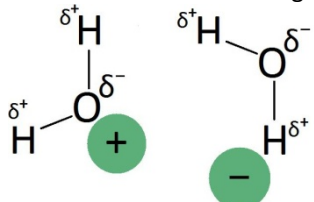


Chem 1a- Study Guide 2

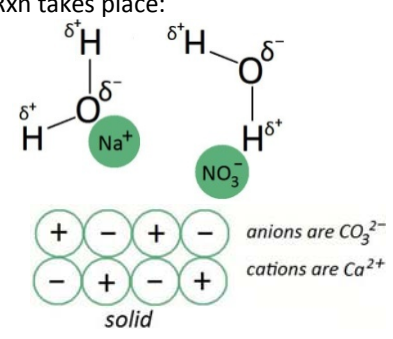
4 Reasons to make something limiting	
Expense	Make less expensive reactant limiting
Importance	Make the more important reactant limiting
Danger	Better to put the safer reactant in excess
Separation	Make reactant that is easier to separate limiting

Reasons you can't get 100% yield	
Reversible	Some chemical rxns are reversible; some products bump into each other and react (ex: weak acids)
Side Rxns	Side products that occur from reactants
Speed	Rxns are slow; product is collected before rxn is 100% complete
Isolation	When trying to isolate desired products, one loses some of actual product

How an Ionic Compounds dissolves (4 steps)	
Recall an ionic compound: has strong ionic bonds, particles are constantly in motion, made up of cations/anions (+/-)	
Step 1	Both +/- particles at surface of the salt crystal are being "sucked" in and out
Step 2	H ₂ O molecule slams into an ion—just as it is moving up & away from the surface of the crystal. This pushes the ion far enough to weaken the attrxn bxn the ion & the particles in the crystal
Step 3	As the ion moves farther away from the crystal, H ₂ O molecules fill up the vacant space
Step 4 Draw Model	Ions get moved out into solution and get stabilized 

Ionic solubility rules	
Ions	Soluble except with
Group 1A metals, NH ₄ ⁺ , NO ₃ ⁻ , C ₂ H ₃ O ₂ ⁻	All soluble
Cl ⁻ , Br ⁻ , I ⁻	Ag ⁺ , Pb ²⁺
SO ₄ ²⁻	Ba ²⁺ , Pb ²⁺
Ions	Insoluble except with
CO ₃ ²⁻ , SO ₃ ²⁻ , PO ₄ ³⁻ , OH ⁻	NH ₄ ⁺ & Group 1A elements
S ²⁻	NH ₄ ⁺ , Group 1A & 2A metal ions

Types of rxns	
Combination	$X + X \rightarrow X$ (2 reactant = 1 product)
Decomposition	$X \rightarrow X + X$ (1 reactant = 2 products)
Combustion	$C_aH_bO_cS_d + O_2 \rightarrow CO_2(g) + H_2O(l) + SO_2(g)$ <ul style="list-style-type: none"> • $SO_2 + O_2 \rightarrow SO_3$ ➢ $SO_3 + H_2O \rightarrow H_2SO_4$ $C_2H_5S(g) + \frac{9}{2}O_2(g) \rightarrow 2CO_2(g) + 3H_2O(l) + SO_2(g)$

Precipitation rxn description	
Part A	Using example: $Ca(NO_3)_2(aq) + Na_2CO_3(aq)$ Both rxn'ts in same container but before the rxn takes place
If Na ⁺ & NO ₃ ⁻ or Na ⁺ & CO ₃ ²⁻ collide they only attract for a short period of time $Ca(NO_3)_2(aq) + Na_2CO_3(aq)$	
Part B	During Rxn $Ca^{2+}(aq) + CO_3^{2-}(aq) \rightarrow CaCO_3(s)$ <ul style="list-style-type: none"> • When Ca²⁺ bumps into CO₃²⁻ there is a stronger attraction & stay together long enough to have other Ca²⁺ & CO₃²⁻ to form crystals
Part C	After Rxn takes place:  anions are CO ₃ ²⁻ cations are Ca ²⁺ solid
Notice	Na ⁺ and NO ₃ ⁻ are still surrounded by H ₂ O molecules (as noted in picture above)

Oxidation Numbers		
Uncharged element	0	No exceptions
Monatomic ions	Charge on ion	No exceptions
Combined F	-1	No exceptions
Combined O	-2	-1 in peroxides
Covalently bonded H	+1	No exceptions
Example	$2Al + 3H_2O \rightarrow Al_2O_3 + 3H_2$	
Reactants	Al = 0	H = +1, O = -2
Products	Al = +2	H = 0, O = -2
Al is oxidized (lost e ⁻ so it became more positive) <ul style="list-style-type: none"> • Al is the reducing agent H in H ₂ O is reduced (gained e ⁻ so it became more negative) <ul style="list-style-type: none"> • H₂O is the oxidizing agent 		

