Cheatography

GenChem I (CHEM 121) Mega Review Cheat Sheet

by VanessaG via cheatography.com/32617/cs/13440/

UNIT 1 -- Concepts!

Proving atoms exist	integer ratios (= represent units of mass= atoms)		
Law of conservation of mass	atoms/are not created nor destroyed only rearranged		
Atomic Molecular Theory	All matter is made up of atoms	Elements can't be decomposed into simpler substances , composed of identical atoms, all elements are defined = elements are composed of atoms	Compounds are chemical substances of elements
	#s and masses of atoms are conserved in a chemical RXN	Compounds are composed of molecules	Atoms of the same element are identical (=identical mass)
All atoms of a single element have the same characteristic mass.	Each compound consists of identical molecules, which are small, identical particles formed of atoms combined in simple whole number ratios.	The number and masses of these atoms do not change during a chemical transformation. Each element is composed of very small, identical particles called atoms.	Each small atom is surrounded by molecules, which allow bonds to form between neighboring atoms.

Law of **definite** Proportions (aka LAw of Constant Compositions)	elements combine in definite proportions *by mass* to make a certain compound	compound composed of *fixed ratio* of elements by **mass**	*NO INTEGERS*

UNIT 1 -- Concepts! (cont)

	Same compund ***do not*** compare *different* compounds		
Law of **Multiple** Proportions	compare multiple compounds made of the ***same*** elements if we fix the mass of one element, the other elements' masses across those compounds will be related in a simple integer ratio	must include examples where a specific element/atom bonds to the same element with different simple integer ratios	*INTEGERS*
Law of Combining **Volumes**	At fixed temp and pressure gases combine in simple integer ratios by volume	Avogadro's Law= At a fixed Temp and Presure *equal volumes* of gases contain *equal #s of particles*	
Diatomic particle : H_2 O_2 N_2 F_2 Cl_2 Br_2 I_2			

Rutherford s's gold foil experiment	alpha particles shot through a thin gold foil sheet		
	most went straight through = atoms are mostly made of empty space	some slightly deflected= positively charged nucleus	very few bounced back=
Mosely's Xray frequency data	sqrt of frequency is prportional to atmoic number	= atomic number measures # protons since	

Unit 1 -- Concepts!!

Emperical Formula	simplify ratios??	P4O10=P2O5
Molecular Formula	as is no simplification	
Determining **moles**	M=n/V	where M = Molarity n = moles (of solute) V = volume in liters (in solution)

Unit 2 -- Concepts!

Rutherford s's gold foil experiment alpha particles shot through a thin gold foil sheet	most alpha particles went straight through = atoms are mostly made of empty space	some slightly deflected= positively charged nucleus	very few bounced back=nucleus is much more massice than alpha particle and really small in position
nuclei are **tiny positively** charged **small** and **massive**			
Mosely's Xray frequency data	sqrt of frequency is prportional to atmoic number = atomic number measures # protons since	integer units - counting something = protons courelated mass	
Ionization Energy	minimum amount of energy required to remove an electron {{IE felt relative to specific electron}}	**COULOMBS LAW** V(r)=(q1 * q2)/r	
		V(r) is potential energy negative because opposite charges attract Positive when salike chgs repel	

Unit 2 -- Concepts! (cont)

Periodic trend:	left to right -> charges increase PE	 top to bottom: radius increases lowering PE decreasing IE

Ionization Energy Graph

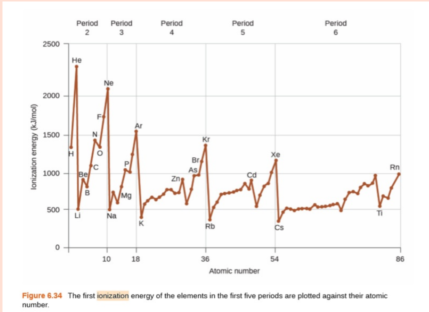
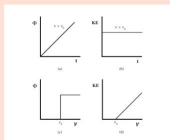


Figure 6.34 The first ionization energy of the elements in the first five periods are plotted against their atomic number.

Unit 2 -- Concepts!

Ionization Energy (con't)	electron electron repulsion decreases ionization energy of electron		
Successive IE	large drop indicates new shell ɐ must be removed from		
Photoelectric effect	E=hv where v is frequency and h is Planck's constant	c=lambda* frequency lambda is frequency	E = (hc)/λ
	Planck's constant (h)= speed of light (c)=		
	Rydberg's equation : Rydberg's constant: $1.097x10^{-7}$		

Photoelectric effect graphs



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graph relationships

More intense light above threshold frequency produces more electrons, greater current	More intense light above threshold frequency does not produce electrons with greater kinetic energy	When intensity is fixed:presence of threshold frequency implies relationship between frequency and energy – if light is above frequency threshold, the current remains fixed	Kinetic energy of electrons increases when frequency is increased – simple linear relationship
§ Summary of experimental results: light which has sufficiently high frequency will eject electrons whether the intensity is low or high–	**increasing intensity gives more electrons** but not more energetic electrons–	**increasing frequency gives more energetic electrons** but not more of them	

Unit 2 -- Concepts!

frequency of light = color of light and amount of energy carried	intensity of light = number of e^-	KE of electron = increases as frequency increases and *not* affected by intensity	current = affected by intensity (increase current there is an increase intensity) unaffected by chnage in frequency
must reach **threshold frequency** of no electrons will be emitted			

Unit 2 -- Concepts!

