

Categories of elements

METALS

- good conductors of heat and electricity
- almost all solids at room temperature (exception: Mercury - Hg - is liquid)
- appearance: shiny, mirrored surface - mostly grey
- ductile (can be drawn into wires), malleable (can be hammered)
- located on the left hand side of the periodic table

NONMETALS

- poor conductors of heat and electricity. Most nonmetals do not conduct well at all (insulators)
- many of the nonmetals are gases at room temperature. A few solids, and one liquid (bromine)
- color: Nonmetals may be white, black, purple, green, blue, orange, or colorless etc.
- usually have low melting points in the solid form
- solids tend to be brittle (not malleable) - break when hit
- located on the right hand side of the periodic table

METALLOIDS / SEMICONDUCTORS

- in between metals and nonmetals on the table
- most periodic tables have a zig-zagging line where the metalloids are
- properties tend to be "between" metals and nonmetals, too!
- some have chemical reactivity like a nonmetal, but conduct electricity better than nonmetals
- some have unusual electrical properties (silicon / germanium diodes) , and are useful in electronics

CHEMICAL COMPOUNDS

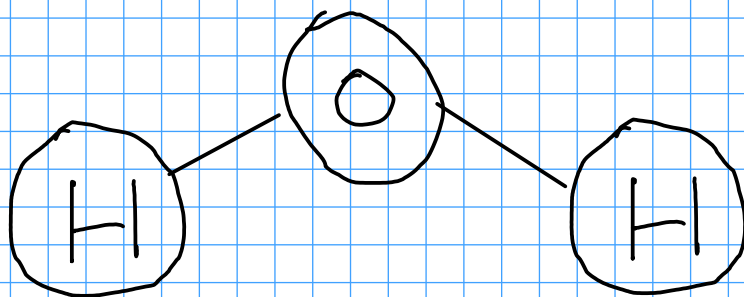
- Dalton's theory does not mention this, but there is more than one way for atoms to come together to make chemical compounds!
- There are TWO common kinds of chemical compound, classified based on how the atoms in the compound are held together:

① MOLECULAR COMPOUNDS

② IONIC COMPOUNDS

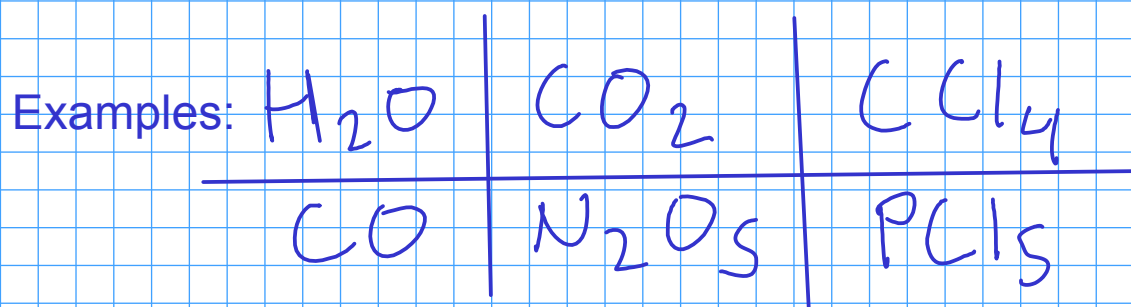
MOLECULAR COMPOUNDS

- form when atoms SHARE outer electrons with each other. This results in a set of connected atoms called a MOLECULE



Stick figure of a water (H_2O) molecule

- usually form between nonmetals and other nonmetals or between nonmetals and metalloids



also,
candle
wax

- some solid at room temperature. These solids tend to have low melting points.

