Package Title: Testbank
Course Title: Visualizing Geology, 3e
Chapter Number: 02

Question Type: Multiple Choice

01) The smallest particle that retains all of the chemical properties of an element is called a(n)

a) molecule.
b) isotope.
c) atom.
d) ion.

Answer: C

Difficulty: Easy
Learning Objective 1: Describe atoms, molecules, and four kinds of chemical bonds.
Section Reference 1: Elements and Compounds

02) Atoms with the same atomic number but different mass numbers are called

a) molecules.
b) isotopes.
c) elements.
d) ions.

Answer: B

Difficulty: Easy
Learning Objective 1: Describe atoms, molecules, and four kinds of chemical bonds.
Section Reference 1: Elements and Compounds

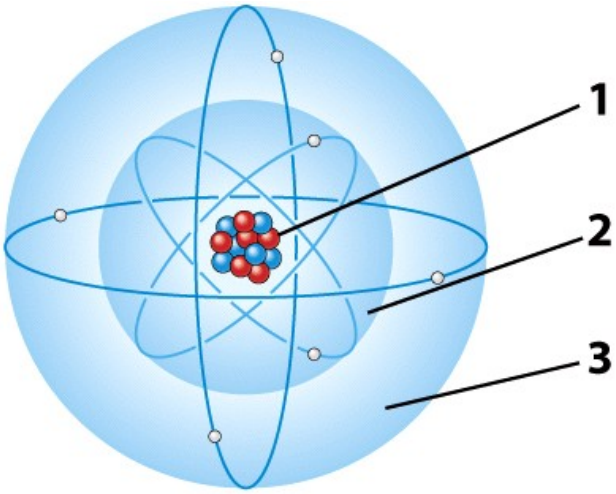
03) The smallest chemical unit that has all the properties of a particular compound is called a(n)

a) molecule.
b) isotope.
c) atom.
d) ion.

Answer: A

Difficulty: Easy
Learning Objective 1: Describe atoms, molecules, and four kinds of chemical bonds.
Section Reference 1: Elements and Compounds

04) In the illustration below, the part of the atom that has a positive charge is referred to as the:

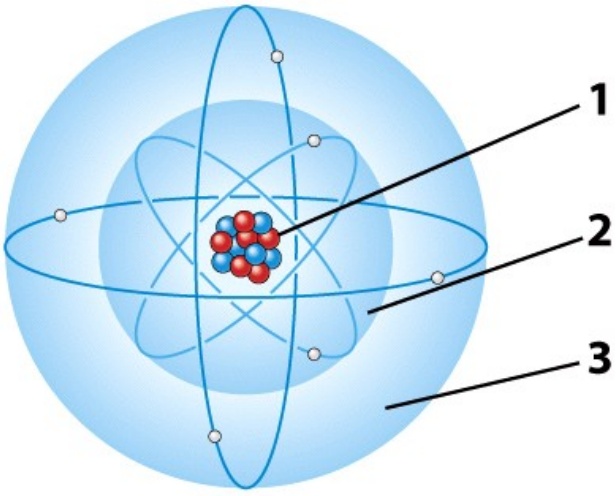


a) first electron energy level.
b) second electron energy level.
c) Both A and B are correct.
d) nucleus.

Answer: D

Difficulty: Low
Learning Objective 1: Describe atoms, molecules, and four kinds of chemical bonds.
Section Reference 1: Elements and Compounds

05) In the illustration below, the part(s) of the atom that has a negative charge is referred to as the:

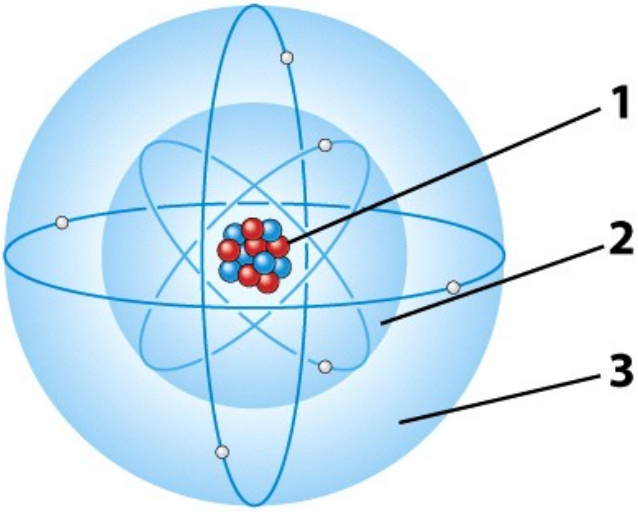


a) first electron energy level.
b) second electron energy level.
c) Both A and B are correct.
d) nucleus.

Answer: C

Difficulty: Easy
Learning Objective 1: Describe atoms, molecules, and four kinds of chemical bonds.
Section Reference 1: Elements and Compounds

06) In the illustration below, the part of the atom in which virtually all the mass is concentrated is referred to as the:



a) first electron energy level.
b) second electron energy level.
c) Both A and B are correct.
d) nucleus.

Answer: D

Difficulty: Low
Learning Objective 1: Describe atoms, molecules, and four kinds of chemical bonds.
Section Reference 1: Elements and Compounds

07) The atomic number of an atom is

a) the number of protons and neutrons in the nucleus.
b) the number of protons in the nucleus.
c) the number of neutrons in the nucleus.
d) the number of electron energy levels.

Answer: B

Difficulty: Easy
Learning Objective 1: Describe atoms, molecules, and four kinds of chemical bonds.
Section Reference 1: Elements and Compounds

08) The mass number of an atom is:

a) the number of protons and neutrons in the nucleus.
b) the number of protons in the nucleus.
c) the number of neutrons in the nucleus.
d) the number of electron energy levels.

Answer: A

Difficulty: Easy
Learning Objective 1: Describe atoms, molecules, and four kinds of chemical bonds.
Section Reference 1: Elements and Compounds

09) A hypothetical ion X has an electrical charge of -2. Which of the following statements best describes the relative number of electrons and protons in the atom?

a) The X ion has 2 less electrons than protons.
b) The X ion has 2 more electrons than protons.
c) The X ion has the same number of electrons as protons.
d) The X ion has 1 less electron than protons.

