"A" students work (without solutions manual)
~ 10 problems/night.

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Office Hours W – F 2-3 pm

FITCH Rules

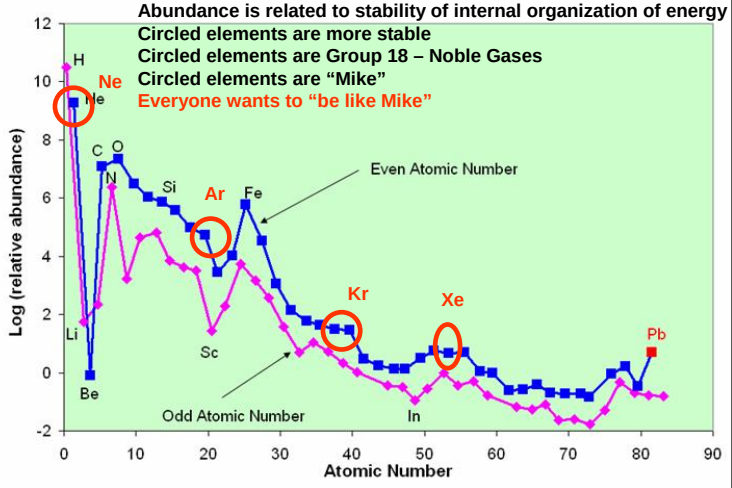
General

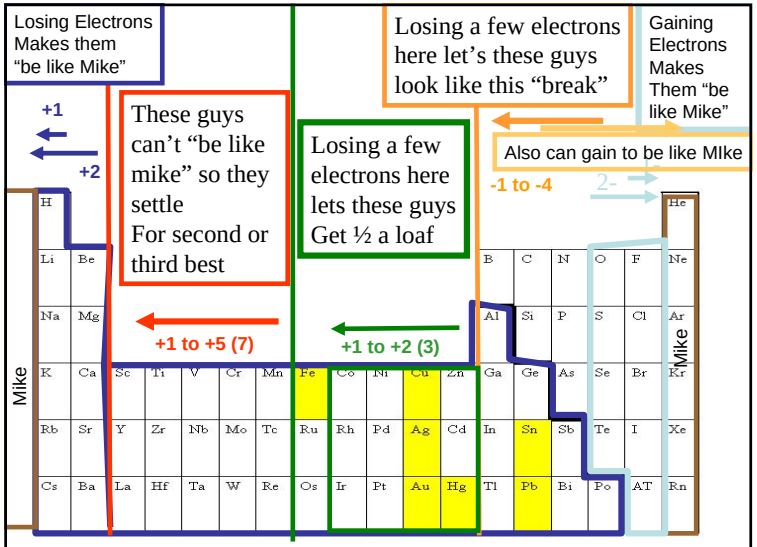
G1: Suzuki is Success
G2. Slow me down
G3. Scientific Knowledge is Referential
G4. Watch out for Red Herrings
G5. Chemists are Lazy

Chemistry

C1. It's all about charge
C2. Everybody wants to "be like Mike"
C3. Size Matters
C4. Still Waters Run Deep
C5. Alpha Dogs eat first

What do you observe about the circle elements?
Generally followed by an element with much lower abundance
Abundance is related to stability of internal organization of energy
Circled elements are more stable
Circled elements are Group 18 – Noble Gases
Circled elements are "Mike"
Everyone wants to "be like Mike"





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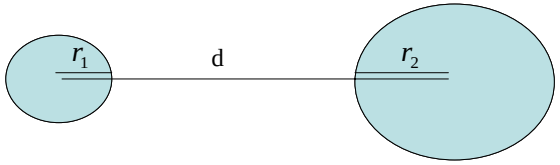
$k = 8.99x10^9 \frac{J\ m}{C^2}$

