Wicander Monroe Historical Geology 7e Chapter 2
Minerals and Rocks

TRUE/FALSE

1. Limestone is mostly composed of the mineral quartz.

   ANS: F PTS: 1

2. An electron is the smallest unit of matter that retains the characteristics of an element.

   ANS: F PTS: 1

3. A proton is a positively charged particle in the nucleus of an atom.

   ANS: T PTS: 1

4. Matter is anything that has mass and occupies space.

   ANS: T PTS: 1

5. The sodium (Na) and chlorine (Cl) in halite have a covalent bond.

   ANS: F PTS: 1

6. Olivine is an example of a ferromagnesian silicate mineral.

   ANS: T PTS: 1

7. Lava is molten rock below the Earth's surface.

   ANS: F PTS: 1

8. Granite is an example of an aphanitic igneous rock.

   ANS: F PTS: 1

9. Calcite is an example of a silicate mineral.

   ANS: F PTS: 1

10. The explosive eruption of Mount St. Helens in 1980 generated a large amount of pyroclastic material.

    ANS: T PTS: 1

11. The glassy texture of obsidian is the result of extremely slow cooling.

    ANS: F PTS: 1

12. Sandstone is a detrital sedimentary rock mostly composed of particles measuring 1/16-2 mm in size.

    ANS: T PTS: 1

13. Limestone is an example of a chemical sedimentary rock.

    ANS: T PTS: 1

14. Coal is an example of a detrital sedimentary rock.

    ANS: F PTS: 1

15. Schist is an example of a foliated metamorphic rock.

    ANS: T PTS: 1

16. Sedimentary rocks that are composed of rounded gravel-sized particles are classified as conglomerates.

    ANS: T PTS: 1

17. An intrusive igneous rock that is ultramafic in composition would be classified as a basalt.

    ANS: F PTS: 1

18. Isotopes of an element all have the same number of neutrons, but differing numbers of protons.

    ANS: F PTS: 1

19. If a quartz sandstone is subjected to metamorphism, the resulting rock will be a marble.

    ANS: F PTS: 1

20. Converging plate boundaries are often sites of metamorphism and igneous activity.

    ANS: T PTS: 1

21. A limestone that is metamorphosed becomes marble.

    ANS: T PTS: 1

22. A sedimentary breccia has the same sized fragments as a conglomerate, but the individual fragments in a breccia are angular.

    ANS: T PTS: 1

23. A shale that is subjected to moderate metamorphism may become a slate.

    ANS: T PTS: 1

24. Rock salt is an example of an evaporite.

    ANS: T PTS: 1

25. The chemical composition of a mineral never has any variation.

    ANS: F PTS: 1

26. Basalt is a fine-grained volcanic rock that is rich in silica.

    ANS: F PTS: 1

27. Ionic bonds commonly are stronger than covalent bonds.

    ANS: F PTS: 1

28. The number of neutrons in the nucleus of an atom is its atomic number.

    ANS: F PTS: 1

29. Sandstone is an example of a metamorphic rock

    ANS: F PTS: 1

30. Marble is an example of a metamorphic rock.

    ANS: T PTS: 1

MULTIPLE CHOICE

1. Any rock altered in the solid state from pre-existing rocks by any combination of heat, pressure, and chemically active fluids:
   a. metamorphic rock
   b. igneous rock
   c. sedimentary rock

   ANS: A PTS: 1

2. Sedimentary rock formed by inorganic precipitation from evaporating water (for example, rock salt and rock gypsum):
   a. evaporite
   b. extrusive
   c. lava
   d. coal
   e. pyroclastic

   ANS: A PTS: 1

3. A naturally occurring, inorganic, crystalline solid, having characteristic physical properties and a narrowly defined chemical composition:
   a. rock
   b. gem
   c. mineral
   d. glass
   e. magma

   ANS: C PTS: 1

4. The process by which loose sand from a beach or desert is converted into a solid rock called sandstone is an example of
   a. lava.
   b. evaporite.
   c. lithification.
   d. mafic.
   e. metamorphism.