Answer: B

Difficulty: Medium
Learning Objective 1: Describe atoms, molecules, and four kinds of chemical bonds.
Section Reference 1: Elements and Compounds

10) One atom of a hypothetical element X has 27 protons while another has 29. This would make the two atoms of the element

a) molecules.
b) compounds.
c) ions.
d) isotopes.

Answer: D
Difficulty: Easy
Learning Objective 1: Describe atoms, molecules, and four kinds of chemical bonds.
Section Reference 1: Elements and Compounds

11) What type of weak bond results from asymmetry in charge distribution?

a) covalent bond
b) metallic bond
c) ionic bond
d) Van der Waals bond

Answer: D

Difficulty: Easy
Learning Objective 1: Describe atoms, molecules, and four kinds of chemical bonds.
Section Reference 1: Elements and Compounds

12) What type of bond forms from the sharing of electrons between atoms?

a) covalent bond
b) metallic bond
c) ionic bond
d) Van der Waals bond

Answer: A

Difficulty: Easy
Learning Objective 1: Describe atoms, molecules, and four kinds of chemical bonds.
Section Reference 1: Elements and Compounds

13) What type of bond forms the strongest chemical bonds and compounds that tend to be strong with great hardness?

a) covalent bond
b) metallic bond
c) ionic bond
d) Van der Waals bond

Answer: A

Difficulty: Easy
Learning Objective 1: Describe atoms, molecules, and four kinds of chemical bonds.
Section Reference 1: Elements and Compounds

14) Based on the definition of a mineral – being a naturally occurring solid, formed by inorganic processes, with a characteristic crystal structure and specific chemical composition, which materials will be classified as minerals?

a) water and ice
b) ice and steel
c) steel and coal
d) ice and quartz

Answer: D

Difficulty: Easy
Learning Objective 1: Define minerals and their properties.
Section Reference 1: What is a Mineral?

15) Why is steel not considered a mineral?

a) It is organic.
b) It is man-made.
c) It doesn't have a crystalline structure.
d) All of the above

Answer: B

Difficulty: Easy
Learning Objective 1: Define minerals and their properties.
Section Reference 1: What is a Mineral?

16) To which of the following groups do most minerals in Earth's crust belong?

a) oxides
b) halides
c) carbonates
d) silicates

Answer: D

Difficulty: Easy
Learning Objective 1: Define minerals and their properties.
Section Reference 1: What is a Mineral?

17) The natural samples of corundum pictured below show variations of color from red (ruby) to blue (sapphire). The differences in color is best explained by:

a) polymerization
b) crystal structure

c) the principle of atomic substitution
d) polymorphism

Answer: C

Difficulty: Easy
Learning Objective 1: Define minerals and their properties.
Section Reference 1: What is a Mineral?

18) The property of a mineral to resist scratching is referred to as

a) streak.
b) density.
c) hardness.
d) tenacity.

Answer: C

Difficulty: Easy
Learning Objective 1: Define minerals and their properties.
Section Reference 1: What is a Mineral?

19. The property of a mineral that relates to how heavy it is for its size is referred to as:

a) streak.
b) density.
c) hardness.
d) tenacity.

Answer: B

Difficulty: Easy
Learning Objective 1: Define minerals and their properties.
Section Reference 1: What is a Mineral?

20) Which element is the most abundant (by weight) in Earth's crust?

a) silicon
b) iron
c) calcium
d) oxygen

Answer: D

Difficulty: Low
Learning Objective 1: Define minerals and their properties.
Section Reference 1: What is a Mineral?

21) The two most common mineral families in Earth's crust are

a) the silicates and the oxides.
b) the silicates and the carbonates.
c) the carbonates and the oxides.
d) the phosphates and the oxides.

Answer: A

Difficulty: Easy
Learning Objective 1: Identify some common chemical elements and mineral families.
Section Reference 1: Mineral Families

22) What element bonds with a silicon atom to form the “silicate” tetrahedron?

a) oxygen
b) hydrogen
c) oxygen and hydrogen
d) carbon

Answer: A

Difficulty: Easy
Learning Objective 1: Identify some common chemical elements and mineral families.
Section Reference 1: Mineral Families

23) What charge does the silicate ion contribute to form the silicate tetrahedron?

a) negative
b) no charge
c) positive
d) negative and positive
e) all of the above

Answer: C

Difficulty: Medium
Learning Objective 1: Identify some common chemical elements and mineral families.
Section Reference 1: Mineral Families

24) Which of the following is the weakest silicate structure?

a) single tetrahedron
b) hexagonal ring
c) sheet
d) framework
e) single chain

Answer: C
Difficulty: Medium
Learning Objective 1: Identify some common chemical elements and mineral families.
Section Reference 1: Mineral Families

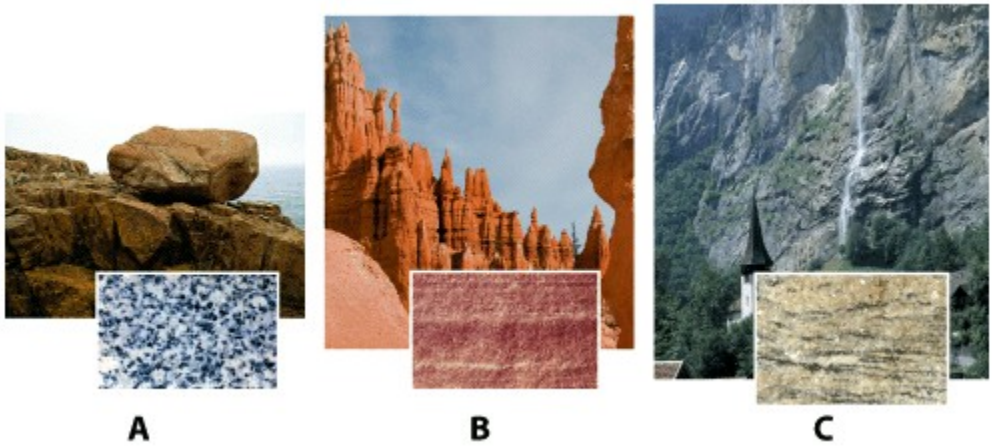
25) Which of the following is the hardest silicate structure?

a) single tetrahedron
b) hexagonal ring
c) sheet
d) framework

Answer: D

Difficulty: Easy
Learning Objective 1: Identify some common chemical elements and mineral families.
Section Reference 1: Mineral Families

26) Which rock sample has been altered by heat and pressure so that a new mineral assemblage and rock fabric has developed?

