

Chapter 6 Packet: Elements and the Periodic Table

6.1 – The Periodic Table

Name: _____

Pd: _____

Metals, Nonmetals, and Metalloids:

- There are about _____ known elements.
 - Based on their physical and chemical properties, these elements belong to one of the 3 main categories: Metals, Nonmetals, and Metalloids.
 - _____ – are malleable (bendable), shiny, and conduct electricity. Usually solid at room temperature
 - _____ – do not conduct electricity, usually gases or liquids at room temperature.
 - _____ – have some properties similar to both metals and nonmetals.
- Silicon is an important metalloid.

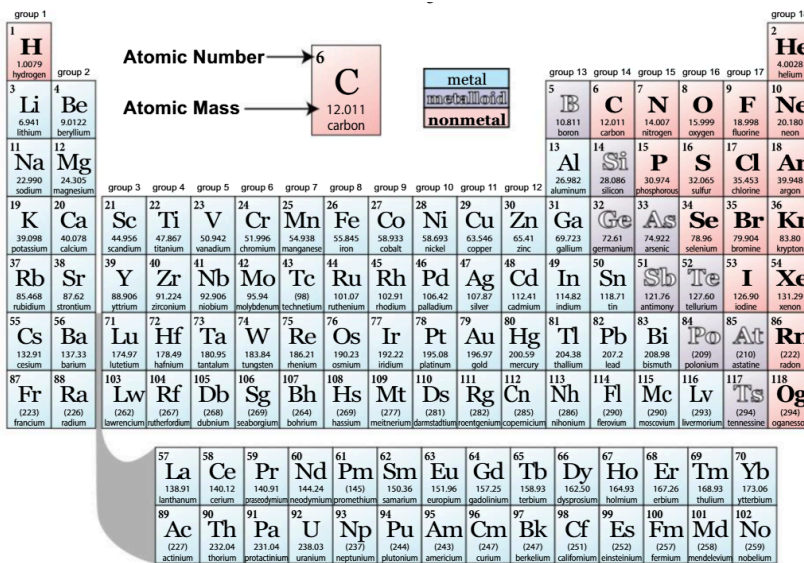


FIGURE 6.3 The periodic table of the elements

Some of the known synthetic elements are

elements are

- Technetium (atomic # 43), Promethium (atomic # 61) and all of the elements above atomic #92 so they do not have any stable isotopes and were formed in the _____.
- They are _____ radioactive
- They were formed by bombarding the _____ of existing atoms with high energy particles like neutrons/other nuclei. (Nuclear Fusion)
 - Don't last long, highly _____.

Periodic Properties of the Elements:

Dimitri _____ (1896)

- Scientist and Chemistry Teacher
- Tried to figure out if there was an organization to the elements
- At this time, _____ had not been discovered, and atomic number was _____ known at the time.
- He knew elements have _____ and some other chemical and physical properties
- He tried organizing the elements by atomic _____.
- When he tried to graph atomic mass with their densities, he saw a _____.

He noticed the density of the elements followed a **PERIODIC** pattern.

- The densities would increase and then decrease in a repeated pattern
- This is how the periodic table got its name because the rows were organized in _____ patterns found in their atomic structures and properties.
- The periodic table is _____ arranged by mass today, but it helped us to structure the modern-day periodic table.

