

Chapter 2

Fundamental Building Blocks: Chemistry, Water, and pH

1)

The subatomic particles that play the greatest role in cellular chemical reactions are:

A)

protons.

B)

neutrons.

C)

electrons.

D)

isotopes.

Answer:

C

Topic:

Section 2.1

Skill:

Conceptual

2)

The mass within an atom comes from:

A)

protons only.

B)

protons and neutrons.

C)

electrons only.

D)

protons, neutrons, and electrons.

Answer:

B

Topic:

Section 2.1

Skill:

Factual

3)

The subatomic particles with the most mass are:

A)

neutrons.

B)

electrons.

C)

protons.

D)

both A and C

Answer:

D

Topic:

Section 2.1

Skill:

Factual

4)

An atom whose atomic number is 10 has how many electrons in its outermost energy level?

A)

eight

B)

ten

C)

two

D)

three

E)

five

Answer:

A

Topic:

Section 2.1

Skill:

Conceptual

5)

If the atomic number is 18, then:

A)

there are seven electrons in the outermost shell.

B)

the atom has 18 electrons in the nucleus.

C)

the outermost energy level is full.

D)

this atom would be considered reactive.

Answer:

C

Topic:

Section 2.1

Skill:

Applied

6)

Isotopes are atoms of the same element that differ in their:

A)

number of electrons.

B)

number of neutrons.

C)

number of protons.

D)

ionic charge.

Answer:

B

Topic:

Section 2.1

Skill:

Factual

7)

The mass of matter is proportional to the:

A)

density of matter.

B)

volume of matter.

C)

number of electrons.

D)

weight of matter.

E)

number of protons.

Answer:

D

Topic:

Section 2.1

Skill:

Conceptual

8)

Which of the following is *not* a component of atoms?

A)

molecules

B)

electrons

C)

protons

D)

neutrons

Answer:

A

Topic:

Section 2.1

Skill:

Factual

9)

Which of the following are found in the nucleus of an atom?

A)

protons

B)

neutrons

C)

electrons

D)

A and B

E)

A, B, and C

Answer:

D

Topic:

Section 2.1

Skill:

Factual

10)

An element with 22 protons, 22 neutrons, and 22 electrons would have an atomic number of:

A)

44.

B)

22.

C)

66.

D)

11.

Answer:

B

Topic:

Section 2.1

Skill:

Applied

11)

Isotopes have been used to:

A)

determine the age of fossils.

B)

detect bone cancer.

C)

create new elements.

D)

A and B

E)

A, B, and C

Answer:

D

Topic:

Section 2.1

Skill:

Conceptual

12)

Chlorine has an atomic number of 17, and argon has an atomic number of 18. From this information alone, you can predict that:

A)

argon has more neutrons than chlorine.

B)

argon is more chemically reactive than chlorine.

C)

argon will more readily ionize than chlorine.

D)

chlorine is more chemically reactive than argon.

E)

chlorine has more neutrons than argon.

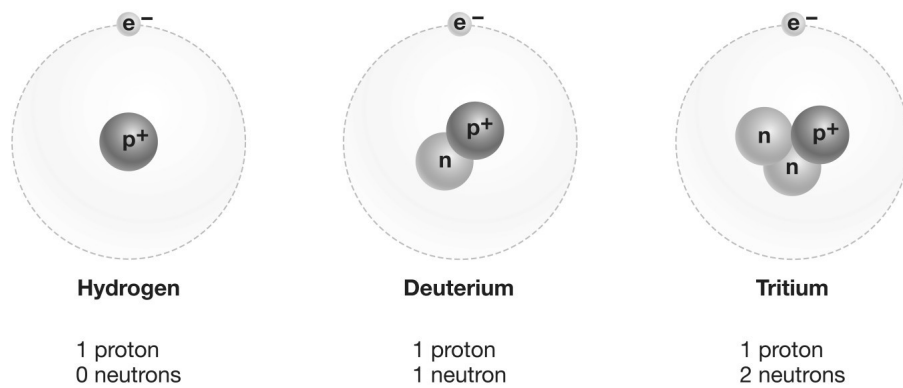
Answer:

D

Topic:

Section 2.1

Applied



Refer to the figure above and then answer the question that follows.