Photo emmision	electrons jump down energy levels emmit light light absorbed when electrons jump up (get excited)	specific frequencies of light emitted because between specific energy levels and energy is quantized *

Unit 2 -- Concepts! (cont)

quantum numbers	n= size **1**s, **2**p **3**d	l= shape 1**s**, 2**p**, 3**d** 0 to n-1	m(l) = orientation (ex: 2p-x, 2p-y, 3d-xy) m(s) = spin + 1/2 -1/2 Range: -l to +l
Rydberg equation	n=shell n1= 1st energy shell n2= second enrgy shell mn	use to calculate Energy emitted when e^- moves between shells	
	(if E(light) fixed) E(light)=hv = IE(e^-)+IE(e^-)		
Visisble light range	~400-750 ish	Ultraviolet - lower energy less than ~ 375nm	Infrared - higher frequencies past ~800

Rydberg Equation

$$\frac{1}{\lambda} = R_\infty\left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right)$$

$(1.097x10^7)m^{-1}$ = Rydberg's constant

Unit 2 -- Concepts!

LEWIS DOT STRUCTURES	A: Available (valence electrons (number of atoms)) N: Needed (8(nuber of element)+ 2(number of element)) B: S/2 S: N-A U:
	8 - octet if follow octet rule 2 for duet if follow duet rule

Calculations

Core Charge	# protons (atomic number) - # inner shell electrons

Calculations (cont)

	CAN calculate for e added and use to figure which has a greater electron affinity		
Formal Charge	valence electrons - bonds- lone electrons (*not lone pairs*)		
Finding Limiting reagent	take moles of substance A and find how many moles of B gotten	take moles of substance B and find moles of substance A needed	compare moles of each substance
	moles A/1 * moles B/moles A (in equation)= moles B needed	moles B/1 * moles A/moles B (in equation)= moles A needed	moles A : moles B (calcuated) mol A: mole B in equation
Finding Emperical formula	find moles of each substance	find corresponding element's moles based off of	
emperical formulas in combustion	* calculate g of C and H and subtract from original compound's mass which gives O's mass	then calculate moles of O	compare ratio of C:H:O and this gives empirical sub numbers
Finding molecular formula	after calculating Emperical, given molecular weight divide by that of Emperical	multiply ratios by this for sub numbers	
Bond Order	½ (# electrons bonding-#electrons antibonding)		

Calculations (cont)

Proving Law of Multiple proportions	fix one element and
OXIDATION RULES	
Molarity	=mol/L

Oxidation Rules

1. The oxidation number of an atom in an elemental substance is zero.
2. The oxidation number of a monatomic ion is equal to the ion's charge.
3. Oxidation numbers for common nonmetals are usually assigned as follows:
   - Hydrogen: +1 when combined with nonmetals, −1 when combined with metals
   - Oxygen: −2 in most compounds, sometimes −1 (so-called peroxides, O_2^{2-}), very rarely $-\frac{1}{2}$ (so-called superoxides, O_2^{-}), positive values when combined with F (values vary)
   - Halogens: −1 for F always, −1 for other halogens except when combined with oxygen or other halogens (positive oxidation numbers in these cases, varying values)
4. The sum of oxidation numbers for all atoms in a molecule or polyatomic ion equals the charge on the molecule or ion.

Note: The proper convention for reporting charge is to write the number first, followed by the sign (e.g., 2+), while oxidation number is written with the reversed sequence, sign followed by number (e.g., +2). This convention aims to emphasize the distinction between these two related properties.

Crystalline Structures

Types of Crystalline Solids and Their Properties

Type of Solid	Type of Particles	Type of Attractions	Properties	Examples
ionic	ions	ionic bonds	hard, brittle, conducts electricity as a liquid but not as a solid, high to very high melting points	NaCl, Al_2O_3
metallic	atoms of electropositive elements	metallic bonds	shiny, malleable, ductile, conducts heat and electricity well, variable hardness and melting temperature	Cu, Fe, Ti, Pb, U
covalent network	atoms of electronegative elements	covalent bonds	very hard, not conductive, very high melting points	C (diamond), SiO_2, SiC
molecular	molecules (or atoms)	IMFs	variable hardness, variable brittleness, not conductive, low melting points	H_2O, CO_2, I_2, $C_{12}H_{22}O_{11}$

Table 10.4

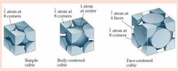
Bonds ~ metallic ionic covalent

metallic bonding	between two metals	low EA/ IE/ EN
ionic bonding	forms salts (nonmetal and metal)	
metallic solids	shiny conductors insoluble in water "ductile" malleable moderate-high melting points	
ionic solid -- salts	hard and brittle white soluble in water *not* good conductor (unless in solution (dissolved) or melted) *very* high melting point	

Bonds ~ metallic ionic covalent (cont)

covalent solids	hard high melting points	high IE/EN/EA?
molecular solids	soft low melting pt	
metallic solids	shiny because... band theory where the d and s electron energy levels are so close together adn in a lattice there are so many and they are so close they seem to form almost a band that has many energy levels for electrons to jump to.	malleable because in the lattice the electrons are delocalized while the nuclei are not. This means that when manipulated the electons can freely move making the structure malleable

unit cells



Webassign questions to look at

Webassign	Question
HW 02: WebAssign Questions (Homework)	HELP: 8, 9, 13 Solidify: 10, 11, 14,
HW 02: CDS Questions (Homework)	1 REVIEW: 2

Assessing the Student Response tips

LoMP	make sure one element (*mass*) is ***fixed***	make sure ra
LoDP		

Unit 3 -- Concepts!

Unit 4 -- Concepts!

Review! dummy

Test	Question
Unit 1 Test	Question 3
	Question 5
	Question 7
Unit 2 Test	