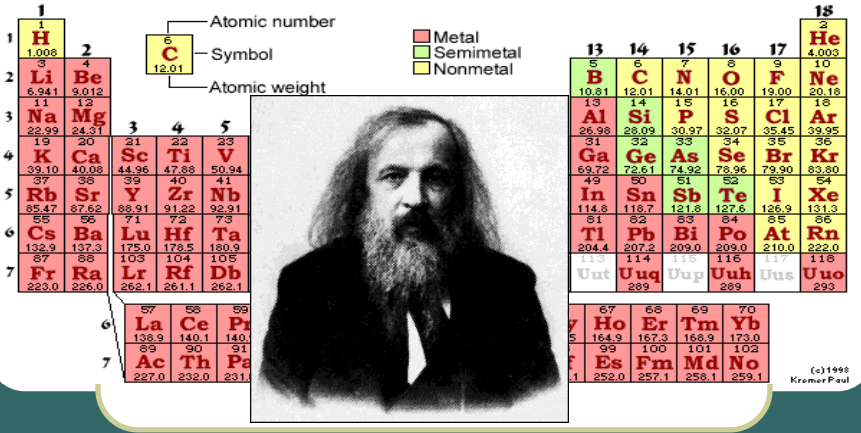
The Periodic Table



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Mid 19th century:

- Mendeleyev was the 1st person to arrange a table of elements based on _____.
  - Noticed _____ appearing at regular intervals
- Mosely later arranged the table by atomic _____ (X-rays were used to determine the atomic # of atoms based on the _____ charges in the nucleus)

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Modern Periodic Table arranged by:

- Periods= number indicates the principal energy level where the _____ are located
  - _____ on table
- Groups= elements with the _____ of valence electrons and thus similar or related _____
  - _____ on table
  - Also known as '_____'

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Arrangement continued:

- Also broken down into metals, non-metals and metalloids or semimetals (B, Si, Ge, As, Sb, Te) based on:
  - Physical properties: _____, _____, hardness, _____, _____, malleability, solubility, _____ and boiling points
  - Chemical properties or reactivity:
    - _____ (active)
    - _____ (inactive)
    - _____ (normally do not react) → Noble Gases

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Metals: Left side of table

- Alloys: mixtures of metals that result in _____ and properties (stainless steel, brass, bronze)
- Metallic properties _____ as you go down a group (_____ Ionization energy and electronegativity)
- Most active metals found, _____ of table
- Density greater than _____ (except group 1)
- _____ electrons to form (___) ions with a _____ atomic radius

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Properties of Metals

- _____ of all elements are metals
- _____ (shiny)
- _____ (shapeable with a mallet)
- _____ (can be drawn into thin wire)
- _____ conductor of electricity and heat
- _____ at room temp (except Hg=liquid)

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Non-Metals: Top right side of table

- _____, molecular or network _____ at room temp. (Br, bromine is an exception as it is in liquid form)
- _____ Ionization Energies (I.E.) and electronegativity
- Most active non metals, found in _____ of table
- _____ electrons to form (____) ions with a _____ atomic radius

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Properties of Non-Metals

- Less than _____ of all elements are non-metals
- _____, no luster
- _____ (if solid)
- _____
- _____ conductor of electricity and heat

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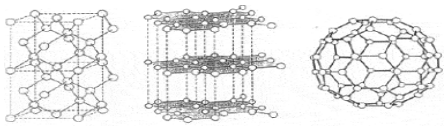
Allotropes:

- Two or more forms of the _____, differing in molecular or crystalline _____.
- Results in different _____
- Ex. Carbon: _____, _____, Fullerines (buckyballs)



- Ex. Oxygen: O_2 and O_3 (ozone)

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Hydrogen:

- Both _____ and _____ properties
- Does ____ belong to group 1
- Does ____ have similar properties to group 1 elements
- Can _____ or _____ an electron to form (+/-) oxidation numbers
  - Ex. when bonding to a metal= metal _____
    - $Na^+ + H^- \rightarrow NaH$