13)

Consider carbon-12, carbon-13, and carbon-14 (the numbers indicate atomic mass). Which of these forms of carbon is an isotope?

A)

carbon-12

B)

carbon-13

C)

carbon-14

D)

None are isotopes.

E)

All are isotopes.

Answer:

E

Topic:

Section 2.1

Skill:

Applied

14)

What is it about carbon-12, carbon-13, and carbon-14 that makes them all carbon?

A)

They all have the number of protons plus neutrons that is characteristic of carbon.

B)

They all have the number of protons that is characteristic of carbon.

C)

They all have the number of neutrons that is characteristic of carbon.

D)

All are radioactive.

E)

All are elements.

Answer:

B

Topic:

Section 2.1

Skill:

Conceptual

15)

You have a substance and begin a set of experiments in which you break it down into other substances through chemical reactions. After a few successive reactions, you discover a set of products that can't be broken down further, no matter what type of chemical reaction you attempt. These substances are:

A)

protons.

B)

elements.

C)

neutrons.

D)

electrons.

E)

isotopes.

Answer:

B

Topic:

Section 2.1

Skill:

Applied

16)

The component of an atom or molecule that is most important in determining its chemical bonding properties is the:

A)

neutron.

B)

nucleus.

C)

proton.

D)

electron.

E)

isotope.

Answer:

D

Topic:

Section 2.1

Skill:

Factual

17)

Which of the following results from the making of a bond?

A)

Atoms become more reactive.

B)

Molecules are broken down.

C)

Electrons are destroyed.

D)

Atoms become more stable.

Answer:

D

Topic:

Section 2.2

Factual

18)

For an atom to be considered an ion:

A)

protons can outnumber neutrons.

B)

protons can outnumber electrons.

C)

neutrons can outnumber protons,

D)

protons equal electrons.

Answer:

B

Topic:

Section 2.2

Skill:

Factual

19)

Which type of bonding occurs between molecules and not within molecules?

A)

ionic

B)

polar covalent

C)

covalent

D)

hydrogen

Answer:

A

Topic:

Section 2.2

Skill:

Factual

20)

When an electron passes from one atom to another:

A)

attraction occurs between two atoms based on opposite charges.

B)

the electron travels in orbitals around both the donor and recipient atom.

C)

a proton is also lost from the nucleus.

D)

the identity of the atom changes.

Answer:

D

Topic:

Section 2.2

Skill:

Factual

21)

An atom will react with other atoms only until:

A)

it has completely filled its outermost energy level.

B)

it has achieved maximum stability.

C)

all of its outermost orbitals have been filled.

D)

All of the above are true.

Answer:

D

Topic:

Section 2.2

Skill:

Factual

22)

The naturally occurring helium atom is chemically inert because:

A)

its outermost shell is filled with electrons.

B)

its nucleus is filled with two neutrons.

C)

it has the most protons that it could ever carry.

D)

it has all of the shared electrons it could ever have.

Answer:

A

Topic:

Section 2.2

Skill:

Factual

23)

An atom becomes an ion when:

A)

it gains or loses neutrons.

B)

it forms a covalent bond.

C)

it gains or loses electrons.

D)

hydrogen ions are shared.

E)

it gains or loses protons.

Answer:

C

Topic:

Section 2.2

Skill:

Conceptual

24)

Sodium chloride (NaCl) crystals (table salt) form as a result of:

A)

covalent bonding.

B)

the lack of chemical attraction.

C)

chemical unreactivity.

D)

the attraction of oppositely charged particles for each other.

Answer:

D

Topic:

Section 2.2

Skill:

Factual

25)

Hydrogen bonds are very important in the functional shape of:

A)

proteins.

B)

sugars.

C)

fats.

D)

nucleic acids.

E)

Both A and D are true.

Answer:

E

Topic:

Section 2.2

Skill:

Factual

26)

Nonpolar molecules develop when:

A)

shared electrons are not shared equally.

B)

both atoms have similar electronegativity.

