Announcements – 11/6/00

- Lab: 1st week of a 2-week sequence
- Quiz #6: *review*
- Exam #3: **Wed. Nov. 15th**
  -see Exam Info page on website

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Ionization Energies (again)

- **Ionization Energy** (IE)

-***Recall:*** IE quantifies the tendency of an electron to leave an atom in the gas phase:

$X\ (g) \quad X^{+}\ (g) + e^{-} \quad \Delta E = IE_1$

$X^{+}(g) \quad X^{2+}\ (g) + e^{-} \quad \Delta E = IE_2$

$\mathbf{IE_2 > IE_1}$ (due to greater nuclear charge/e^-)

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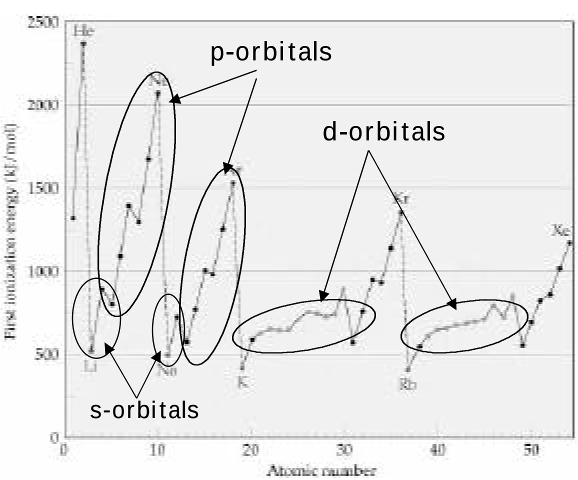
More Ionization Energies

TABLE 7.2 Successive Values of Ionization Energies, *I*, for the Elements Sodium Through Argon (kJ/mol)

Element	I_1	I_2	I_3	I_4	I_5	I_6	I_7
Na	496	4560			(Inner-shell electrons)		
Mg	738	1450	7730				
Al	578	1820	2750	11,600			
Si	786	1580	3230	4360	16,100		
P	1012	1900	2910	4960	6270	22,200	
S	1000	2250	3360	4560	7010	8500	27,100
Cl	1251	2300	3820	5160	6540	9460	11,000
Ar	1521	2670	3930	5770	7240	8780	12,000

Note: IE is always a *positive* value (**endothermic process)**

Ionization Energy: Periodic Trends

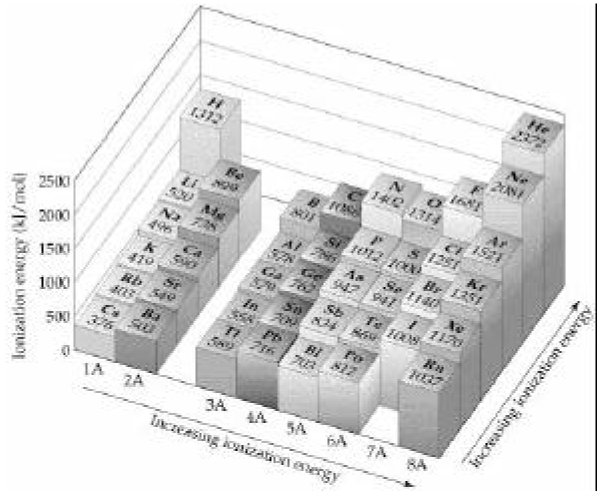


Generally:

-as **size decr** across a period, the **ionization energy *increases***

-as **size increases** down a group, the **ionization energy *decreases***

Ionization Energy: Periodic Table



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Electron Affinities: Periodic Trends

Recall: quantifies ability of an atom to *attract* an e^- in the gas phase:

$$X\ (g) + e^- \rightarrow X^-\ (g)$$

$$\Delta E = -EA$$

1A	2A	3A	4A	5A	6A	7A	8A
H –73							He >0
Li –60	Be >0	B –27	C –122	N >0	O –141	F –328	Ne >0
Na –53	Mg >0	Al –43	Si –134	P –72	S –200	Cl –349	Ar >0
K –48	Ca –2	Ga –30	Ge –119	As –78	Se –195	Br –325	Kr >0
Rb –47	Sr –5	In –30	Sn –107	Sb –103	Te –190	I –295	Xe >0

Increasing EA →

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Magnetic Properties

- Electrons are "natural magnets" due to their spin properties:

Na: $1s^2 2s^2 2p^6 3s^1$ *unpaired e⁻* will be ***attracted*** by an external magnetic field (**PARAMAGNETIC)**

Mg: $1s^2 2s^2 2p^6 3s^2$ *paired e⁻* will be ***repelled*** by an external magnetic field (**DIAMAGNETIC)**

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From Atoms to Molecules: The Covalent Bond

- So, what happens to e^- in *atomic orbitals* when two atoms approach and form a *covalent bond?*

Mathematically:

-let's look at the formation of a **hydrogen molecule**:

-*we start with:* 1 e^-/each in 1s atomic orbitals

-*we'll end up with:* **2 e^- in *molecular obital(s)***

HOW? Make linear combinations of the 1s orbital wavefunctions:

$$\psi_{mol} = \psi_{1s}(A) \pm \psi_{1s}(B)$$

Then, solve via the SWE!

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Hydrogen Wavefunctions