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Group 1: Alkali metals
Group 2: Alkaline Earth metals

- Occur in nature only in _____ due to _____ reactivity
- Easily _____ electrons due to low I.E.
- Typically form stable _____ compounds (with _____)
  - Ex. Sodium Chloride: NaCl
- Elements can be reduced to their free state by _____

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Group 3-12: Transition elements

- May exhibit multiple oxidation states
- Are generally less active than groups _____
- Form ions with _____(ex. $CuSO_4 \cdot 5H_20$ is blue)

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Group 17: Halogens

- Occur only as _____ due to high reactivity
- Fluorine also derived by _____
- Salts formed called _____
- Held together by _____ forces
- Only group to contain all _____ at room temperature
  - F, Cl→ _____
  - Br→ _____
  - I→ _____

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Group 18: Noble Gases

- _____ elements with filled valence shells
  - Can be found as individual _____
- May actually form bonds (though not common)

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- *Lanthanides: elements 58-71 (extension of period 6)
  - all have similar properties to _____
  - Would be stacked like a deck of cards on #57
- **Actinides: elements 89-103 (extension of period 7)

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Naming elements over 100= latin root system

- 0= ____
- 1= ____
- 2= ____
- 3= ____
- 4= ____
- 5= ____
- 6= ____
- 7= ____
- 8= ____
- 9= ____

Three prefixes + ium ending

Ex. 117 = _____

Ex. 209 = _____

Ex. 320 = _____

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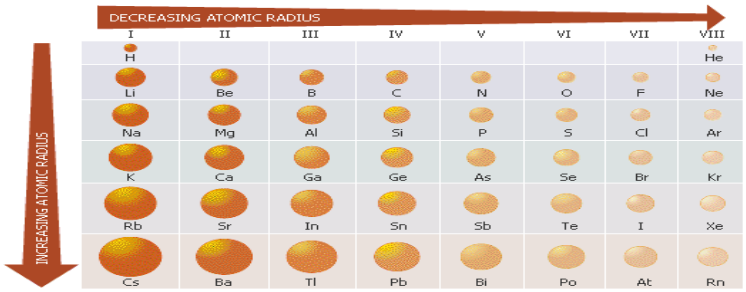
Atomic Radius

- _____ the distance between adjacent nuclei of the same element
- helpful to determine _____, solubility, _____ point and acid strength



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Atomic Radius

- Across period (left to right) a ___ occurs
  - as atomic number ___, nuclear charge also ___ due to _____ protons
  - Electons are held more tightly around the nucleus, thus radius will ___
- Down a group (top to bottom) an ___ occurs
  - additional energy levels will shield the (__) nucleus, thus the attractive force is _____ and the radius will ___

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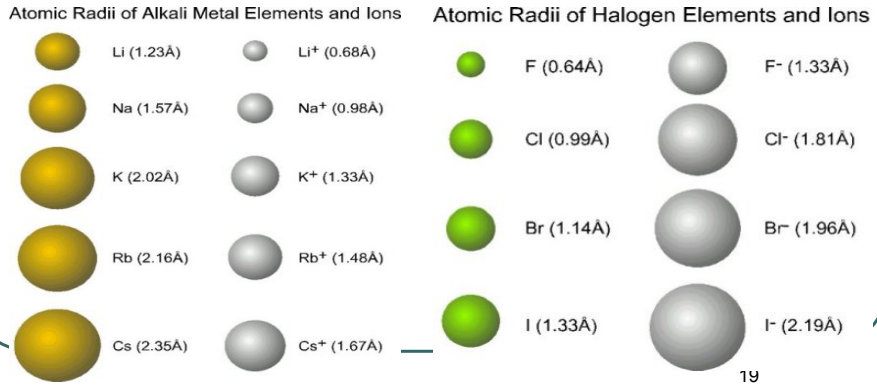
Ionic Radius: relative to a neutral atom