C)

one atom is much more electronegative than the other.

D)

electrons transfer from one atom to another.

Answer:

D

Topic:

Section 2.2

Skill:

Applied

27)

The symbol 3CO_2 represents:

A)

three molecules of carbon dioxide.

B)

three carbon atoms and one molecule of oxygen.

C)

one atom of carbon and three atoms of oxygen.

D)

one atom of oxygen and three of carbon.

Answer:

A

Topic:

Section 2.2

Skill:

Applied

28)

In a bottle of water, hydrogen bonding occurs between the hydrogen of one atom and:

A)

a hydrogen atom in the same molecule.

B)

an oxygen atom in a different molecule.

C)

an oxygen atom in the same water molecule.

D)

a hydrogen atom in a different molecule.

Answer:

B

Topic:

Section 2.2

Skill:

Conceptual

29)

Which of the following is *not* a compound?

A)

a protein

B)

glucose

C)

methane

D)

nitrogen

E)

table salt

Answer:

D

Topic:

Section 2.2

Skill:

Applied

30)

When atoms form bonds, they share or exchange:

A)

electrons.

B)

protons.

C)

neutrons.

D)

A and B

E)

A, B, and C

Answer:

A

Topic:

Section 2.2

Skill:

Factual

31)

Which of the following is true of chemical bonds?

A)

Atoms can achieve a higher energy state and less stability by forming bonds.

B)

One atom can give up a proton to another to form bonds.

C)

Two atoms can share an electron unequally, with one drawing it more toward itself.

D)

They cannot occur between two identical atoms.

Answer:

C

Topic:

Section 2.2

Skill:

Conceptual

32)

Atoms form bonds to:

A)

fill their outer shells with neutrons.

B)

obtain an equal number of protons and electrons.

C)

fill their outer shells with electrons.

D)

fill their outer shells with protons.

E)

obtain an equal number of protons and neutrons.

Answer:

C

Topic:

Section 2.2

Skill:

Conceptual

33)

Two hydrogen atoms (atomic number 1) form a covalent bond. Which of the following is true?

A)

Both hydrogen atoms now have two electrons in their outer shell.

B)

Both hydrogen atoms now have two protons in their outer shell.

C)

One hydrogen atom now has zero protons in its outer shell, and the other has two.

D)

One hydrogen atom now has zero electrons in its outer shell, and the other has two.

E)

Each hydrogen atom still has one electron in its outer shell.

Answer:

A

Topic:

Section 2.2

Skill:

Applied

34)

Oxygen has six electrons in its second outer shell. How many covalent bonds is oxygen likely to make with hydrogen, which has one electron in its first outer shell?

A)

eight

B)

one

C)

two

D)

six

E)

three

Answer:

C

Topic:

Section 2.2

Skill:

Applied

35)

Which of the following would form the fewest covalent bonds?

A)

neon (eight electrons in the second shell)

B)

carbon (four electrons in the second shell)

C)

hydrogen (one electron in the first shell)

D)

oxygen (six electrons in the second shell)

Answer:

A

Topic:

Section 2.2

Skill:

Applied

36)

Water is a polar molecule because:

A)

oxygen is more electronegative than hydrogen.

B)

hydrogen has more neutrons than oxygen.

C)

oxygen has more electrons than hydrogen.

D)

oxygen has more neutrons than hydrogen.

E)

hydrogen is more electronegative than oxygen.

Answer:

A

Topic:

Section 2.2

Skill:

Conceptual

37)

H₂S is an example of a:

A)

structural formula.

B)

ball-and-stick formula.

C)

molecular formula.

D)

space-filling model.

E)

none of the above

Answer:

C

Topic:

Section 2.2

Skill:

Factual

38)

Covalent bonds form when one atom _____ its _____ with another atom.

A)

shares; electrons

B)

gives up; neutrons

C)

gives up; protons

D)

gives up; electrons

E)

shares; protons

Answer:

A

Topic:

Section 2.2

Skill:

Conceptual

39)

Potassium has one electron in its fourth shell, and chloride has seven electrons in its third shell. Which of the following is most likely to be true?

