Chemistry

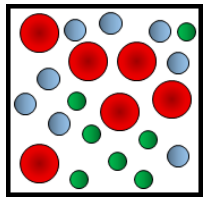
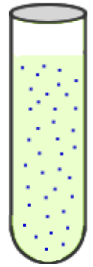
Chapter 2a

Substances

Chemistry recognizes several different kinds of substances. They are separated based on what goes into them and how they are arranged. We are going to start by identifying the major categories.

- Elements
- Molecules
- Compounds
- Solids
- Liquids
- Gases
- Ions
- Solutions
- Mixtures



Elements are the chemicals that make up the world. Each element has a symbol and an atomic number for the number of protons in one atom. Each element is different with its own personality. Learning about them is like learning about friends.

- Hydrogen is the smallest element, a light case that loves to be friends with everyone.
- Mercury is a silvery, liquid metal that is poisonous.
- Fluorine is explosively dangerous and is used in toothpaste to kill bacteria.
- Copper is a red-orange metal used in electric wires.
- Xenon is a strange gas that doesn't' want to be friends with anyone.
- Nitrogen is the element that makes up most of our air.

Mercury

Hydrogen

Fluorine

Nitrogen

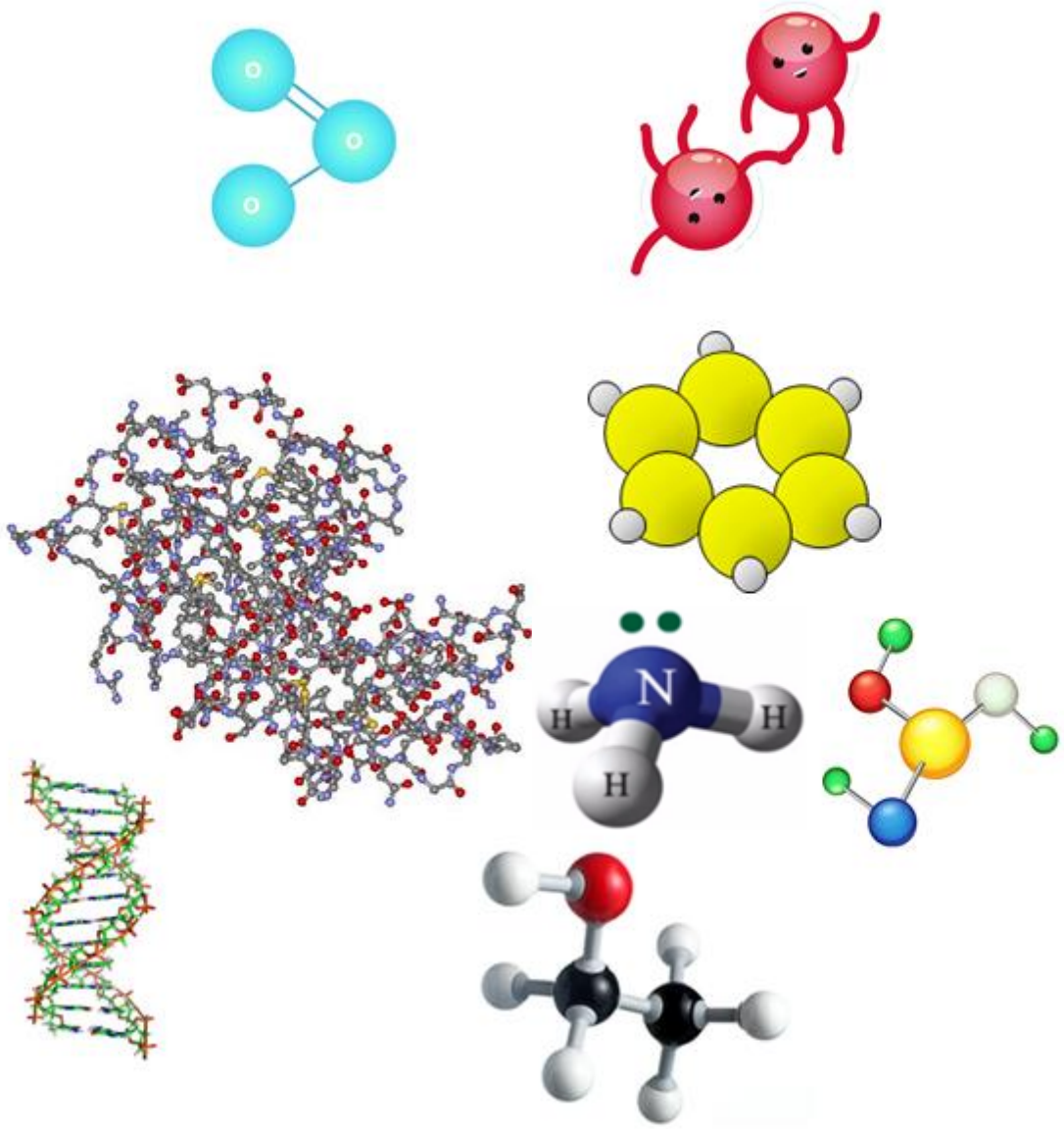
Copper

Xenon

When two atoms are combined chemically, they make a ***molecule***. It doesn't matter how many atoms are stuck together. It is still a molecule. Molecules of just one element are rare.

We also use the word molecule when there are more than one kind of element. These are called ***compounds***. Compounds can get pretty complex.

Living things make especially complicated compounds. Some compounds are so complicated that only living things can make them.



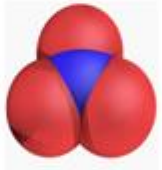
Ions are chemicals that have too many or too few electrons. This makes the ion magnetic and ready to react with other elements.

Some ions are ***negative***. They have too many electrons. These are called ***anions***. Some ions are positive. They have too few electrons. These are called ***cations***.

Some of the cations and anions are famous building blocks. These ions can be used to make more complicated molecules.

