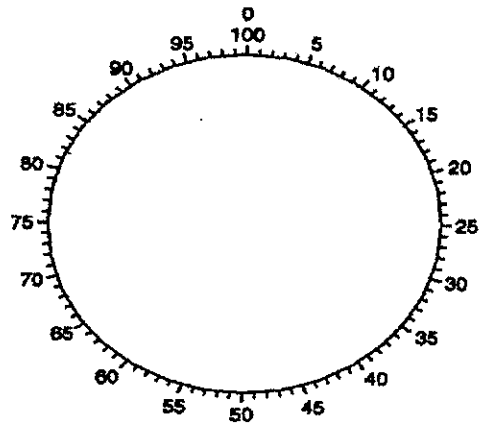
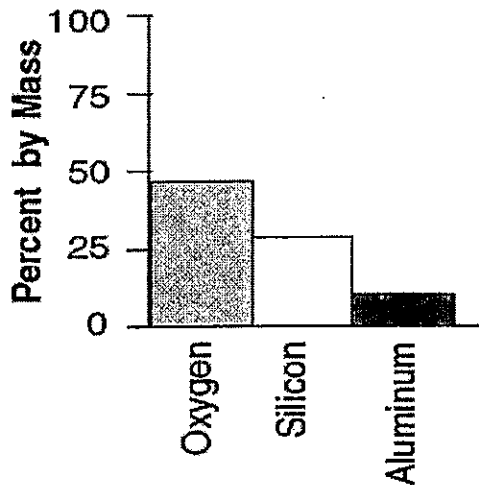
11. Put an S under the sedimentary rock.
12. What is the name of that sedimentary rock?
13. Put an E under the extrusive igneous rock.
14. Put an M under the metamorphic rock.
15. Put a G under the rock that could be granite.



16. Name rock layer X.



17. Create a pie graph from the following data.



Use the following picture to answer questions 18-20.

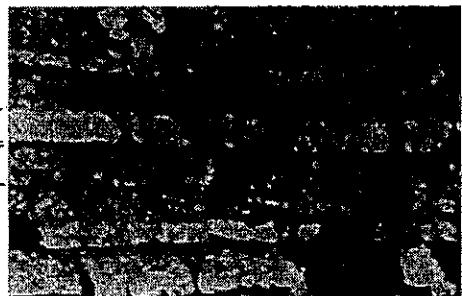
18. What rock could this be?

19. What observational clues did you use?



(Shown to actual size)