   ANS: C PTS: 1

5. Granite is an example of a coarse-grained _____ rock.
   a. extrusive
   b. intrusive

   ANS: B PTS: 1

6. Metamorphism taking place adjacent to a body of magma (a pluton) or beneath a lava flow from heat and chemically active fluids:
   a. orogeny
   b. contact metamorphism
   c. burial metamorphism
   d. nonconformity
   e. regional metamorphism

   ANS: B PTS: 1

7. You are hiking in the desert in Namaqualand in South Africa and you notice an area covered with white sedimentary deposits. You taste the deposits and they taste salty. This is most likely an example of
   a. an evaporite.
   b. a metamorphic rock.
   c. a detrital sedimentary rock.
   d. a pyroclastic rock.
   e. a volcanic rock.

   ANS: A PTS: 1

8. An adjective describing fragmental materials, such as ash, explosively erupted from volcanoes:
   a. metamorphic
   b. intrusive
   c. pyroclastic
   d. cementation
   e. sedimentary

   ANS: C PTS: 1

9. The number of protons in an atom's nucleus:
   a. orogeny
   b. atomic mass
   c. atom
   d. nucleus
   e. atomic number

   ANS: E PTS: 1

10. Molten rock material below the surface of the Earth:
    a. lithosphere
    b. evaporite
    c. mantle
    d. magma
    e. lava

    ANS: D PTS: 1

11. A strong chemical bond in which electrons are shared rather than transferred or exchanged (HINT: An example is the bond in quartz):
    a. covalent bond
    b. metallic bond
    c. malleable
    d. orogeny
    e. ionic bond

    ANS: A PTS: 1

12. An uncharged particle in the nucleus of an atom:
    a. neutron
    b. proton
    d. isotope
    e. electron

c. ion

ANS: A PTS: 1

13. A type of metamorphic rock that results from the recrystallization of limestone or dolostone:
    a. quartzite
    b. marble
    c. gneiss
    d. anthracite
    e. slate

ANS: B PTS: 1

14. A type of metamorphic rock that results from the recrystallization of quartz sandstone:
    a. marble
    b. slate
    c. gneiss
    d. anthracite
    e. quartzite

ANS: E PTS: 1

15. A type of metamorphic rock that results from the heating and compression of coal:
    a. quartzite
    b. marble
    c. gneiss
    d. anthracite
    e. slate

ANS: D PTS: 1

16. Isotopes of the same element have
    a. different numbers of protons, but the same number of neutrons.
    b. the same number of electrons, but different numbers of neutrons.
    c. different numbers of neutrons, but the same number of protons.
    d. different numbers of electrons, but the same number of neutrons.
    e. different numbers of protons and neutrons.

ANS: C PTS: 1

17. Which of the following rock types can be metamorphosed?
    a. igneous rocks
    b. sedimentary rocks
    c. metamorphic rocks
    d. a and b
    e. all of the above

ANS: E PTS: 1

18. For a neutrally-charged atom to become a positively-charged ion of the same element it must
    a. lose a proton.
    b. lose an electron.
    c. gain a proton.
    d. gain an electron.
    e. b and c

    ANS: B PTS: 1

19. When an atom becomes positively charged, it is called a/an
    a. electron.
    b. neutron.
    c. ion.
    d. isotope.
    e. positron.

    ANS: C PTS: 1

20. You observe a dark colored igneous rock with very fine crystals that are only visible under magnification. What can you say about this rock?
    a. It cooled slowly in a magma chamber.
    b. It cooled quickly in a magma chamber.
    c. It cooled slowly on Earth's surface.
    d. It cooled quickly on Earth's surface.
    e. It was ejected as a fine ash and later cemented together.

    ANS: D PTS: 1

SHORT ANSWER

1. The three major rock groups are _____, _____, and _____.

   ANS:
   igneous, sedimentary, metamorphic

   PTS: 1

2. Silicate minerals make up approximately _____ percent of the Earth's crust.

   ANS:
   95

   PTS: 1

3. All silicate minerals have _____ in common.

   ANS:
   the silica tetrahedron

   PTS: 1

4. The four major groups of igneous and volcanic rocks based on chemical composition are _____, _____, _____, and _____.

   ANS:
   felsic, intermediate, mafic, ultramafic

   PTS: 1

5. The two textural types of metamorphic rocks are _____ and _____.

   ANS:
   foliated, nonfoliated

   PTS: 1

6. Members of this mineral group all contain the silica tetrahedron: _____.

   ANS:
   silicate minerals

   PTS: 1

7. Members of this mineral group all contain the carbonate ion $(CO_3)^{-2}$: _____.

   ANS:
   carbonate minerals

   PTS: 1

8. A volcanic rock with a glassy texture commonly has experienced _____ cooling.

   ANS:
   rapid

   PTS: 1

9. The fine-grained equivalent of granite is _____.

   ANS:

rhyolite

PTS: 1

10. The coarse-grained equivalent of basalt is _____.

ANS:
gabbro

PTS: 1

ESSAY

1. Write a short essay comparing and contrasting the definitions of "mineral" and "rock." How are these concepts related? Provide specific examples of both concepts.

