

Why do elements react?

Elements to react to complete their outer shell; they lose or gain an electron(s). This allows them to achieve a full outer shell.

Ions and ionic compounds

An ion is an atom or molecule with a net electric charge due to the loss or gain of one or more electrons.

Positive and Negative Ions: Cations and Anions. Cations (positively-charged ions) and anions (negatively-charged ions) are formed when a metal loses electrons, and a nonmetal gains those electrons.

Reactions of metals and acids

metal + oxygen → metal oxide

metal + acid → salt + hydrogen

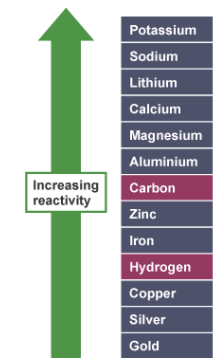
metal oxide + acid → salt + water

metal carbonate + acid → salt + carbon dioxide+ water

metal + water → metal hydroxide + hydrogen

Displacement reactions

If a reactive element comes into contact with the compound of a less reactive element a chemical reaction may take place.

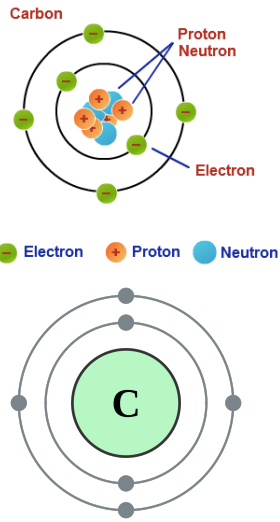


Covalent bonds

A covalent bond forms when two non-metal atoms share a pair of electrons. The electrons involved are in the outer shells of the atoms. An atom that shares one or more of its electrons will complete its outer shell.

Covalent bonds are strong - a lot of energy is needed to break them. Substances with covalent bonds often form molecules with low melting and boiling points, such as hydrogen and water.

Configurations



Group 7 – the halogens

The Group 7 elements are called the halogens. They are placed in the vertical column, second from the right, in the periodic table.

Chlorine, bromine and iodine are the three common Group 7 elements. Group 7 elements form salts when they react with metals. The term ‘halogen’ means ‘salt former’.

Reactivity of halogens

The non-metal elements in Group 7 - known as the halogens - get less reactive as you go down the group. This is the opposite trend to that seen in the alkali metals in Group 1 of the periodic table. Fluorine is the most reactive element of all in Group 7.

Testing gases

CO2

- Collect gas produced by reaction
- Bubble gas through limewater using a bung delivery tube
- If limewater goes cloudy, carbon dioxide gas is present

H2

- Collect gas produced by reaction in test tube
- Place lit splint near mouth of test tube
- If a squeaky pop is heard, hydrogen gas is present

Electronegativity

Electronegativity is a measure of the tendency of an atom to attract a bonding pair of electrons. The Pauling scale is the most commonly used. Fluorine (the most electronegative element) is assigned a value of 4.0, and values range down to caesium and francium which are the least electronegative at 0.7.

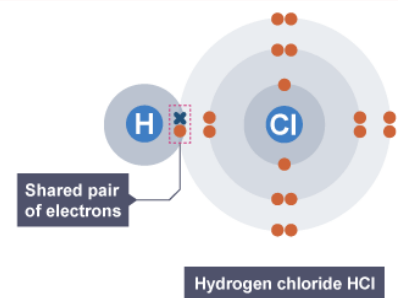
The periodic table

There are more than 100 different elements. The periodic table is a chart showing all the elements arranged in order of increasing atomic number. The vertical columns in the periodic table are called groups. Each group contains elements that have similar properties.

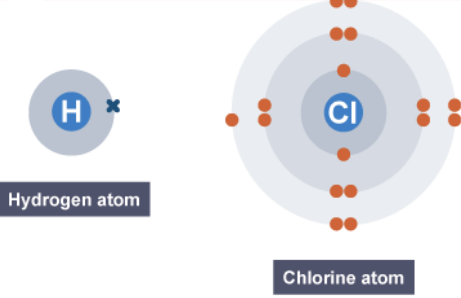
The periodic table has eight main groups. For example, Group 1 contains very reactive metals such as sodium (Na), while Group 7 contains very reactive non-metals such as chlorine (Cl).

There are no compounds in the periodic table, because these consist of two or more different elements joined together by chemical bonds.

1. A hydrogen atom with one electron and a chlorine atom with 17 electrons



2. The hydrogen atom has bonded with the chlorine atom, meaning there is now a shared pair of electrons



Group 1 – the alkali metals

The Group 1 elements are called the alkali metals. They are placed in the vertical column on the left-hand side of the periodic table.

All the Group 1 elements are very reactive. They must be stored under oil to keep air and water away from them. Group 1 elements form alkaline solutions when they react with water, which is why they are called alkali metals.

Explaining reactivity

The Group 1 elements have similar properties because of the electronic structure of their atoms - they all have one electron in their outer shell.

Explaining trends

In a reaction, an atom of a Group 1 element will form an ion with a single positive charge. For example, for sodium forming a sodium ion:



A change like this, where an electron is lost, is an example of oxidation. The ions formed have a stable electronic structure, like a noble gas from Group 0.

The reactivity of Group 1 elements increases as you go down the group because:

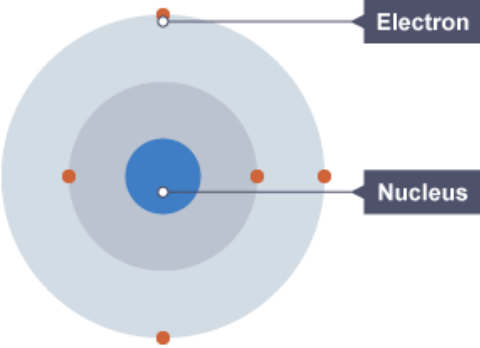
- the atoms get larger as you go down the group
- the outer electron gets further from the nucleus as you go down the group
- the attraction between the nucleus and outer electron gets weaker as you go down the group - so the electron is more easily lost

Structure of the atom

The nuclear model

Atoms contain three sub-atomic particles called protons, neutrons and electrons.

The protons and neutrons are found in the nucleus at the centre of the atom. The



nucleus is very much smaller than the atom as a whole. The electrons are arranged in shells around the nucleus.

Metals, Chemicals and Reactivity