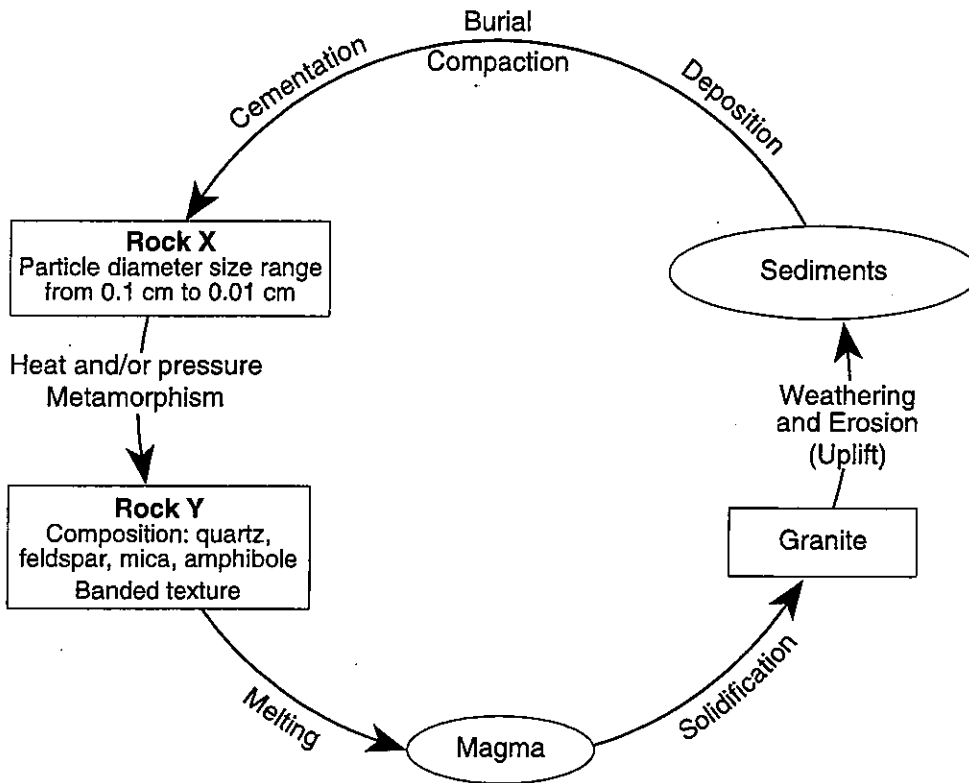
Sandstone  
Shale



20. What two processes formed these layers?

## Rock & Minerals Review

Base your answers to questions 1 through 3 on the diagram below, which represents a part of the rock cycle. The igneous rock granite, and the characteristics of sedimentary rock X and metamorphic rock Y are shown.

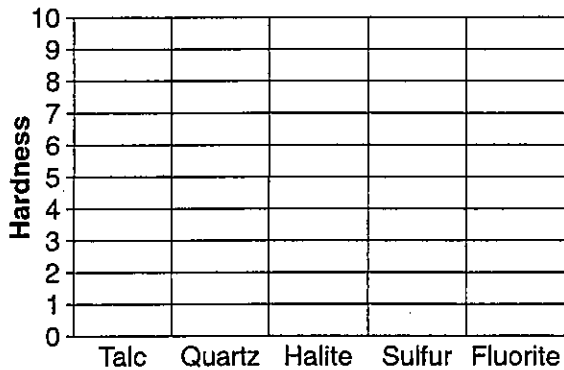


1. Identify sedimentary rock X
  
2. Identify metamorphic rock Y
  
3. Complete the table with descriptions of the observable characteristics used to identify granite.

Characteristic of Granite	Description
Texture	
Color	
Density	

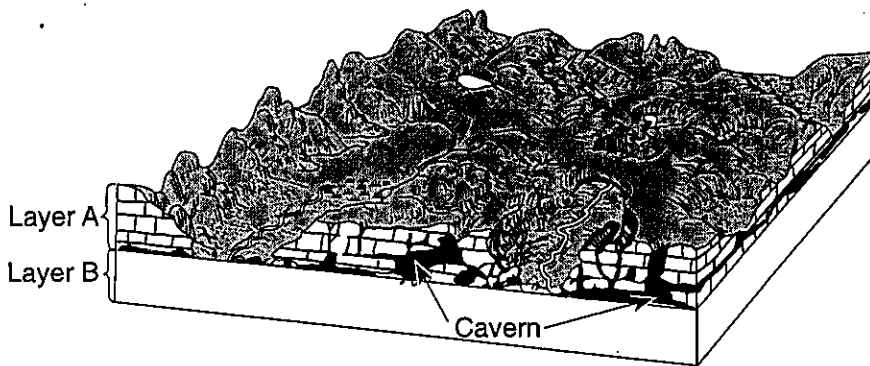
Base your answers to questions 4 and 5 on the hardness of the minerals talc, quartz, halite, sulfur, and fluorite.

4. On the grid, construct a bar graph to represent the hardness of these minerals.

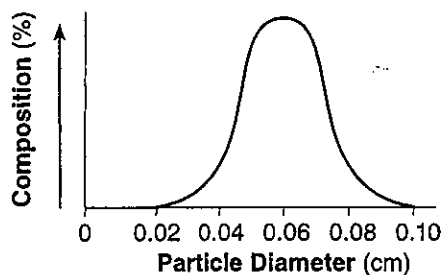


5. Which mineral shown on the grid would be the best abrasive? State *one* reason for your choice.

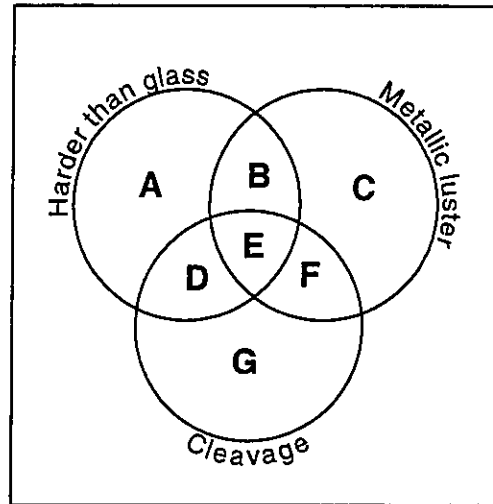
Base your answers to questions 6 through 8 on the block diagram below, which shows the landscape features of an area of Earth's crust. Two sedimentary rock layers, A and B, are labeled in the diagram. The rock symbol for layer B has been omitted.