A)

Chloride will give an electron to potassium to form an ionic bond.

B)

Potassium will give an electron to chloride to form an ionic bond.

C)

The two atoms will share the electron unequally in a polar bond.

D)

The two atoms will share an electron equally in a covalent nonpolar bond.

Answer:

B

Topic:

Section 2.2

Skill:

Applied

40)

Nitrogen has seven protons, and hydrogen has one proton. Based on your knowledge of the rules of covalent bonding, which of the following molecules will form from the reaction of nitrogen and hydrogen?

A)



B)



C)



D)



E)



Answer:

B

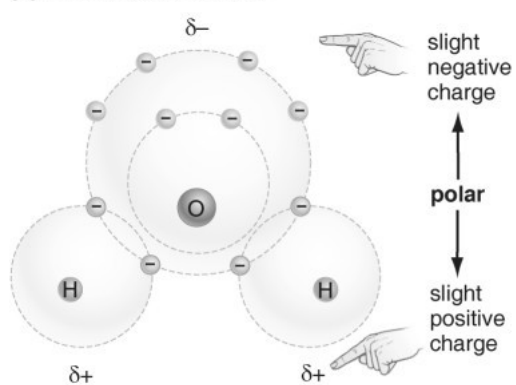
Topic:

Section 2.2

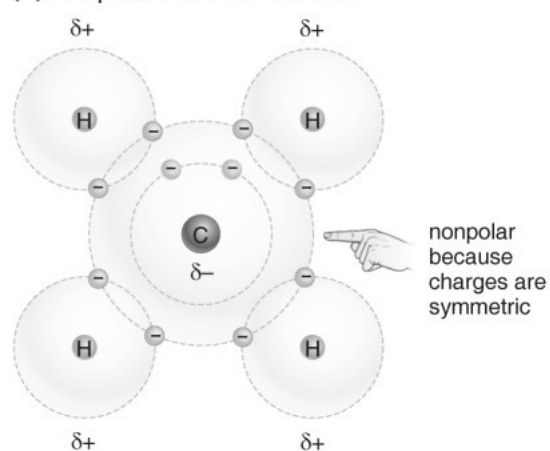
Skill:

Applied

(a) Polar water molecule



(b) Nonpolar methane molecule



Refer to the figure above and then answer the question that follows.

41)

Which of the following molecules is most likely to bind to an ion, and why?

A)

Molecule A, because it has electrical charges that will attract an ion.

B)

Molecule B, because it has four hydrogen atoms on the exterior of the molecule.

C)

Molecule A, because any molecule with oxygen is able to bind to an ion.

D)

Molecule B, because it has a carbon at in the center of the molecule.

Answer:

A

Topic:

Section 2.2

Skill:

Conceptual

42)

In what ways are hydrogen bonds and ionic bonds similar?

A)

Both are based on attraction between atoms that carry differences in electrical charge.

B)

Both involve an even sharing of electrons between atoms.

C)

Both are based on attraction between two atoms that each carry a positive charge.

D)

Both are based on repulsion between atoms that carry differences in electrical charge.

E)

Both are based on attraction between two atoms that each carry a negative charge.

Answer:

A

Topic:

Section 2.2

Skill:

Conceptual

43)

If an atom has an atomic number of 11, which of the electron shells are filled?

A)

the first shell

B)

the first and second shell

C)

the first, second, and third shell

D)

the first, second, third, and fourth shell

Answer:

B

Topic:

Section 2.2

Skill:

Conceptual

44)

Enzymes are proteins that catalyze specific reactions within a cell. For catalysis to occur, they require a starting substance to bind directly to the enzyme. What must be true for this binding to happen correctly?

A)

Both the enzyme and the starting substance must be hydrophilic.

B)

The starting substance must be larger than the enzyme.

C)

The enzyme must be acidic, and the starting substance must be basic.

D)

Both the enzyme and the starting substance need to have matching shapes.

Answer:

D

Topic:

Section 2.3

Skill:

Applied

45)

When you put sugar into your morning coffee or tea, the sugar is the _____, and the tea or coffee is the _____.