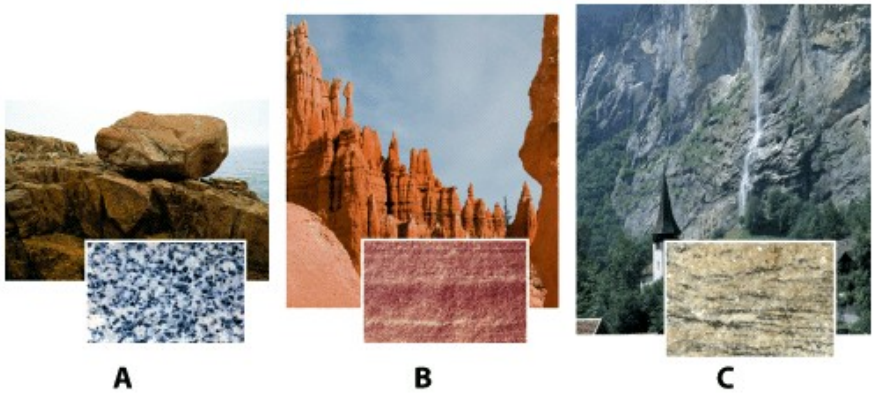


a) Sample A.
b) Sample B.
c) Sample C.
d) None of the above answers are correct.

Answer: C

Difficulty: Medium
Learning Objective 1: Describe the three major families of rocks.
Section Reference 1: Rock: A First Look

27) Which sample is an example of an igneous rock?

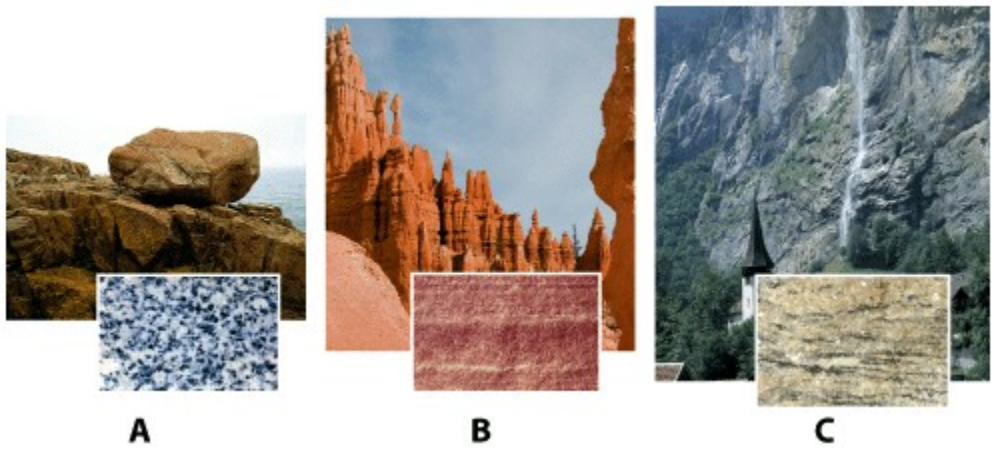


a) Sample A.
b) Sample B.
c) Sample C.
d) None of the above answers are correct.

Answer: A

Difficulty: Medium
Learning Objective 1: Describe the three major families of rocks.
Section Reference 1: Rock: A First Look

28) Which rock sample is held together by naturally forming cement?

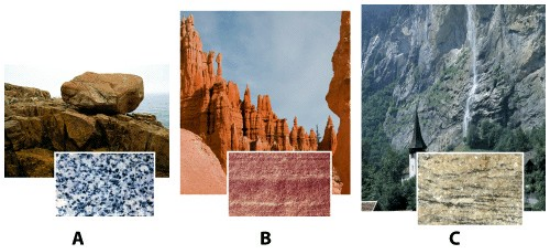


a) Sample A.
b) Sample B.
c) Sample C.
d) None of the above answers are correct.

Answer: B

Difficulty: Medium
Learning Objective 1: Describe the three major families of rocks.
Section Reference 1: Rock: A First Look

29) Which sample is an example of sedimentary rock?

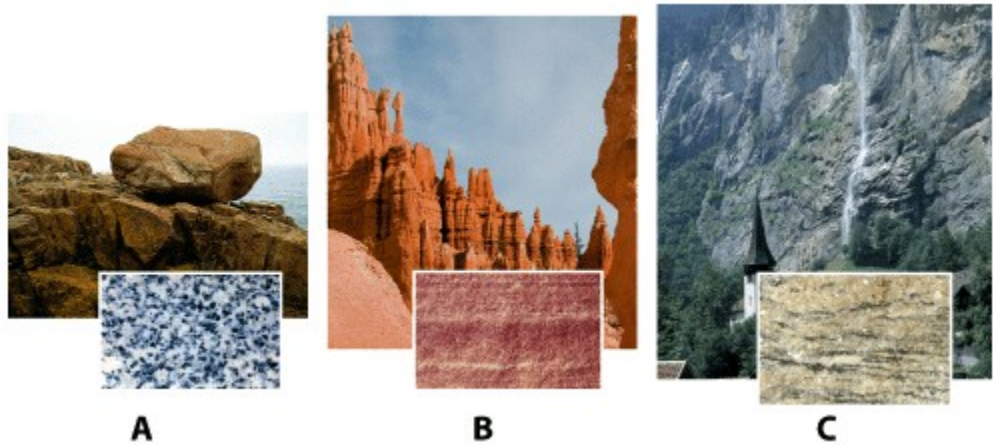


a) Sample A.
b) Sample B.
c) Sample C.
d) None of the above answers are correct.