6. Identify the most abundant mineral in rock layer A.
7. Describe how the caverns formed in rock layer A.
8. The graph below shows the particle sizes that compose the **clastic sedimentary rock** in layer B. In the box below, draw the map symbol from the *Earth Science Reference Tables* that represent rock layer B.



Base your answers to questions 9 and 10 on the diagram below of a mineral classification scheme that shows the properties of certain minerals. Letters A through G represent mineral property zones. Zone E represents the presence of all three properties. For example, a mineral that is harder than glass, has a metallic luster, but does not have cleave, would be placed in zone B. Assume that glass has a hardness of 5.5.

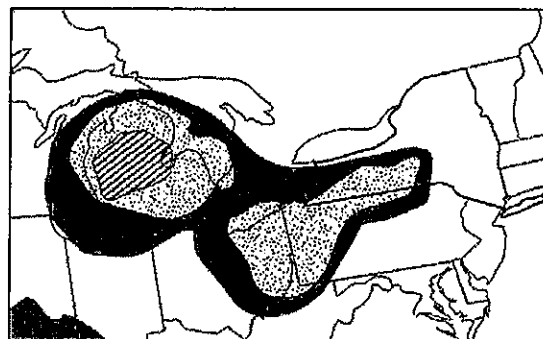





9. In which zone would the mineral potassium feldspar be placed?

10. State the name of *one* mineral listed on the *Properties of Common Minerals Table* that could *not* be placed in any of the zones.

Base your answers to questions 11 and 12 on the map below. The map shows the approximate area in a portion of North America where some sedimentary rock layers composed of gypsum, halite, and potassium salt minerals found in Earth's crust.

Mineral Deposits



Key			
	Gypsum		Gypsum and halite
	Gypsum, halite, and potassium salts		

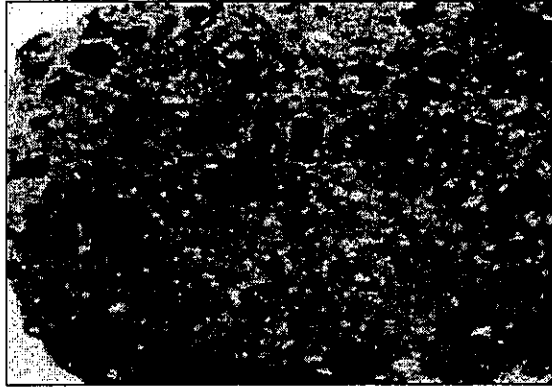
11. Identify *one* New York State landscape region in which deposits of gypsum and halite are commonly found.

12. Identify the sedimentary rock composed of halite and explain how this rock is usually formed.

Base your answers to questions 13 and 14 on the passage and photograph below. The passage describes the properties of porphyritic rocks. The photograph shows a sample of andesite rock that has a porphyritic texture.

**Porphyritic Rocks**

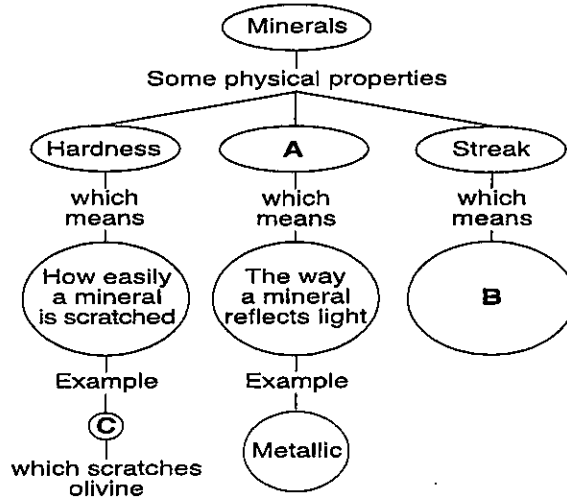
Igneous rocks that have two distinctly different crystal sizes have a porphyritic texture. They contain large, coarse-grained crystals called phenocrysts, which are visible to the naked eye. These crystals are surrounded by fine-grained crystals called groundmass.



