Chemical Bonding

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1 Chemical Compounds

DEFINITION

Compound.

A compound is a substance that is made up of two or more elements combined together chemically.

1.1 Noble Gases

- Nobel gases have full outer shells.
- Stable and non-reactive.
- All nobel gases (excluding helium) have 8 electrons in their valence shells (outermost energy levels)
- Some example usage

1.2 The Octet Rule

- Stable compounds are wanted in chemistry.
- This is done by having 8 electrons in their outermost energy levels (valence shells).

DEFINITION

Octet Rule.

When bonding occurs, atoms tend to reach an electron arrangement with eight electrons in their outermost energy level.

- Not a law, rather a 'rule of thumb'.
- There are some exceptions
  - Transition metals - they have more or less than 8 electrons in their outermost energy level
  - Elements near helium (hydrogen, lithium and beryllium) tend to have 2 electrons, rather than 8

2 Ionic Bonding

DEFINITION

Ion.

A charged atom or group of atoms

- A Positively charged ion is a *cation*.

- A negatively charged ion is a *anion*.

DEFINITION

Ionic Bond.

*The **electrostatic** force of attraction between oppositely charged ions in a compound.*

- Ionic bonding generally occurs between metals and non-metals.
- These compounds are generally quite stable, and often come in crystalline form such as salts.

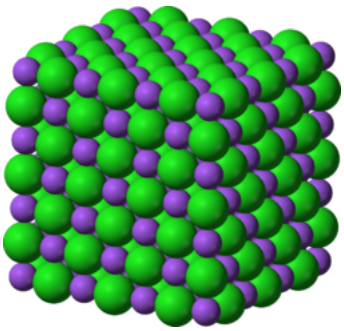

Figure 1: The crystal structure of soduim chloride, NaCL. The purple spheres are sodium cations (Na^+), and the green spheres represent chloride anions (Cl^-)

- This structure, the three-dimensional arrangement of ions, is called a *crystal lattice*.
- In figure 1, the repeating unit in the crystal lattice is shown. This is called the *unit cell*.
- In the crystal lattice of NaCL, each chloride ion is surrounded by six sodium ions, and vice versa.

2.1 Uses of Ionic Compounds

- Sodium chloride to preserve and flavour food.
- Brine to cure bacon.
- Flouridation of water supplies to prevent tooth decay.

2.2 Showing Ionic Bonding

The usual way of showing the formation of the ionic bonding in a compound is using *dot-and-cross diagrams*.

$$\mathrm{Na}\bullet + \bullet\ddot{\mathrm{Cl}}: \longrightarrow [\mathrm{Na}]^+ + [:\ddot{\mathrm{Cl}}:]^-$$

Figure 2: The formation of the ionic bond in sodium chloride using a dot and cross diagram

- In these diagrams, you can also draw the electrons from one atom as crosses, and show their transfer.
- The transfer of electrons is shown by the arrow.