

## How to Recognize one Chemical Reaction from another.

| Type                    | Abstracts  | Real examples  | Thinks to remember   |
|-------------------------|--|--|--|
| Synthesis               | $M + N \rightarrow MN$ $X + Y \rightarrow XY$  | $2\text{Na} + \text{Cl}_2 \rightarrow 2 \text{NaCl}$ $\text{N}_2 + 3\text{H}_2 \rightarrow 2\text{NH}_3$   | Two or more smaller reactants become a bigger product.<br>AKA Combination Reaction.  |
| Decomposition           | $MN \rightarrow M + N$ $XY \rightarrow X + Y$  | $\text{CuCO}_3 \rightarrow \text{CuO} + \text{CO}_2$ $2\text{Al}_2\text{O}_3 \rightarrow 4\text{Al} + 3\text{O}_2$   | Opposite of synthesis.<br>Start with one reactant, which breaks down into smaller products.  |
| Single Replacement (SR) | <p>Cation (metal) replacement</p> $Z + \text{BC}_{(\text{AQ})} \rightarrow \text{ZC}_{(\text{AQ})} + \text{B}$ <p>Anion (nonmetal) replacement</p> $\text{N} + \text{CA}_{(\text{AQ})} \rightarrow \text{CN}_{(\text{AQ})} + \text{A}$ | $\text{Li} + \text{NaCl}_{(\text{AQ})} \rightarrow \text{LiCl}_{(\text{AQ})} + \text{Na}$ $\text{F}_2 + 2\text{NaCl}_{(\text{AQ})} \rightarrow 2\text{NaF}_{(\text{AQ})} + \text{Cl}_2$ <p><math>\text{Au} + \text{HCl}_{(\text{AQ})} \rightarrow \text{X}</math> no reaction<br/>A “no reaction” happens when the atoms are “lower” - less reactive than the ion already in solution.<br/>Gold is less reactive than hydrogen; the Au “can’t bump” the H out of solution.</p> | <p>Start: atoms are added to a SINGLE aqueous solution.</p> <p>Product is new AQ and diff. atoms.</p> <p>Check Table F, but in every SR a new AQ forms.</p> <p>Find the 2/3 on Table J ♥</p> <p>Which ever metal (or H) is higher, goes into solution, or stays in solution.</p> <p>Which ever nonmetal is higher goes into solution, or stays in solution.</p> <p>Switch, fix, balance.</p> |

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| Double Replacement (DR) | $AQ + AQ \rightarrow \text{diff } AQ + \text{SOLID}$<br><br>$\underline{AB} + \underline{XY} \rightarrow \underline{AY} + \underline{XB}$<br>Make sure the first part, the <u>CATION</u> , stays in front.<br>Switch the anions only.   | These are “so big” they would not fit in this box.<br>Example below.  | Always start with TWO AQ solutions.<br><br>Switch, fix, balance, F’em.<br>On the odd chance you end up with 2AQ products, that means it was no reaction, just a mixture forms.  |
|                         |   | $2LiBr_{(AQ)} + Pb(NO_3)_{2(AQ)} \rightarrow 2LiNO_{3(AQ)} + PbBr_{2(S)}$ $NaC_2H_3O_{2(AQ)} + AgNO_{3(AQ)} \rightarrow AgC_2H_3O_{2(AQ)} + NaNO_{3(AQ)}$ The 2nd line is NO REACTION, 2 AQ products means a mixture, not a reaction.                                   |   |
| Combustion              | $HC^* + O_2 \rightarrow CO_2 + H_2O$<br>No real “abstract”, you always burn a hydrocarbon and oxygen; always get carbon dioxide & water products.<br><br>*You might start with an oxygenated hydrocarbon. Rarely you have “incomplete combustion” (insufficient oxygen), then $C_{(S)}$ or $CO_{(G)}$ forms <u>with</u> $CO_2 + H_2O$ | $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$<br><br>$2C_4H_{10} + 13O_2 \rightarrow 8CO_2 + 10H_2O$<br><br>$C_{23}H_{48(S)} + 35O_2 \rightarrow 23CO_2 + 24H_2O$<br><br>$2C_2H_5OH + 5O_2 \rightarrow 4CO_2 + 4H_2O$<br><br>$2CH_4 + 3O_2 \rightarrow C_{(S)} + CO_2 + 4H_2O$ | These are always exothermic, heat is a product.<br><br>Sometimes the numbers get bigger than “normal”.<br><br>You will always be given the formula for the HC or oxygenated HC. |