CHE 1301

Basic Principles of Modern Chemistry I

Final Review

I guess this is it, guys! This resource's Topic of the Week has compiled vocab words and types of problems from throughout the semester. It also finishes a couple of topics that were not covered previously. All the best of luck with finals prep! Make sure you don't forget to get food and sleep, and know when/where you study best. Y'all can do this!

Visit our website, https://baylor.edu/tutoring, to sign up for appointments and check out additional resources for your course! You'll find helpful links with the following titles:

- "Online Study Guide Resources" – The pace of your course may vary slightly from what's shown in this document. If you don't see the topics you're learning right now, use this link to find the weekly resources for the rest of the semester.
- "How to Participate in Group Tutoring" - See if there is a Chemistry 1301 group tutoring session being hosted this semester. These are weekly question/answer sessions taught by our master tutors!
- "View tutoring times for your course" or "Schedule a private 30-minute appointment!"

You can also give us a call at (254)710-4135, or drop in! Our hours are Monday-Thursday 9 am – 8 pm on class days.

KEY WORDS: Final Review

TOPIC OF THE WEEK: Final Review

1. One of the best ways to study for an exam like this is to use a blank sheet of paper to see what you know.
    a. Pick a topic, take a blank sheet of paper, and write down everything you know about it. The next section will map out the relationships between various topics. However, I've written out the words before the map. I'd suggest trying to make a "map" on your own, then comparing with the one given here!
    b. Protons, neutrons, electrons, electron configuration, periodic trends, electronegativity, non-polar covalent bond, polar covalent bond, ionic bond, Lewis structure, VSEPR, atomic orbital theory, hybridization, molecular orbital theory, combustion reaction, precipitation reaction, acid-base reaction, energy of system, energy of surroundings, energy of universe, enthalpy, work, ideal gas, density of a gas, MW, intermolecular force, intramolecular force, iondipole/dipole-dipole/Van der Waals/etc., boiling point, phase change, sublimation/condensation/deposition

subatomic particles:
protons neutrons electrons

electrons $\xrightarrow{\text{comprise}}$ electron configurations

subatomic particles $\xrightarrow{\text{determine}}$ periodic trends $\xrightarrow{\text{concerning}}$ electrons

periodic trends $\xrightarrow{\text{such as}}$ electronegativity

electrons $\xrightarrow{\text{such as}}$ valence electrons

representations:
$\xrightarrow{\text{on which atom?}}$ Lewis structures
$\xrightarrow{\text{where around the atom?}}$ VSEPR

electron configurations $\xrightarrow{\text{represent}}$ atomic orbital theory

reconciled by hybridization

electroneg. difference btwn two atoms:

low → non-polar covalent bond
medium → polar covalent bond
high → ionic bond

*think about why this is the case!

$\xrightarrow{\text{for multiple atoms}}$ molecular orbital theory

bonding = intramolec. forces (multiple atoms)
$\xrightarrow{\text{has}}$ molecular weight (MW)
$\xrightarrow{\text{has}}$ empirical/molecular formulas

reactions = changes in bonding = mult. molecules
~ everything in a beaker + see which relationships are strongest ~

*intermolec. forces
$\xrightarrow{\text{such as}}$ ion-dipole
$\xrightarrow{\text{such as}}$ Van der waals

$\xrightarrow{\text{such as}}$ combustion
$\xrightarrow{\text{such as}}$ precipitation
$\xrightarrow{\text{such as}}$ acid-base

$\xrightarrow{\text{absorb or release energy}}$ = enthalpy

energy of system $\xrightarrow{\text{changing transferring it to}}$ energy of surroundings

changes work

$\xrightarrow{\text{increase}}$ boiling point

$\xrightarrow{\text{determine}}$ phase change $\xleftarrow{\text{determines}}$ temperature

$\xrightarrow{\text{such as}}$ sublimation, evaporation, etc.

