Name: _____ Minerals and Rocks

Date: _____ Period: _____ Earth Science

Packet: Metamorphic Rocks

CLASS NOTES

- Metamorphic Rocks - _____

  _____

  _____

- Parent Rock - preexisting rock from which metamorphic rocks are formed

- Methods to classify sedimentary rocks:

  1. Texture - the description of its minerals along with their arrangement and size
     - Foliation - _____

       _____
       - Examples: Slate and Gneiss
     - Banding - _____

       _____
       - Examples: Gneiss
     - Nonfoliated - _____

       _____
       - Examples: Marble and Quatzite

  2. Grain Size - size of the individual _____ in the rock

  3. Composition - _____

     _____

4. Type of Metamorphism - the different conditions which exist for a metamorphic rock to form
   - Regional Metamorphism - _____
     _____
     - Heat from geothermal gradient and/or magma causes minerals to flow [not break] and cause the minerals to rearrange, realign and become elongated
     - Pressure from overlying rock squeezes the pore spaces out between the minerals within the rock and cause it to become more dense
   - Contact Metamorphism - _____
     _____
     - Heat from magma or lava causes minerals to rearrange
     - No _____

Scheme for Metamorphic Rock Identification

TEXTURE	GRAIN SIZE	COMPOSITION	TYPE OF METAMORPHISM	COMMENTS	ROCK NAME	MAP SYMBOL
FOLIATED – MINERAL ALIGNMENT	Fine	MICA, QUARTZ, FELDSPAR, AMPHIBOLE, GARNET, PYROXENE	Regional (Heat and pressure increases)	Low-grade metamorphism of shale	**Slate**	
FOLIATED – MINERAL ALIGNMENT	Fine to medium	MICA, QUARTZ, FELDSPAR, AMPHIBOLE, GARNET, PYROXENE	Regional (Heat and pressure increases)	Foliation surfaces shiny from microscopic mica crystals	**Phyllite**	
FOLIATED – MINERAL ALIGNMENT	Fine to medium	MICA, QUARTZ, FELDSPAR, AMPHIBOLE, GARNET, PYROXENE	Regional (Heat and pressure increases)	Platy mica crystals visible from metamorphism of clay or feldspars	**Schist**	
FOLIATED – BANDING	Medium to coarse	MICA, QUARTZ, FELDSPAR, AMPHIBOLE, GARNET, PYROXENE	Regional (Heat and pressure increases)	High-grade metamorphism; mineral types segregated into bands	**Gneiss**	
NONFOLIATED	Fine	Carbon	Regional	Metamorphism of bituminous coal	**Anthracite coal**	
NONFOLIATED	Fine	Various minerals	Contact (heat)	Various rocks changed by heat from nearby magma/lava	**Hornfels**	
NONFOLIATED	Fine to coarse	Quartz	Regional or contact	Metamorphism of quartz sandstone	**Quartzite**	
NONFOLIATED	Fine to coarse	Calcite and/or dolomite	Regional or contact	Metamorphism of limestone or dolostone	**Marble**	
NONFOLIATED	Coarse	Various minerals	Regional or contact	Pebbles may be distorted or stretched	**Metaconglomerate**	

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PART I QUESTIONS: MULTIPLE CHOICE

1. Where is metamorphic rock frequently found?
    a. along the interface between igneous intrusions and sedimentary bedrock
    b. within large lava flows
    c. on mountaintops that have horizontal layers containing marine fossils
    d. as a thin surface layer covering huge areas of the Continents

2. What is the main difference between metamorphic rocks and most other rocks?
    a. Many metamorphic rocks contain a high amount of oxygen- silicon tetraheda
    b. Many metamorphic rocks contain only one mineral
    c. Many metamorphic rocks have an organic composition
    d. Many metamorphic rocks exhibit banding and distortion of structure

3. The metamorphism of a sandstone rock will cause the rock
    a. to occupy a greater volume
    b. to be melted
    c. to become more dense
    d. to contain more fossils

4. Metamorphic rocks result from the
    a. erosion of rocks
    b. compression and cementation of soil particles
    c. cooling and solidification of molten magma
    d. recrystallization of rocks

5. The recrystallization of unmelted material under high temperature & pressure results in
    a. volcanic rock
    b. rock
    c. metamorphic rock
    d. sedimentary rocks

6. Which rock has never melted, but was produced by great heat and pressure, which distorted and rearranged its minerals?
    a. siltstone
    b. breccia
    c. pegmatite
    d. metaconglomerate

7. 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

8. During the intrusion of the Palisades Sill, contact metamorphism changed limestone into
    a. diorite
    b. marble
    c. sandstone
    d. hornfels