13. Identify the evidence shown by the photograph that indicates that two different cooling events occurred during the formation of this rock.

14. The andesite sample in the photograph has a small percentage of quartz. List *three* other minerals that are found in this sample.

Base your answers to questions 15 through 17 on the chart below, which shows some physical properties of minerals and the definitions of these properties. The letters A, B, and C indicate parts of the chart that have been left blank. Letter C represents the name of a mineral.

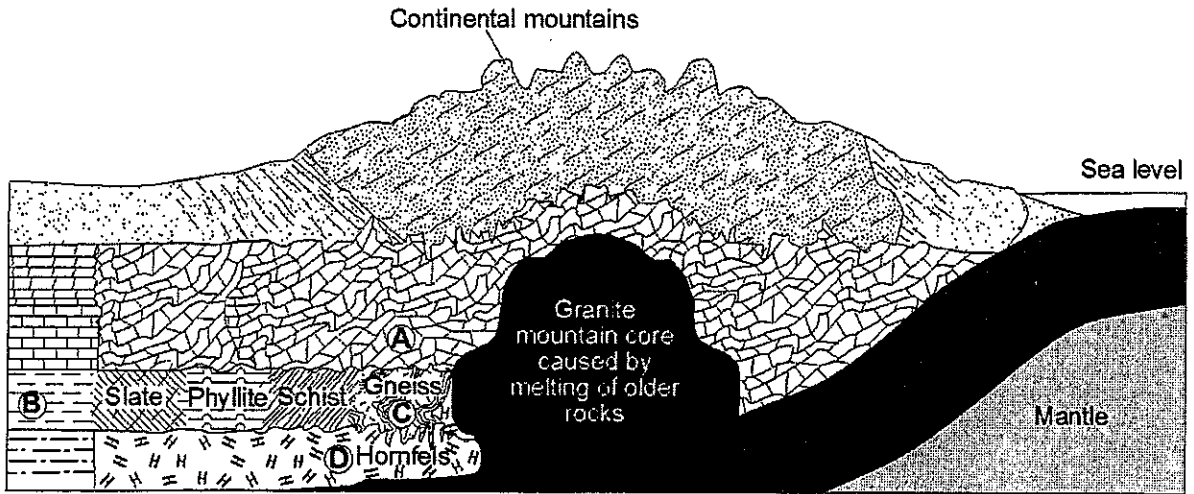


15. Which physical property of a mineral is represented by letter A?

16. State the definition represented by letter B.

17. Identify *one* mineral that could be represented by letter C.

Base your answers to questions 18 through 21 on the cross section below, which shows the bedrock structure of a portion of the lithosphere. Letters A through D represent locations in the lithosphere.



18. Identify *one* of the most abundant minerals in the metamorphic rock at location A.

19. Explain why the type of rock changes between locations B and C.

20. Identify the grain size of the metamorphic rock at location D.

21 Explain why the oceanic crust (basalt) sinks beneath the continental crust (granite) when the two plates collide.

Base your answers to questions 22 through 24 on the data table below, which shows some characteristics of four rock samples, numbered 1 through 4. Some information has been left blank.

Data Table

Rock Sample Number	Composition	Grain Size	Texture	Rock Name
1	mostly clay mineral		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

22. State a possible grain size, in centimeters, for most of the particles found in sample 1.
23. Write the rock name of sample 2.
24. Write a term or phrase that correctly describes the texture of sample 4.

Base your answers to questions 25 through 27 on the photograph of a sample of gneiss below.



25. What observable characteristic could be used to identify this rock sample as gneiss?
26. Identify *two* minerals found in gneiss that contain iron and magnesium.
27. A dark-red mineral with a glassy luster was also observed in this gneiss sample.
- (a) Identify the mineral
- (b) State *one* possible use for this mineral.