The Activity Series for Single Displacement Reactions

CHEM 30A

Higher oxidation potential
(greater tendency to form cations)

Activity Series:

Metals and H	Non-metals (Halogens)
K	F_2
Ca	Cl_2
Na	Br_2
Mg	I_2
Al	
Zn	
Fe	
Ni	
Sn	
Pb	
H	
Cu	
Ag	
Hg	
Au	

Increasing Activity ↑

Higher reduction potential
(greater tendency to form anions)

A more active element (higher on the table above) will form an ion and displace the ion of like charge from the compound. The displaced ion will become a neutral element (see diatomic elements below).

$Al + PbCl_2 \rightarrow$ **?**

Predict products: $Al + PbCl_2 \rightarrow$ **$AlCl_3 + Pb$**

Balance: **2** Al + **3** $PbCl_2 \rightarrow$ **2** $AlCl_3$ + **3** Pb

Al forms cations, and is more active than Pb

$Cl_2 + FeBr_3 \rightarrow$ **?**

Predict products: $Cl_2 + FeBr_3 \rightarrow$ **$FeCl_3 + Br_2$**

Balance: **3** Cl_2 + **2** $FeBr_3 \rightarrow$ **2** $FeCl_3$ + **3** Br_2

Cl forms anions, and is more active than Br

A less active element (lower on the table) cannot displace the ion from the compound, therefore, there will be no reaction.

$Pb + AlCl_3 \rightarrow$ **?**

Predict products: $Pb + AlCl_3 \rightarrow$ **no reaction**

Pb forms cations, but is less active than Al

$Br_2 + FeCl_3 \rightarrow$ **?**

Predict products: $Br_2 + FeCl_3 \rightarrow$ **no reaction**

Br forms anions, but is less active than Cl

Diatomic elements:

There are seven elements that exist as diatomic (two atom) neutral molecules:

Br I N Cl H O F

These elements can have a subscript of one if they are an ion or part of a compound, but will pair up (subscript of two) when alone and neutral.

Example: oxygen

O^{2-} ✓ okay (ion)

H_2O ✓ okay (compound)

O ✘ not okay (alone and neutral)

write O_2 instead

When a non-metal ion is being displaced, be sure to check whether or not the neutral element produced is diatomic.