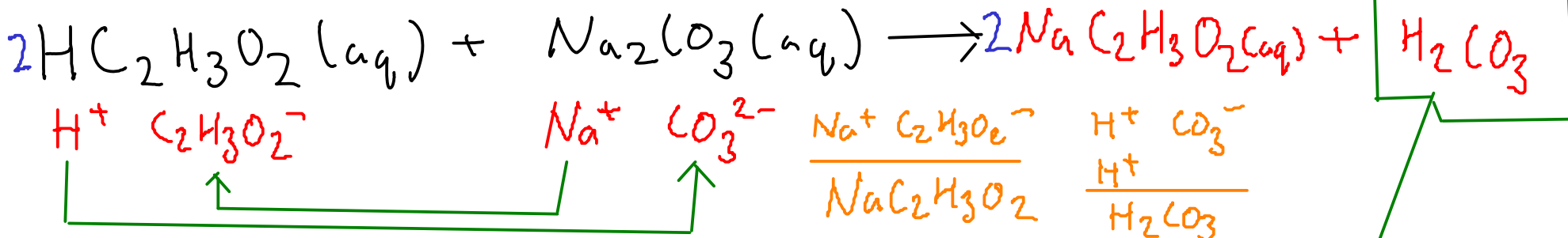
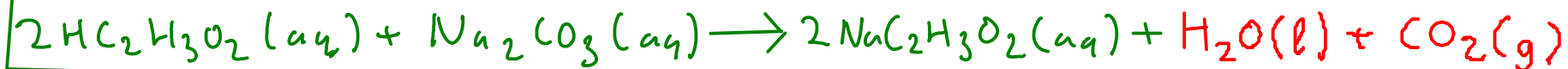


Example of a reactions that forms carbonic acid, then gas:



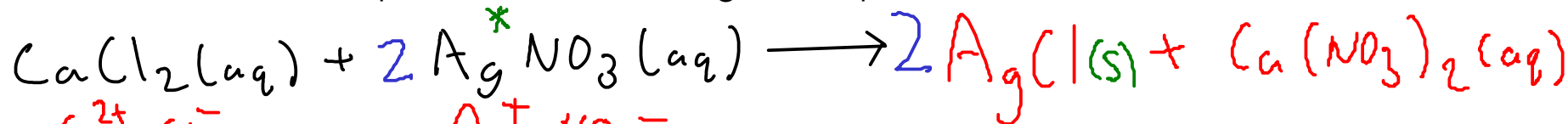
... but carbonic acid decomposes, and we get GAS BUBBLES



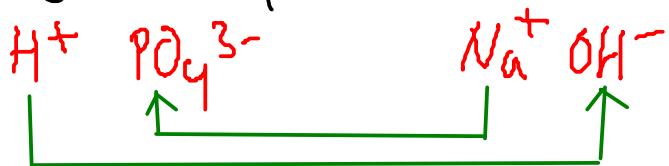
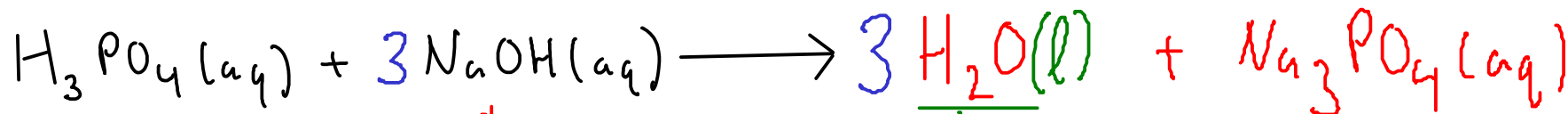
This is the overall process. We show carbon dioxide and water as products, since we want to show the reaction as it's actually observed -with carbonic acid broken down to water and (gaseous) carbon dioxide.

A few more double replacement / exchange examples:

