Chemistry 20
Final Exam Review

BONDING

Ionic Bonding – Transfer of Electrons, held together by electrostatic attraction of ions
- Do Electron Dot Diagram and show transfer

Molecular Bonding – Sharing of Electrons, held together by electrostatic attraction of electrons to the nucleus of the other
- Do Lewis Dot Diagram

FORCES

London Dispersion (INTERMOLECULAR)
- momentary attractions between dipoles
- London forces increase as number of electrons increase
- increase #e-, increase LF, increase BP/MP

Dipole Dipole (INTERMOLECULAR)
- attraction between the negative and positive ends of a polar molecule
- increase polarity, increase solubility in water, BP, MP

Polarity (INTRAMOLECULAR)
- the increased attraction of electrons to one side of a molecule due to electronegativity
- if something is polar it will have dipole forces present as well

Van der Waals (INTERMOLECULAR)
- the tendency of molecules to disperse however stay in one area (this is why a liquid remains a liquid without the input of energy)
- everything has VDW forces

Hydrogen Bonding (INTERMOLECULAR)
- the attraction between a hydrogen molecule and lone pairs on a different molecule (S, N or O)
- must have 1 very electronegative molecule
- must contain hydrogens attached to that electroneg molecule
- must show more than 1 molecules

Electrostatic Attraction (INTRAMOLECULAR)
- attraction of + and – ions

The relative strength of the four intermolecular forces is: Ionic > Hydrogen bonding > dipole dipole > Van der Waals dispersion forces. The influence of each of these attractive forces will depend on the functional groups present.

EFFECT ON BOILING POINT (AND MELTING POINT)

London Forces
- as # of total electrons increases, boiling point increases (due to London Forces increasing)

Increasing Forces
- as the number of forces present increases, the boiling point increases (due to more attraction between electrons)

Increased Branching and Carbons in Organic Chemistry
- as the number of carbons increases, the boiling point increases (due to increased London Forces)
- as the amount of branching increases, the boiling point decreases

Lattice Structures
- ionic compounds will form lattice structures due to the electrostatic attractions between multiple ions
- these lattice structures cause ionic compounds to be extremely strong and condensed and thus have an extremely high boiling point

STEPS TO LEWIS DOT / STRUCTURAL DIAGRAMS

1. count number of valence electrons present
2. place central atom in the middle (carbon is often cental atom) and surround with the peripheral atoms
3. bond using 2 electrons
4. complete peripheral atoms' octect
5. place remaining electrons on the central atom
6. check that all atoms have a complete octet, if not, create a multiple bond to complete octet
7. convert your bonded pairs into lines (2 electrons become 1 bond), keep all lone pair electrons

VSEPR

Name	Electrons	Shape
Linear	All bonded	
Trigonal planar	All bonded	
Bent (trigonal)	2 bonded 1 lone pair	
Tetrahedral	All bonded	
Trigonal pyramidal	3 bonded 1 lone pair	
Bent (tetrahedral)	2 bonded 2 lone pairs	

e- dot = Lewis dot – just electrons (no bonds)

Structural – line dot diagram

Stereochemistry – VSEPR structures (aka geometry)

Gas Law Equations

Boyle's Law
- as pressure increases volume decreases

Ex.

Charles' Law
- as volume increases temperature increases
- must use KELVIN

Ex.

Combined Gas Law
- as pressure decreases, volume and temperature increase

Ex.

Ideal Gas Law
- the number of moles is consistent at the same pressure, temperature and volume
- R = 8.314 L kPa / mol K
- R = 0.08206 L atm / mol K
- R = 62.364 L mmHg / mol K

Ex.

