Chemical Reactions

SINGLE REPLACEMENT REACTIONS

Element + Compound

- If the single element is a metal --- use REACTIVITY SERIES of metals
- If the single element is a nonmetal --- use HALOGEN family
- The single element must be higher to replace an element in a compound
- ACIDS and WATER are special compounds
- water should be written as H OH (H^+ OH^-)

Metal $M^+ + A^+B^- \rightarrow MB + A$

Nonmetal $N^- + A^+B^- \rightarrow AN + B$

Is (the single metal) above (metal in the compound)? If yes continue reaction. If no write N.R. – no reaction.

DECOMPOSITION REACTIONS

More Products than Reactants

Metal / Nonmetal → Individual elements
or (cation/anion)

Acids → nonmetal oxides + water

Bases (OH) → metal oxides + water

Carbonates → metal oxides + carbon dioxide

Chlorates → metal chlorides + oxygen

For some decomposition rxns to occur, heat or electricity is needed.

DOUBLE REPLACEMENT REACTIONS

Compound + Compound (not H_2O)

- acids(H^+) and bases (hydroxides, OH-) are special D.R.'s --- they are Neutralization Rxn --> they form SALTS & Water
- If H_2CO_3, carbonic acid, is a product it will decompose into CO_2 & H_2O
- Predict products by switching B & D of the equation below

$$A\,B + C\,D \rightarrow AD + CB$$

- For the products look at solubility chart for an "SS" or "I", if you see this, a chemical reaction will occur. (ppt. - gas - molecular compound)
- Write products using charges and criss-cross method.
- Label each reactant and product….. (g), (s), (l)…….

SYNTHESIS REACTIONS

More Reactants than Products

Metal + Nonmetal → Binary Ionic (Use Charges)

Metal Oxide + water → Hydroxides

MgO + H OH → Mg^{2+} OH^{-1} → $Mg(OH)_2$

Nonmetal Oxide + water → Acids

SO_3 + H OH → H_2SO_4

Nonmetal + Nonmetal → Molecular compounds

Metals + Metals → N.R.

COMBUSTION REACTIONS

Reactions that usually involve a hydrocarbon, (C_xH_y), that will react with oxygen, O_2, to produce carbon dioxide and water.

$CH_4 + O_2 \rightarrow CO_2 + H_2O$ --- complete combustion (CO_2 is the products)

$CH_4 + O_2 \rightarrow CO + H_2O$ --- incomplete combustion (CO is a product)

Diatomic Molecules

H_2, Hydrogen – N_2, Nitrogen – O_2, Oxygen – F_2, Fluorine – Cl_2, Chlorine – Br_2, Bromine – I_2, Iodine

Double Replacement Reactions	acetate	bromide	carbonate	chlorate	chloride	chromate	hydroxide	iodide	nitrate	oxide	phosphate	sulfate	sulfide	silicate
aluminum	s	s	-	s	s	-	I	s	s	I	I	s	d	I
ammonium	s	s	s	s	s	s	s	s	s	-	s	s	s	-
barium	s	s	I	s	s	I	ss	I	s	s	I	ss	d	s
cadmium	s	s	I	s	s	-	I	s	s	I	I	s	I	ss
calcium	s	s	I	s	s	s	ss	s	s	I	I	ss	s	I
copper (I)	-	ss	I	-	I	I	I	I	-	I	-	d	-	-
copper (II)	s	s	d	s	s	I	I	-	s	I	I	s	I	I
hydrogen	s	s	s	s	s	s	HOH	s	s	s	s	s	s	-
iron (II)	s	s	I	-	s	n	I	s	s	I	I	s	I	-
iron (III)	-	s	-	-	s	I	I	-	s	I	I	ss	I	-
lead (II)	s	ss	I	s	ss	I	I	I	s	I	I	ss	I	I
lead (IV)	d	-	-	-	d	-	-	-	-	I	-	-	-	-
magnesium	s	s	ss	s	s	s	I	s	s	I	I	s	d	-
manganese (II)	s	s	I	-	s	-	I	s	s	I	-	s	I	I
mercury (I)	ss	I	I	ss	I	ss	-	ss	s/d	I	I/d	ss	I	-
mercury (II)	s	ss	I	s	s	ss	I	I	s	I	ss	d	I	-
nickel (II)	s	s	I	s	s	-	I	s	s	I	I	s	I	I
potassium	s	s	s	s	s	s	s	s	s	d	s	s	s	-
silver	s	I	I	s	I	ss	-	I	s	I	I	ss	I	-
sodium	ss	s	s	s	s	s	s	s	s	d	s	s	s	-
tin (II)	-	-	-	-	s	-	I	s	-	I	-	s	I	-
tin (IV)	-	s/d	-	-	s/d	-	-	s/d	-	I	I	s/d	I	-
zinc	s	s	I	s	s	s	I	s	d	I	I	s	I	I
strontium	s	s	ss	s	s	ss	ss	s	s	s	I	ss	I	I

s-soluble (use (aq))
I-insoluble (use (s))
ss-slightly soluble (use (s))

d-decomposes
"-" - does not exist

Single Replacement Reaction

ACTIVITY SERIES of METALS

Replaces "H" in acids and HOH:
lithium
rubidium
potassium
cesium
barium
strontium
calcium
sodium

Replaces "H" only in Acids:
magnesium
aluminum
manganese
zinc
chromium
iron
cadmium
cobalt
nickel
tin
lead

HYDROGEN
antimony
bismuth
arsenic
copper
mercury
silver
platinum
gold