Essentials of Geology, 13e **(Lutgens/Tarbuck/Tasa)**
Chapter 3 Matter and Minerals

1) Which of the following best defines a mineral and a rock?
A) A rock has an orderly, repetitive, geometrical, internal arrangement of minerals; a mineral is a lithified or consolidated aggregate of rocks.
B) A mineral consists of its constituent atoms arranged in a geometrically repetitive structure; in a rock, the atoms are randomly bonded without any geometric pattern.
C) In a mineral, the constituent atoms are bonded in a regular, repetitive, internal structure; a rock is a lithified or consolidated aggregate of different mineral grains.
D) A rock consists of atoms bonded in a regular, geometrically predictable arrangement; a mineral is a consolidated aggregate of different rock particles.
Answer: C
Diff: 1
Chapter Subhead: 3.1 Minerals: Building Blocks of Rocks
Bloom's: Remembering/Understanding

2) Which one of the following is NOT true for minerals?
A) They have a specific, internal, crystalline structure.
B) They can be a liquid, solid, or gas.
C) They have a specific, predictable chemical composition.
D) They can be identified by characteristic physical properties.
Answer: B
Diff: 1
Chapter Subhead: 3.1 Minerals: Building Blocks of Rocks
Bloom's: Remembering/Understanding

3) _____ is NOT a mineral.
A) Halite
B) Calcite
C) Oxygen
D) Gold
Answer: C
Diff: 1
Chapter Subhead: 3.1 Minerals: Building Blocks of Rocks
Bloom's: Remembering/Understanding

4) A compound is a stable chemical substance composed of two or more _____.
A) elements
B) molecules
C) minerals
D) electrons
Answer: A
Diff: 1
Chapter Subhead: 3.2 Atoms: Building Blocks of Minerals
Bloom's: Remembering/Understanding

5) What is the smallest particle of matter that exhibits and defines the distinctive chemical characteristics of the individual elements?
A) electron
B) element
C) compound
D) atom
Answer: D
Diff: 1
Chapter Subhead: 3.2 Atoms: Building Blocks of Minerals
Bloom's: Remembering/Understanding

6) A(n) _____ is not a fundamental particle found in atoms.
A) neutron
B) photon
C) electron
D) proton
Answer: B
Diff: 1
Chapter Subhead: 3.2 Atoms: Building Blocks of Minerals
Bloom's: Remembering/Understanding

7) Each atom of the same element, zinc for example, has the same number of _____.
A) electrons in the nucleus
B) protons in the nucleus
C) neutrons in the outer nuclear shell
D) electrons in the valence bond level
Answer: B
Diff: 1
Chapter Subhead: 3.2 Atoms: Building Blocks of Minerals
Bloom's: Remembering/Understanding

8) How many neutrons are in its nucleus?
A) 21
B) 7
C) 14
D) 6
Answer: B
Diff: 2
Chapter Subhead: 3.2 Atoms: Building Blocks of Minerals
Bloom's: Applying/Analyzing

9) _____ denote positively charged, nuclear particles.
A) Protons
B) Electrons
C) Isotrons
D) Neutrons
Answer: A
Diff: 1
Chapter Subhead: 3.2 Atoms: Building Blocks of Minerals
Bloom's: Remembering/Understanding

10) What are the lightest or least massive of the fundamental atomic particles?
A) uranium nuclei
B) protons
C) electrons
D) neutrons
Answer: C
Diff: 1
Chapter Subhead: 3.2 Atoms: Building Blocks of Minerals
Bloom's: Remembering/Understanding

11) A _____ denotes the purity of gold used in jewelry.
A) carnot
B) carette
C) karat
D) carlot
Answer: C
Diff: 1
Chapter Subhead: 3.2 Atoms: Building Blocks of Minerals - "Did You Know?" Box
Bloom's: Remembering/Understanding

12) Which of the following is an accurate description of ionic bonding?
A) Nuclei of bonding atoms exchange electrons; the resulting ions are bonded together by the attractive forces between the negative and positive nucleons.
B) Atoms of two different elements share electrons and protons; the resulting compound is bonded together by the strong, binding energy of shared protons.
C) Nuclei of two different atoms share electrons, and the resulting compound is tightly bonded by the very strong, induced, electronuclear bonds.
D) Atoms of different elements, having gained or lost electrons, form negative and positive ions that are bonded together by attractive forces between ions with opposite charges.
Answer: D
Diff: 1
Chapter Subhead: 3.3 Why Atoms Bond
Bloom's: Remembering/Understanding