Answer: B

Difficulty: Medium
Learning Objective 1: Describe the three major families of rocks.
Section Reference 1: Rock: A First Look

30) Which rock sample is formed from cooling and solidifying magma?



a) Sample A.
b) Sample B.
c) Sample C.
d) None of the above answers are correct.

Answer: A

Difficulty: Medium
Learning Objective 1: Describe the three major families of rocks.
Section Reference 1: Rock: A First Look

Question Type: True/False

31) The properties of compounds are not the same as the properties of their constituent elements.

Answer: True

Difficulty: Easy
Learning Objective 1: Describe atoms, molecules, and four kinds of chemical bonds.
Section Reference 1: Elements and Compounds

32) A molecule is the smallest individual particle that retains the distinctive properties of an element.

Answer: False

Difficulty: Easy
Learning Objective 1: Describe atoms, molecules, and four kinds of chemical bonds.
Section Reference 1: Elements and Compounds

33) A neutron is a positively charged particle with an atomic mass of 1, which resides in the nucleus of an atom.

Answer: False

Difficulty: Easy
Learning Objective 1: Describe atoms, molecules, and four kinds of chemical bonds.
Section Reference 1: Elements and Compounds

34. In ionic bonding, one atom may transfer electrons to another, creating ions with differing electrical charge.

Answer: True

Difficulty: Easy
Learning Objective 1: Describe atoms, molecules, and four kinds of chemical bonds.
Section Reference 1: Elements and Compounds

35) Ionic bonds are the strongest chemical bonds, and elements and compounds with ionic bonds (such as diamond) tend to be strong and hard.

Answer: False

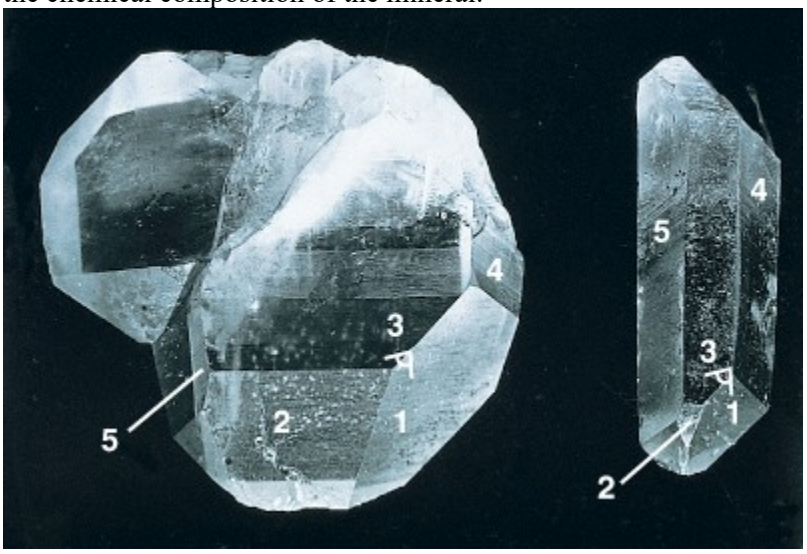
Difficulty: Easy
Learning Objective 1: Describe atoms, molecules, and four kinds of chemical bonds.
Section Reference 1: Elements and Compounds

36) The principle of atomic substitution is an exception to the rule that minerals have a specific chemical formula.

Answer: True

Difficulty: Easy
Learning Objective 1: Define minerals and their properties.
Section Reference 1: What is a Mineral?

37) In the photograph of the quartz crystal below, the angles between similar faces are constant because of the chemical composition of the mineral.



Answer: False

Difficulty: Medium
Learning Objective 1: Define minerals and their properties.
Section Reference 1: What is a Mineral?

38) The color of a mineral is not necessarily useful in identification.

Answer: True

Difficulty: Easy
Learning Objective 1: Define minerals and their properties.
Section Reference 1: What is a Mineral?

39) Silicon is the most abundant element in Earth's crust.

Answer: False

Difficulty: Easy
Learning Objective 1: Identify some common chemical elements and mineral families.
Section Reference 1: Mineral Families

40) Minerals can be described in terms of two kinds of features: assemblage and texture.

Answer: False

Difficulty: Easy
Learning Objective 1: Describe the three major families of rocks.
Section Reference 1: Rock: A First Look

Fill-In-The-Blank

41) A(n) _____ is the most fundamental substance into which matter can be separated by chemical means.

Answer: element

Difficulty: Easy
Learning Objective 1: Describe atoms, molecules, and four kinds of chemical bonds.
Section Reference 1: Elements and Compounds

42) An atom that has an excess positive or negative electrical charge caused by the loss or addition of one or more electron is called a(n) _____.

Answer: ion

Difficulty: Easy
Learning Objective 1: Describe atoms, molecules, and four kinds of chemical bonds.
Section Reference 1: Elements and Compounds

43) A(n) _____ is the smallest chemical unit that retains all of the properties of a compound.

Answer: molecule

Difficulty: Easy
Learning Objective 1: Describe atoms, molecules, and four kinds of chemical bonds.
Section Reference 1: Elements and Compounds

44) The mass number of an atom is the sum of the protons and _____.

Answer: neutrons

Difficulty: Low
Learning Objective 1: Describe atoms, molecules, and four kinds of chemical bonds.
Section Reference 1: Elements and Compounds

45) The four types of bonding that are important in minerals are _____, covalent, metallic, and Van der Waals.

Answer: ionic

Difficulty: Easy
Learning Objective 1: Describe atoms, molecules, and four kinds of chemical bonds.
Section Reference 1: Elements and Compounds

46) To be considered a mineral, a naturally occurring, inorganic solid must have a specific chemical composition and a characteristic _____ structure.

