



# Combinations of Atoms

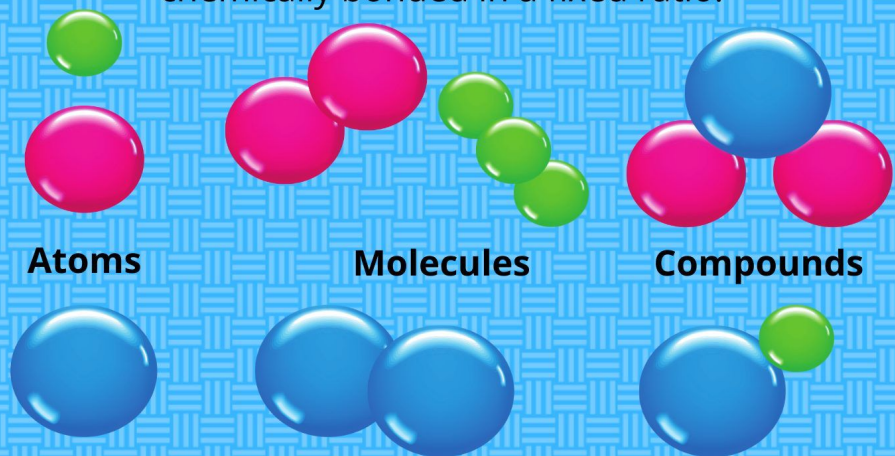
## Section 2

A. When atoms of more than one element combine, they form a Compound.

B. Chemical Properties —describes a change that occurs when one substance reacts with another substance

## Atoms, Molecules, Compounds

A compound consists of two or more elements chemically bonded in a fixed ratio.



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## Properties of Matter

### Physical Properties

Observed and measured without changing chemical identity of sample



Color



Length



Volume



Opacity

### Chemical Properties

Observed and measured as sample changes chemical identity



Acidity



Reactivity



Flammability



Toxicity

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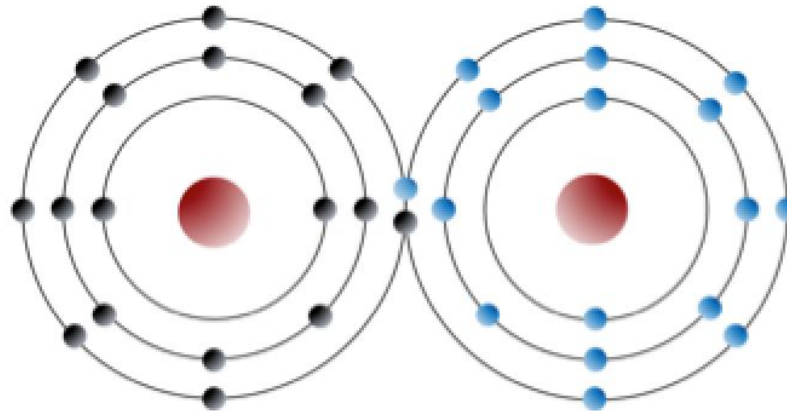
C. Bond —the force that holds atoms in compounds together

1. Covalent bonds form by sharing electrons.

2. Atoms that combine if they become positively or negatively charged have ionic bonds.

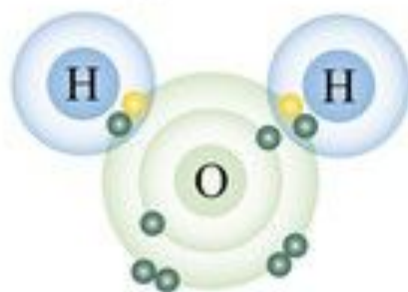
a. Electrically charged atoms are called ions.

b. Ions are attracted to each other when they have opposite charges.

