

IDENTIFYING REACTIONS

You may see one or more of these signs when a chemical reaction occurs

- ① - A change in temperature that can't be explained in another way.
- ② - Emission of light that can't be explained in another way
- ③ - The formation of a solid - or PRECIPITATION - in a previously liquid solution. (Not a simple phase change!) *or gas formation. ✓*
- ④ - Color change (not simply lightening of color caused by diluting a solution!)

CLASSIFYING REACTIONS

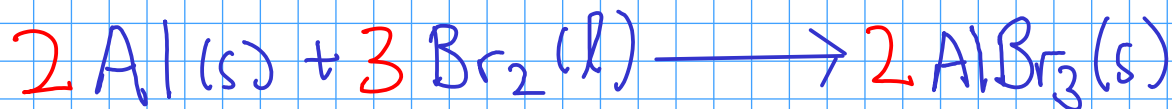
- It's simpler to talk about different reactions if we can classify them into a small number of classes.

① COMBINATION REACTIONS

- Reactions that involve two or more simple substances **COMBINING** to form a **SINGLE** product
- Often involve large energy changes. Sometimes violent!

- Form: $A + B + \dots \longrightarrow C$

Example:



CLASSIFYING REACTIONS

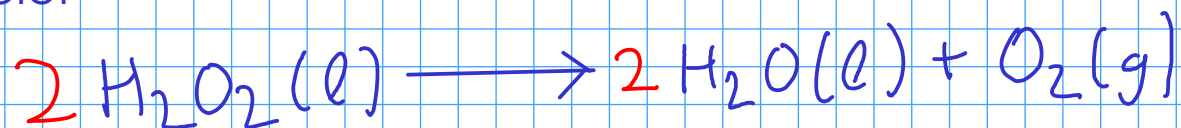
② DECOMPOSITION REACTIONS

- Reactions where a SINGLE REACTANT breaks apart into several products

- Form:



Example:



* This reaction is NOT a combustion reaction, even though O_2 is involved!

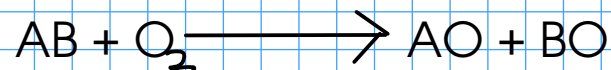
* Combustion reactions CONSUME O_2 , while this reaction PRODUCES O_2

CLASSIFYING REACTIONS

3 COMBUSTION REACTIONS

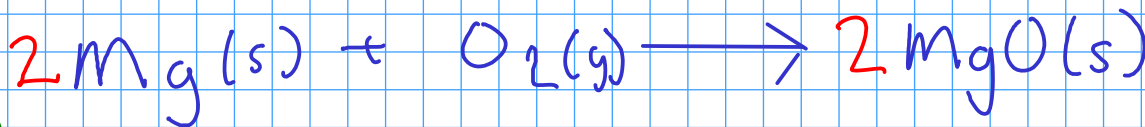
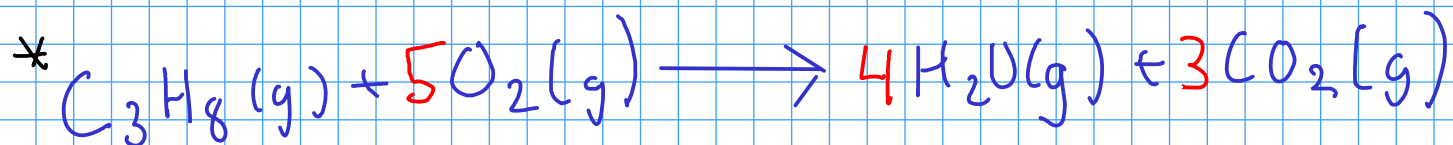
- Reactions of substances with MOLECULAR OXYGEN (O_2) to form OXIDES.
- Combustion forms an OXIDE of EACH ELEMENT in the burned substance!

- Form:



Oxide: a compound containing OXYGEN and one other element!

Examples:



This reaction can also be called a combination!
Two reactants form a single product.

* Combustion of hydrocarbons makes carbon dioxide and water, if enough oxygen is present. In low-oxygen environments, carbon monoxide is made instead!