A)

solvent, solution

B)

solvent, solute

C)

solute, solution

D)

solution, solute

E)

solute, solvent

Answer:

E

Topic:

Section 2.4

Skill:

Conceptual

46)

Hydrophobic molecules tend to be _____ by water.

A)

repelled

B)

absorbed

C)

mixed

D)

attracted

Answer:

A

Topic:

Section 2.4

Skill:

Applied

47)

You mix sugar in water and stir until it's completely dissolved. In this system, the water is the _____, the sugar is the _____, and the end result is a _____.

A)

solute; solution; solvent

B)

solute; solvent; solution

C)

solvent; solution; solute

D)

solution; solvent; solute

E)

solvent; solute; solution

Answer:

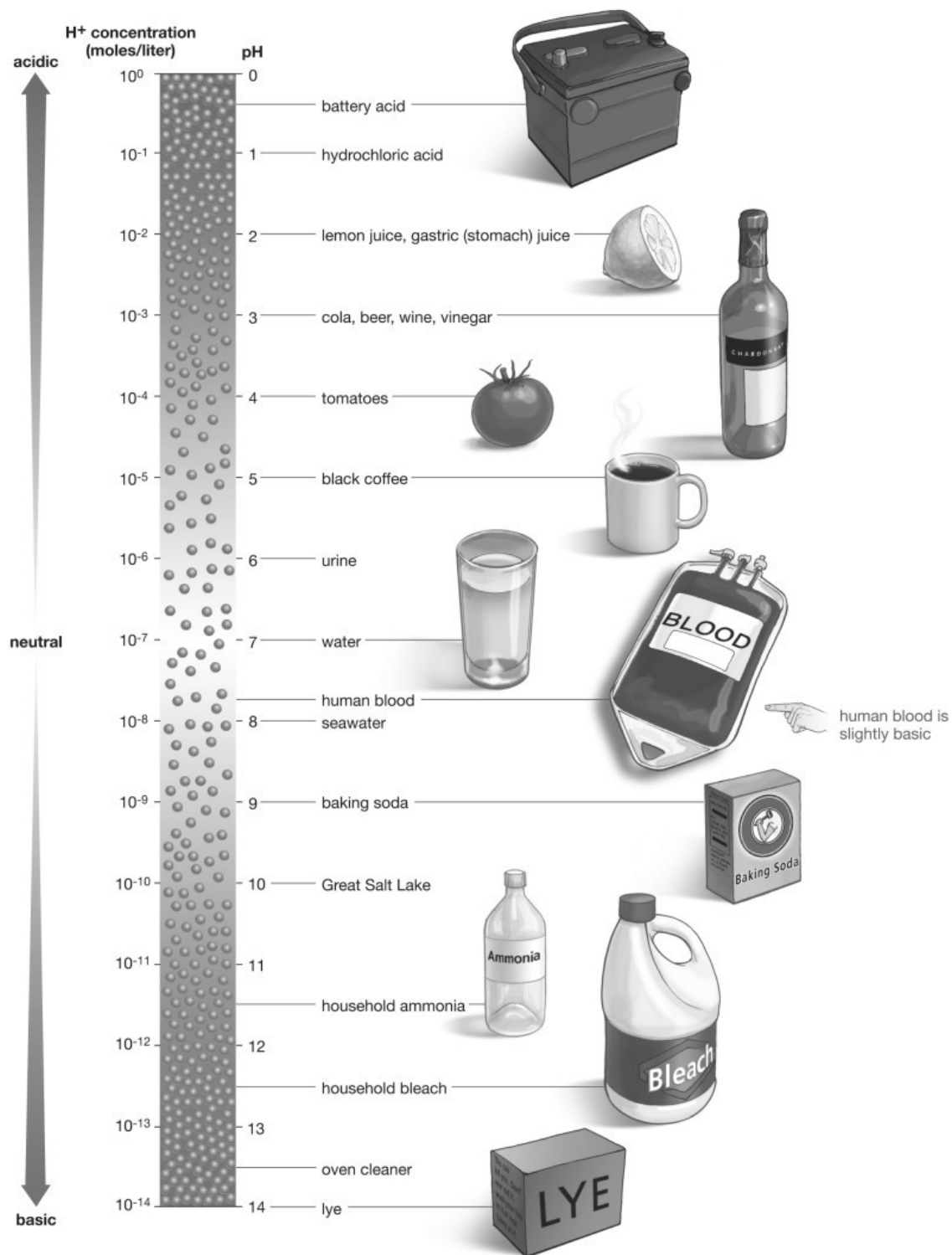
E

Topic:

Section 2.4

Skill:

Applied



Refer to the figure above and then answer the question that follows.