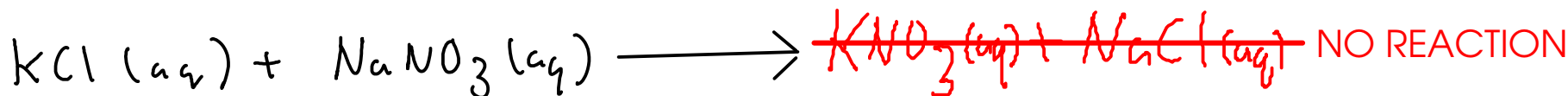
See page 172 for a solubility chart



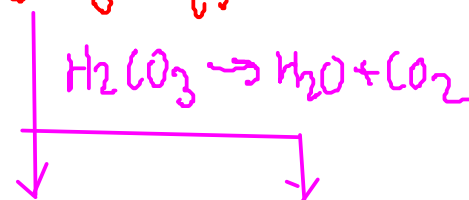
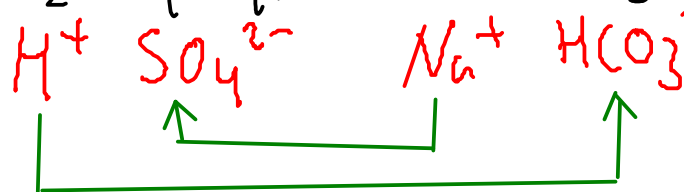
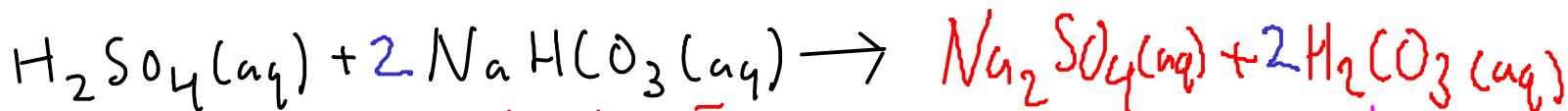
Formation of insoluble AgCl drives this PRECIPITATION reaction!



Formation of WATER drives this NEUTRALIZATION reaction!

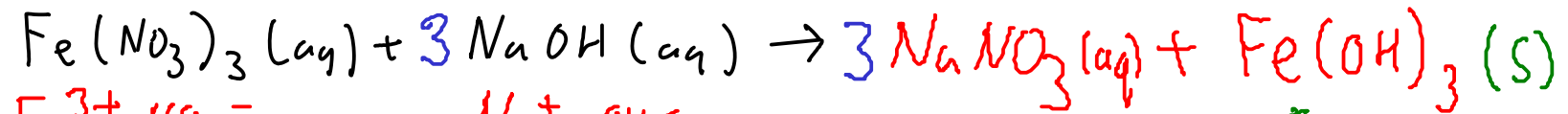


We conclude that there's NO REACTION. We form no molecules or insoluble solids, and the ions remain floating around in solution exactly as they were before mixing.

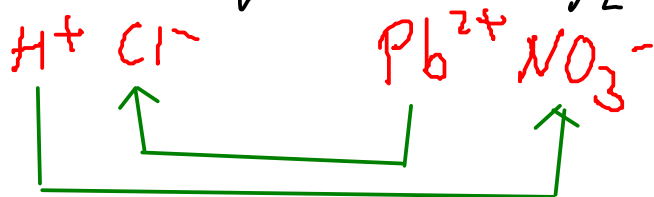
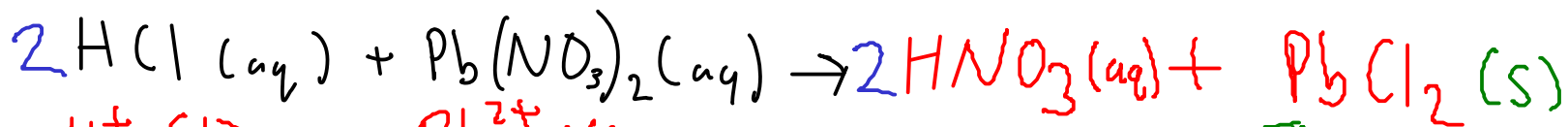


* TRANSITION METALS do not change their charge in exchange reactions!

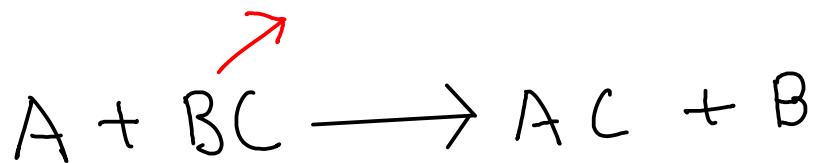
*Reminder: Transition metals do not change charge during an exchange reaction!