Answer: crystal

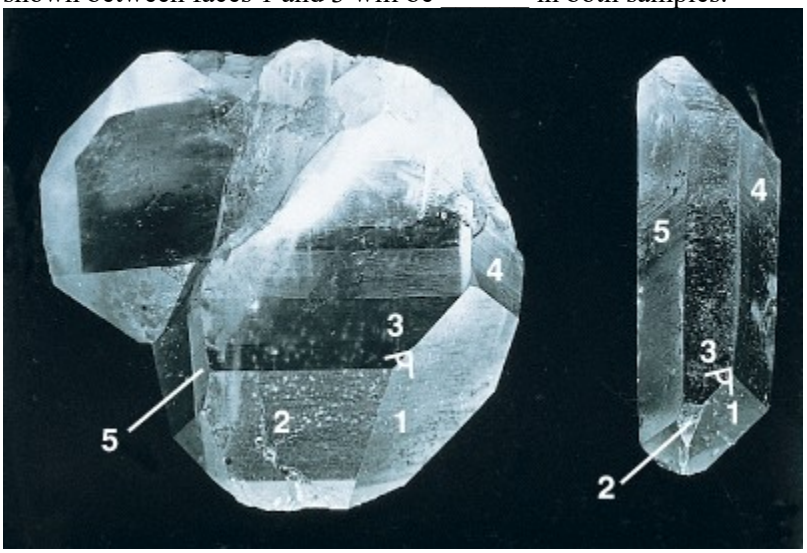
Difficulty: Easy
Learning Objective 1: Define minerals and their properties.
Section Reference 1: What is a Mineral?

47) In _____, two elements are so similar in size and bonding properties that one can exchange for the other during crystallization.

Answer: atomic substitution

Difficulty: Easy
Learning Objective 1: Define minerals and their properties.
Section Reference 1: What is a Mineral?

48) The photo below shows two specimens of the mineral quartz. According to Steno's law the angle shown between faces 1 and 3 will be _____ in both samples.



Answer: the same; identical

Difficulty: Easy
Learning Objective 1: Define minerals and their properties.
Section Reference 1: What is a Mineral?

49) The property of _____ is a mineral's resistance to scratching.

Answer: hardness

Difficulty: Easy
Learning Objective 1: Define minerals and their properties.
Section Reference 1: What is a Mineral?

50) Some minerals break along specific directions of weakness in their crystal structures. This property of a mineral to break in this predictable way is referred to as_____.

Answer: cleavage

Difficulty: Easy
Learning Objective 1: Define minerals and their properties.
Section Reference 1: What is a Mineral?

51) The _____ of a mineral is the color of the mineral when powdered, which is usually accomplished in soft minerals by rubbing the sample against an unglazed porcelain plate.

Answer: streak
Difficulty: Easy
Learning Objective 1: Define minerals and their properties.
Section Reference 1: What is a Mineral?

52) _____ and silicon are the two most common elements in Earth's crust.

Answer: Oxygen

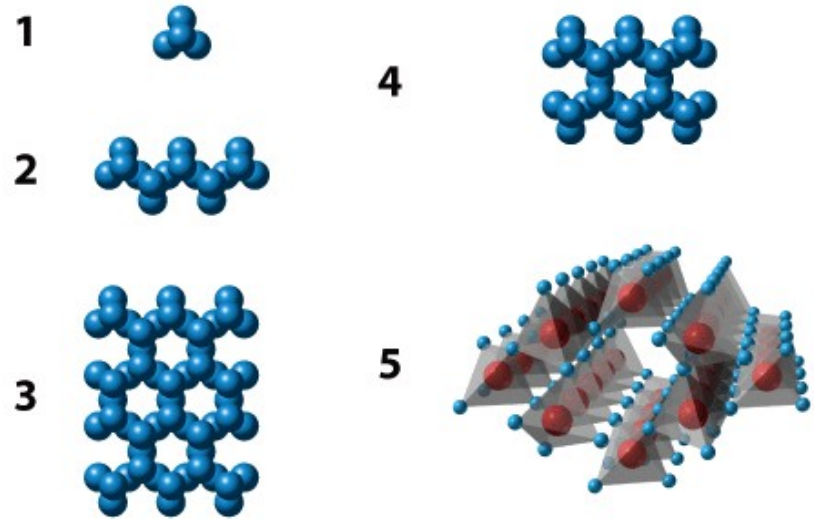
Difficulty: Low
Learning Objective 1: Identify some common chemical elements and mineral families.
Section Reference 1: Mineral Families

53) The two most abundant mineral families of Earth's crust are the silicates and the _____.

Answer: oxides

Difficulty: Easy
Learning Objective 1: Identify some common chemical elements and mineral families.
Section Reference 1: Mineral Families

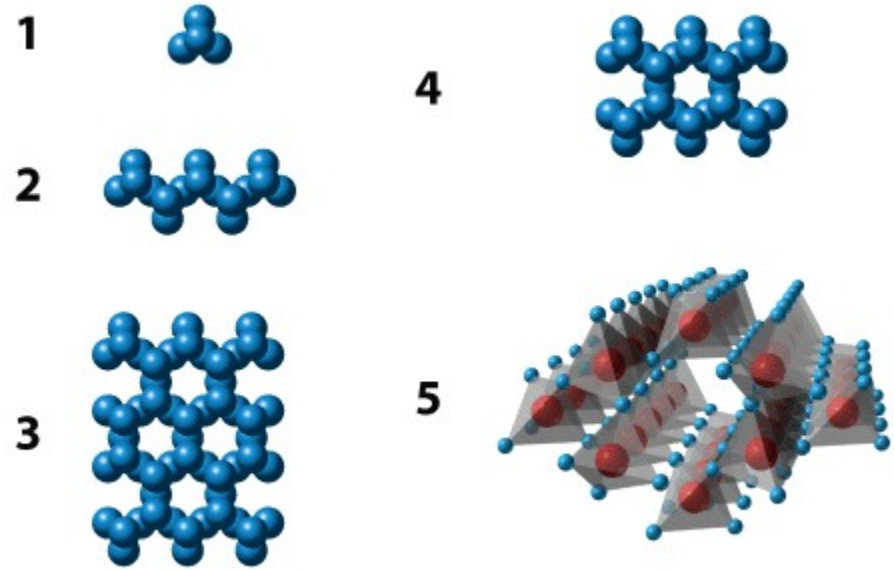
54) The illustration below shows five different silicate structures. Of these, the structure labeled _____ exhibits the strongest structure for silicates.



Answer: 5

Difficulty: Easy
Learning Objective 1: Identify some common chemical elements and mineral families.
Section Reference 1: Mineral Families

55) The illustration below shows five different silicate structures. Of these, the structure labeled _____ is the most abundant in silicate minerals of Earth's crust.



