Honor’s Chemistry: Final Exam Study Topics

# Introduction to Chemistry

law of conservation of mass

law of conservation of energy

pure science vs. technology

organic / inorganic compounds

scientific law

theory

 phlogiston vs. combustion theory of burning

hypothesis

properties of acids and bases

the scientific method

 controlled experiment

 avoid bias (Drunken Goldfish book)

 conclusions must follow logically from data

quantitative and qualitative observations

graphing (line, bar, pie)

laboratory equipment

SI System (Metric System)

 base units [meter, second, liter, gram]

 derived units

 prefixes [kilo-, base, deci-, centi, milli-, micro, atomo-]

Measurement

 scientific notation

Accuracy vs. precision

Conversion Factors

safety

Material Safety Data Sheet

Chronic vs. Acute exposure

 LD50 values

# Matter and Energy

reactants and products

chemical and physical properties

 extensive vs. intensive properties

 color, boiling point, density, mass

chemical and physical changes

states of matter (solid, liquid, gas)

 phase diagram

 sublimation (solid --> gas)

energy: potential and kinetic

 KE = ½ mv2

endothermic and exothermic reactions

 effect of catalyst (activation energy)

Nuclear energy

 fission (splitting atoms) & fusion (joining nuclei)

 half-life (radioactive decay)

heat vs. temperature

 temperature scales (Celcius, Kelvin, Farenheit)

oF – 32 = 1.8 oC & oC + 273 = K

absolute zero

 calorimetry problems – heating curve

(specific heat, latent heat, heat of fusion, heat of vaporization)

latent heat

 Classification of Matter

pure substances: elements and compounds vs. mixtures

heterogeneous and homogeneous mixtures

 solution (alloys), colloid, suspension

atoms – HOBrFINCl twins (diatomic), P4 S8 (polyatomic), allotropes

SI base units

conversions

density

 Archimedes Principle – water displacement method

metals, nonmetals, metalloids

 Separation techniques

 magnetism, distillation, chromatography, centrifugation, decant, evaporation, electrolysis

 Problem solving

 Fermi approximations

# Atomic Structure

development of model of atom

 Greek, Dalton, Thomson, Rutherford, Bohr, Quantum mechanical model

 Cathode Ray tube – electrons

 Gold-foil experiment – nucleus (atom mostly empty space)

 alpha particles (He2+ nucleus) deflected away

 Geiger-counter

 Bohr model – electrons in fixed orbit

 Quantum mechanical model – electrons in orbitals (*s*, *p*, *d*, and *f*-orbitals)

 electrons, protons, neutrons

electron configuration

 1s22s22p63s23p64s23d104p65s24d10 [shorthand configuration]

 excited state vs. ground state

Filling order of electrons in atom

Aufbau Principle (bottom to top);

Pauli Exclusion Principle (two electrons per orbital);

Hund’s Rule (most unfilled orbitals)

light (dual nature...particle & wave)

 electromagnetic spectra ...IR...ROYGBIV...UV...

 high frequency...short wavelength (high energy)

 c = f /  (c = 3 x 108 m/s) E = h f (h = 6.6 x 10-34 J/Hz)

 continuous vs. quantized energy

 emission spectra

 lyman series (UV), balmer series (visible), paschen series (IR)

periodic table

atomic number (# protons), mass number (# protons + # neutrons)

isotopes (same element (# protons) but different # neutrons)

 isotope notation: C-12 vs. C-14

ions (same element (# protons) but different number of electrons

cations (+) charge: formed from metals that lose electrons

anions (-) charge: formed from non-metals that gain electrons

average atomic mass

 AAM = (% A)(mass A) + (%B)(mass B) + ...

**Periodicity (Periodic Table Trends)**

Mendeleev & Mosely

 atomic mass vs. atomic number

group, period

names of elements (Greek, location, planets, people, Latin, synthetic)

names of families and groups...alkali metals, alkaline earth metals, transition metals, halogens, noble

gases, lanthanide and actinide series, coinage metals, metalloids, essential elements

trends in atomic / ionic radius

 down a column (family) atoms get larger due to increasing shielding effect

 across a period (horizontally) atoms get smaller due to increased coulombic attraction

valence electrons

ionization energy

cations, anions

electronegativity

nuclear fission and nuclear fusion

Avogadro's number

molar mass, moles, atoms

properties of metals

salts – metal & non-metal

properties of ionic compounds

 strong bonds, high melting points, rigid

# Nomenclature & Chemical Formulas

oxidation number

apparent charge

finding formulas from oxidation number

naming compounds

 binary (with fixed charge – Group 1, 2, Ag, Zn, Al)

 binary (with variable charge)

 Stock system (uses Roman numeral to signify charge on metal ion)

 Old system “-*ic*” (higher oxidation state) & “-*ous*” (lower oxidation state)

 polyatomic ions

 memorize “–*ates*” PO43-, SO42-, CO32-, NO31- & CN1-, OH1-

 “-*ites*” one less oxygen

 “*hypo* \_\_\_-*ite*” two less oxygen

 “*per*\_\_\_-*ate*” one more oxygen

percentage composition (by mass)

formula of a hydrate MN. XH2O

properties of covalent compounds

ionic (transfer electrons), covalent (share electrons), hydrogen bonds

Lewis “dot” structures

single, double, triple covalent bonds

structural diagrams

empirical formula / molecular formula

mole island

 1 mole = 22.4 L @ STP = 6.02 x 1023 particles = Molar Mass

The following is a brief list of many of the topics we covered first semester. All topics covered on the final man not be listed below. Use your own notes to check for completeness.