ANS:
The student should discuss the definitions of both terms and recognize that rocks are aggregates of one or more minerals. Examples of minerals may include quartz, calcite, diamond, etc. Examples of rocks may include limestone, quartz sandstone, etc.

PTS: 1

2. Provide a brief discussion of the structure of an atom. How do atoms of different minerals vary? Give specific examples of various elements and discuss their characteristics.

ANS:
The student should discuss electrons, neutrons, protons, the nucleus of an atom, and electron energy levels. Also important are the terms atomic mass number and atomic number.

PTS: 1

3. Provide a definition for chemical bonding. Compare and contrast ionic and covalent bonding. Provide specific examples of the different kinds of bonds.

ANS:
The student should provide definitions and discuss "sharing" versus "transferring" electrons in covalent and ionic bonding. Examples may include quartz or diamond for covalent bonding and halite (salt) for ionic bonding.

PTS: 1

4. Compare and contrast magma and lava. Why do scientists consider these materials separately?

ANS:

The student should recognize that magma is molten rock below the surface of the Earth and lava is molten rock above the surface of the Earth. The most important reason that scientists consider these two materials separately is that their cooling rates are very different. Magma cools very slowly because it is insulated by surrounding rock and lava cools very quickly because it is in contact with air or water.

PTS: 1

5. Compare and contrast igneous rocks and volcanic rocks. How and why are they different? Provide specific examples of both.

   ANS:
   The student should recognize that much of the difference between igneous and volcanic rocks is the result of different cooling rates. Igneous rocks commonly are coarse-grained because they cool slowly below the surface of the Earth and volcanic rocks commonly are glassy or fine-grained because they cool quickly above the surface of the Earth. Examples may include granite or gabbro for igneous rocks and basalt or rhyolite for volcanic rocks.

   PTS: 1

6. Provide a detailed description and discussion of the Rock Cycle. Provide specific examples of each of the three rock families.

   ANS:
   The student should be able to describe the formation of the three rock families: igneous, metamorphic, and sedimentary. The student also should recognize that there are cross-paths within the Rock Cycle. For example, metamorphic rocks may be uplifted and weathered to form sediments and sedimentary rocks. The term “lithification” also should be part of the discussion.

   PTS: 1

7. Compare and contrast detrital and chemical sedimentary rocks. Provide specific examples of each group.

   ANS:
   The student should recognize that detrital sedimentary rocks are made of detritus, including fragments of other rock types and weathering products. In contrast, chemical sedimentary rocks are composed of minerals derived from solutions. Examples of detrital sedimentary rocks may include sandstones and breccias. Examples of chemical sedimentary rocks may include limestones and evaporites.

   PTS: 1

8. Discuss the three agents responsible for metamorphism. How does each agent influence the metamorphic process?

ANS:
The student should discuss heat, pressure, and chemical fluids. Heat increases the rate of chemical reactions and may cause recrystallization of minerals. Pressure may cause tabular or platy minerals to display parallel orientations. Chemical fluids may result in deposition of soluble compounds in metamorphic rocks.

PTS: 1

9. Discuss the relationship between plate tectonics and the rock cycle. Provide examples of where various types of rocks might be found in terms of plate tectonics.

ANS:
The student should recognize that volcanic and igneous rocks very often are formed at convergent and divergent plate boundaries. Metamorphic rocks also are commonly found along these boundaries due to the heat and pressure generated at convergent plate boundaries. Sedimentary rocks may be formed in intraplate areas that are undergoing weathering and subsidence.

PTS: 1

10. Discuss the two major types of sedimentary rocks. What are the criteria for classifying each of these two types of rocks? Provide specific examples of each type.

ANS:
The student should recognize that sedimentary rocks are either detrital or chemical. Detrital rocks are classified primarily by grain size, whereas chemical sedimentary rocks are classified by chemical composition. Examples of detrital rocks are sandstone and conglomerate; examples of chemical sedimentary rocks are rock salt and limestone.

PTS: 1