Acids	
Strong	HCl(aq), HBr(aq), HI(aq), HNO ₃ (aq), HClO ₄ (aq), H ₂ SO ₄ (aq)
Weak	HSO ₄ ⁻ , H ₂ PO ₄ ⁻ & all the rest are weak acids
Bases	
Strong	OH ⁻ , H ⁻ , NH ₂ ⁻
Weak	NH ₃ & all the rest are weak bases
Anions	Except for neutral bases
Neutral	Cl ⁻ , Br ⁻ , I ⁻ , NO ₃ ⁻ , ClO ₄ ⁻ (take off one H from monoprotic acids) Remember that NH ₃ is an uncharged molecular base

Arrhenius Acid: a substance that makes H_3O^+ [H^+] when you add H_2O

Characteristics: sour taste, acid turns litmus paper from red to blue, acids react w/ bases

Arrhenius Base: anything that you drop w/ H_2O & yields OH^-

- **Characteristics:** bitter taste, feels slippery on your fingers, base turns litmus paper from red to blue, bases react w/ acids

Reason why we use pH system: System designed to describe how acidic/basic a dilute in solution is

Low #s \rightarrow excess of H^+ \rightarrow More concentration of H^+

High #s \rightarrow excess of OH^- \rightarrow more concent. of OH^-

Why H_2O is neutral: $2\text{H}_2\text{O}(\text{l}) \leftrightarrow \text{H}_3\text{O}^+(\text{aq}) + \text{OH}^-(\text{aq})$

Why HCl is a strong acid: HCl dissolves in H_2O to form H_3O^+ (H^+) & Cl^-

The HCl loses an H^+ \rightarrow 100% yield for $\text{HCl} + \text{H}_2\text{O}$

Why OH^- is a strong base: due to a completion rxn w/ H_2O , it generates close to one (or more) OH^- for each formula unit of base added to water.

Why is Acetic acid a weak acid: When acetic acid collides w/ a H_2O molecule, an H_3O^+ (H^+) ion is transferred to the H_2O molecule. Reversible rxn eventually goes to equilibrium, same amt of rxn products making products (vice versa)

$\text{HC}_2\text{H}_3\text{O}_2(\text{aq}) + \text{H}_2\text{O}(\text{l})$ is a reversible rxn

Neutralization rxns only occur when you have an acid **and** a base (you will be told whether this type of rxn is completion or reversible)

Bronsted-Lowry acid/base rxns are double displacement rxns

Redox rxn occurs if any atoms change their oxidation #

Include short answer questions: makin a solution from solid....

It helps to be familiar with the following tables:

Endergonic Change	
More stable + E \rightarrow less stable system	
Lesser capacity + E \rightarrow greater capacity to do work	
Lower P.E. + E \rightarrow higher P.E.	
Bond breaking + P.E.	
Atoms in bond + E \rightarrow separate atoms	
Example	$\text{O}_2(\text{g}) + \text{E} \rightarrow 2\text{O}(\text{g})$

Exergonic Change	
Less stable system \rightarrow more stable + E	
Greater capacity to do work \rightarrow lesser capacity + E	
Higher P.E. \rightarrow lower P.E. + E	
Bond making + P.E.	
Separate atoms \rightarrow atoms in bond + E	
Example	$\text{O}(\text{g}) \rightarrow \text{O}_3(\text{g}) + \text{E}$

Heat transfer	
Higher T \rightarrow greater ave internal K.E. \rightarrow greater ave momentum \rightarrow greater ave force per collision	
E will always transfer from hot area-to-cold area	
Think of a truck slamming into another truck; the 1 st truck will slow down & the 2 nd truck will speed up	

Radiant Energy Spectrum

RADIO MICROWAVES IR ROYGBIV UV X-RAYS GAMMA

Longer (less E)

Shorter (more E)

Heat is E transfer: from a region of higher T to a region of lower T due to collisions of particles

Why is heat released when hydrogen reacts with oxygen to form water?

Stronger bonds are more stable \rightarrow less likely for the bonds to change \rightarrow lesser P.E. \rightarrow E is released & transferred to K.E. \rightarrow makes H_2O molecules move faster \rightarrow increase in T \rightarrow if we assume that T inside was the same as the T outside, when the T goes up inside the container the heat gets transferred to surroundings (area w/ lower temp) \rightarrow Exothermic Rxn

Why do cold packs get cold?

Weaker bonds are less stable \rightarrow higher P.E. \rightarrow E needs to be absorbed or else **system** won't be able to release E \rightarrow decreases K.E. of product particles \rightarrow decreased T (inside T is less than outside T) \rightarrow heat is transferred to area w/ lower T \rightarrow Endothermic Rxn