Term	Resource week	Problems to be able to work
Proton	3	
neutron	3	
electron	3/4	Amount of energy present on each energy level $E = -2.18 * 10^{-18} * \frac{Z^{2}*1}{n^{2}}$ Quantum energy E=hv
Electron configuration	4	Identify quantum numbers possible in different situations Write electron configurations
Periodic trends	4	Predict relative size/electronegativity/ionization energy
electronegativity	4/6/9	Be able to order the 3 types of bonds in terms of their relative electronegativity differences
Non-polar covalent bond	5	
Polar covalent bond	5	Draw dipoles based on electronegativities of each atom
Ionic bond	5	
Lewis structure	5	Draw a compound given its name
Compound name	5	*highlighted items were not in the map on p.2 Be able to name compounds
Empirical formula	8	Determine empirical formula given masses present of each

		element (these masses could be in terms of percent composition, or they could be from a combustion problem)
Molecular formula	8	Based on empirical formula and molecular mass, calculate molecular formula
VSEPR	7	Name **VSEPR electron geometry** and molecular geometry based on number of groups and number of lone pairs
Atomic orbital theory	6/7	Use quantum numbers to describe 3D regions of electron probability around an atom Draw energy diagrams with lines representing each atomic orbital
hybridization	7	Identify hybridization number based on number of electron groups *my guess is that this won't be huge on the final* Draw energy diagrams representing atomic orbitals before and after hybridization
Molecular orbital theory	9	Draw energy diagrams representing atomic orbitals and the molecular orbitals that they combine to form
Combustion reaction	12	Determine empirical formula based on masses

Precipitation reaction	10/11	Predict products of a precipitation reaction based on solubility rules
Acid-base reaction (neutralization reaction)	11/12	**Titration calculations:** know that the number of moles of acid/base that you start with will need a *stoichiometrically equal* (that is, if 2A+B→products, you will need 2 mol of A for every mol of B) amount of base/acid to reach equivalence point Be able to identify equivalence and end points on a titration curve
Oxidation/reduction reaction	11/12	Calculate oxidation numbers Identify the oxidizing and reducing agents, and which gets oxidized & which reduced
Energy of system	15	$E_{system} = E_{products} - E_{reactants}$ Hess's Law $\Delta E = q + w$ where w= $P\Delta V$ $\Delta H = \Sigma n\Delta H_{products} - \Sigma n\Delta H_{reactants}$ Calorimetry problems: $q_{lost} = q_{gained}$
Energy of surroundings	15	$E_{universe} = E_{system} + E_{surroundings}$
Energy of universe	15	
Enthalpy	15	See energy of system

Work	15	
Ideal gas	13	PV=nRT Partial pressures $P_{total}=P_A+P_B+P_C$... and $P_A P_{tot}=n_A n_{tot}$
Density of a gas	13	D=m/V, so according to PV=nRT, D=MP/RT
Intermolecular force	14	Be able to rank the IMFs by strength
Intramolecular force	14	Rank covalent and ionic bonds by strength
Boiling point	14	Rank substances in order of increasing boiling point based on their chemical formulas (look for IMFs)
Phase change	15	Identify triple point, critical point, and lines of fusion/vaporization/sublimation on a phase diagram
Molecular mass	10	Limiting reagent problems Calculate molecular mass Calculate percent composition

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Check Your Learning

1. As you move to the right in the periodic table, size generally (increases/decreases)
2. What is the ideal gas law formula?
3. Give an example of a soluble salt.

4. If an atom has 4 electron groups attached to it, what is its electron geometry? Say that 3 of those groups are bonds. What is its molecular geometry?

Things You May Struggle With

1. Be sure to know VSEPR! Try a model kit – we have one in the TC that you're welcome to come use – to visualize the structures.
2. Hybridization is a very tricky concept. Make sure that you know the relationship between number of electron groups and number of hybrid orbitals! And remember that hybridization is the atom's attempt to *increase the number of possible bonds* without *expending too much extra energy*.
3. Lots of practice problems for: predicting products of various types of reactions, calculating empirical/molecular formulas, Hess's Law, the ideal gas law, etc.
4. Figure out your trouble spots early so that you can make sure they get the most repetition.

And that's it! Please reach out if you have any questions and don't forget to visit the Tutoring Center website for further information at www.baylor.edu/tutoring. Answers to Check Your Learning are below.

1. Decreases (more protons = they hold on to the electrons more tightly)
2. PV=nRT
3. NaCl
4. Tetrahedral, trigonal pyramidal