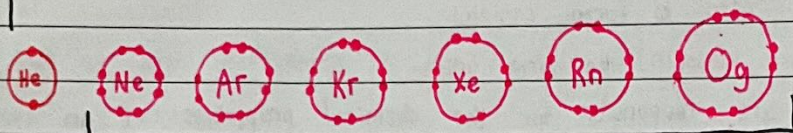


Chapter 4: Chemical bonding & Structure

Why do atoms combine?

- Noble gases are elements in group 18 of the periodic table.
- They have full ^{valence} electron shells, thus have a noble gas electronic configuration.
- These elements are chemically stable and unreactive.
- Noble gases are also **monoatomic**, meaning they exist as single atoms.

→ Only has 1 electron shell w 2 electrons, thus a **duplet** electronic configuration



Have 8 electrons in outermost shells,
thus having an **octet** electronic configuration

- Unlike noble gases, most atoms do not have duplet or octet electronic configurations.
- Thus, their outermost shells may undergo changes to allow them to be **more stable**.
- To achieve a complete valence shell of electrons, atoms chemically combine to form bonds. This can be done in three ways:
 - **loss of electrons**
 - **gain of electrons**
 - **Sharing of electrons**

What is ionic bonding?

- Positive ions (cations)

- A cation is formed when an atom **loses one or more electrons**
- It is no longer an atom as it is not electrically neutral
- It is positively charged as it **has more protons than electrons**
- Metal atoms **lose electrons** to form cations

- Negative ions (anions)

→ An anion is formed when an atom or combination of atoms **gain** one or more **electrons**.

→ An anion is **negatively charged**, as it has more **electrons** than **protons**.

→ Most non-metal atoms will gain electrons to form anions.

- Ionic bonds

→ Ionic bonding joins ions of opposite charges together

→ An **ionic bond** is the mutual electrostatic attraction between ions of opposite charges

- Ionic compounds

→ A **neutral substance** that consists of ions of opposite charges held together by ionic bonds

→ Ionic compounds have **no net charge**, because the total positive charge from the ions must be equal to the total negative charge from the negative ions.

- Ionic structures

→ Ionic compounds have **giant ionic crystal lattice structures** which is a three-dimensional structure with alternating positive and negative ions.

What is covalent bonding?

- It is the **sharing of electrons** equally between atoms of **non-metals** in order to attain the electronic configuration of a noble gas.

- The chemical bond in covalent molecules is called the **covalent bond**.

The **number of covalent bonds** between atoms depends on the **number of pairs of shared electrons**.

- Some covalent molecules are **giant molecules** as they have uncountable number of atoms in each molecule.

What is metallic bonding?

- Metal atoms are held strongly together by metallic bonding.

- Metal atoms lose their outermost electrons and become positively charged

ions.

- Hence, metallic lattice structure is described as a lattice of positive ions surrounded by a "sea of mobile electrons".