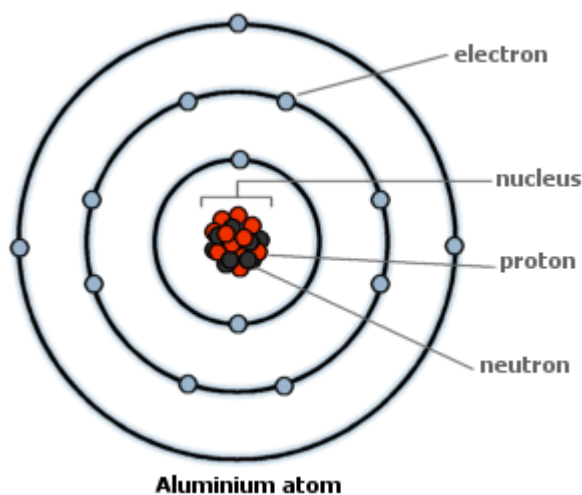


INTRODUCTION TO ATOMS

WHAT IS AN ATOM?

All matter is made up of particles. There are three types of particles that we talk about in science - atoms, molecules and ions. The word 'atom' comes from the Greek word meaning 'unsplitable'. Everything is made of atoms.



All atoms have a nucleus. The nucleus contains *protons* and *neutrons*, except for Hydrogen which has no neutrons. *Electrons* can be found circulating around the nucleus. For any neutral atom, the number of protons is the same as the number of electrons.

If an atom loses or gains electrons, it is called an *ion*.

SUB-ATOMIC PARTICLES

Elements are made from only one type of atom. For example, iron contains nothing but iron atoms. Oxygen contains nothing but oxygen atoms. Scientists can tell different atoms apart by looking at the number of protons they have in their nucleus. The only atoms with 2 protons are Helium atoms, the only atoms with 3 protons are Lithium atoms, and so on.

A special name is given to the number of protons in an atom – it's called the *atomic number*. This number never changes. In a neutral atom, it is also equal to the number of electrons.

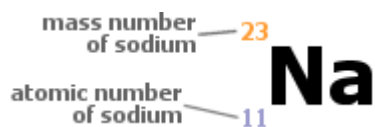
atomic number = number of protons in an atom

Atoms also contain neutrons in their nucleus. The mass of a neutron is the same as the mass of a proton. The overall mass of an atom depends on the number of protons AND neutrons in the nucleus. Scientists call this number the mass number of an element.

mass number = number of protons + number of neutrons in an atom

The mass of an electron is so small compared to the protons and neutrons that we consider it when calculating the mass of an atom.

The mass number and the atomic number are written above and below the chemical symbol for the element.

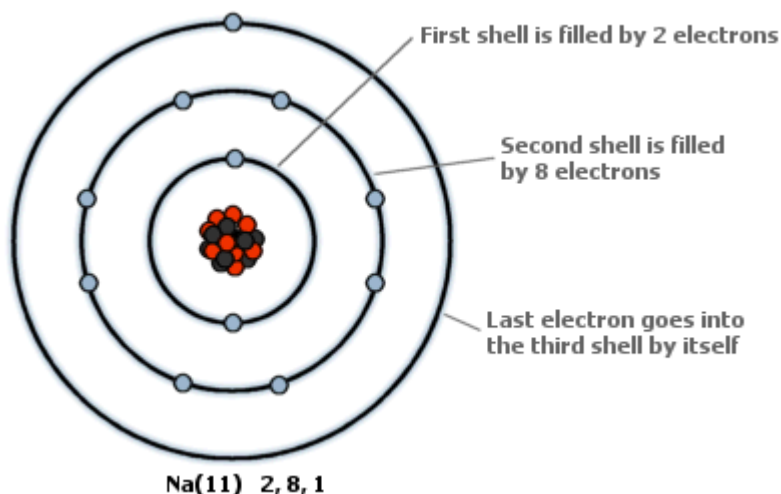


ELECTRONIC STRUCTURE

Electrons move around the nucleus of an atom. This movement takes place in clearly defined regions in the atom. Electrons are pictured as being arranged in orbits and these orbits are sometimes referred to as shells.

Each shell or orbit can only hold a certain number of electrons. The first shell is full when it has two electrons in it; the second is full when it contains eight electrons.