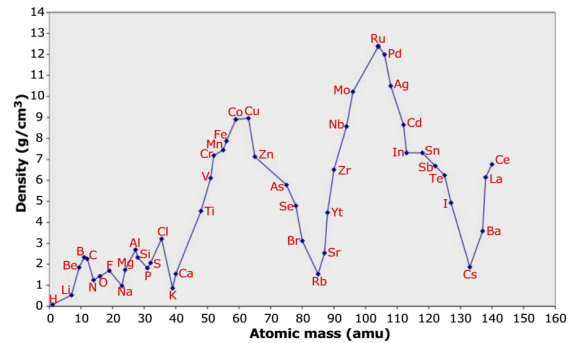


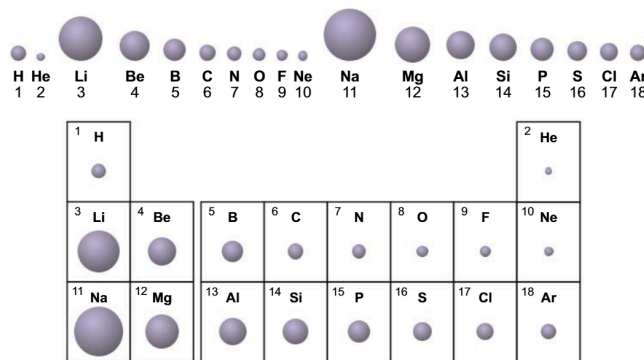
FIGURE 6.7 Patterns in element density versus atomic mass for many elements known by Mendeleev

Periodic Table Trends:

- After Mendeleev's time and as new atomic discoveries were made, it was determined that other atomic properties followed the same periodic pattern.
- We called these _____ TABLE _____, and these properties are as follows..
 - _____
 - _____
 - _____
 - _____

Atomic Radius:

- Atomic _____ – the distance from the center of the atom to its “_____” (where the probability of finding an electron in the electron cloud gets really low)



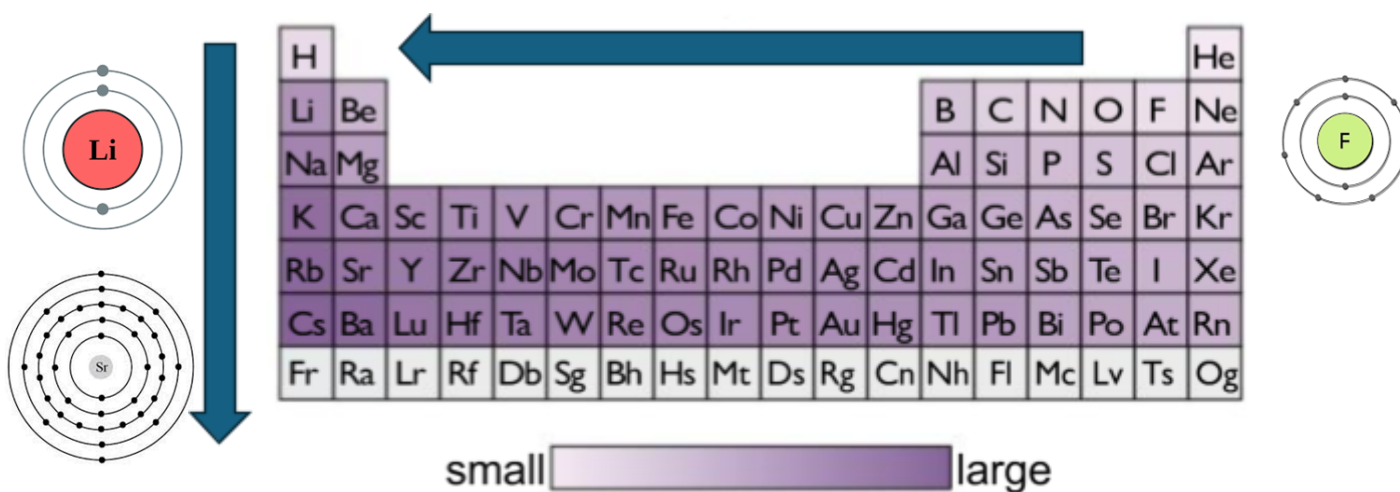
- _____ down a group (column)
- _____ across a period (row)

Atomic Radius increases down a group (column)

- Each period row adds a _____ “ring” of electrons which increases the atoms size.
- _____ – as the number of shells increase, the electrons in the outer shells get shielded from the attracting protons in the nucleus due to the other inner electrons repelling the electrons in the outer shell away.

Atomic Radius decreases across a period (row)

- Moving left to right, atoms gain more _____. The extra positive charge holds the electrons _____ to the nucleus more tightly making the atom smaller.