48)

You are working in a chemistry lab, and your lab partner knocks over a beaker of hydrochloric acid. You alert your laboratory instructor, and he immediately pours another solution over the spill to neutralize the acid. What did he pour onto the acid to neutralize it?

A)

water

B)

sodium hydroxide

C)

lemon juice

D)

a buffer at pH 3

Answer:

B

Topic:

Section 2.5

Skill:

Factual

49)

As an acid mixes in water:

A)

the number of hydroxide ions will increase.

B)

the number of hydrogen ions will increase.

C)

The pH remains at 7.

D)

The solution will cool down.

Answer:

B

Topic:

Section 2.5

Skill:

Factual

50)

Chemical reactions that occur within living things change the nucleus of atoms.

Answer:

FALSE

Topic:

Section 2.1

Skill:

Factual

51)

An atom always contains the same number of protons as neutrons.

Answer:

FALSE

Topic:

Section 2.1

Skill:

Factual

52)

Neutrons are negatively charged.

Answer:

FALSE

Topic:

Section 2.1

Skill:

Factual

53)

Protons move at very fast speeds around the outside of the nucleus of an atom.

Answer:

FALSE

Topic:

Section 2.1

Skill:

Factual

54)

Anything that occupies space is energy.

Answer:

FALSE

Topic:

Section 2.1

Skill:

Factual

55)

An element can't be broken down into another form of pure matter.

Answer:

TRUE

Topic:

Section 2.1

Skill:

Factual

56)

The number of neutrons in the nucleus of an atom gives it a unique chemical nature.

Answer:

FALSE

Topic:

Section 2.1

Skill:

Factual

57)

Isotopes differ from each other in the number of protons that they possess.

Answer:

FALSE

Topic:

Section 2.1

Skill:

Factual

58)

Atoms are electrically neutral.

Answer:

TRUE

Topic:

Section 2.1

Skill:

Factual

59)

The electrons of an atom contribute significantly to the mass of an atom.

Answer:

FALSE

Topic:

Section 2.1

Skill:

Factual

60)

Ionic bonds occur through a sharing of electrons.

Answer:

FALSE

Topic:

Section 2.2

Skill:

Factual

61)

Acids release hydrogen ions into aqueous solutions.

Answer:

TRUE

Topic:

Section 2.5

Skill:

Factual

62)

_____ orbit around the nucleus of an atom.

Answer:

Electrons

Topic:

Section 2.1

Skill:

Factual

63)

A single covalent chemical bond represents a sharing of _____ electrons between two atoms.

Answer:

two

Topic:

Section 2.2

Skill:

Conceptual

64)

Hydrogen bonds may form between oxygen of one water molecule and _____ of another water molecule.

Answer:

hydrogen

Topic:

Section 2.2

Skill:

Conceptual

65)

Cigarette smoking and exposure to sunlight _____ the production of free radicals by our bodies.

Answer:

increase

Topic:

Section 2.2

Skill:

Factual

66)

A signal will _____ to a receptor if the molecules shape match, similar to a key in a lock.

Answer:

bind

Topic:

Section 2.3

Skill:

Factual

67)

Water molecules are uncharged and _____.

Answer:

polar

Topic:

Section 2.4

Skill:

Applied

68)

A(n) _____ has a higher pH than a(n) _____.

Answer:

base, acid

Topic:

Section 2.5

Skill:

Factual

Match column 1 with the items in column 2.

