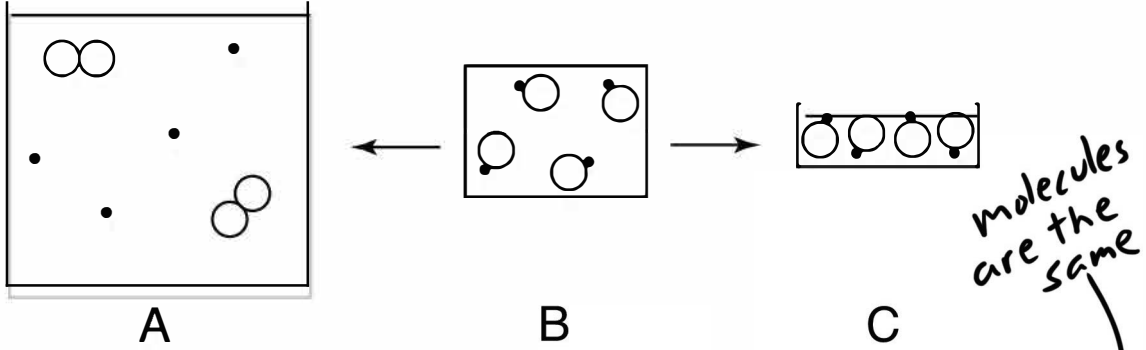


Conceptual Biology

Chapter 2: The Chemistry of Life

The Submicroscopic

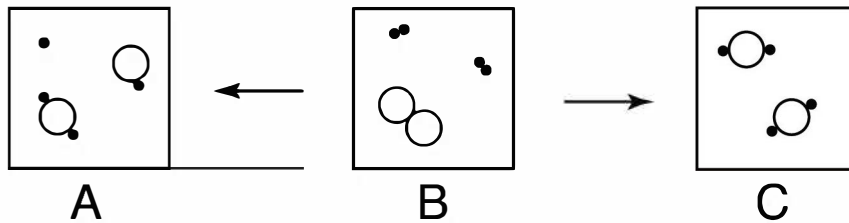
Each circle or dot represents an atom.



1. How many molecules are shown in
2. How many atoms are shown in
3. Which represents a physical change?
4. Which represents a chemical change?
5. Which box(es) represent(s) a mixture?
6. Which box contains the most mass?
7. Which box contains the most air between molecules?

A <u>2</u>	B <u>4</u>	C <u>4</u>
A <u>8</u>	B <u>8</u>	C <u>8</u>
B → A	<u>B → C</u> (circle one)	
<u>B → A</u> (circle one)	B → C	(circle one)
A <input checked="" type="checkbox"/>	B _____	C _____
A <u>same</u>	B <u>same</u>	C <u>same</u>
A <u>none</u>	B <u>none</u>	C <u>none</u>

There is no air between the molecules



8. How many molecules are shown in
9. How many atoms are shown in
10. Which represents a physical change?
11. Which represents a chemical change?
12. Which box(es) represent(s) a mixture?
13. Which box contains the most mass?

A <u>2</u>	B <u>3</u>	C <u>2</u>
A <u>6</u>	B <u>6</u>	C <u>6</u>
B → A	B → C	(circle one)
<u>B → A</u> (circle one)	<u>B → C</u> (circle one)	(circle one) two
A <input checked="" type="checkbox"/>	B <input checked="" type="checkbox"/>	C _____
A <u>same</u>	B <u>same</u>	C <u>same</u>

neither!

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Chapter 2: The Chemistry of Life Subatomic Particles

Three fundamental particles of the atom are the **proton**, **neutron**, and **electron**. At the center of each atom lies the atomic **nucleus**, which consists of **protons** and **neutrons**. The **atomic number** refers to the number of **protons** in the nucleus. All atoms of the same element have the same number of **protons**, hence, the same atomic number.

Isotopes are atoms that have the same number of **protons** but a different number of **neutrons**. An isotope is identified by its **atomic mass number**, which is the total number of **protons** and **neutrons** in the nucleus. A carbon isotope that has 6 **protons** and 6 **neutrons** is identified as carbon-12, where 12 is the atomic mass number. A carbon isotope having 6 **protons** and 8 **neutrons** on the other hand, is carbon-14.