Answer: 5

Difficulty: Medium
Learning Objective 1: Identify some common chemical elements and mineral families.

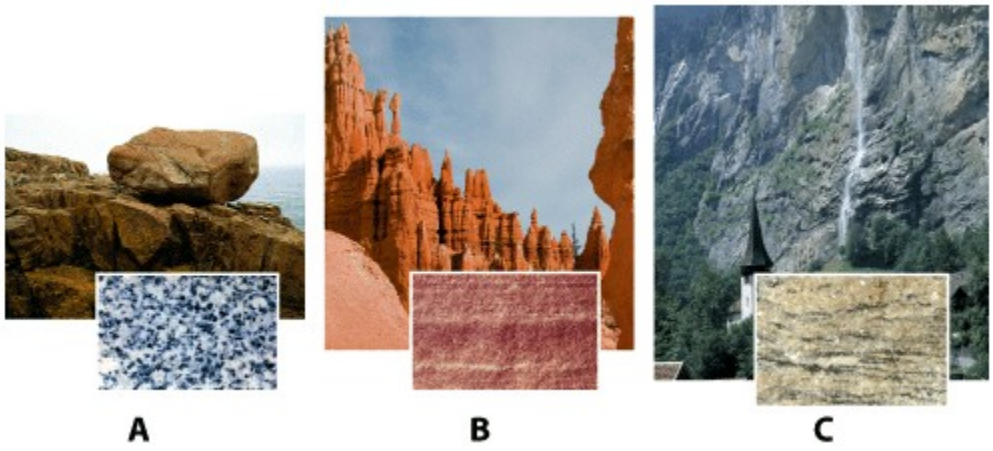
Section Reference 1: Mineral Families

56) Based on their origins, rocks can be divided into three distinct families: _____, sedimentary, and metamorphic.

Answer: igneous

Difficulty: Easy
Learning Objective 1: Describe the three major families of rocks.
Section Reference 1: Rocks: A First Look

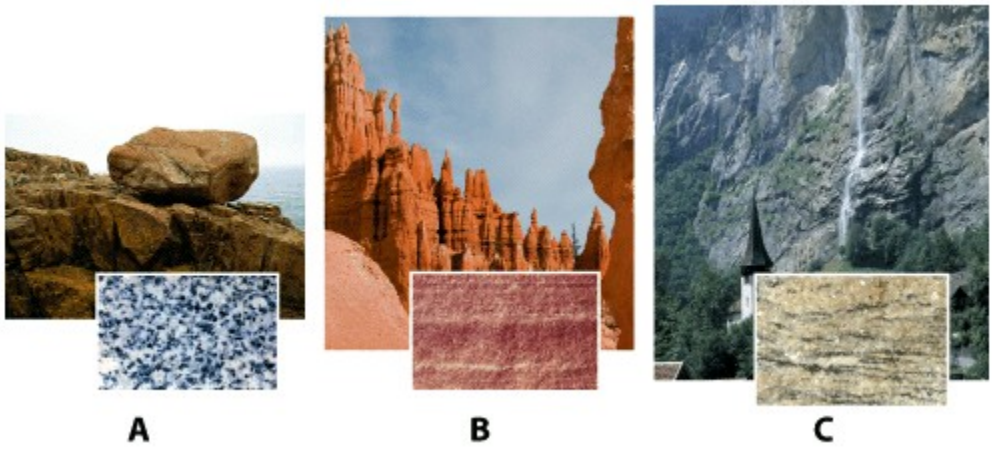
57) Sample (A, B, or C) _____ is of a rock whose original sedimentary or igneous form and mineral assemblage have been changed as a result of exposure to high temperature, high pressure or both. This type of rock is referred to as a metamorphic rock.



Answer: C

Difficulty: Medium
Learning Objective 1: Describe the three major families of rocks.
Section Reference 1: Rocks: A First Look

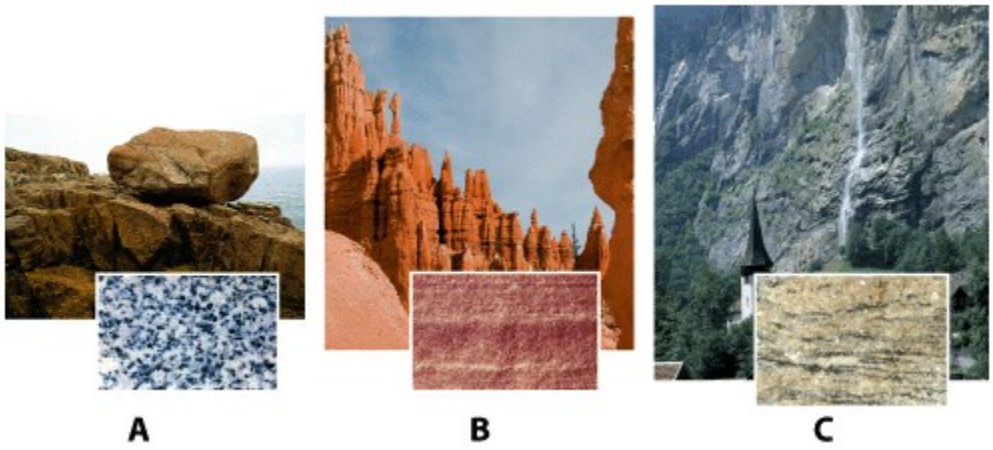
58) Sample (A, B, or C) _____ is a rock formed when mineral and rock particles are transported by water, wind, or ice and then deposited in a given location. Such rocks are classified as sedimentary rocks.