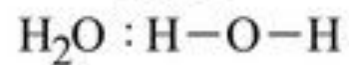


## Types of Covalent Bonds

### Single Bonds

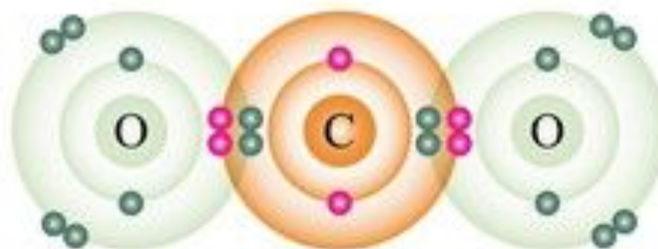


Water

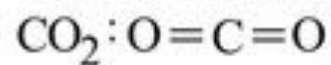


Share 2 electrons

### Double Bonds

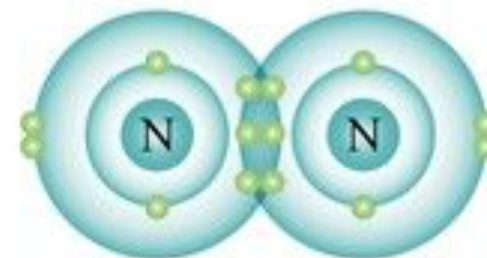


Carbon Dioxide

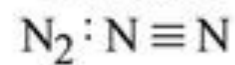


Share 4 electrons

### Triple Bonds

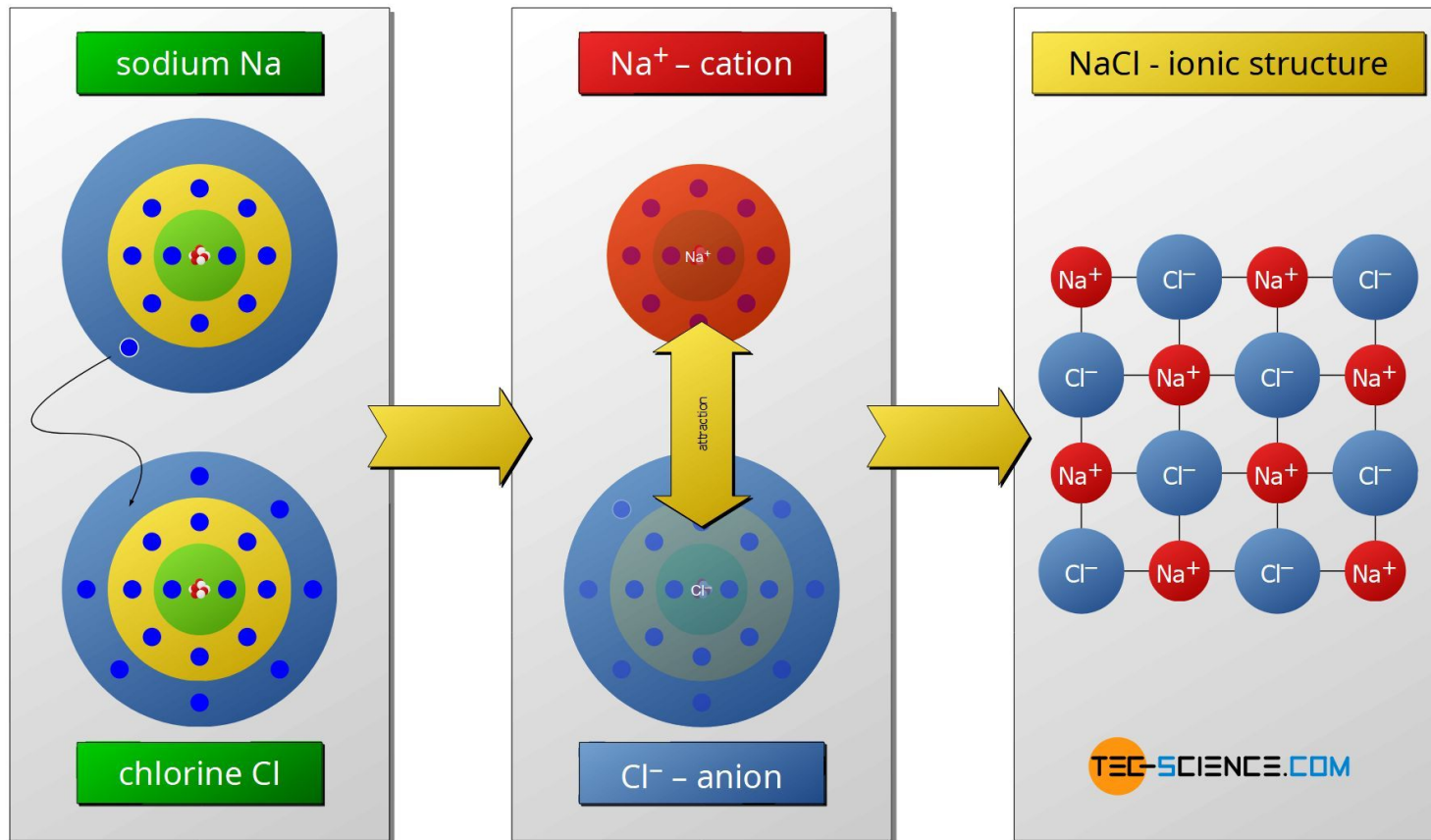


Nitrogen



Share 6 electrons

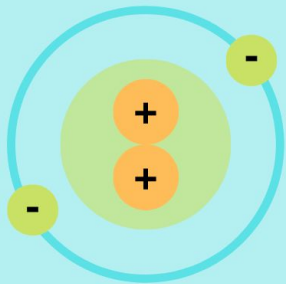
# IONIC BONDING



## Difference Between an Atom and an Ion

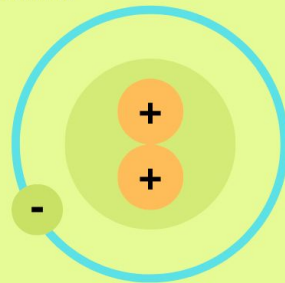
