

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

- 1) What is the approximate density of a mineral with a mass of 262.2 grams that displaces 46 cubic centimeters of water?
  - A) 6.1 g/cm<sup>3</sup>
  - B) 5.7 g/cm<sup>3</sup>
  - C) 1.8 g/cm<sup>3</sup>
  - D) 12.2 g/cm<sup>3</sup>
- 2) In which two Earth regions is oxygen the second most abundant element by volume?
  - A) crust and hydrosphere
  - B) core and crust
  - C) hydrosphere and troposphere
  - D) troposphere and core

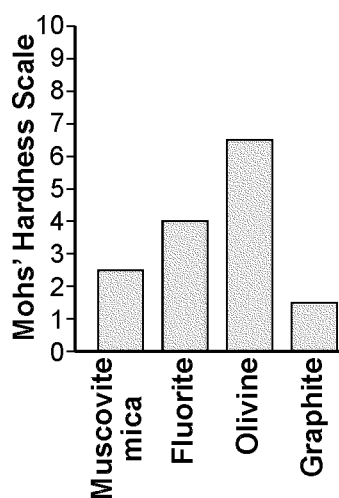
Questions 3 through 5 refer to the following:

The data table below lists some properties of four minerals that are used as ores of zinc (Zn).

Mineral Property	Mineral			
	Smithsonite	Sphalerite	Willemite	Zincite
Composition	ZnCO <sub>3</sub>	ZnS	Zn <sub>2</sub> SiO <sub>4</sub>	ZnO
Hardness	4–4.5	3.5–4	5.5	4
Density (g/cm <sup>3</sup> )	4.4	4.0	4.0	5.6
Color	white, gray, green, blue, yellow	brown, yellow, red, green, black	white, yellow, green, reddish brown, black	deep red to orange yellow
Streak	white	white to yellow to brown	white	orange yellow

- 3) A sample of sphalerite has a mass of 176.0 grams. What is the volume of the sample?
  - A) 40.0 cm<sup>3</sup>
  - B) 44.0 cm<sup>3</sup>
  - C) 22.7 cm<sup>3</sup>
  - D) 31.4 cm<sup>3</sup>
- 4) A mineral with a hardness of 5 would scratch which of the minerals listed in the data table?
  - A) zincite, sphalerite, and smithsonite, but not willemite
  - B) zincite, but not sphalerite, smithsonite, or willemite
  - C) all four zinc minerals in the table
  - D) zincite and sphalerite, but not smithsonite or willemite
- 5) Which mineral in the data table belongs in the same mineral group as quartz and olivine?
  - A) willemite
  - B) smithsonite
  - C) sphalerite
  - D) zincite
- 6) Which mineral precipitates from oceans and forms rock salt?
  - A) olivine
  - B) fluorite
  - C) halite
  - D) quartz

- 7) Which material is made mostly of the mineral quartz?  
 A) pencil lead  
 B) plaster of paris  
 C) sulfuric acid  
 D) window glass
- 8) Mineral crystals of quartz, biotite mica, and amphibole are produced primarily by the  
 A) cooling and solidification of magma  
 B) metamorphism of bituminous coal  
 C) chemical reaction of elements in seawater  
 D) deposition of sediments by a glacier
- 9) Which two properties are *most* useful in distinguishing between galena and halite?  
 A) hardness and streak  
 B) luster and color  
 C) cleavage and color  
 D) streak and cleavage
- 10) Which mineral will scratch fluorite, galena, and pyroxene?  
 A) dolomite  
 B) graphite  
 C) olivine  
 D) calcite
- 11) The graph below shows the hardness of four minerals.



Which mineral is hard enough to scratch calcite but is *not* hard enough to scratch amphibole?

- A) muscovite mica  
 B) graphite  
 C) olivine  
 D) fluorite

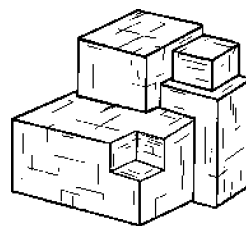
Questions 12 and 13 refer to the following:

The table provides information about four minerals, *A* through *D*.

