Conservation of… Types of Reactions

Chapter 6 & 7

Conservation of…

- Mass
- Mass is neither created nor destroyed in a reaction.
- The mass of the reactants is equal to the mass of the products.
- This is often forgotten, or is a common misconception due to certain reactions.

Fire!

- Is the mass of the products equal to the mass of the reactants in a fire?
- Absolutely!!
- You are probably thinking of one reactant (wood) and not the other (oxygen), and one product (ashes, or buckminster fullerene) and not the others (water, carbon dioxide)
- Mass is not lost in this reaction.
- You are likely just letting most of the product blow away
- There is actually more mass of product than there was initial wood. That is because you are ignoring the mass of the reactant oxygen.

Conservation of…

- Atoms
- Atoms are always conserved in a chemical reaction.
- Atoms don't spontaneously change into one another
- (at least not in this chapter, when we get to nuclear reactions it will be a different story).

Reactions in a water solution

- What happens when ions dissolve in water?
- Ions become free floating.
- In a crystaline solid, they are "stuck together".
- In a solution, they are free to move.
- Obviously, this increases the rate of reactivity.

Conduction of Electricity

- to conduct electricity a substance must contain positive and negative particles that are able to move about the substance.
- Pure water does NOT conduct electricity
- ~there are no (+) and (-) particles
- For water to conduct electricity you must dissolve an *electrolyte* in it.
- Electrolyte- any substance that increases a solvent's conductivity

What makes a good electrolyte

- ~something that produces ions when it dissolves
- NaCl is a strong electrolyte because it produces ions, sucrose $C_{12}H_{22}O_{11}$ is a *nonelectrolyte* , because it does not.
- HCl is a *strong electrolyte*, because it completely dissociates in water. Acetic acid CH_3COOH is a *weak electrolyte* , because it does not.

Tap water

- Tap water is not pure water
- ~this is NOT necessarily a bad thing
- fluoride and chloride are intentionally added
- Electrolytes present in water make it a weak electrical conductor
- Which is why it is dangerous to drop electrical appliances in water

Precipitation Reaction

- ~ a reaction where a solid product is produced from aqueous reactants
- This is the reaction we have been looking at with net ionic equations
- A precipitation reaction may occur when solutions are mixed based off the solubility rules sheets you have been handed.

Exceptions to the "Solubility Rules"

- There are lots of exceptions that didn't make the list we are using in class.
- Or at least would make the list very long.

After a precipitation reaction…

- What happens to the spectator ions?
- Nothing they are still there. Just sitting in solution.
- Another reaction may cause them to precipitate out.
- You can also drive the water off (heat it) to force them out of solution.

Acid Base Reactions

- Reactions that form water are acid base reactions
- Arrhenius, winner of the 1903 Nobel prize, defined an acid as anything that produces H^+ in water.
- Like HCl
- $HCl \rightarrow H^+ + Cl^-$

Hydronium

- The H^+ produces H_3O^+, hydronium, in water.
- So Arrhenius' definition is commonly updated to make an acid anything that produces hydronium
- $HCl + H_2O \rightarrow H_3O^+ + Cl^-$

Cont.

- And he defined a base as anything that produced OH^- in water.
- Like NaOH
- $NaOH \rightarrow Na^+ + OH^-$
- When you put those together…
- $H^+ + OH^- \rightarrow H_2O$
- Which is why acid base reactions produce water

Salts

- Acid base reaction also produce salts.
- $HCl + NaOH \rightarrow H^+ + Cl^- + Na^+ + OH^-$
- $\rightarrow H_2O_{(l)} + NaCl_{(aq)}$
- The "leftovers" from an acid base reaction is a salt.
- It does not have to be NaCl, there are 1000's of salts
- $HNO_3 + Ba(OH)_2 \rightarrow H_2O + Ba(NO_3)_2$
- Barium nitrate is the salt in this reaction