### Atom

- Electrically neutral
- Same number of protons and electrons
- Number of protons defines its element

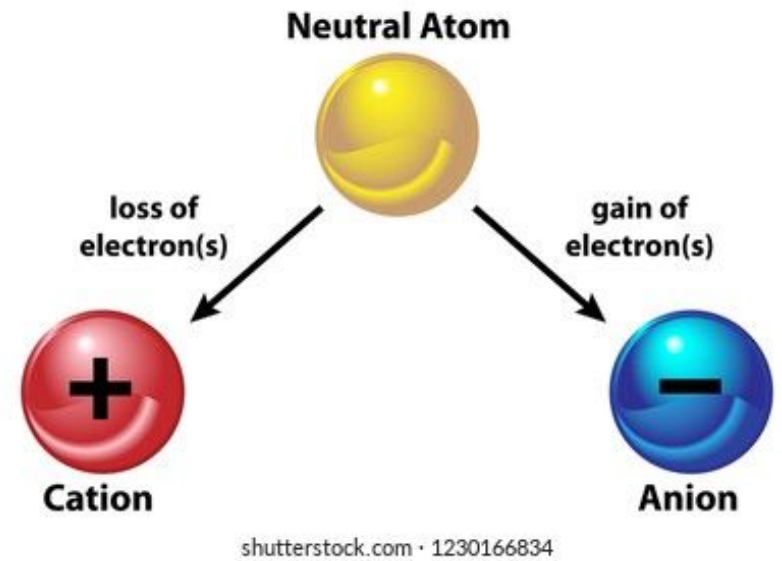


### Ion

- Electrically charged
- Different number of protons and electrons
- May contain one or more atoms

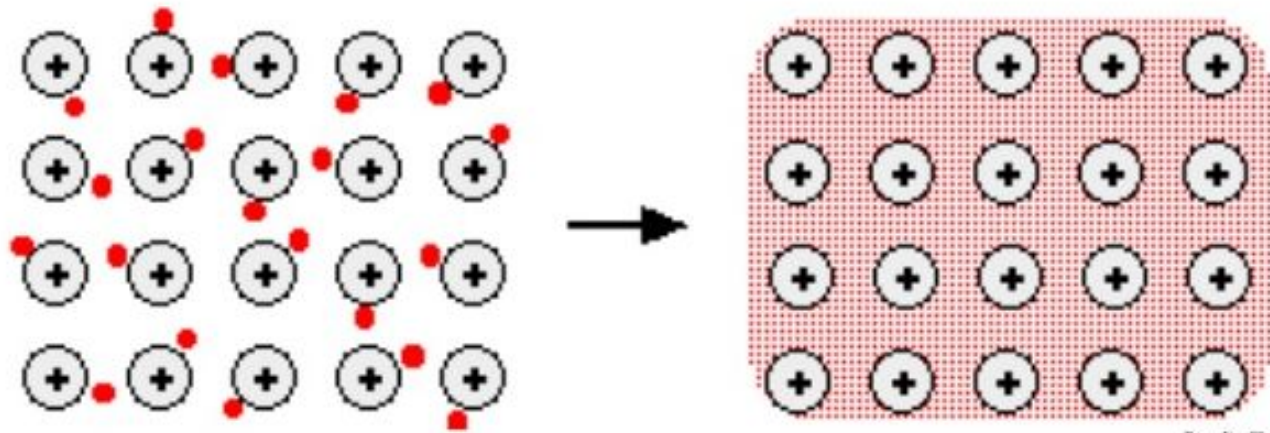


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3.     Metallic     bonds—electrons are free to move from one ion to the other.
- a. Found in     metals     such as copper, gold, aluminum, and silver
- b. Give metals the ability to conduct     electricity