DATA TABLE:

Mineral	Breakage	Hardness	Luster	Color
<i>A</i>	cleavage	2.5	metallic	silver
<i>B</i>	cleavage	2.5	nonmetallic	black
<i>C</i>	cleavage	3	nonmetallic	colorless
<i>D</i>	fracture	6.5	nonmetallic	green

- 12) The diagram below represents a sample of mineral A.



According to the information given in the table, mineral A is most likely

- A) olivine                      B) garnet                      C) galena                      D) halite
- 13) Based on the data given in the table, which mineral can scratch A, B, and C, but can *not* scratch D?
- A) fluorite    C) talc  
B) quartz    D) selenite gypsum
- 14) The table below lists some information about the minerals graphite and diamond.

DATA TABLE:

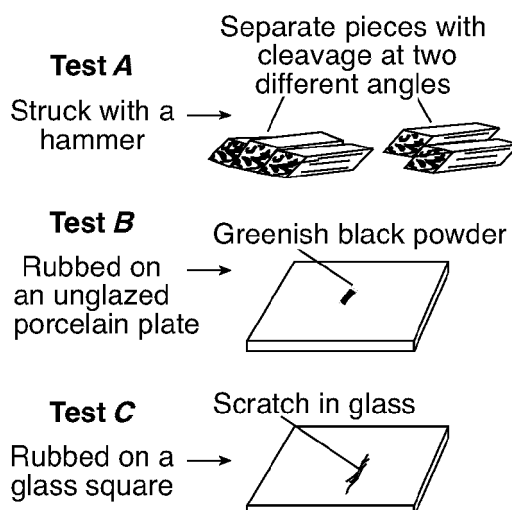
Mineral	Composition	Depth of Formation	Hardness	Electrical Conductor
graphite	carbon	shallow	1	good
diamond	carbon	very deep	10	poor

Some properties of diamond are different from those of graphite because diamond

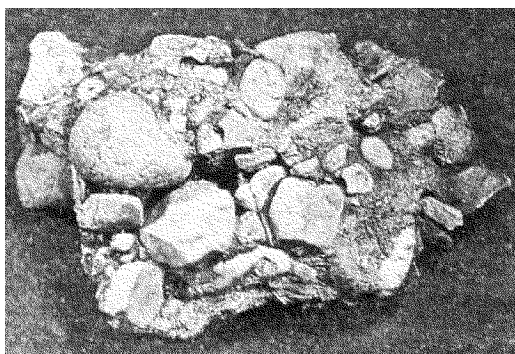
- A) has a different composition  
B) has a different arrangement of atoms  
C) forms larger crystals  
D) is older in geologic age

Questions 15 and 16 refer to the following:

The diagram below shows the results of three different physical tests, A, B, and C, that were performed on a mineral.



- 15) Which mineral was tested in the given diagram?  
 A) quartz  
 B) galena  
 C) graphite  
 D) amphibole
- 16) The luster of the mineral tested in the given diagram could be determined by  
 A) using a graduated cylinder  
 B) observing what happens when acid is placed on the mineral  
 C) using an electronic balance  
 D) observing how light reflects from the surface of the mineral
- 17) Most of the sediment that is compacted and later forms shale bedrock is  
 A) silt  
 B) pebbles  
 C) clay  
 D) sand
- 18) A student classified the rock below as sedimentary.

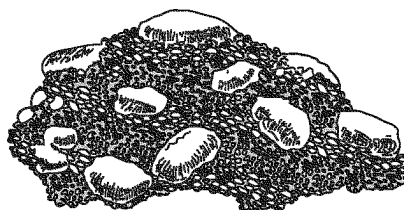


Which observation about the rock *best* supports this classification?