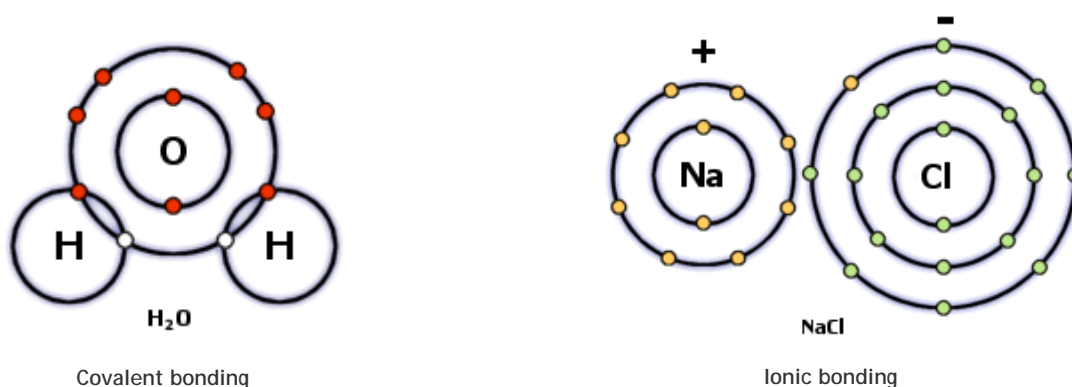
To draw the electronic structure of an element, number the electrons as they fill the shells. Let's take a sodium (Na) atom, which has 11 electrons in total, as an example.



Try drawing the electronic structure of some other atoms yourself. How about carbon? Its electronic structure would be C (6) 2, 4. Or aluminium? Its electronic structure would be Al (13) 2, 8, 3.

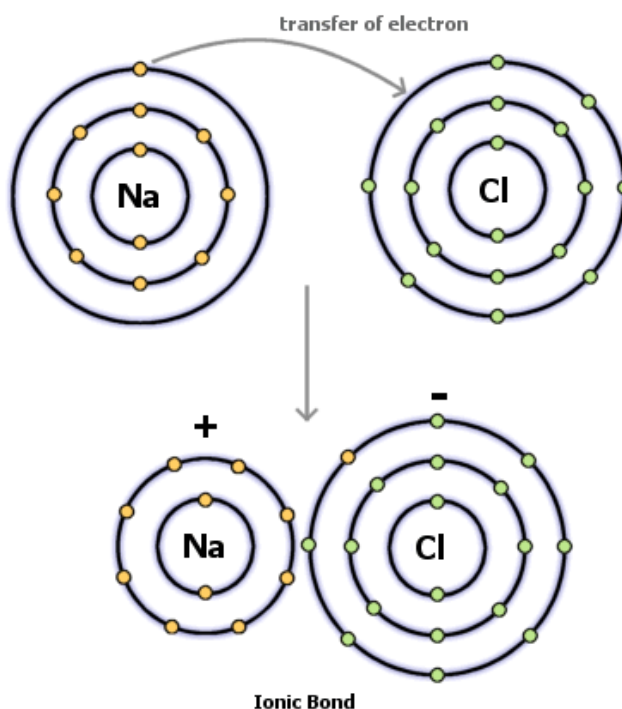
BONDING

When atoms of different elements join together, a *molecule* is formed. This joining together is called *bonding*. Bonds form when the outer shell electrons of the bonding atoms rearrange themselves. There are two types of bonds - ionic bonds and covalent bonds.



IONIC BONDING

Ionic bonds involve ions and are formed between metals and non-metals. For example, an ionic bond forms between an atom of sodium and an atom of chlorine.

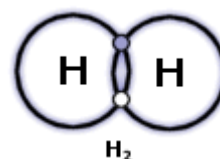


Sodium loses its outer electron to chlorine. This causes sodium to become positive and chlorine to become negative. Notice, the sodium ion now has eight electrons in its outer shell and the chlorine atom now has eight electrons in its outer shell, making both atoms very stable. This example describes the type of bonding that occurs in a very common substance – salt (NaCl).

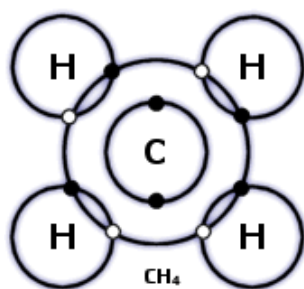
COVALENT BONDING

When non-metals react with other non-metals, they share electrons to form a covalent bond. Covalently bonded compounds form molecules.

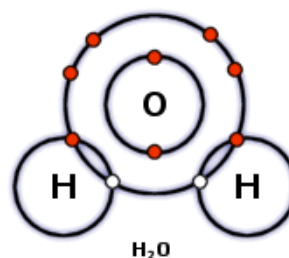
Covalent bonding occurs when electrons are shared between atoms. This type of bonding occurs between non-metals due to the fact that all of the atoms involved need to gain electrons. The best way for them to do this is to share with each other, as shown in the hydrogen atom on the right.



Common substances where covalent bonding occurs include water and methane.



Methane



Water