- (__) ion = smaller = known as a _____
- (__) ion = larger = known as an _____



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Ionization Energy

- A) The ease at which an atom will _____ an electron
- B) The smaller the IE, the easier the electron will be _____
  - 1) Metals have _____ IE (especially Groups 1+2)
  - 2) Non-metals have _____ IE
- C) _____ relationship exists between the size of an atom and its first Ionization Energy
  - 1) The larger the atom the _____ it will lose an electron, as it is _____ from positive nucleus
  - 2) The smaller the atom, the _____ to remove/lose an electron as it is _____ to positive nucleus

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Ionization Energy continued

- <u>IE Summary</u>
- Across a period = general _____
- Down a group = general _____
- 2nd + 3rd I.E. are successively _____ due to more (+) nucleus holding the outer electrons closer
  - Ex. 1st IE X + energy→ X^+ + e-
  - Ex. 2nd IE X^+ + More energy→ X^{2+} + e-

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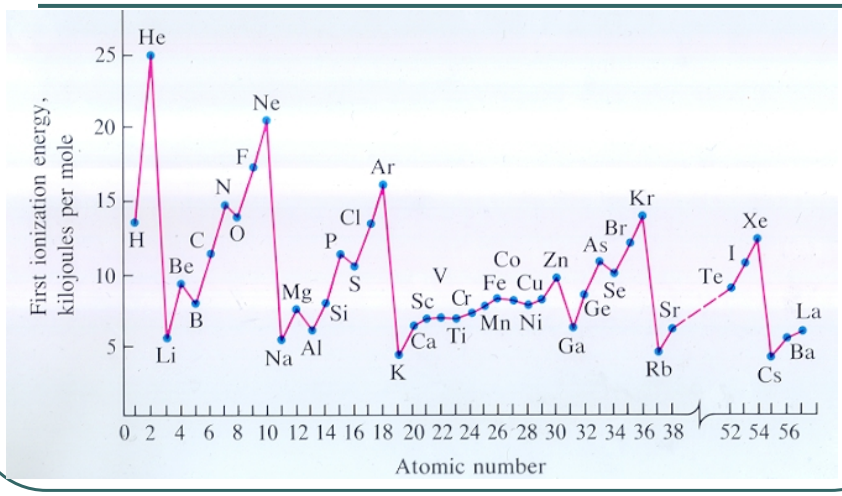
Ionization Energy Periodic Trends



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Electronegativity:

- A measure of the ability of an atom or molecule to _____ in a chemical bond.
  - Across a period= general _____
  - Down a group = general _____
- Basis for determining bond types (_____, _____ and _____)
  - If difference is zero = _____
  - Difference of 0.1→1.7 = _____
    - Though lower values are sometimes considered to be non-polar (ex. 0.1→0.3 etc)
  - Difference of 1.7 and above = _____

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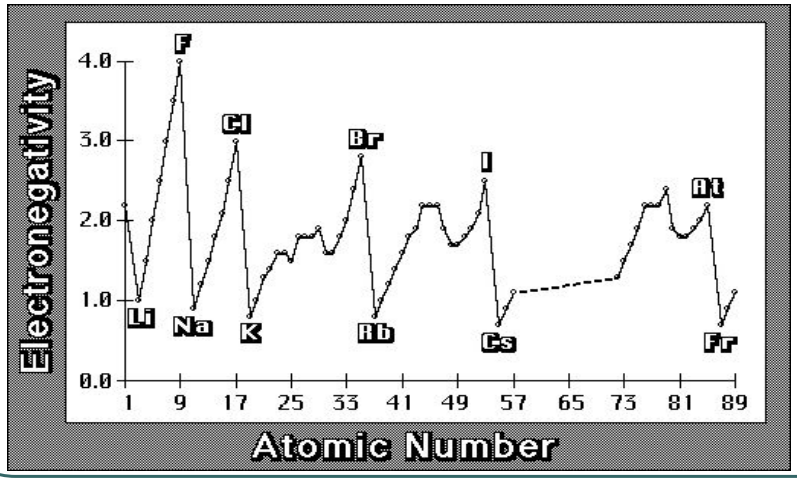
Electronegativity:



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