Chapter 6

I. Chemical Periodicity

A. Periodic Table

1. Development

a. 1864 – _____ – Elements arranged in order of atomic mass, every eighth element had similar properties. Law of _____. Worked up to _____. Why?

b. _____developed first periodic table that related chemical and physical properties of the elements and their atomic weight(1869). He was writing his own text book and wanted to include the new atomic weights of the elements. He began with _____that had the elements' _____, _____and _____ _____. As he arranged them in order of increasing atomic _____he noticed that their properties started to repeat at _____intervals. He also left blanks for elements that had not yet been discovered. His table was used to _____the properties of elements not yet discovered. Mendeleev used _____reasoning to build his periodic table (_____**reasoning** - predicting a general theory from known details). He then used _____reasoning to predict the properties of the properties of the elements yet to be discovered (_____**reasoning** - predicting details from a known general theory). This didn't always work, some elements were out of order when placed strictly by their weights. Dimitri knew something was wrong and arranged his table according to properties.

c. 44 years later, in 1913, _____ _____, using the ideas presented by _____ _____ _____ experiment, determined the nuclear charge of many elements. He did this using x-rays, the same way Rutherford had used _____particles, shooting them through various elements noticing the _____change as the x-rays came through the element. This allowed _____to arrange the elements in order of increasing atomic number and the _____ _____ _____was complete -

_____

_____

_____

2. Table design

a. _____- vertical columns on the periodic table in which the elements have similar chemical properties and the same number of valence electrons.

b. _____- horizontal rows on the periodic table in which each successive element increases by one proton and have electrons in the same outer shell.

c. Groups and electron configurations

(a) Group 1	_____metals	s^1
(b) Group 2	_____ _____metals	s^2
(c) Group 3-12	_____elements	s^2 (d^1 - d^{10})

(d) Group 13 _____group s^2 , p^1
(e) Group 14 _____group s^2 , p^2
(f) Group 15 _____group s^2 , p^3
(g) Group 16 _____group s^2 , p^4
(h) Group 17 _____ s^2 , p^5
(i) Group 18 _____ _____ (octets) s^2 , p^6
(j) Lanthanide rare earth elements s^2 ($4f^1$-$4f^{14}$)
(k) Actinide series s^2 ($5f^1$-$5f^{14}$)

d. Representative Elements – Groups _____

B. Periodic Trends

1. _____ _____– size of the atom
   a. Groups - as atomic number _____the atomic radii _____. Due to additional energy level and shielding effect - _____
      _____
   b. Periods - as atomic number _____the atomic radii _____. Due to increasing _____ _____ _____and electrons are filling in same energy level.
2. _____ _____- the energy needed to remove an electron from an atom
   a. ion - _____.
   b. A + energy ➔ $A^+ + e^-$ endothermic always
      Na + 496 kJ / mol ➔ $Na^{+1} + e^-$
   c. Groups - as atomic number _____the ionization _____. Due to electron being held _____tightly because of _____distance and _____effect.
   d. Periods - as atomic number _____the ionization energy _____. Due to _____positive - negative attraction and getting closer to _____
   e. Removal of successive electrons always requires more energy. Wherever the largest increase in successive ionization energies is the most stable configuration. (Table 8.2 pg. 331)
   f. Noble gases have _____I.E. Thus the octet is _____stable; next is full _____orbital; then _____orbital. Stability also determines the most common ion. If largest inc. is between 1st and 2nd then +1 is most common. If largest increase is between 3rd and 4th then +3 is most common.
3. _____ _____- the energy **change** when an atom gains an electron.
   a. A + energy + e^- ➔ A^- endothermic (positive)
   b. A + e^- ➔ A^- + energy exothermic (negative)
   c. Processes in nature tend toward lower energy and higher entropy (state of disorder). Thus the more negative the more stable.
   d. E. A. tells us how much an atom wants an electron. Halogens have "highest" E. A. More evidence for octet being most stable.
   e. Groups - as atomic number _____the E. A. generally _____
   f. Periods - as atomic number _____the E. A. generally _____
4. _____ _____

a. Positive ions - cations - are always _____than the corresponding atom since losing electron(s) and electrons give the atom _____and the positive - negative attraction is _____. _____stable in E considerations; _____stable in configuration considerations.
b. Negative ions - anions - are always _____since gaining an electron and electrons give atom _____and the positive - negative attraction is _____. If E.A. is negative then more stable in E considerations and configuration considerations.
c. Group and Period trends are the same as atomic radii trends for the same reasons.

5. _____- the tendency for atoms to attract electrons to itself when chemically combined with another atom.
   a. arbitrary scale developed by _____ _____called _____electronegativity scale (won his 1st Nobel Prize for this)
   b. based numerous factors including _____ _____.
   c. values help us determine the type of _____involved in chemical compounds and molecules and also the _____ _____
   d. Group trends - very generally _____as atomic number _____; reasons- _____effect and _____of energy levels electrons held more loosely
   e. Period trends - very generally _____as atomic number _____; reasons- _____positive negative attraction and getting _____ _____