PCl_5 is a solid, $mp = 180^\circ C$

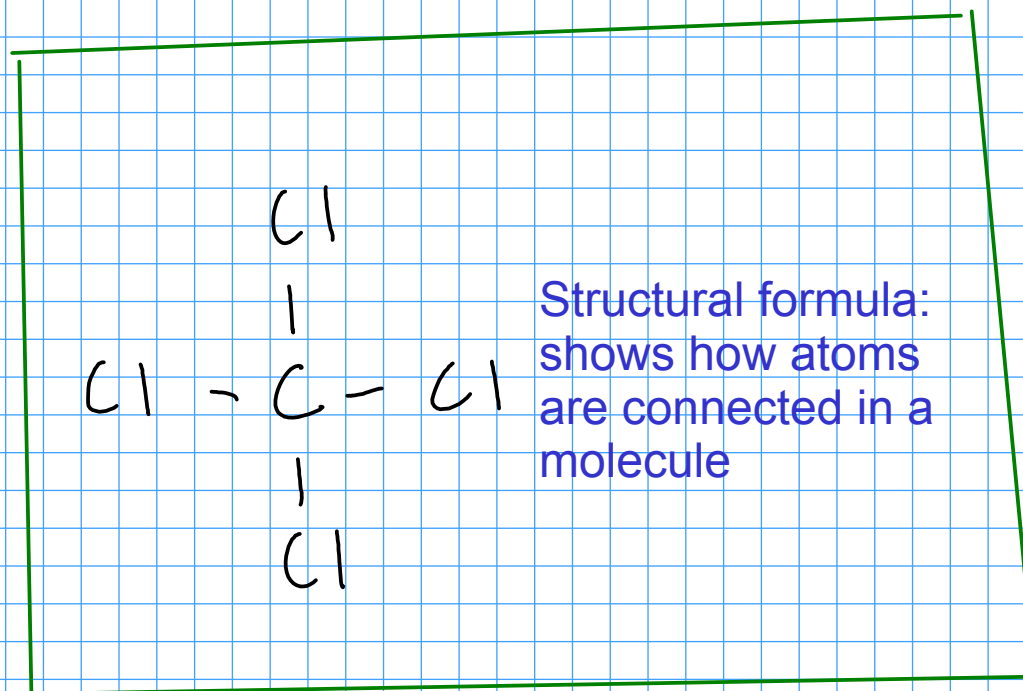
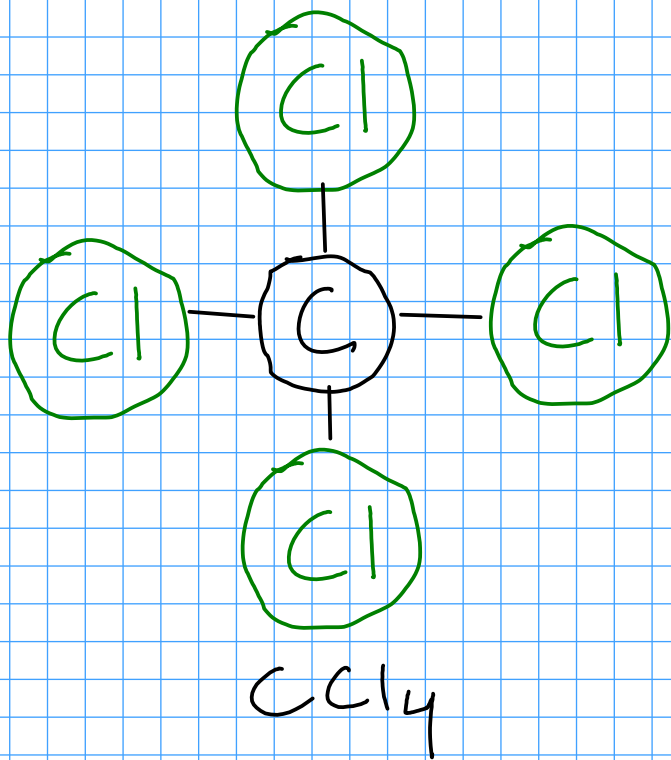
- many are liquids or gases at room temperature

H_2O, CCl_4 : liquids CO, CO_2, N_2O_5 : gases

MOLECULAR FORMULAS

- formula of a molecular compound represents the EXACT NUMBER OF ATOMS OF EACH ELEMENT in a single molecule of the compound

Example: Each molecule of CCl_4 contains exactly one carbon atom and four chlorine atoms



IONIC COMPOUNDS

- formed when atoms TRANSFER ELECTRONS between each other forming charged atoms, called IONS.

Two kinds of ions:

cation

① CATIONS: formed when an atom LOSES one or more electrons.

- overall, a cation has a POSITIVE charge, because it has more protons in the nucleus than electrons in the electron cloud

- usually formed by METALS, but occasionally hydrogen will also form a cation

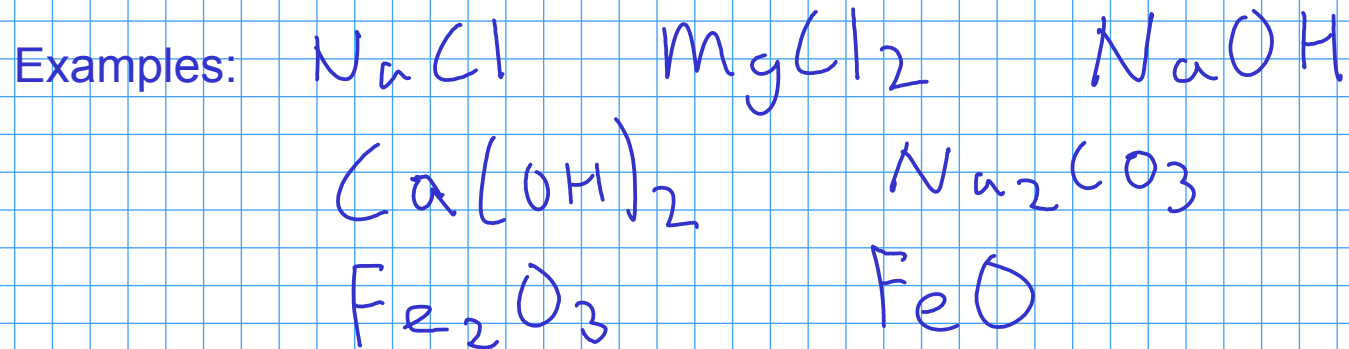
② ANIONS: formed when an atom GAINS one or more electrons