13) What in the name given to an atom that gains or loses electrons in a chemical reaction?
A) molecule
B) ion
C) isotope
D) nucleon
Answer: B
Diff: 1
Chapter Subhead: 3.3 Why Atoms Bond
Bloom's: Remembering/Understanding

14) When an atom gains an electron during a chemical reaction, which of the following is true?
A) That atom has a negative charge.
B) That atom has a positive charge.
C) That atom has no charge.
D) That atom has no valence electrons.
Answer: A
Diff: 1
Chapter Subhead: 3.3 Why Atoms Bond
Bloom's: Remembering/Understanding

15) In which type of chemical bonding are electrons shared between adjacent atoms?
A) ionic
B) subatomic
C) covalent
D) isotopic
Answer: C
Diff: 1
Chapter Subhead: 3.3 Why Atoms Bond
Bloom's: Remembering/Understanding

16) How do the electrons behave in a mineral with metallic bonding?
A) They are tightly bound to certain atoms and cannot readily move.
B) They can move relatively easily from atom to atom inside the mineral.
C) They react with protons to make neutrons in the outer valence shells.
D) They move to adjacent negative ions, forming positive ions.
Answer: B
Diff: 1
Chapter Subhead: 3.3 Why Atoms Bond
Bloom's: Remembering/Understanding

17) In which type of bond are electrons transferred?
A) covalent bond
B) metallic bond
C) ionic bond
D) Electrons are transferred in all of these types of bonds.
Answer: C
Diff: 1
Chapter Subhead: 3.3 Why Atoms Bond
Bloom's: Remembering/Understanding

18) What mineral is the hardest known substance in nature?
A) silicate
B) native gold
C) diamond
D) muscovite
Answer: C
Diff: 1
Chapter Subhead: 3.4 Properties of Minerals
Bloom's: Remembering/Understanding

19) The strong tendency of certain minerals to break along smooth, parallel planes is known as _____.
A) streak
B) cleavage
C) cracking luster
D) crystal form
Answer: B
Diff: 1
Chapter Subhead: 3.4 Properties of Minerals
Bloom's: Remembering/Understanding

20) A cubic centimeter of quartz, olivine, and gold weigh 2.5, 3.0, and 19.8 grams respectively. This indicates that _____.
A) gold has a higher density and specific gravity than quartz and olivine
B) gold is 6 to 7 times harder than olivine and quartz
C) gold and olivine are silicates, quartz is elemental silicon
D) olivine and quartz powders are harder than metallic gold
Answer: A
Diff: 2
Chapter Subhead: 3.4 Properties of Minerals
Bloom's: Applying/Analyzing

21) _____ has the highest specific gravity.
A) Wood
B) Water
C) Gold
D) Quartz
Answer: C
Diff: 1
Chapter Subhead: 3.4 Properties of Minerals
Bloom's: Remembering/Understanding

22) The Mohs scale measures which property of minerals?
A) hardness
B) cleavage
C) specific gravity
D) opacity
Answer: A
Diff: 1
Chapter Subhead: 3.4 Properties of Minerals
Bloom's: Remembering/Understanding

23) What physical property denotes the color of a powdered mineral?
A) fracture
B) hardness
C) streak
D) luster
Answer: C
Diff: 1
Chapter Subhead: 3.4 Properties of Minerals
Bloom's: Remembering/Understanding

24) Which of the following is true about a mineral's streak?
A) All minerals produce a streak when rubbed across a streak plate.
B) A mineral's color is a better way to identify it than by its streak.
C) A mineral's streak is always the same color as the solid mineral's color.
D) Streak is a more reliable way to identify a mineral than by color.
Answer: D
Diff: 1
Chapter Subhead: 3.4 Properties of Minerals
Bloom's: Remembering/Understanding

25) _____ reacts readily with acids such as hydrochloric.
A) Calcite
B) Quartz
C) Diamond
D) Talc
Answer: A
Diff: 1
Chapter Subhead: 3.4 Properties of Minerals
Bloom's: Remembering/Understanding