1. Complete the following table:

Isotope	Number of...		
	Electrons	Protons	Neutrons
Hydrogen-1	1	1	0
Chlorine-36	17	17	19
Nitrogen-14	7	7	7
Potassium-40	19	19	21
Arsenic-75	33	33	42
Gold-197	79	79	118

2. Which results in a more valuable product — **adding** or **subtracting** protons from gold nuclei?
Subtract for platinum (more valuable)

3. Which has more mass, a helium atom or a neon atom?
Neon

4. Which has a greater number of atoms, a gram of helium or a gram of neon?
Helium!



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Types of Chemical Bonds

Based upon their positions in the periodic table, predict whether each pair of elements will form an ionic, covalent, or metallic bond (See also Section 18.3 of the textbook)

- a. Gold (79) and Platinum (78) M b. Rubidium (37) and Iodine (53) I
 c. Sulfur (16) and Chlorine (17) C d. Sulfur (16) and Magnesium (12) I
 e. Calcium (20) and Chlorine (17) I f. Germanium (32) and Arsenic (33) M/C
 g. Iron (26) and Chromium (24) M h. Chlorine (17) and Iodine (53) C
 i. Carbon (6) and Bromine (35) C j. Barium (56) and Astatine (85) I

2. The most common ions of lithium, magnesium, aluminum, chlorine, oxygen, and nitrogen nitrogen and their respective charges are as follows:

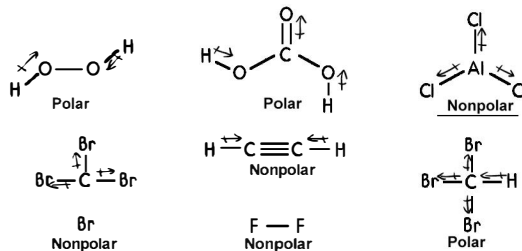
Positively Charged Ions	Negatively Charged Ions
Lithium ion: Li^{1+}	Chloride ion: Cl^{1-}
Barium ion: Ba^{2+}	Oxide ion: O^{2-}
Aluminum ion: Al^{3+}	Nitride ion: N^{3-}

Use this information to predict the chemical formulas for the following ionic compounds

- a. Lithium Chloride: $LiCl$ b. Barium Chloride: $BaCl_2$ c. Aluminum Chloride: $AlCl_3$
 Lithium Oxide: Li_2O e. Barium Oxide: BaO f. Aluminum Oxide: Al_2O_3
 Lithium Nitride: Li_3N h. Barium Nitride: Ba_3N_2 i. Aluminum Nitride: AlN

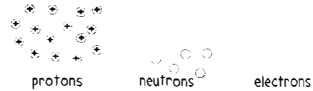
How are elements that form positive ions grouped in the periodic table relative to elements that form negative ions? _____

3. Predict whether the following chemical structures are polar or nonpolar:



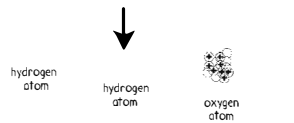
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Chapter 2: The Chemistry of Life Atoms to Molecules to Molecular Attractions



Subatomic particles are the fundamental building blocks of all **atoms**

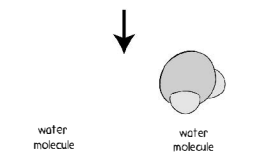
SUBATOMIC PARTICLES



An atom is a group of **subatomic particles** held tightly together. An oxygen atom is a group of 8 **protons**, **neutrons** and 8 **electrons**. A hydrogen atom is a group of only 1 **proton** and 1 **electron**

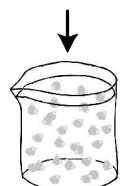


ATOMS



A **molecule** is a group of atoms held tightly together. A water **molecule** consists of 2 **hydrogen** atoms and 1 **oxygen** atom

MOLECULES



WATER

Water is a material made up of billions upon billions of **water molecules**. Water's physical properties are based upon how these water **molecules** interact with one another. The electrical attractions between **molecules** is the main topic of Chapter 7, "Molecular Mixing."

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Chapter 2: The Chemistry of Life Solutions

1. Use these terms to complete the following sentences. Some terms may be used more than once



- | | | |
|-----------|---------------|----------------|
| solution | solvent | solute |
| dissolve | concentrated | dilute |
| saturated | concentration | mole |
| molarity | solubility | soluble |
| insoluble | precipitate | supersaturated |

Sugar is **soluble** in water, for the two can be mixed homogeneously to form a **solution**. The **solubility** of sugar in water is so great that **concentrated** homogeneous mixtures are easily prepared. Sugar, however, is not infinitely **soluble** in water, for when too much of this **solute** is added to water, which behaves as the **solvent**, the solution becomes **saturated**. At this point any additional sugar is **insoluble** for it will not **dissolve**. If the temperature of a saturated sugar solution is lowered, the **solubility** of the sugar in water is also lowered. If some of the sugar comes out of solution, it is said to form a **precipitate**. If, however, the sugar remains in solution despite the decrease in solubility, then the solution is said to be **supersaturated**. Adding only a small amount of sugar to water results in a **dilute** solution. The **concentration** of this solution or any solution can be measured in terms of **molarity**, which tells us the number of solute molecules per liter of solution. If there are 6.022×10^{23} molecules in 1 liter of solution, then the **concentration** of the solution is 1 **mole** per liter