Circle the Element in the Pair that has the LARGEST Atomic Radius:

1. Ca	or	Br	2. Mg	or	Ba
3. Ga	or	Zn	4. I	or	Ag

Ionic Radius

- Ionic _____ – The radius of an element in _____ form.
- _____ (metals) – become _____
 - Cations lose electrons which makes the # of protons more than the # of electron thus the electrons get pulled in tighter to the nucleus
 - When electrons are lost, the element loses the _____ of electrons making it smaller in size.
- _____ (nonmetals) – become _____
 - Anions gain more electrons so the protons cannot hold them in as tightly since there are more electrons than protons

Circle the Element in the Pair that has the SMALLEST Atomic Radius:

1. Ca or Ca^{2+}

2. Cl or Cl^{-}

3. N or N^{3-}

4. Ag or Ag^{1+}

Electronegativity:

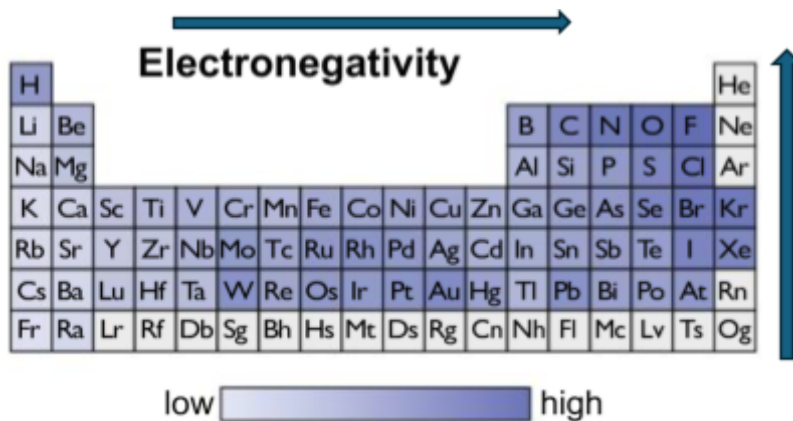
- _____ (EN) – How well one atom can attract electrons from another atom to which it is bonded
 - _____ across a period (row)
 - _____ down a group (column)
 - _____ have _____ EN because they are _____ attracting electrons. They lose electrons while bonding (become cations)
 - _____ have _____ EN because they _____ /attract more electrons while bonding (become anions)

Electronegativity Increases across a period (row)

- More _____ get added across the period so the atom can hold onto _____ more strongly

Electronegativity Decreases down a group (column)

- As more electron _____ get added, their attraction to the nucleus gets _____ away causing the electrons to not be held as strongly.



Circle the Element in the Pair that has the LARGEST Electronegativity:

1. K or Br

2. Mg or Rb

3. Cs or Zn

4. O or Ag

Ionization Energy:

- _____ (IE) – The minimum energy required to _____ an _____ to form an ion.
- Follows the same trend as _____
 - _____ across the period (row)
 - _____ down a group (column)
 - _____ have _____ IE because they want to _____ electrons while bonding (become cations) so it _____ require much energy to do so.
 - _____ have _____ IE because they take in/ _____ more _____ while bonding (become anions) so the energy to remove an electron is very _____.
- Ionization Energy Increases across the period (row)

- However, two things from Mendeleev's time still holds true.
 - Each column (_____) represents elements with _____ chemical properties
 - Each row (_____) still marks the beginning of a _____ pattern of properties
- The periodic table is broadly categorized into metals, nonmetals, and metalloids.
- Some _____ have names to represent those elements characteristics.
 - Example: Group 18 = Noble Gases (That don't react)

The periodic table is color-coded as follows:

- metals**
 - alkali metals (green)
 - alkaline earth metals (light blue)
 - transition metals (red)
 - rare earth metals (blue)
 - other metals (yellow)
- nonmetals**
 - halogens (orange)
 - noble gases (pink)
 - other nonmetals (light green)
- metalloids**
 - metalloids (grey)