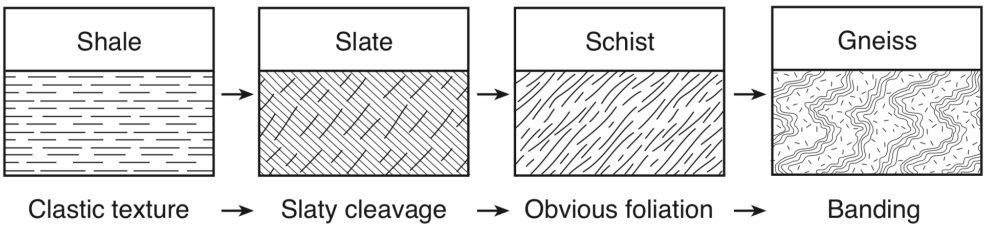
9. Which mineral is commonly found in the three metamorphic rocks slate, schist, and gneiss?
    a. pyroxene
    b. feldspar
    c. quartz
    d. mica

10. Slate is formed by the
    a. deposition of chlorite and mica
    b. foliation of schist
    c. metamorphism of shale
    d. folding and faulting of gneiss

11. Which nonfoliated rock forms only in a zone of contact metamorphism?
    a. conglomerate
    b. hornfels
    c. pegmatite
    d. quartzite

12. If a metamorphic rock bubbles when a drop of acid is placed on its surface, the rock is most likely
    a. schist
    b. slate
    c. marble
    d. quartzite

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



13. Which geologic process is occurring to cause this conversion?
    a. sedimentary layering
    b. intrusion of magma
    c. metamorphism
    d. weathering

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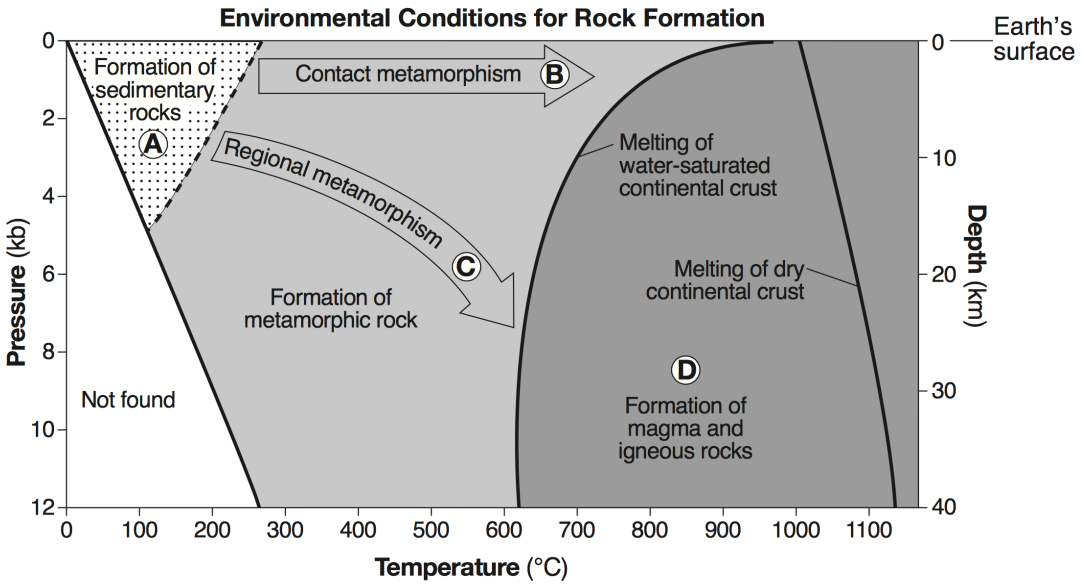
Base your answers to questions 14 through 17 on the graph below and on your knowledge of Earth science. The graph shows the temperature, pressure, and depth environments for the formation of the three major rock types. Pressure is shown in kilobars [kb]. Letters A through D identify different environmental conditions for rock formation.



14. Which rock is likely to form from rock material at a depth of 30 km and a temperature of 1000°C?
    a. quartz
    b. scoria
    c. shale
    d. granite

15. Which letter represents the environmental conditions necessary to form gneiss?
    a. A
    b. B
    c. C
    d. D

16. At what pressure and temperature is sand most likely to be compacted into sandstone?
    a. 2 kb and 150°C
    b. 6 kb and 200°C
    c. 10 kb and 400°C
    d. 12 kb and 900°C

17. Which letter represents the environmental conditions necessary to form hornfels?
    a. A
    b. B
    c. C
    d. D