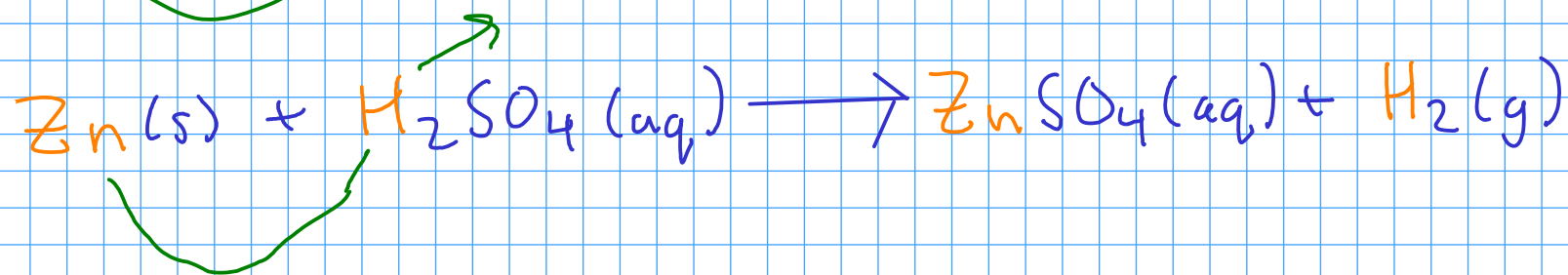
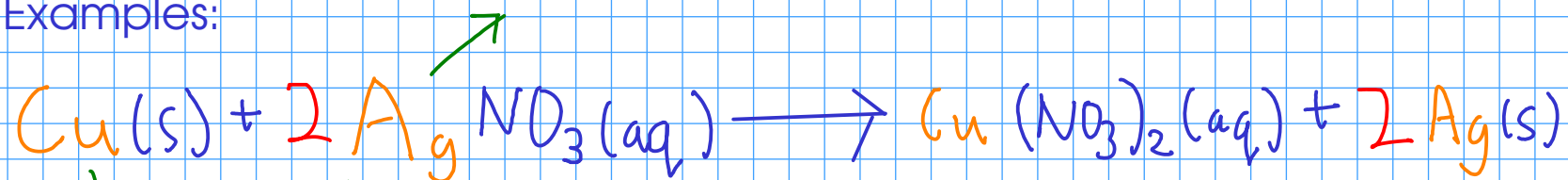
Oxides!

CLASSIFYING REACTIONS

④ SINGLE REPLACEMENT REACTIONS

- Reactions where one element REPLACES another element in a compound.
- Can be predicted via an ACTIVITY SERIES (more on that later!)
- Form: $A + BC \longrightarrow AC + B$ "A" and "B" are elements., often metals.
- Easy to spot, since there is an element "by itself" on each side of the equation.

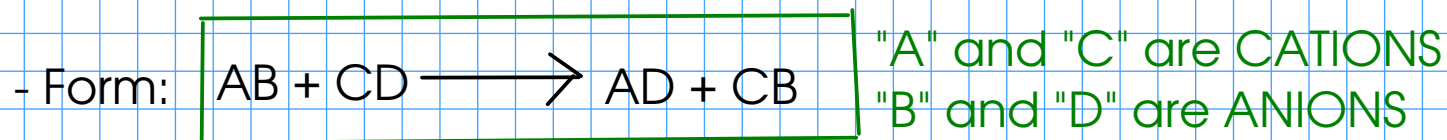
Examples:



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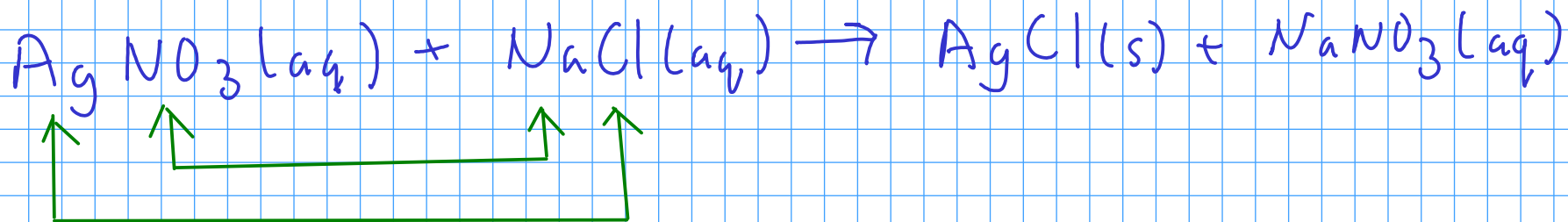
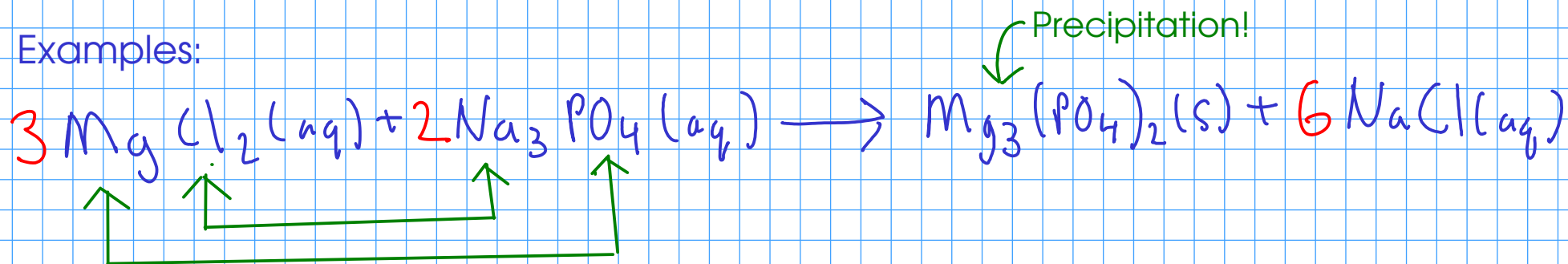
5 DOUBLE REPLACEMENT REACTIONS

- Also called "exchange" reactions
- The ions in two ionic compounds (one compound may also be an acid) EXCHANGE PARTNERS, forming two new compounds.

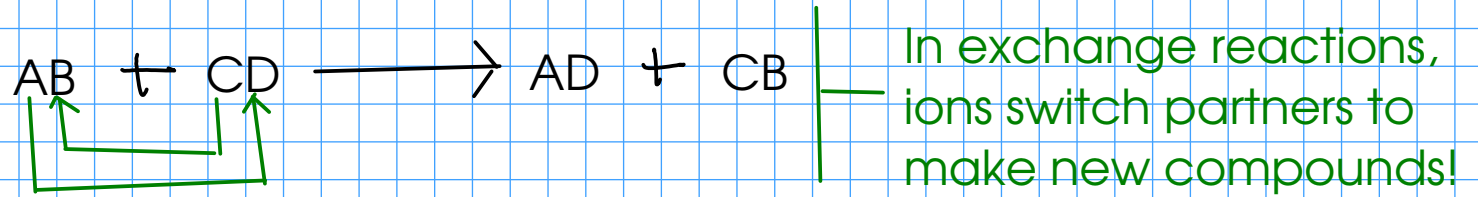


- Can be predicted based on the characteristics of the potential products (More on that later!)
- Occur in AQUEOUS SOLUTION

Examples:



DOUBLE REPLACEMENT (EXCHANGE) REACTIONS

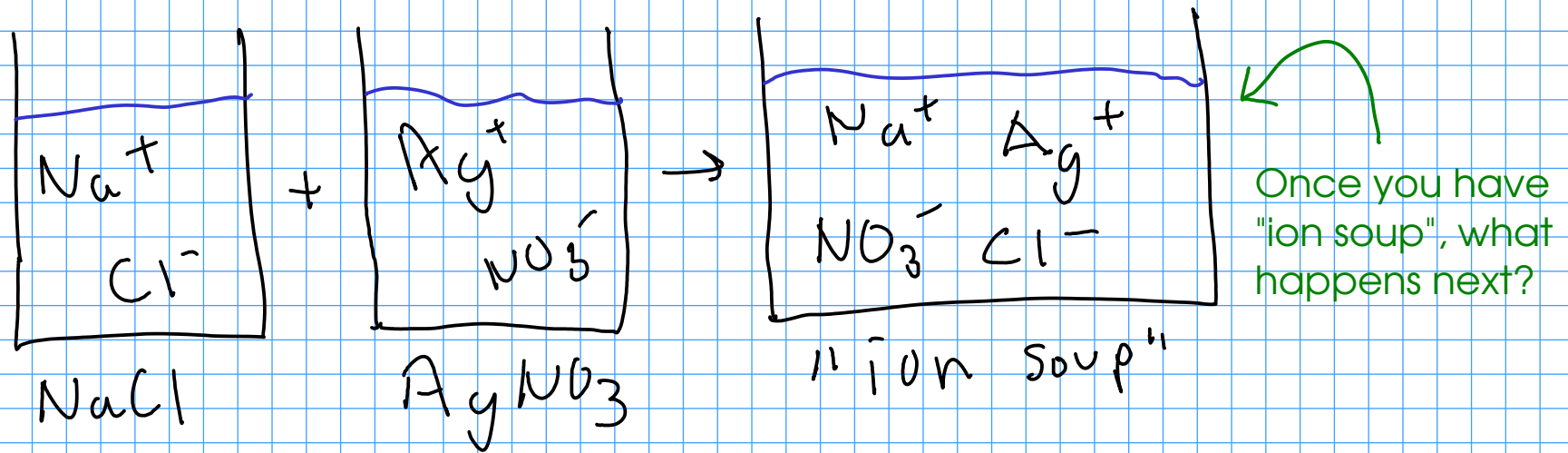
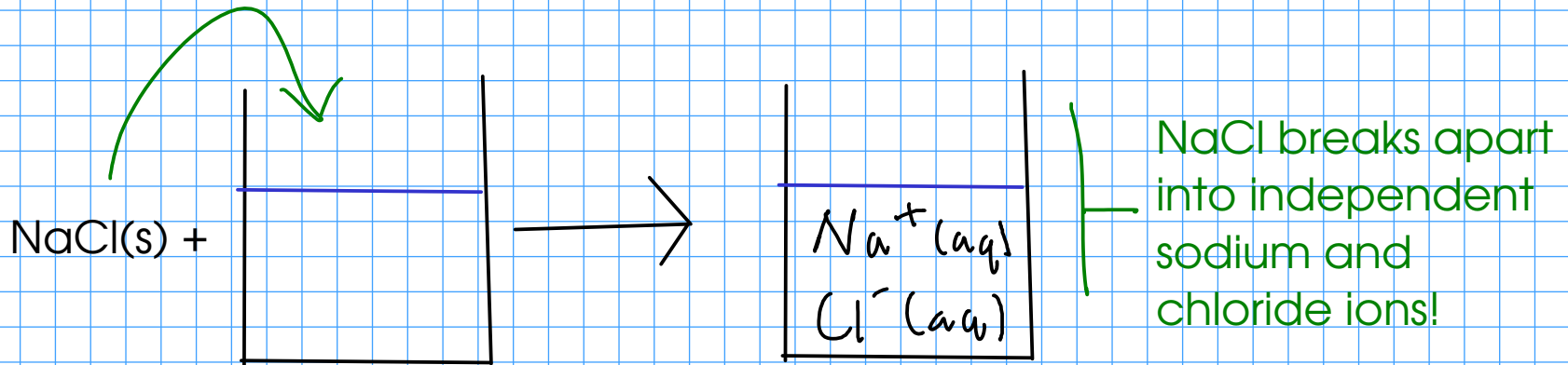