# *Metallic Bonds*

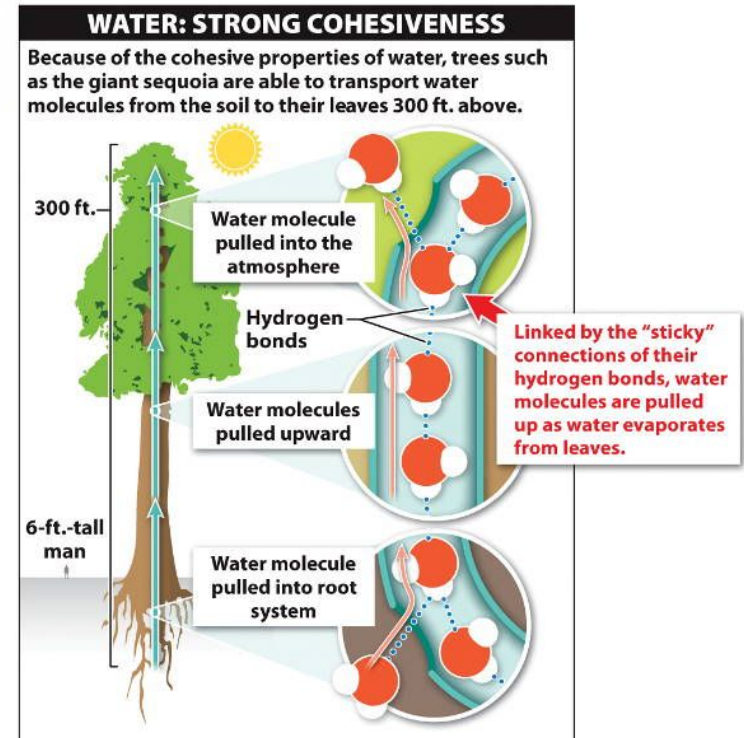
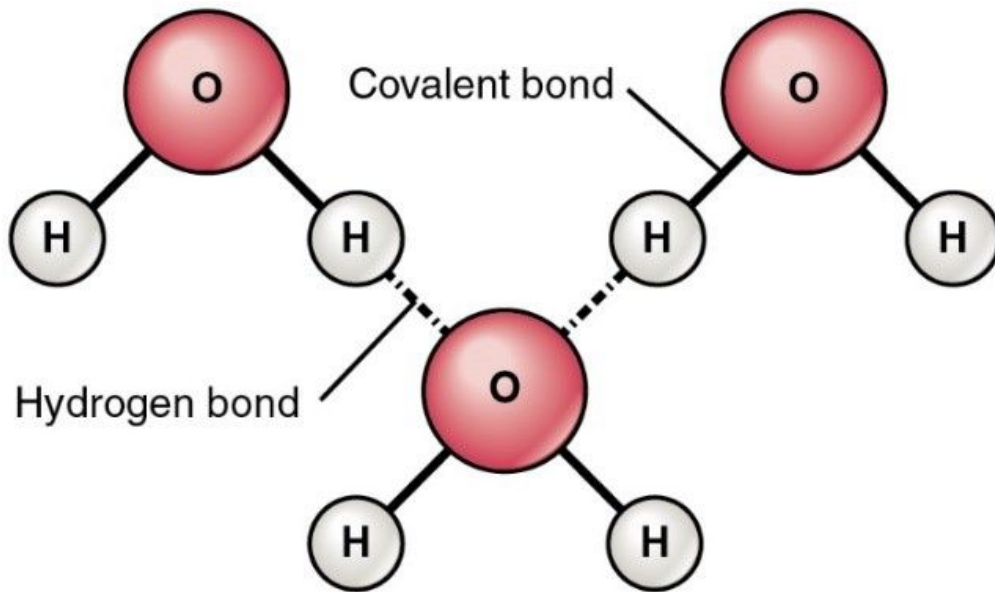


From Jim Clark

A metallic bond is produced when electron orbitals overlap and all electrons are shared between atoms. This is often referred to as a “sea of electrons,” and is responsible for the high conductivity, reflectivity, malleability, and ductility of metals. Metallic bonding is restricted to atoms of a single element.