26) Which of the following describes the light reflecting characteristics of a mineral?
A) luster
B) color streak
C) virtual absorption
D) fluorescence
Answer: A
Diff: 1
Chapter Subhead: 3.4 Properties of Minerals
Bloom's: Remembering/Understanding

27) Gold's tenacity can be described as _____.
A) malleable
B) sectile
C) elastic
D) brittle
Answer: A
Diff: 1
Chapter Subhead: 3.4 Properties of Minerals
Bloom's: Remembering/Understanding

28) You come across a whitish mineral in the field. You think it might be calcite, but you aren't sure. Which of the following would be the best way to determine if your sample is calcite?
A) Smash it with a rock hammer to see if it fractures.
B) Apply dilute hydrochloric acid to see if it fizzes.
C) Check its streak color.
D) Test its hardness.
Answer: B
Diff: 2
Chapter Subhead: 3.4 Properties of Minerals
Bloom's: Applying/Analyzing

29) Which group of minerals are the most abundant in the Earth's crust?
A) sulfides
B) carbonates
C) silicates
D) chlorides
Answer: C
Diff: 1
Chapter Subhead: 3.5 Mineral Groups
Bloom's: Remembering/Understanding

30) How many elements compose the majority of rock-forming minerals?
A) 4
B) 6
C) 8
D) 10
Answer: C
Diff: 1
Chapter Subhead: 3.5 Mineral Groups
Bloom's: Remembering/Understanding

31) Which of the following best describes the way minerals are classified?
A) on the basis of similar crystal structures and compositions
B) on the basis of similar color and shape
C) on the basis of similar names and color
D) on the basis of being found in the same place
Answer: A
Diff: 1
Chapter Subhead: 3.5 Mineral Groups
Bloom's: Remembering/Understanding

32) All silicate minerals contain _____ and _____.
A) iron; silicon
B) silicon; sodium
C) oxygen; carbon
D) silicon; oxygen
Answer: D
Diff: 1
Chapter Subhead: 3.6 The Silicates
Bloom's: Remembering/Understanding

33) What element is the most abundant in the Earth's crust by weight?
A) carbon
B) chlorine
C) oxygen
D) sodium
Answer: C
Diff: 1
Chapter Subhead: 3.6 The Silicates
Bloom's: Remembering/Understanding

34) The ion at the center of a silicate tetrahedron is surrounded by _____.
A) 4 oxygen ions
B) 6 oxygen ions
C) 4 sodium ions
D) 6 sodium ions
Answer: A
Diff: 1
Chapter Subhead: 3.6 The Silicates
Bloom's: Remembering/Understanding

35) Silicate minerals polymerize to form a variety of structures. Three-dimensional structures have _____ silicon than those composed of independent tetrahedra.
A) less
B) more
Answer: B
Diff: 1
Chapter Subhead: 3.6 The Silicates
Bloom's: Remembering/Understanding

36) Which mineral is composed of silicon dioxide (SiO_2)?
A) calcite
B) diamond
C) olivine
D) quartz
Answer: D
Diff: 1
Chapter Subhead: 3.7 Common Silicate Minerals
Bloom's: Remembering/Understanding

37) Parallel, straight, linear imperfections visible on the cleavage surfaces of plagioclase feldspar are called _____.
A) striations
B) fractures
C) cleavage
D) streaks
Answer: A
Diff: 1
Chapter Subhead: 3.7 Common Silicate Minerals
Bloom's: Remembering/Understanding

38) Which of the following minerals is a silicate?
A) hematite
B) muscovite
C) calcite
D) halite
Answer: B
Diff: 1
Chapter Subhead: 3.7 Common Silicate Minerals
Bloom's: Remembering/Understanding

39) Which one of the following is a sodium and calcium feldspar with striations?
A) orthoclase
B) microcline
C) plagioclase
D) sanidine
Answer: C
Diff: 1
Chapter Subhead: 3.7 Common Silicate Minerals
Bloom's: Remembering/Understanding

40) Which of the following minerals is a ferromagnesian silicate?
A) quartz
B) orthoclase
C) hornblende
D) muscovite
Answer: C
Diff: 1
Chapter Subhead: 3.7 Common Silicate Minerals
Bloom's: Remembering/Understanding