STP – 22.4L/mol, 273K, 101.3kPa **SATP – 24.8L/mol, 298K, 100kPa**

Solution Preparation Steps

1. **Calculate** what you need
- if a STOCK SOLUTION – use C1V1 = C2V2
- if a creating a solution from a solid, calculate the number of grams using unit conversions (solve for #g)

2. **Measure**
- If solid use a scale
- If solution, use a pipet or graduated cylinder

3. Place into a beaker, **Add ½ solvent** to the solute

4. **Stir**

5. **Transfer** to volumetric flask
- Use a funnel

6. **Rinse** all tools involved

7. **Fill** to line
- Use eye dropper for exact fill near the line

8. **Invert** 20 times

9. **Check** and **refill** if require
- Re-invert to ensure complete mixture if refilled at all

Acid Base Equations

$pH = -\log [H_3O^+]$

$pOH = -\log [OH^-]$

$14 = pH + pOH$

$1.0 \times 10^{-14} = [H_3O^+] [OH^-]$

$[H_3O^+] = 10^{-pH}$

$[OH^-] = 10^{-pOH}$

Steps to Acid Base Questions

1. Create ionization equation for acids and/or dissociation equations for bases
2. Balance equation
3. Using given amounts, find concentration of H_3O^+ for acids (OH^- for bases)
4. Using the concentration, determine the pH for an acid (pOH for a base)

Molecular, Total Ionic and Net Ionic Equations

Molecular formula is the chemical reaction including solubilities

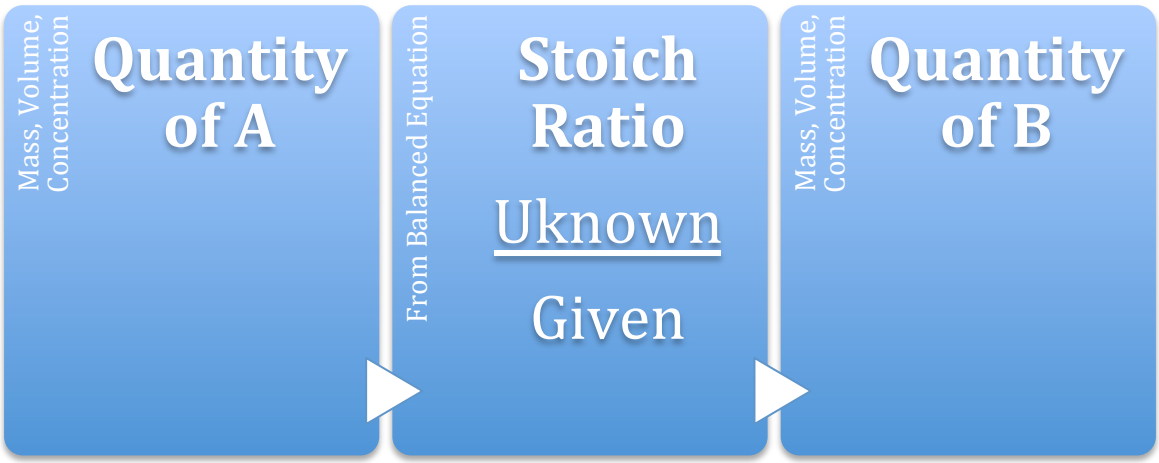
Total Ionic formula IONIZES the aqueous solutions in the chemical reaction

- Break the solutions into their ions and balance

Net Ionic formula cancels the ions that remain the same on both the reactant and product side of the reactions

STOICHIOMETRY REVIEW

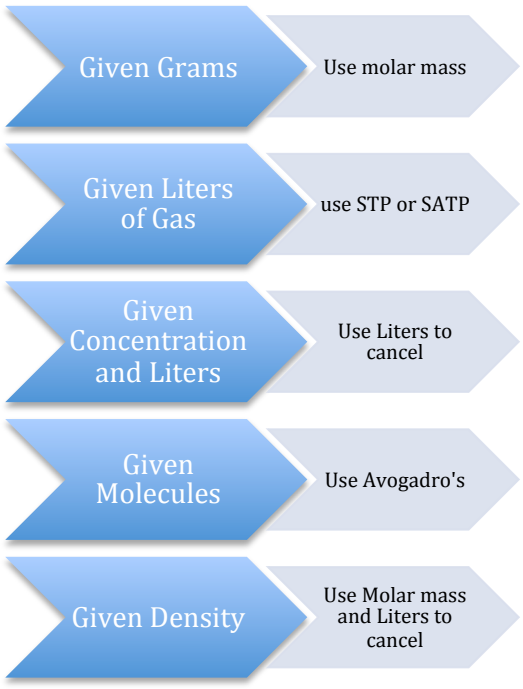
All stoich can be solved from a basic pattern:



Steps to Solving Stoich

1. Balanced Equation
2. Define your unknown (what you want) and place that underneath with an equals sign beside it
3. State your given to the right of the equals sign
4. Use unit conversions to get your given to moles
5. Stoich ratio (unknown / given)
6. Turn moles into whatever you need to get (your goal) using unit conversions
7. If percent yield calculation, put smaller number over bigger number to calculate the percent (obtained in experiment / expected by stoich)
8. If limiting reagent question, use both givens to find the mass of a product and take the smaller number as the limiting reagent (and max yield)
9. To find excess, use the limiting reagent (given) to calculate the amount of the excess reagent required to react. Subtract this number from the given amount of excess reagent.

Reminders:



Titration Lab Set Up:

Titration of 25.0mL of unknown concentration of NaOH with 0.030M phosphoric acid solution

	Trial 1	Trial 2	Trial 3
Initial Volume	0.01	14.36	28.70
Final Volume	14.36	28.70	43.02
Color	Pink	Pink	Pink
Change in Volume			

1. complete the chart (find the change in volume of each trial and then find the average)
2. draw a titration diagram (labeled completely)
3. balanced equation
4. stoich calculations

Chemistry 20 Final Exam Guide

Unit 1: The Diversity of Matter and Chemical Bonding

Yes or No	Concept	Yes or No	Concept
	Naming ionic compounds		Composing ionic compounds
	Valence electrons		Electronegativity
	Ionic bonds (theory and explain)		Intramolecular force
	Electron dot diagrams		Naming molecular compounds
	Composing molecular compounds		Electron pairing and multi-bonds
	Lewis dot diagrams		VSEPR theory and shapes
	Intermolecular forces		London forces
	Dipole-dipole forces		Hydrogen bonding
	Properties of substances due to intermolecular forces		Polarity of molecules
	Continuum of bonding from complete electron transfer (ionic bonds) to equal sharing (molecular bond)		

Unit 2: Forms of Matter: Gases

Yes or No	Concept	Yes or No	Concept
	Real vs ideal gases		Kinetic molecular theory
	Convert between Celsius & Kelvin		Boyle's Law
	Charles' Law		Combined Gas Law
	Ideal Gas Law		STP, SATP

Unit 3: Matter as Solutions: Acids and Bases

Yes or No	Concept	Yes or No	Concept
	Pure substances vs mixtures		Chemical change in solution
	Endothermic vs exothermic rxns		Breaking and forming bonds
	Electrolytes vs non-electrolytes		Concentration (mol/L)
	Dilutions (C1V1 = C2V2)		Production of a solution (steps)
	Ionization equations		Dissociation equations
	Production of a solution calculations		Solubility rates
	Factors affecting solubility (temp, pressure)		Equilibrium of solution
	Saturated solutions		Procedure of dilution
	Naming acids and bases		Define an acid, using pH
	Define a base, using pH		Define a neutral, using pH
	Calculate H3O+		Calculate pH
	Calculate OH-		Calculate pOH
	Sig figs of pH		Indicators, pH paper
	Arrhenius acids and bases		Modified Arrhenius acids and bases
	Neutralization reactions		Strong vs weak acids & bases
	Monoprotic acids and bases		Polyprotic acids and bases

Unit 4: Quantitative Relationships in Chemical Changes

Yes or No	Concept	Yes or No	Concept
	Predict the product of chemical rxns		Balance equations
	Qualitative analysis		Quantitative analysis
	Write balanced ionic equations		Calculate quantities using stoich
	Conservation of mass		Identify limiting and excess
	Theoretical and actual yields		Titration curves
	Choice of indicators		Equivalence points