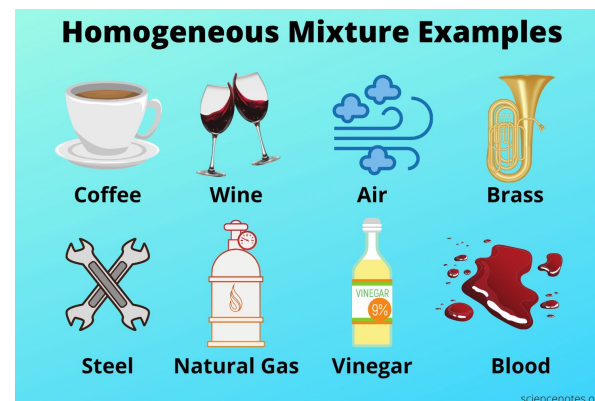
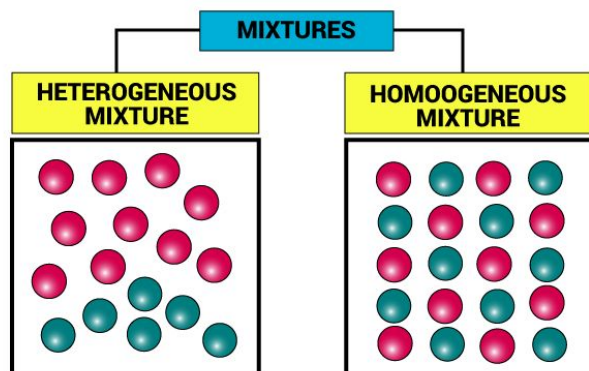
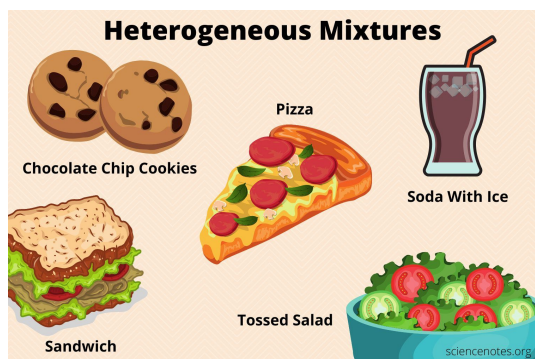


4. Hydrogen bonds—form when the positive end of one molecule is attracted to the negative end of another molecule
- a. Form without the interaction of                      electrons
  - b. Responsible for the property of cohesion —allows water to form raindrops
  - c. Hydrogen bonds are easily                      broken.



D. Mixture—two or more substances that are not chemically combined

1. Heterogeneous mixture—components not mixed evenly; each component retains its own properties.
2. Homogeneous mixture—compounds evenly mixed; can't see each component; also called Solutions
3. The components of a mixture can be separated by physical means.
4. The components of a compound must be separated by chemical means.



## Physical Change

Any time the physical properties of a substance are changed, we can say the substance has undergone a **physical change**. All substances undergo physical changes where there is a change in the form of the substance but not in its chemical composition. For instance, the grinding of granular sugar into powdered sugar is a physical change. Similarly, dissolving sugar in water is a physical change. We can also use physical changes to separate mixtures into their components. There are a variety of methods used, and the best procedure depends largely on the nature of the mixture. Depending on the states of matter involved, the relative sizes of the mixture components, and whether the mixture is homogeneous or heterogeneous will determine the necessary separation technique.

## Chemical Change

Much of the field of chemistry is devoted to the study of chemical changes. A **chemical change**, also referred to as a chemical reaction, is one in which the chemical identity of a substance is altered. We witness chemical changes every day. For example, the burning of wood or the rusting of iron are chemical changes. The burning of wood is a process in which cellulose molecules break down into water and carbon dioxide. The rusting of iron is a process in which elemental iron combines with oxygen (from air or water) to produce iron oxide (**Figure below**).