- A) The rock shows distorted and stretched pebbles.  
 B) The rock has a vesicular texture.  
 C) The rock is composed of several minerals.  
 D) The rock contains fragments of other rocks.
- 19) Most rocks that form from fragmental rock particles are classified as  
 A) chemical sedimentary  
 B) clastic sedimentary  
 C) intrusive igneous  
 D) extrusive igneous

Questions 20 and 21 refer to the following:

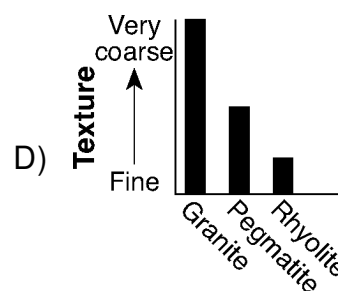
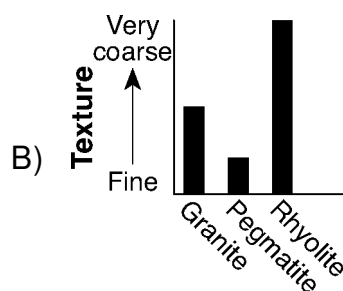
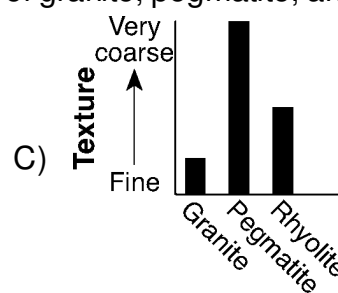
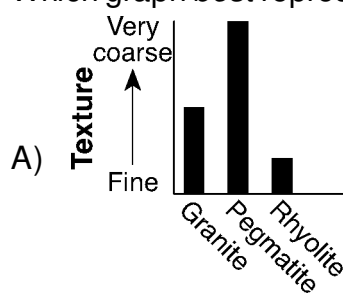
The diagram below represents a rock composed of cemented pebbles and sand.



- 20) The rock shown in the diagram should be classified as  
 A) an intrusive igneous rock  
 B) an extrusive igneous rock  
 C) a bioclastic sedimentary rock  
 D) a clastic sedimentary rock

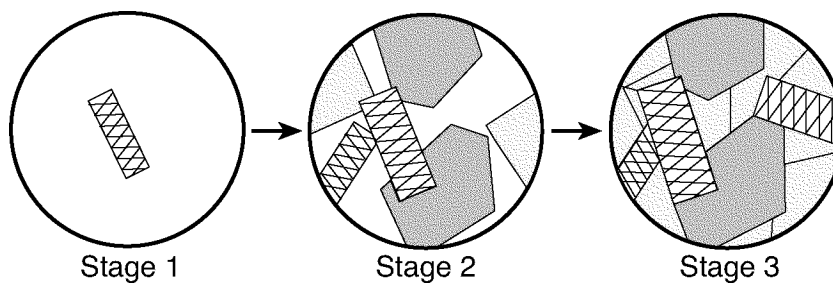
- 21) Which change would most likely occur if the given rock became buried deep within Earth's crust and was subjected to intense heat and pressure, but did *not* melt?
- A) The pebbles would become distorted and the sand would be recrystallized.  
 B) The rock would become more felsic with a higher concentration of magnesium.  
 C) The density of the pebbles and sand would decrease.  
 D) The rock would become a plutonic rock composed mostly of quartz.
- 22) Which processes lead directly to the formation of igneous rock?
- A) heat and pressure  
 B) melting and solidification  
 C) compaction and cementation  
 D) weathering and erosion
- 23) Which mineral can be found in all samples of rhyolite and andesite?
- A) pyroxene  
 B) potassium feldspar  
 C) quartz  
 D) biotite

- 24) Which graph *best* represents the textures of granite, pegmatite, and rhyolite?



- 25) Which texture *best* describes an igneous rock that formed deep underground?
- A) vesicular  
 B) glassy  
 C) coarse grained  
 D) fine grained
- 26) What is the color and type of rock that forms oceanic crust at mid-ocean ridges?
- A) dark colored and igneous  
 B) light colored and igneous  
 C) light colored and sedimentary  
 D) dark colored and sedimentary

- 27) Obsidian's glassy texture indicates that it formed
- slowly, on Earth's surface
  - slowly, deep below Earth's surface
  - quickly, on Earth's surface
  - quickly, deep below Earth's surface
- 28) Which igneous rock has a vesicular texture and a felsic composition?
- basalt
  - pumice
  - scoria
  - granite
- 29) The diagram below shows magnified views of three stages of mineral crystal formation as molten material gradually cools.