41) Which of the following minerals is in the mineral group known as mica?
A) orthoclase
B) muscovite
C) augite
D) olivine
Answer: B
Diff: 1
Chapter Subhead: 3.7 Common Silicate Minerals
Bloom's: Remembering/Understanding

42) Which of the following best characterizes ferromagnesian silicates?
A) They contain iron and magnetite, are black in color, and they have metallic lusters.
B) They are black to dark-green silicate minerals containing iron and magnesium.
C) They contain magnetite and ferrite, and they are clear to light green.
D) They are mostly clear, colorless, and rich in the elements magnesium and ferrum.
Answer: B
Diff: 1
Chapter Subhead: 3.7 Common Silicate Minerals
Bloom's: Remembering/Understanding

43) Which of the following correctly describes the difference between ferromagnesian and nonferromagnesian silicates?
A) Nonferromagnesian silicates are darker in color and do not contain iron or magnesium.
B) Nonferromagnesian silicates are lighter in color and do not contain iron or magnesium.
C) Nonferromagnesian silicates are lighter in color and contain iron or magnesium.
D) Nonferromagnesian silicates are darker in color and contain iron or magnesium.
Answer: B
Diff: 1
Chapter Subhead: 3.7 Common Silicate Minerals
Bloom's: Remembering/Understanding

44) _____ exhibit a sheet-like silicate structure.
A) Carbonates
B) Pyroxenes
C) Clays
D) Feldspars
Answer: C
Diff: 1
Chapter Subhead: 3.7 Common Silicate Minerals
Bloom's: Remembering/Understanding

45) Which one of the following is a typical product of weathering?
A) micas
B) ferromagnesians
C) feldspars
D) clays
Answer: D
Diff: 1
Chapter Subhead: 3.7 Common Silicate Minerals
Bloom's: Remembering/Understanding

46) What is the name of the dark-colored mica?
A) calcite
B) biotite
C) quartz
D) olivine
Answer: B
Diff: 1
Chapter Subhead: 3.7 Common Silicate Minerals
Bloom's: Remembering/Understanding

47) Hornblende and the other amphiboles have what type of silicate structure?
A) metallic
B) sheet
C) 3-D framework
D) double chains
Answer: D
Diff: 1
Chapter Subhead: 3.7 Common Silicate Minerals
Bloom's: Remembering/Understanding

48) How does one classify a nonsilicate mineral group?
A) silicon tetrahedra
B) negatively charged ion or complex ion
C) cleavage direction
D) opacity
Answer: B
Diff: 1
Chapter Subhead: 3.8 Important Nonsilicate Minerals
Bloom's: Remembering/Understanding

49) Which common nonsilicate mineral is used in wallboard?
A) gypsum
B) pyrite
C) bentonite
D) halite
Answer: A
Diff: 1
Chapter Subhead: 3.8 Important Nonsilicate Minerals - "Did You Know?" Box
Bloom's: Remembering/Understanding

50) Which of the following is an important nonsilicate mineral?
A) calcite
B) dolomite
C) quartz
D) Calcite and dolomite are both important nonsilicate minerals.
E) Calcite and quartz are both important nonsilicate minerals.
Answer: D
Diff: 1
Chapter Subhead: 3.8 Important Nonsilicate Minerals
Bloom's: Remembering/Understanding

51) What is a naturally occurring concentration of one or more metallic minerals that can be extracted economically called?
A) nonrenewable resource
B) compound
C) ore
D) deposit
Answer: C
Diff: 1
Chapter Subhead: 3.9 Minerals: A Nonrenewable Resource
Bloom's: Remembering/Understanding

52) Cell phones are often recycled to collect gold and other metals from them. This is profitable because _____.
A) the demand for the precious metals has increased
B) technological advances allow the metals to be extracted more efficiently
C) it is a renewable resource
D) the demand for the precious metals has increased, and technological advances allow the metals to be extracted more efficiently
E) technological advances allow the metals to be extracted more efficiently, and it is a renewable resource
Answer: D
Diff: 1
Chapter Subhead: 3.9 Minerals: A Nonrenewable Resource
Bloom's: Remembering/Understanding

53) Ruby and sapphire are red and blue forms of the mineral _____.
A) diamond
B) turquoise
C) emerald
D) corundum
Answer: D
Diff: 1
Chapter Subhead: 3.9 Minerals: A Nonrenewable Resource - "Did You Know?" Box
Bloom's: Remembering/Understanding