69)

proton

A)

no charge

Topic:

Section 2.1

B)

positive charge

Skill:

Factual

70)

neutrons

C)

polar covalent bond

Topic:

Section 2.1

D)

electron-proton interaction

Skill:

Factual

71)

electrons

E)

hydrogen bond

Topic:

Section 2.1

F)

negative charge

Skill:

Factual

72)

Results from electrons being transferred between atoms

G)

nonpolar covalent bond

Topic:

Section 2.2

H)

ionic bond

Skill:

Factual

73)

Results from an unequal sharing of shared electrons

Topic:

Section 2.2

Skill:

Conceptual

74)

Explains the attraction of water molecules for each other

Topic:

Section 2.2

Skill:

Conceptual

75)

Would be the least affected by the presence of water

Topic:

Section 2.2

Skill:

Conceptual

76)

Keeps most electrons from escaping the nucleus of an atom

Topic:

Section 2.2

Skill:

Conceptual

69)

B

70)

A

71)

F

72)

H

73)

C

74)

E

75)

G

76)

D

77)

What are the four most important types of elements necessary for life on this planet?

Answer:

carbon, oxygen, nitrogen, and hydrogen

Topic:

Section 2.1

Skill:

Conceptual

78)

What are the three most important subatomic particles in an atom called? Which one is involved in forming chemical bonds?

Answer:

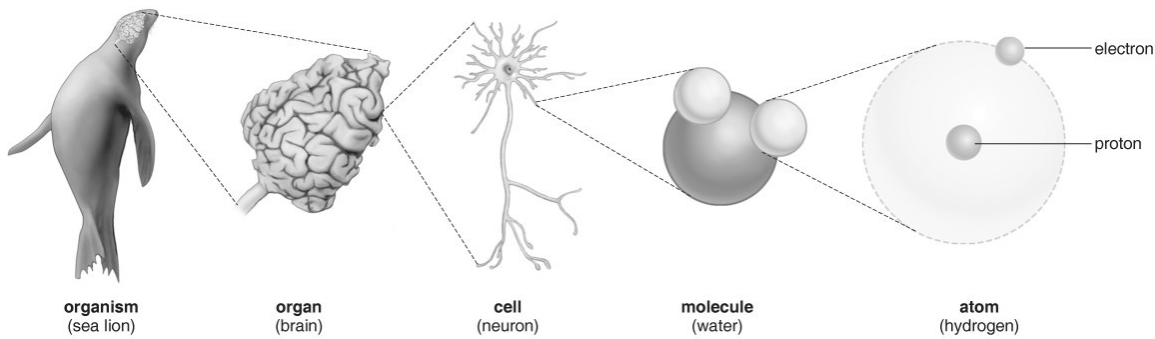
Protons, neutrons, and electrons are the three most important subatomic particles. Only electrons are involved in chemical bonding.

Topic:

Section 2.1

Skill:

Factual



Refer to the figure above and then answer the question that follows.

79)

Describe at which level life begins.

Answer:

Everything that is below the level of the cell is nonliving. Atoms make up molecules, and molecules are necessary for life, but neither atoms nor molecules are themselves living.

Topic:

Section 2.1

Skill:

Conceptual

80)

What is chemical bonding? Explain the differences between covalent and ionic bonding.

Answer:

Atoms react if they need electrons to complete their outer orbitals. Covalent bonding results from sharing of electrons between two atoms, whereas ionic bonding results when one atom transfers electrons to the other atom.

Topic:

Section 2.2

Skill:

Factual

81)

Explain how a polar molecule, such as water, has a charge imbalance but is also electrically neutral.

Answer:

Because the electronegativity of oxygen and hydrogen is so different, oxygen keeps shared electrons more around its nucleus than does the hydrogen in water, creating an electrical imbalance. Because each atom of the water molecule at some time has its outermost energy level full, the water molecule is electrically neutral.

Topic:

Section 2.2

Skill:

Conceptual

82)

How are ions formed? Why do ionic compounds readily dissolve in water?

Answer:

Ions are formed when one atom completely transfers one or more electrons to another atom. Because ionic compounds are made up of oppositely charged ions, water molecules readily dissociate them from each other, dissolving the ionic compound.

Topic:

Section 2.2

Skill:

Conceptual