Which rock normally forms when minerals crystallize in these stages?

- gabbro
  - shale
  - gneiss
  - breccia
- 30) A nonvesicular rock is made entirely of green 2-millimeter-diameter crystals that have a hardness of 6.5 and show fracture, but *not* cleavage. The rock is most likely
- schist
  - phyllite
  - shale
  - dunite
- 31) Which rock is only formed by regional metamorphism?
- hornfels
  - marble
  - dunite
  - slate
- 32) The data table below lists characteristics of rocks *A*, *B*, *C*, and *D*.

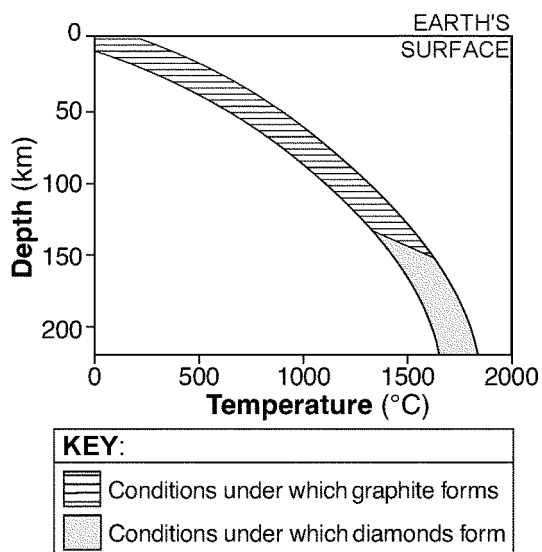
**Rock Characteristics**

Rock	Texture	Grain Size	Mineral Composition
<i>A</i>	nonfoliated	fine to coarse	calcite, dolomite, carbon
<i>B</i>	banding	coarse	biotite, quartz, plagioclase feldspar
<i>C</i>	bioclastic	microscopic to coarse	carbon, pyroxene, mica
<i>D</i>	foliated	fine to medium	quartz, amphibole, garnet

Which rock is most likely phyllite?

- A*
  - B*
  - C*
  - D*
- 33) Identify *two* elements that can be found in *both* olivine and pyroxene.
- 34) Identify *two* uses for the mineral graphite.

- 35) The graph below shows the depth and temperature conditions in Earth's interior under which carbon becomes either the mineral graphite or the mineral diamond.



Compared to the depth and temperature conditions under which graphite forms, describe the difference in the relative depth and relative temperature conditions under which *most* diamonds form.

Questions 36 and 37 refer to the following:

### **CARBON:**

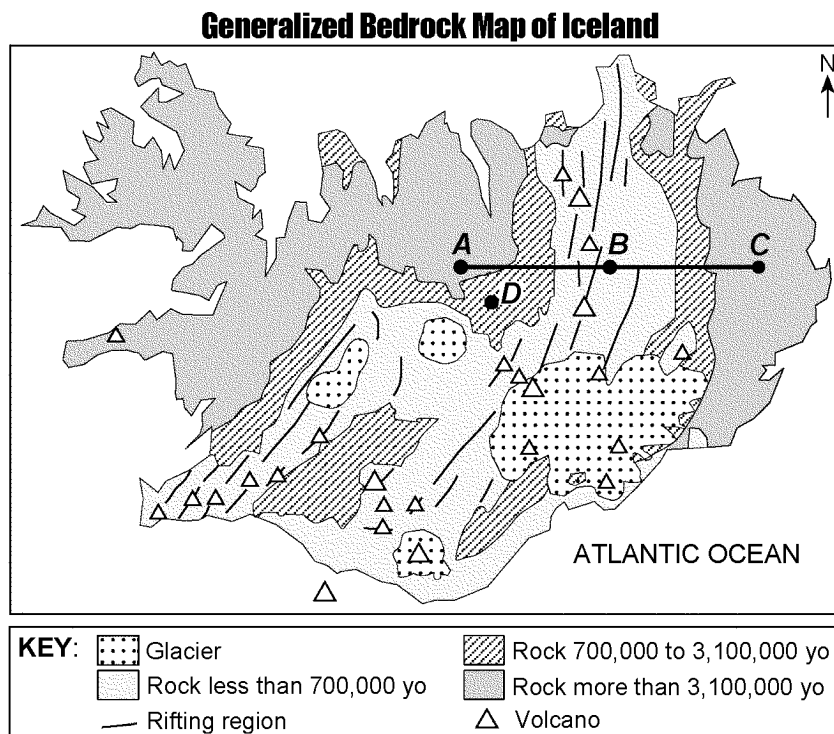
Carbon may be the most important element on our planet because it is the chemical building block of all living things. The element carbon is formed in dying stars and scattered when the stars explode. Our solar system formed from such star remnants. Pure carbon comes in several forms, which include the minerals graphite and diamond (hardness = 10), and the fossil fuels bituminous coal and anthracite coal. Almost all diamonds are mined from igneous rocks that originate at an approximate depth of 150 kilometers under immense pressure. Most graphite is formed through the metamorphism of organic material in rocks closer to Earth's surface.

- 36) Explain why graphite and diamond have different properties.

- 37) Complete the table below to show the properties of the minerals diamond and graphite.

Property	Diamond	Graphite
color	variable	
luster	nonmetallic	
hardness		

- 38) The map below shows the generalized surface bedrock geology of Iceland, an island located on the Mid-Atlantic Ridge. Points *A*, *B*, *C*, and *D* are locations on surface bedrock which is igneous in origin. Glaciers cover some surface bedrock.



Based on the given information, identify *one* fine-grained, highly mafic, volcanic rock likely found as surface bedrock in Iceland.



Questions 39 through 41 refer to the following:

The table below shows the approximate mineral percent composition of an igneous rock. The photograph shows the true-scale crystal sizes in this igneous rock.



Mineral Name	Percentage of Mineral Present
plagioclase feldspar	55%
biotite	15%
amphibole	30%

0 1  
centimeter

- 39) Identify *two* elements that are commonly found in all three minerals in the given data table.
- 40) Identify the igneous rock shown in the photograph.
- 41) Identify *two* processes that formed the rock shown in the photograph.

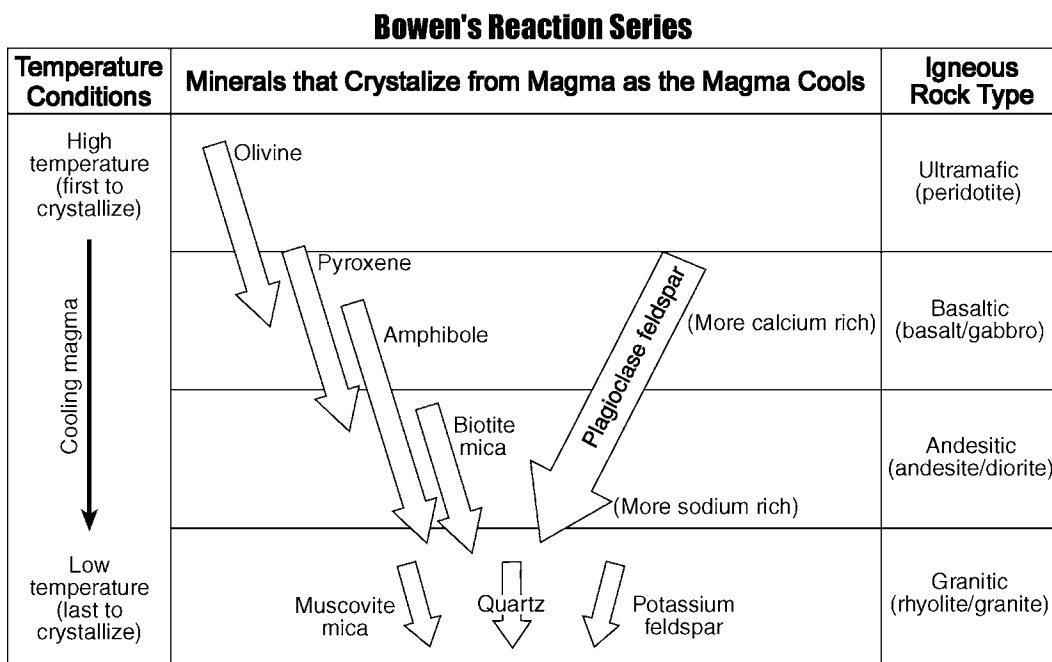
Questions 42 through 44 refer to the following:

A student on a field trip in New York State collected a sample of metamorphic bedrock containing bands of coarse-grained crystals of plagioclase feldspar, pyroxene, quartz, and mica.

- 42) List *two* of the chemical elements found in plagioclase feldspar.
- 43) Describe *two* physical properties of pyroxene.
- 44) Identify the metamorphic rock found by the student.

Questions 45 through 47 refer to the following:

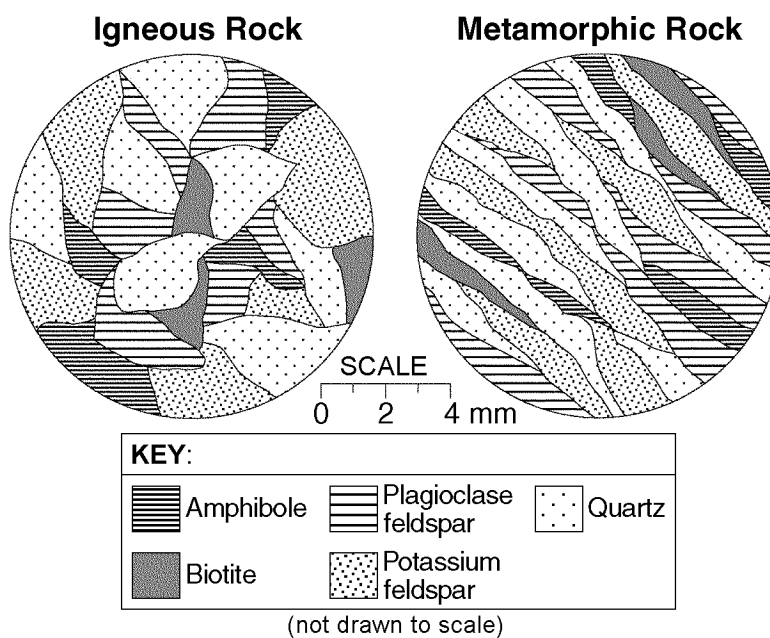
The diagram of *Bowen's Reaction Series* below shows the sequence in which minerals crystallize as magma cools and forms different types of igneous rocks from the same magma. The arrow for each mineral represents the relative temperature range at which that mineral crystallizes.



- 45) According to *Bowen's Reaction Series*, how is the chemical composition of plagioclase feldspar found in basaltic rock different from the chemical composition of plagioclase feldspar found in granitic rock?
- 46) Describe the temperature conditions shown in *Bowen's Reaction Series* that explain why olivine and quartz are *not* usually found in the same igneous rock type.
- 47) Identify *one* similarity and *one* difference between the igneous rocks andesite and diorite.

Questions 48 through 50 refer to the following:

The magnified views below show the minerals found in an igneous rock and in a metamorphic rock. The millimeter scale indicates the size of the crystals shown in the magnified views.



- 48) Identify the environment of formation of the igneous rock shown based on the size of its intergrown crystals.
- 49) Based on the minerals present, identify the relative color and density of the igneous rock shown compared to mafic igneous rocks with the same crystal size.
- 50) Describe the texture of the metamorphic rock shown that indicates it could be schist.