54) Mineral resources are _____ resources.
A) renewable
B) nonrenewable
C) Mineral resources can be both renewable and nonrenewable.
Answer: B
Diff: 1
Chapter Subhead: 3.9 Minerals: A Nonrenewable Resource
Bloom's: Remembering/Understanding

55) Examine the words and/or phrases below and determine the relationship among the majority of words/phrases. Choose the option that does not fit the pattern.
A) electron
B) compound
C) proton
D) neutron
Answer: B
Diff: 1
Chapter Subhead: 3.2 Atoms: Building Blocks of Minerals
Bloom's: Remembering/Understanding

56) Examine the words and/or phrases below and determine the relationship among the majority of words/phrases. Choose the option that does not fit the pattern.
A) quartz
B) mica
C) feldspar
D) calcite
Answer: D
Diff: 2
Chapter Subhead: 3.7 Common Silicate Minerals
Bloom's: Applying/Analyzing

57) Examine the words and/or phrases below and determine the relationship among the majority of words/phrases. Choose the option that does not fit the pattern.
A) diamond
B) calcite
C) gypsum
D) dolomite
Answer: A
Diff: 2
Chapter Subhead: 3.8 Important Nonsilicate Minerals
Bloom's: Applying/Analyzing

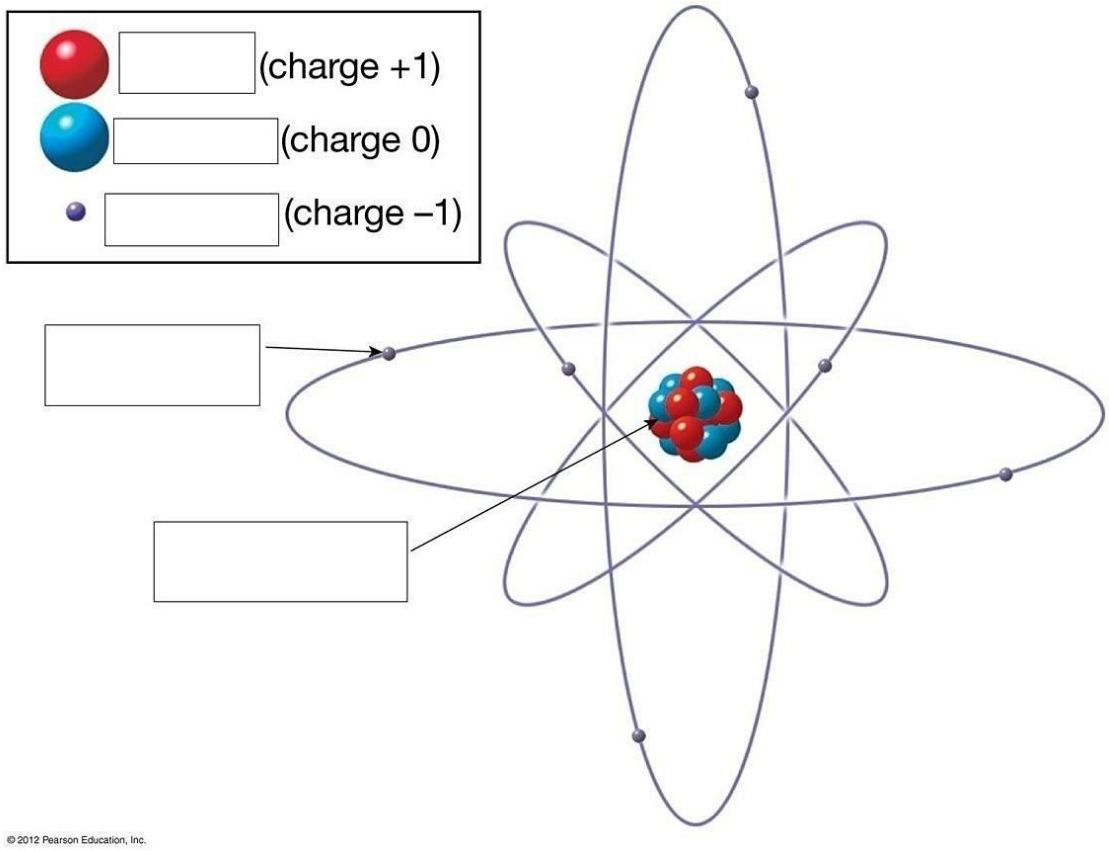
Critical thinking and discussion questions. Use complete sentences, correct spelling, and the information presented in chapter 3 to answer the questions below.