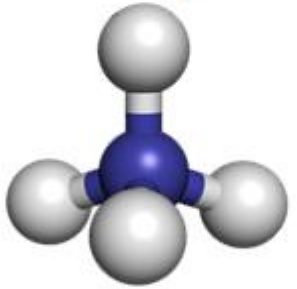
Nitrate

NO_3^-



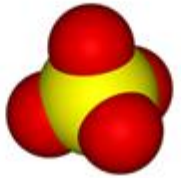
Ammonium

NH_4^+



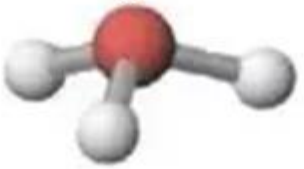
Sulfate

SO_4^{2-}



Hydronium

H_30^+

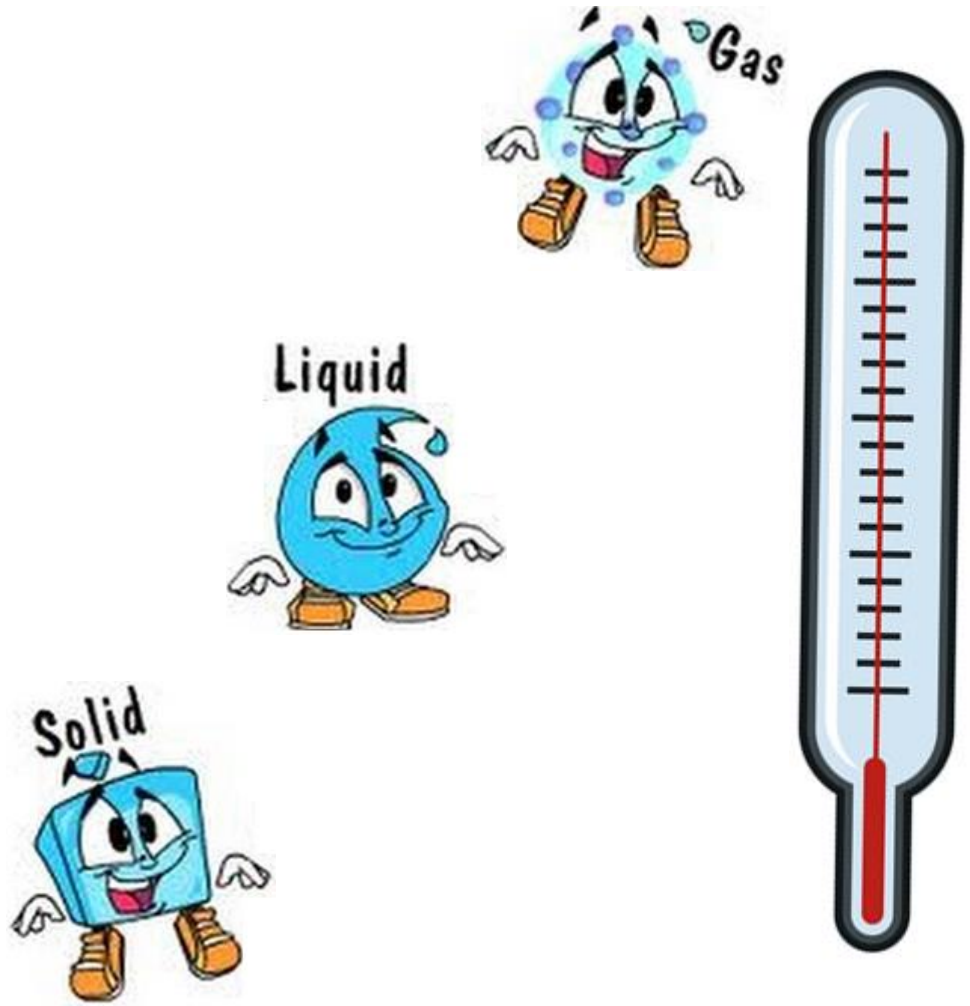


All substances exist in one of three states. Depending on the energy in the substance it will be in one of these states.

Solids are pretty low energy. Nothing is moving around too much, and the substance has a fixed shape and size.

Liquids have more energy as their pieces move around each other. A liquid still has a fixed size, but it is free to move into any shape.

Gases are high energy. They move around the space they are in, but there is still a lot of space between the pieces. They can be squished into a smaller space of any size.



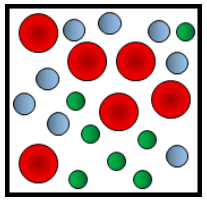
Some substances are made by combining other substances in a non-chemical way. We refer to these as mixtures. Mixtures tend to fall apart because the pieces can't stick together properly.

Mixtures can have all kinds of different things. Like a chocolate chip cookie there are just so many different things in the mix. These are ***heterogeneous*** mixtures (***hetero***-different; ***geneous***-types).

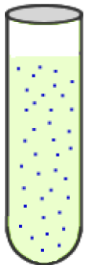
Other mixtures have a smooth and even placement of things. They are the same all over like a sugar cookie. They are ***homogeneous*** mixtures (***homo***-same).

Solutions are a special kind of mixture where two substances bond lightly together. They can stay together for a long time. Water is used to make ***aqueous*** solutions. Alcohol is used to make ***tincture*** solutions.