Answer: B

Difficulty: Medium
Learning Objective 1: Describe the three major families of rocks.
Section Reference 1: Rocks: A First Look

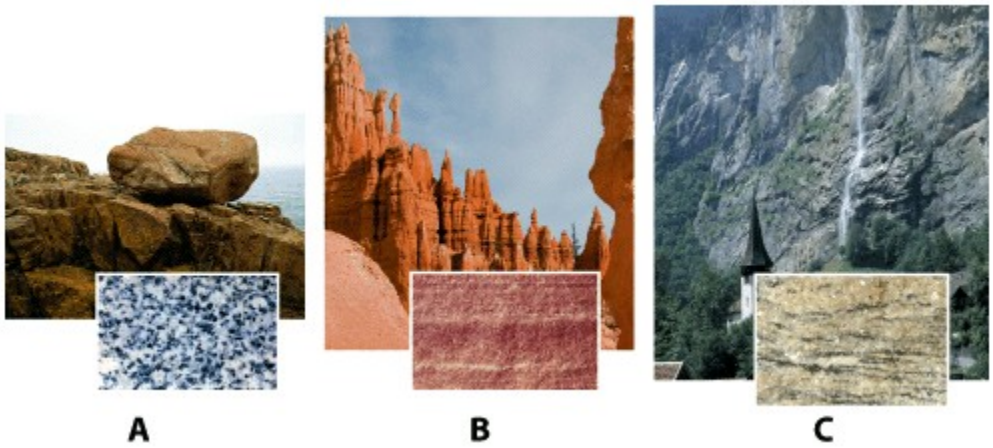
59) Igneous rocks form from the cooling and solidification of magma. Sample (A, B, or C) _____ has formed by this processes.



Answer: A

Difficulty: Medium
Learning Objective 1: Describe the three major families of rocks.
Section Reference 1: Rocks: A First Look

60) In the photograph of rock samples and outcrops, shown below, sample (A, B, or C) _____ is the rock held together by naturally occurring cement.



Answer: B

Difficulty: Medium
Learning Objective 1: Describe the three major families of rocks.
Section Reference 1: Rocks: A First Look

Question Type: Essay

61) There are 8 protons in the nucleus of an oxygen atom. How many neutrons are there in oxygen 16, oxygen 17, and oxygen 18, respectively?

Answer: There are 8, 9, and 10 neutrons respectively.

Difficulty: Easy
Learning Objective 1: Describe atoms, molecules, and four kinds of chemical bonds.
Section Reference 1: Elements and Compounds

62) What is the difference between ionic and covalent bonding? Which type of bonding creates compounds that tend to be relatively strong and hard?

Answer: Ionic bonding involves electron transfer from one atom to another. The electric charge set up by the imbalance between electrons and protons in the resulting ion creates an attractive force with an ion of opposite charge. In covalent bonding, electrons are shared between different atoms, creating a strong bond. The strength of the covalent bonds produces compounds that are relatively strong and hard.

Difficulty: Medium
Learning Objective 1: Describe atoms, molecules, and four kinds of chemical bonds.
Section Reference 1: Elements and Compounds

63) What are the four requirements necessary to classify a solid material as a mineral?

Answer: To be classified as a mineral, a substance must be a naturally occurring solid, formed by inorganic processes, with a characteristic crystal structure and specific chemical composition.

Difficulty: Easy
Learning Objective 1: Define minerals and their properties.
Section Reference 1: What is a Mineral?

64) Explain why it is not necessary to chemically analyze a common mineral in order to make an identification.

Answer: Geologists can use the properties of a mineral sample to identify it. These properties include color, hardness, luster, streak, habit, cleavage, and density.

Difficulty: Easy
Learning Objective 1: Define minerals and their properties.
Section Reference 1: What is a Mineral?

65) Why is color an unreliable property to use when identifying a mineral?

Answer: Many minerals occur in a variety of colors (e.g. quartz and fluorite). A mineral's color is determined by several factors, mainly chemical composition. Some elements create strong color effects, even when they are present as only trace impurities. Color can also be confusing in opaque minerals, because the color is partly a property of the size the mineral grains (i.e. very fine grains may appear to be a different color than a larger sample of the same mineral).

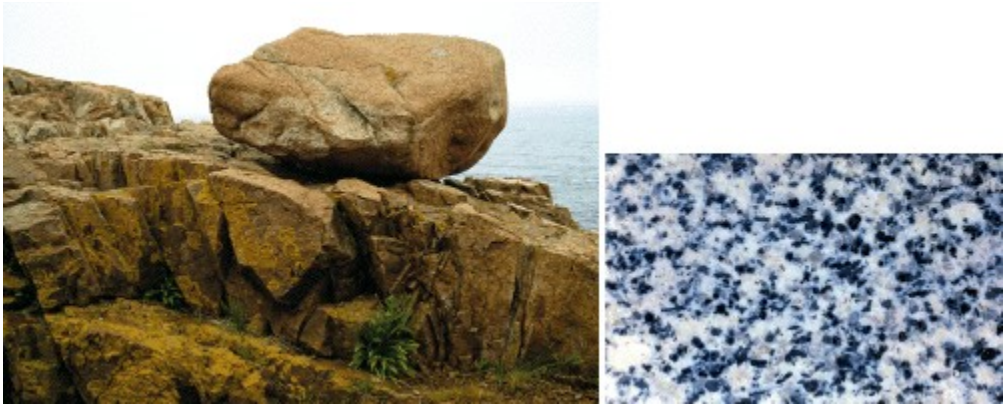
Difficulty: Easy
Learning Objective 1: Define minerals and their properties.
Section Reference 1: What is a Mineral?

66) Two chemical elements make up 70 percent of Earth's crust by weight. What are the two elements, and what family of minerals do they form?

Answer: The two elements are oxygen and silicon. They combine to form silicate minerals.

Difficulty: Easy
Learning Objective 1: Identify some common chemical elements and mineral families.
Section Reference 1: Mineral Families

67) The photographs below show an outcrop and close up view of a particular kind of rock. What type of rock is it, and what holds this type of rock together? Also, explain how such a rock might form.



Answer: The photographs are of an igneous rock (specifically granite). This type of rock is held together by interlocking silicate minerals. Igneous rocks form when molten rock (magma) cools and crystallizes.

Difficulty: Medium
Learning Objective 1: Describe the three major families of rocks.
Section Reference 1: Rock: A First Look

68) Crystals of the same type (i.e. quartz) all have a similar shape with flat crystals and specific angles between crystal faces. What controls this predictable geometry?

