**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.

**Metals, Chemicals and Reactivity**

**Group 1 – the alkali metals**

The Group 1 elements are called the alkali metals. 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
  - Gas produced by reaction in test tube
  - Place lit splint near mouth of test tube;
    - a squeaky pop is heard, hydrogen gas is present

**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.

- The less reactive element is removed from the compound and replaced by the more reactive element.
- chlorine + sodium bromide → sodium chloride + bromine
- chlorine + sodium iodide → sodium chloride + iodine
- bromine + sodium chloride → no reaction

**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.

**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'.

**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.

**Structure of the atom**

Atoms contain three subatomic 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.

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**Configurations**

Metals, Chemicals and Reactivity

Covalent bonds

A covalent bond forms when two non-metal atoms share one or more of their electrons to complete their 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.