Single Displacement & Combustion Reactions Notes

A Single Displacement Reaction occurs when one element displaces (or replaces) another element in a chemical compound

General form: A + BC → AC + B In this reaction, B has been replaced by A in BC, leaving B to exist by itself

Types of Single Displacement Reactions:

A metal displacing another metal in an ionic compound

$Al_{(s)} + FeCl_{2(aq)} \rightarrow Fe_{(s)} + AlCl_{3(aq)}$

A metal displacing Hydrogen in water or an acid

$Mg_{(s)} + HCl_{(aq)} \rightarrow MgCl_{2(aq)} + H_{2(g)}$

A non-metal displacing another non-metal in an ionic compound

$Cl_{2(g)} + NaBr_{(aq)} \rightarrow NaCl_{(aq)} + Br_{2(l)}$

Metal	Displaces Hydrogen...		Reactivity
	Water	*Acids*	
Lithium			MOST
Potassium			
Barium			
Calcium			
Sodium			
Magnesium			
Aluminum			
Zinc			
Chromium			
Iron			
Cadmium			
Cobalt			
Nickel			
Tin			
Lead			
Hydrogen			
Copper			
Mercury			
Silver			
Platinum			
Gold			LEAST

Some metals are more reactive than others and can be ranked relative to one another. This is called the **Metal Activity Series.** We can use the activity series to predict the products in Single Displacement Reactions.

A metal (element) higher up on the series will replace any element lower down

$Zn_{(s)} + CoCl_{2\,(aq)} \rightarrow Co_{(s)} + ZnCl_{2(aq)}$

$Fe_{(s)} + Mg(NO_3)_{2(aq)} \rightarrow$ No Reaction

Displacement of Hydrogen

Notice that **Hydrogen** is also on the list. **Anything above Hydrogen will displace it in an *acid***

Some <u>highly reactive</u> elements can also replace the **Hydrogen** in water

- ➢ These include: Lithium, Potassium, Barium, Calcium and Sodium
- ➢ Metal will take **Hydroxide** from the water, leaving **H_2 Gas**
  - $Na_{(s)} + H_2O_{(l)} \rightarrow NaOH_{(aq)} + H_{2(g)}$

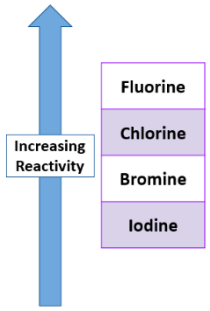
<u>Activity Series of Halogens</u>

There is also a series for **Halogens** that can be used to determine whether certain anions can be replaced in reactions

- ➢ This series works the same way as the Metal Series (higher replaces lower)

$Cl_2 + NaBr \rightarrow NaCl + Br_2$

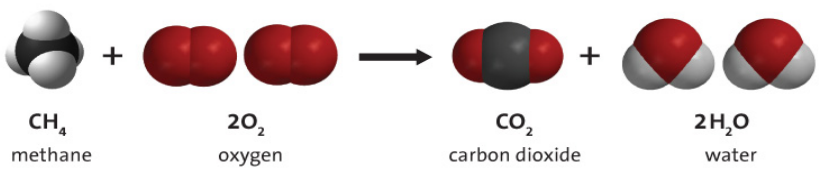
$Cl_2 + NaF \rightarrow$ No Reaction



Combustion Reactions

A **combustion reaction** occurs when a substance is reacted with oxygen. This reaction releases energy in the form of **heat and light**, as well as several oxides. Many things can undergo combustion, but most of the compounds that do are known as **Hydrocarbons**

- A **Hydrocarbon** is a compound made exclusively out of **Carbon** and **Hydrogen** (sometimes Oxygen)



Here is a table of common Hydrocarbons

Name	Formula	Use
Methane	CH_4	Fuel for cooking
Ethane	C_2H_6	Raw Material for plastics
Propane	C_3H_8	Fuel for cooking
Butane	C_4H_{10}	Fuel in lighters
Acetylene (Ethyne)	C_2H_2	Fuel for welding
Benzene	C_6H_6	Common solvent

Complete Combustions reacts to produce the same products all the time: <u>Carbon Dioxide & Water</u> in <u>plentiful oxygen</u>

- General formula: $C_xH_y + O_2 \rightarrow CO_2 + H_2O$
- This will produce a **blue** flame , as there is plenty of oxygen for the reaction
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Incomplete Combustions reacts to produce the a variety of products:
<u>Carbon Dioxide, Carbon Monoxide, Carbon (soot) & Water</u> in <u>limited oxygen</u>

- General formula: $C_xH_y + O_2 \rightarrow C_?H_? + CO_2 + CO + C + H_2O$ ***($C_?H_?$ represents various smaller hydrocarbons that result from incomplete combustion of the larger fuel source)***
- This will produce a **yellow/orange** flame , as there is limited oxygen for the reaction