It's all about charge

$Energy_{electrostatic} = k\left(\frac{q_1 q_2}{d}\right)$

Charge on object 1 or 2, in coulombs

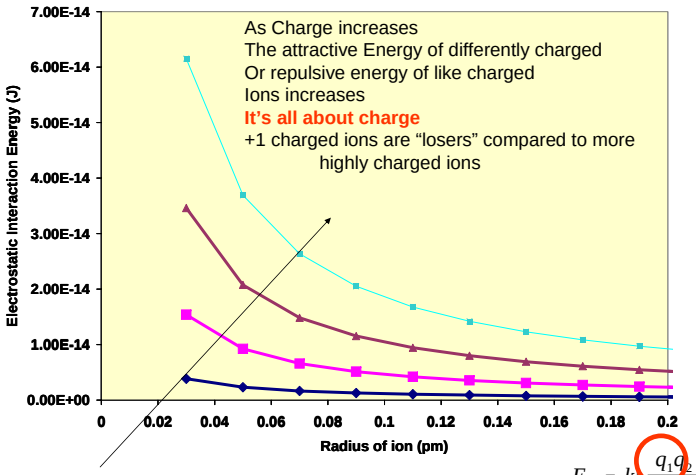
Distance between the objects



$r_1 + r_2$

$E_{el} = k\left(\frac{q_1 q_2}{r_1 + r_2}\right)$

Ionic Charge = 1 2 3 4



$E_{el} = k\left(\frac{q_1 q_2}{r_1 + r_2}\right)$

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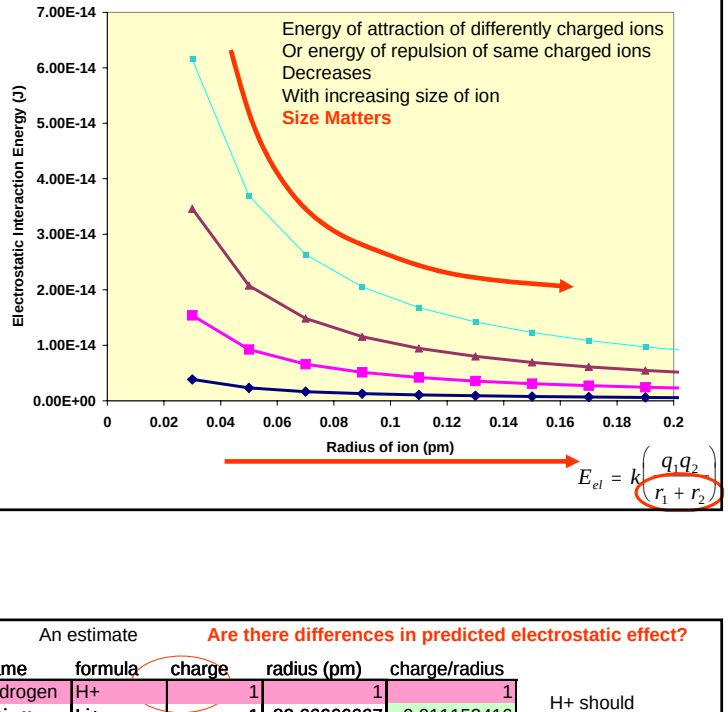
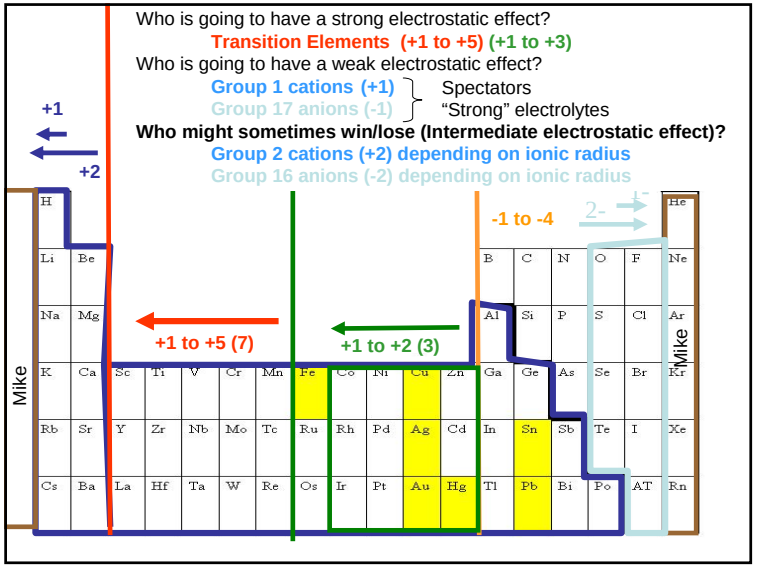
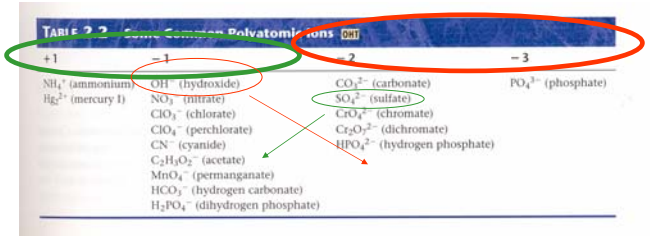




An estimate **Are there differences in predicted electrostatic effect?**

name	formula	charge	radius (pm)	charge/radius	
hydrogen	H+	1	1	1	H+ should behave differently
lithium	Li+	1	89.66666667	0.011152416	
potasium	K+	1	164	0.006097561	
sodium	Na+	1	164	0.006097561	
cesium	Cs+	1	192.8333333	0.005185825	
beryllium	Be2+	2	59	0.033898305	Be^{2+} and Mg^{2+} should behave differently
magnesium	Mg2+	2	85	0.023529412	
calcium	Ca2+	2	129.5	0.015444015	
strontium	Sr2+	2	143.3333333	0.013953488	
barium	Ba2+	2	149	0.013422819	
oxide	O2-	-2	124.2	-0.01610306	O^{2-} and S^{2-} should behave differently
sulfide	S2-	-2	170	-0.011764706	
selenide	Se2-	-2	184	-0.010869565	
telluride	Te2-	-2	207	-0.009661836	
fluoride	F-	-1	116.625	-0.008574491	F^- should behave differently
chloride	Cl-	-1	167	-0.005988024	
bromide	Br-	-1	182	-0.005494505	
iodine	I-	-1	206	-0.004854369	

What about polyatomic ions we memorized?
Who has a strong electrostatic effect?