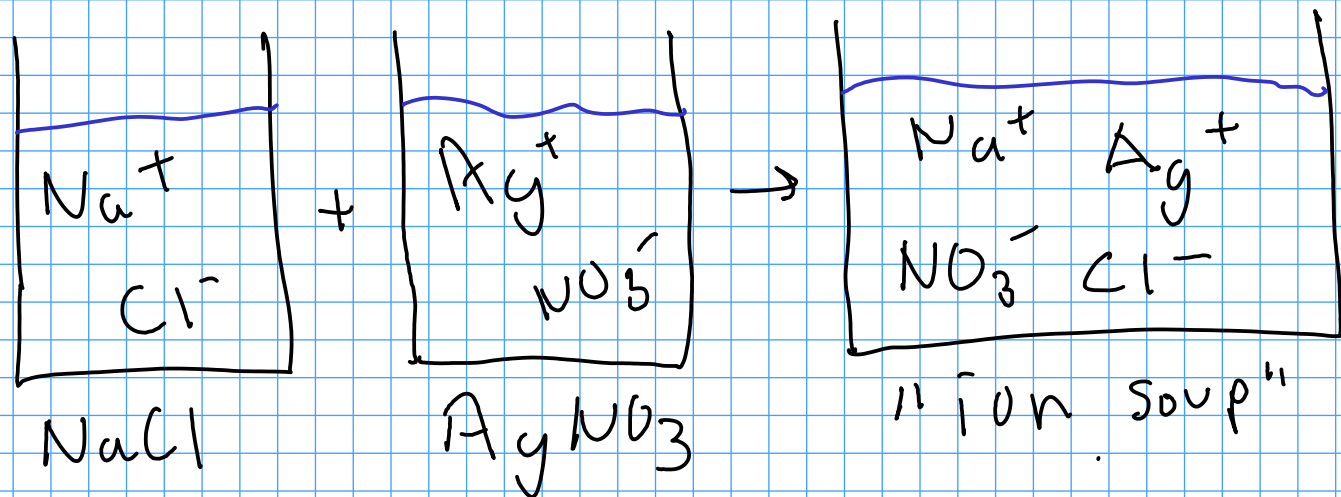
... but HOW do they switch partners?

- ① Exchange reactions almost always take place in AQUEOUS SOLUTION
- ② In aqueous solution, IONIC THEORY applies!

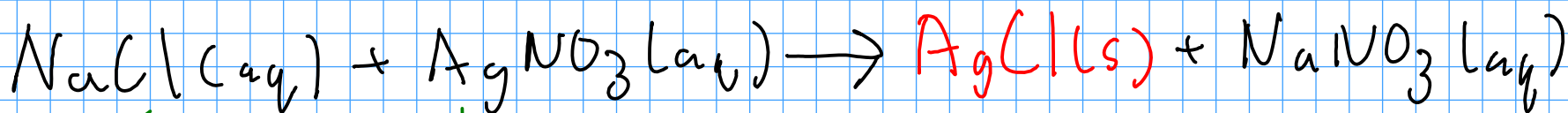
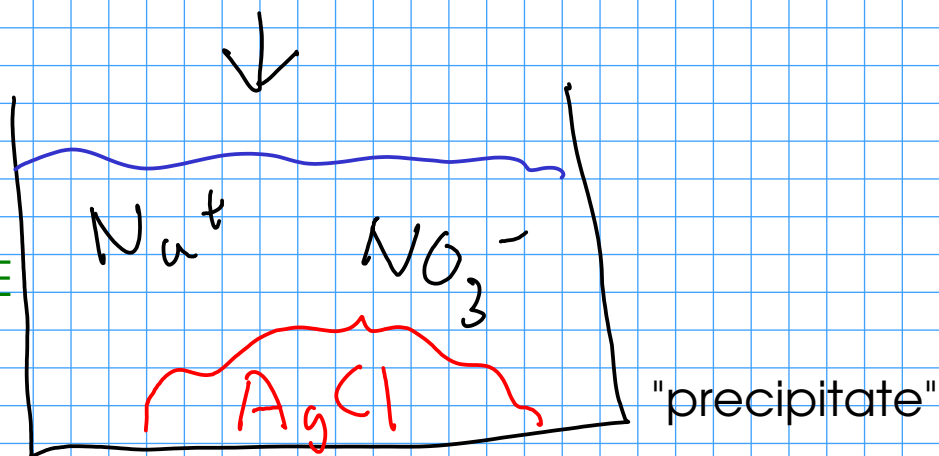
IONIC THEORY OF SOLUTIONS

- Briefly, ionic theory states that certain substances (like soluble ionic compounds) break apart into their component ions when dissolved in water!





When silver and chloride ions meet, they form an **INSOLUBLE** compound, silver(I) chloride. This falls out of the solution



Formation of AgCl drives this reaction!

For an exchange reaction to proceed, there must be something (a new product) DRIVING the reaction.

3 kinds of exchange chemistry:

- ① Reactions that form PRECIPITATES (insoluble ionic compounds)
- ② Reaction that form STABLE MOLECULES like water
- if water forms, reaction is called "neutralization"
- ③ Reactions that form UNSTABLE MOLECULES that break down into other small molecules, often gases.



If any of these three possibilities form from the "ion soup", a reaction will occur.

If not, NO reaction occurs.