Mixture



Solution



Heterogeneous

Aqueous

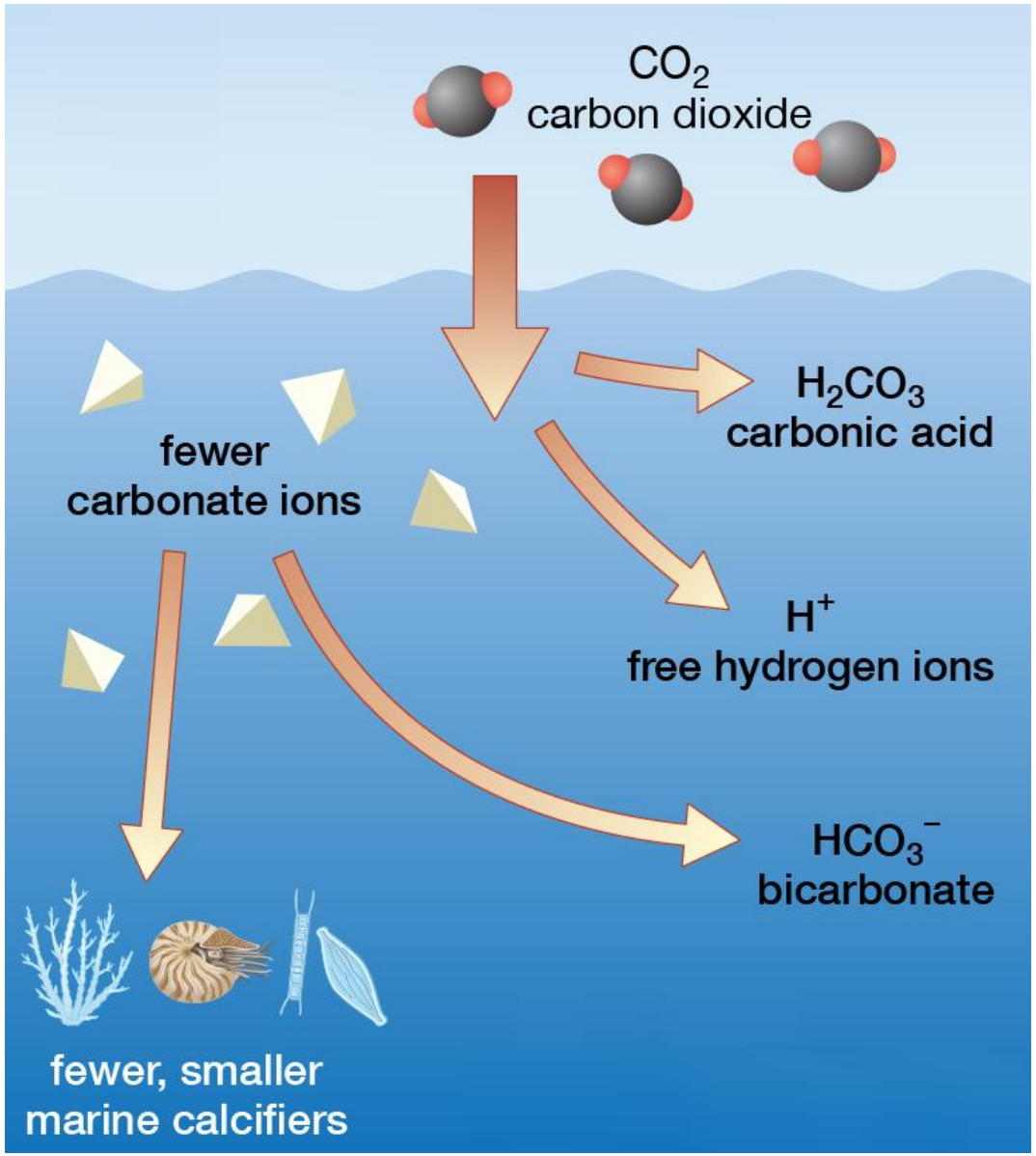
Homogeneous

Tincture

The names for these substances are important. You can't just say "stuff" is in the ocean. No one will know what you mean, and it won't help. If you know the names of these substances, you can talk about it so that everyone understands.

- Gases from the air form solutions in the ocean.
- There are hydrogen and bicarbonate ions in the water.
- Aqueous carbonate ions are used by corals and mollusks.
- These sea creatures can turn the aqueous ions into solid skeletons.

How many of these new words can you find.



There are lots of other times that these words will help. Using the right words for things helps you understand the world around you.

When you are sick, there are lots of options. Some tinctures can help you to sleep and feel less pain. Other pills are homogenous mixtures of medicine and chalk. Some drinks contain all the aqueous ions you need in your body. Which would you pick?

Volcanoes release liquid rock called lava. As the lava cools it solidifies on the outside forming a tube. These lava tubes can flow directly into the ocean where the hot lava turns the ocean water and water gases boil out.

Did you find more words?