58) Based on the brief discussion of chemistry and chemical bonding in chapter 3, why do minerals rarely exhibit pure chemical compositions (100% always the same chemical composition)?
Answer: Certain elements can substitute for others of similar size without changing the minerals' internal structure.
Diff: 3
Chapter Subhead: 3.1 Minerals: Building Blocks of Rocks
Bloom's: Evaluating/Creating

59) Overall, the physical properties of minerals provide a reliable means to identify common minerals. However, certain properties can exhibit a range of characteristics or values making them less useful for identification purposes. Choose three physical properties that might vary considerably between samples of the same mineral and explain why such variability would exist.
Answer: Certain elements can substitute for others of similar size without changing the minerals' internal structure.
Diff: 3
Chapter Subhead: 3.4 Properties of Minerals
Bloom's: Evaluating/Creating

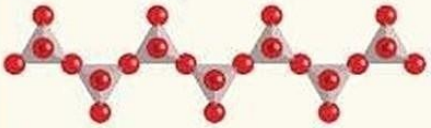
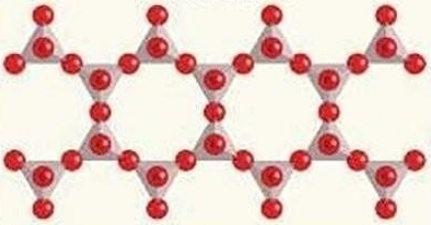
60) Considering the composition and structure of Earth discussed in chapter 1, do you think all of the possible silicate (and even mineral) structures have been identified by scientists? Discuss why or why not. Also, does this same reasoning apply to all possible chemical elements of Earth?
Answer: It is probable that there are more silicate and mineral structures yet to be identified by scientists. We have not been able to extensively explore the layers of the earth nor the surface of other planets.
Diff: 3
Chapter Subhead: 3.5 Mineral Groups
Bloom's: Evaluating/Creating

61) Label the various parts of an atom in the diagram below.



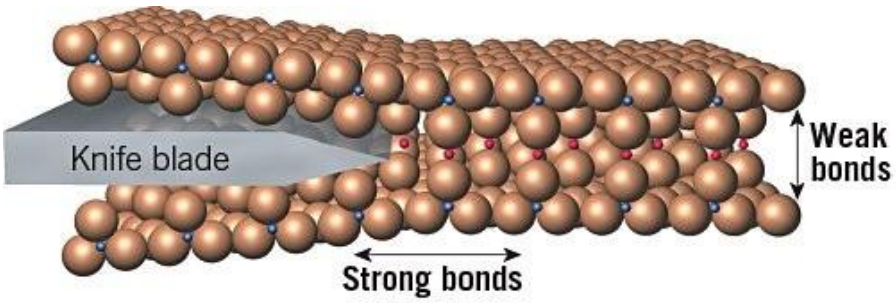
Answer: See Figure 3.4A in chapter 3 of the *Essentials of Geology, 13e* textbook
Diff: 1
Chapter Subhead: 3.2 Atoms: Building Blocks of Minerals
Bloom's: Remembering/Understanding

62) Fill in the table below on silicate minerals.

Mineral/Formula	Cleavage	Silicate Structure
Olivine group $(Mg, Fe)_2SiO_4$	(a)	Single tetrahedron 
(b)	Two planes at 90°	Single chains 
(c)	(d)	Double chains 

Answer: (a) none
(b) pyroxene group - augite
(c) amphibole group - hornblende
(d) two planes at 60 and 120 degrees
Diff: 2
Chapter Subhead: 3.7 Common Silicate Minerals
Bloom's: Applying/Analyzing

63) Look at the figure below. Which mineral is best represented by this figure?



A) mica
B) quartz
C) diamond
D) calcite
Answer: A
Diff: 1
Chapter Subhead: 3.4 Properties of Minerals
Bloom's: Remembering/Understanding