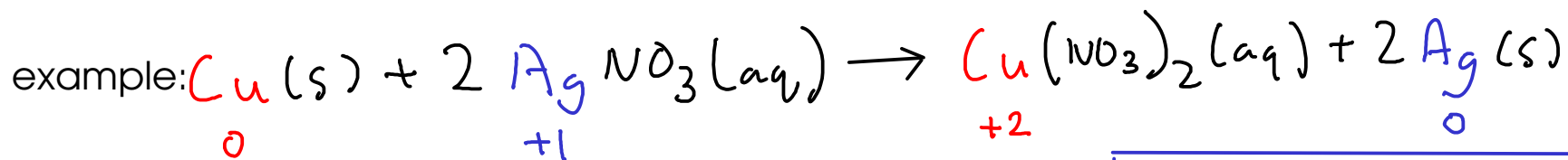
Formation of insoluble iron(III) hydroxide drives this precipitation reaction!



Formation of solid lead(II) chloride drives this precipitation reaction!

SINGLE REPLACEMENT REACTIONS

One element, usually a metal, replaces another element in a compound. This forms a new compound and leaves behind a new free element!



Copper loses electrons, goes from 0 charge to +2 charge!

Silver gains electrons, goes from +1 charge to 0 charge!

... but just because you combine an element and a compound doesn't mean that a reaction will occur. Some combinations react, some don't!

- Whether a reaction occurs depends on how easily the replacing and replaced elements lose electrons. An atom that loses electrons more easily will end up in IONIC form (in other words, in the compound). An atom that loses electrons less easily will end up as a free element.

- We say that an atom that loses electrons more easily than another is MORE ACTIVE than the other element. But how would you get information about ACTIVITY?

A single replacement reaction is an example of a reaction where ELECTRON TRANSFER is a driving force. Electron transfer reactions are generally called OXIDATION-REDUCTION reactions.

ACTIVITY SERIES

- comes from experiential data. It's a list of elements in order of their ACTIVITY - more active elements are higher in the series!

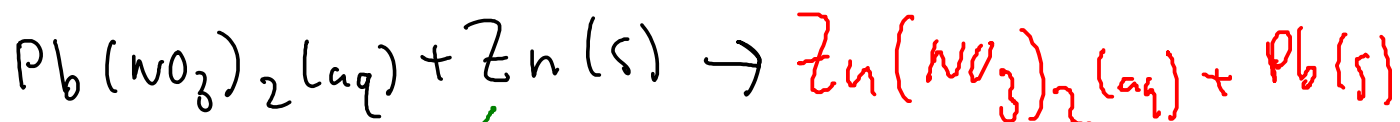
A sample activity series

Activity ↑	Sodium Na^+] Very active metals will replace hydrogen in acids AND in water!
	Magnesium Mg^{2+}	
	Aluminum Al^{3+}] Metals more active than hydrogen will replace hydrogen in acids!
	Zinc Zn^{2+}	
	Iron Fe^{2+}	
	Lead Pb^{2+}	
	Hydrogen H^+] These metals are unreactive to most acids!
	Copper Cu^{2+}	
	Silver Ag^+	
	Gold Au^{3+}	

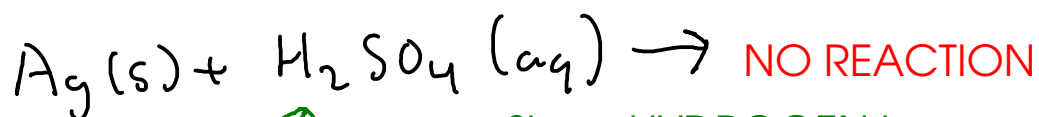
PREDICTING SINGLE REPLACEMENT REACTIONS



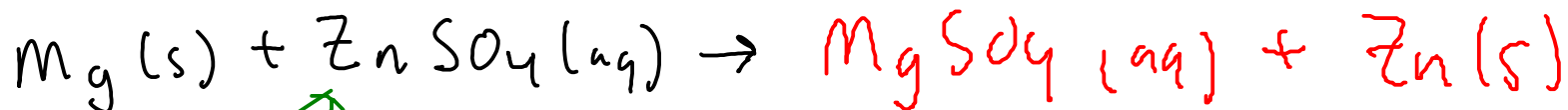
Since LEAD is more active than hydrogen, we expect it to replace H in HCl.



Since ZINC is more active than lead, we expect it to replace Pb in lead(II) chloride.



Since HYDROGEN is more active than silver, silver will not be able to replace hydrogen in sulfuric acid!



MAGNESIUM is more active than zinc, so it will replace zinc in this reaction.

Activity ↑

Sodium	Na^+
Magnesium	Mg^{2+}
Aluminum	Al^{3+}
Zinc	Zn^{2+}
Iron	Fe^{2+}
Lead	Pb^{2+}
Hydrogen	H^+
Copper	Cu^{2+}
Silver	Ag^+
Gold	Au^{3+}