- overall, an anion has a NEGATIVE charge, because it has more electrons in the electron cloud than protons in the nucleus

- usually formed by NONMETALS

IONIC COMPOUNDS

- USUALLY form from metals combining with nonmetals, or from metals combining with metalloids



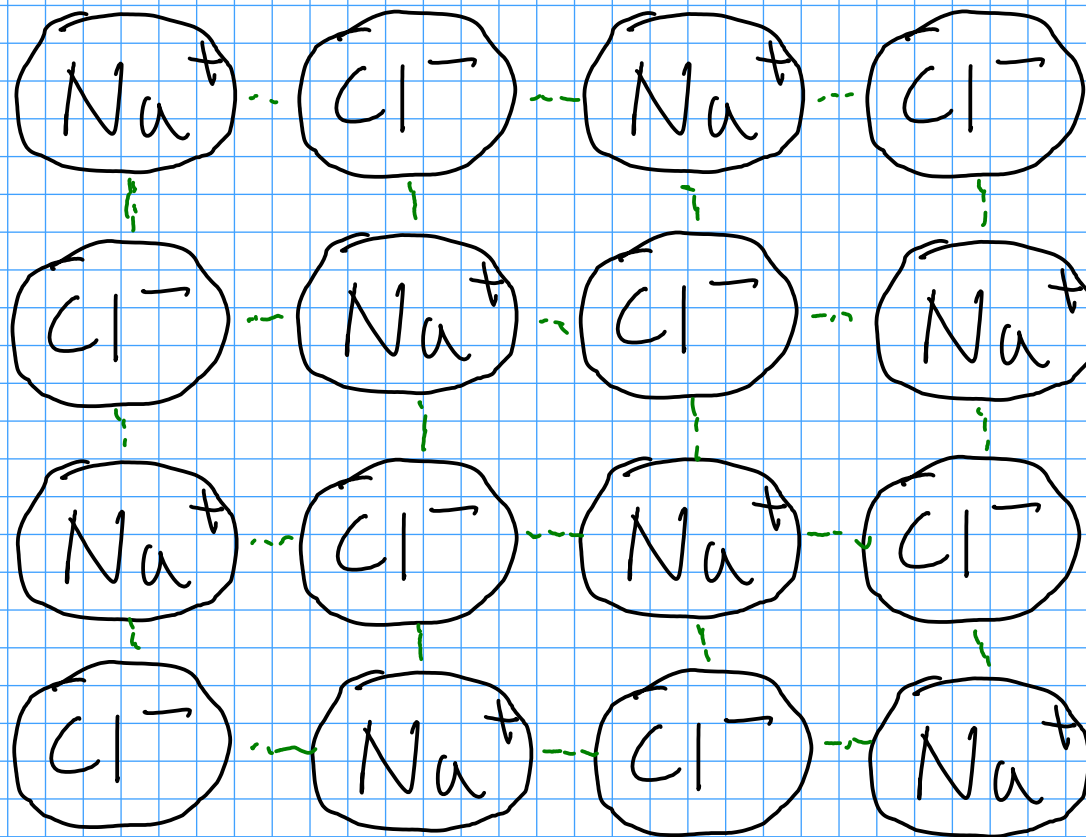
- almost always solid at room temperature, and usually have relatively high melting points

All of the above are solids at room temperature. NaCl has a melting point of 801°C .

- as solids, do not conduct electricity. If dissolved in water (some do not dissolve significantly in water), will form a solution that conducts electricity.

IONIC COMPOUNDS

- ionic compounds are held together by ELECTROSTATIC INTERACTIONS
(in other words, the attraction between oppositely charged ions!)



A chloride ion is strongly attracted to ALL of the sodium ions surrounding it!

A sodium ion is strongly attracted to ALL of the chlorine atoms surrounding it!

There are no "molecules" in ionic compounds - in the sense that you can't point to a discrete unit of atoms that are connected to only each other