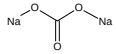
Weak effect predicted based On charge

Strong effect predicted based On charge

Two main exceptions: OH^-
SO_4^{2-}

http://www.usm.maine.edu/~newton/Chy251_253/Lectures/Resonance/Resonance.html

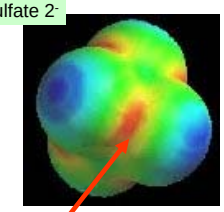
$$charge\ density \approx \frac{q}{r}$$



"ionic size" = 230 pm

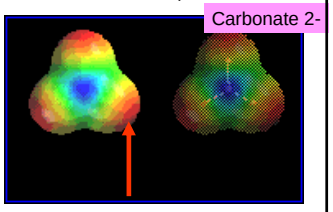
Ionic size = 185 pm

Sulfate 2-



Sulfate has
Less impact
Than
Carbonate
Even though
It is -2

Carbonate 2-



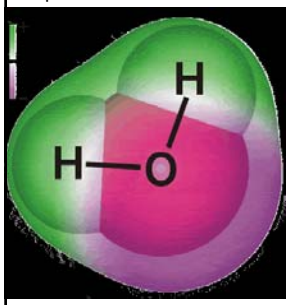
Most negative part of the molecule
How would you describe this?
Are the negative parts of the molecule isolated?
Are the negative parts of the molecule at the edges?
What is q/r for sulfate?

Most negative part of molecule
How would you describe this?
Are the negative parts of the molecule isolated?
Are the negative parts of the molecule at the edges?
What is q/r for carbonate?

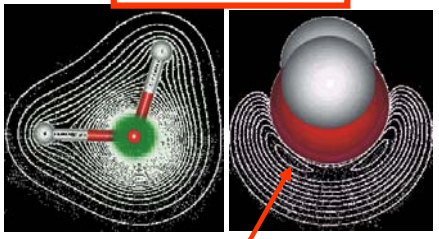
http://www.madsci.org/posts/archives/jan2000/949098457.Ch.r.html

http://www.lsbu.ac.uk/water/molecule.html

$$charge\ density \approx \frac{q}{r}$$



Shape and charge distribution
On water



Electron density of water

Electrons on Oxygen sit
"out there" causing large
Electrostatic potential
Oriented on the electrons

What would happen to the charge if we remove H and leave
Behind electrons to make OH-?

Expect OH- to have highly localized negative charge
What is q/r for OH-?

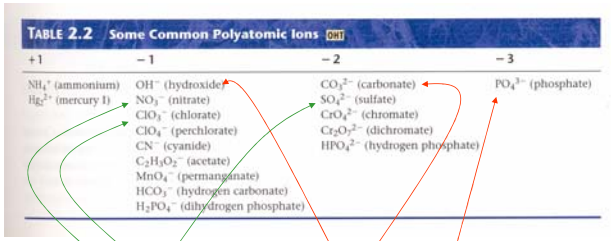


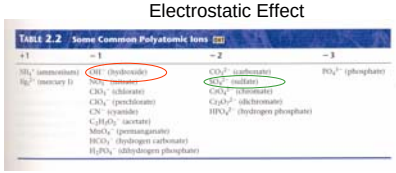
TABLE 2.2 Some Common Polyatomic Ions

+1	−1	−2	−3
NH_4^+ (ammonium)	OH^- (hydroxide)	CO_3^{2-} (carbonate)	PO_4^{3-} (phosphate)
Hg_2^{2+} (mercury I)	NO_3^- (nitrate)	SO_4^{2-} (sulfate)	
	ClO_3^- (chlorate)	CrO_4^{2-} (chromate)	
	ClO_4^- (perchlorate)	$Cr_2O_7^{2-}$ (dichromate)	
	CN^- (cyanide)	HPO_4^{2-} (hydrogen phosphate)	
	$C_2H_3O_2^-$ (acetate)		
	MnO_4^- (permanganate)		
	HCO_3^- (hydrogen carbonate)		
	$H_2PO_4^-$ (dihydrogen phosphate)		

No Clean Socks

Oh, Card me PleaSe

Electrostatic Effect



+1

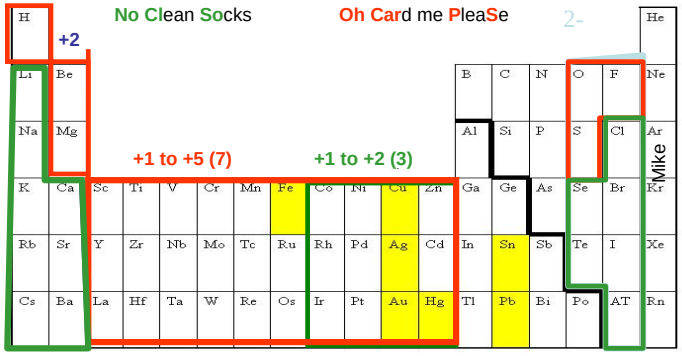
+2

No Clean Socks

Oh Card me PleaSe

1-

2-



+1 to +5 (7)

+1 to +2 (3)

Mike

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