Answer: Steno demonstrated that the angles between corresponding faces of two minerals of a specific type is constant. Because the crystal structure dictates how a mineral grows, the constancy of interfacial angles is a reflection of the internal order of each mineral.

Difficulty: Easy
Learning Objective 1: Define minerals and their properties.
Section Reference 1: What is a Mineral?

69) What's the difference between a rock and a mineral?

Answer: A rock is an aggregate of mineral grains or possibly non-mineral matter. A rock may consist of many grains of different kinds of minerals mixed together.

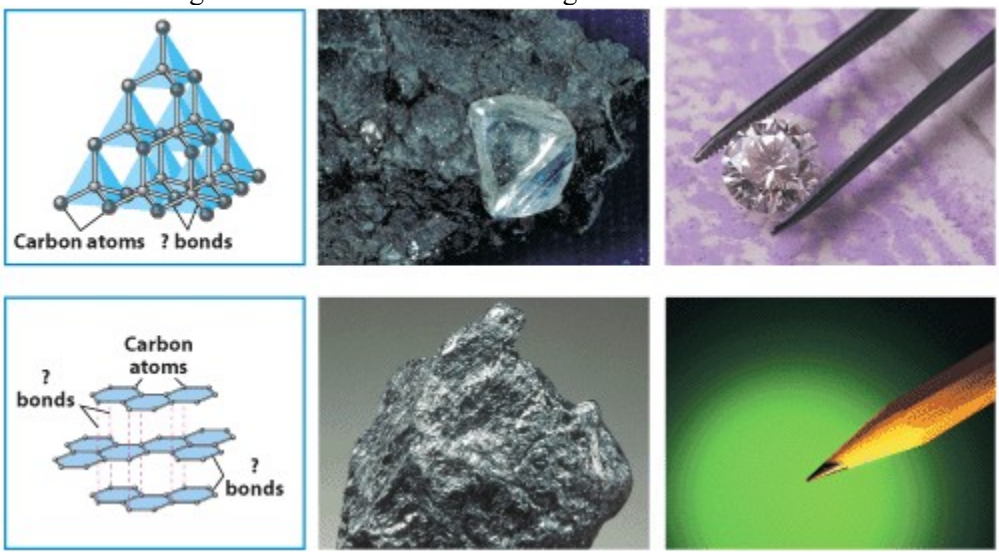
Difficulty: Easy
Learning Objective 1: Describe the three major families of rocks.
Section Reference 1: Rock: A First Look

70) What are the three families of rocks? How does each of these families differ?

Answer: Rocks are classified into three families: igneous, sedimentary, and metamorphic. Igneous rocks are formed by the solidification of magma, either slowly beneath Earth's surface or rapidly at the surface. Sedimentary rocks are formed at or near the surface by the deposition of many layers of sediment. Metamorphic rocks start as either igneous or sedimentary rocks, or other metamorphic rocks, but change their form as a result of high temperature, high pressure, or both.

Difficulty: Easy
Learning Objective 1: Describe the three major families of rocks.
Section Reference 1: Rock: A First Look

71) The figure below illustrates bonding in two crystalline structures of carbon. Indicate which one is the structure of graphite and which diamond. Identify the type of bonding in each case and explain how the different bonding in the structures relates to the great difference in hardness between the two minerals.



Answer: The first structure (upper) is that of diamond, the second graphite (lower). In the diamond crystal structure, the carbon atoms are connected in a network of covalent bonds. These are the strongest chemical bonds, and elements and compounds with covalent bonds tend to be strong and hard. In graphite, the carbon atoms form covalent bonds in layers; however, each layer is weakly bonded to the next by Van der Waals bonds. These weak bonds account for the relatively low hardness of graphite.

Difficulty: Medium
Learning Objective 1: Describe atoms, molecules, and four kinds of chemical bonds.
Section Reference 1: Elements and Compounds

72) What is the relationship between cleavage, crystal structure, and crystal faces? Speculate about how different types of bonding might influence each of these.

Answer: Cleavage in some minerals and crystal form, which is related to the shape and arrangement of crystal faces, are both dictated by a mineral's crystal structure. The crystal structure develops during the growth process and shapes the geometry and orientation of crystal faces. Within the crystal structures, the orientation of the bonds or the differences between types of bonds allows for certain directions of weakness. These directions of weakness, called cleavage planes allow the crystal structure to break in these directions more easily.

Difficulty: Medium
Learning Objective 1: Define minerals and their properties.
Section Reference 1: What is a Mineral?

73) With approximately 3,500 known minerals, why are there only about thirty common rock-forming minerals?

Answer: The number of rock-forming minerals is limited by the abundance of the various chemical elements in Earth's crust. Only 12 elements are present at a level of more than one part in a thousand by mass. Oxygen makes up approximately half of the crust and silicon accounts for nearly another one quarter. This uneven distribution of chemical elements in Earth's crust limits the number of naturally occurring minerals. The number of important rock-forming minerals is even smaller.

Difficulty: Medium
Learning Objective 1: Identify some common chemical elements and mineral families.
Section Reference 1: Mineral Families

74) Discuss some of the ways in which the properties of minerals and rocks can affect our daily lives?

Answer: There are a number of ways in which the properties of minerals and rocks affect our daily lives. The hardness of minerals is an important factor for gemstones and industrial abrasives. The softness of graphite allows its use in pencils. The relative durability and malleability of gold makes it an ideal substance for coins and jewelry. Table salt's ionic bonds allow it to dissolve easily in water. The properties of various rocks also make them ideal for use in everything from building materials to decorative art. These are a few of the ways in which the properties of minerals and rocks affect our daily lives.

Difficulty: Medium
Learning Objective 1: Define minerals and their properties.
Section Reference 1: What is a Mineral?

75) What holds rocks together?

Answer: Igneous and metamorphic rocks are held together by the interlocking of their grains. The loose particles of sedimentary rocks are held together by compaction, during which the mineral grains are held together by the pressure of overlying sediment, cementing of open spaces within a rock, and/or recrystallization – a process that occurs when growing grains interlock because of increasing pressure and heat.

Difficulty: Easy
Learning Objective 1: Describe the three major families of rocks.
Section Reference 1: Rock: A First Look