6.2 Properties of Elements

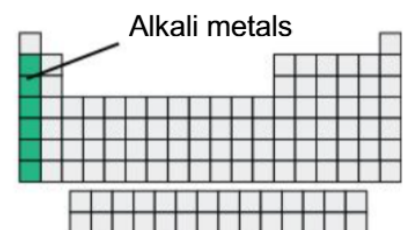
of Groups of

Properties of Elements:

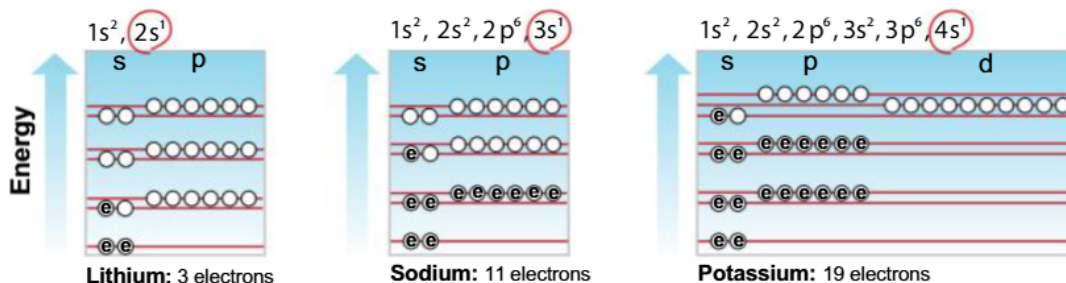
- Elements in the same group (column) have similar _____ in their outer orbitals.
- This gives them similar properties
- We will now look at the major groups on the periodic table and their properties

Group 1: Alkali Metals

- Group 1 is called the _____.



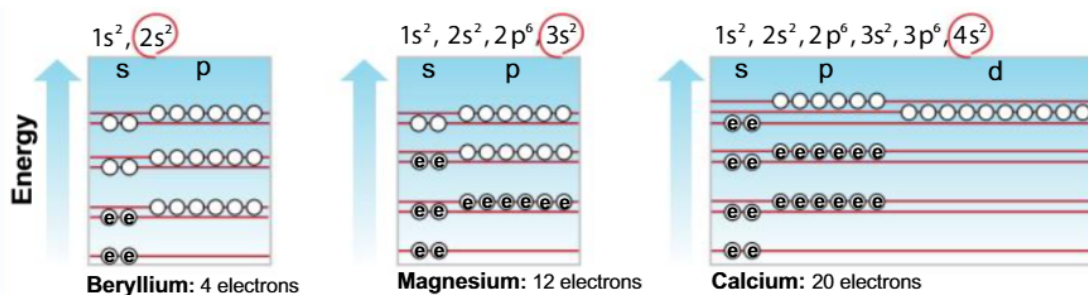
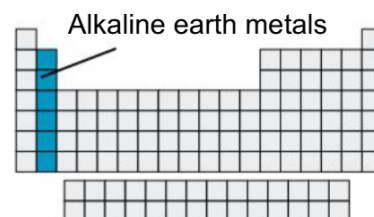
- Remember Hydrogen is in this column because of similar electron properties; however, hydrogen is a nonmetal, not an alkali metal
- Look at the electron structures below. Can you see what they have in common?



- When elements in group one lose the electron in their outer shell, they obtain a _____ as a cation.

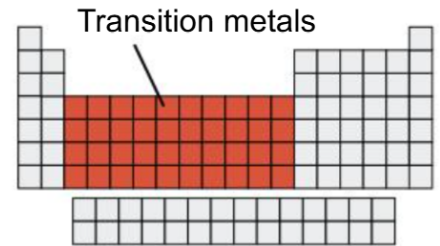
Group 2: Alkaline Earth Metals

- Group 2: _____
 - This group is also pretty reactive.
 - Also tend to lose electrons easily. They will _____ electrons to become a _____. This is due to having 2 electrons in the outer most shell



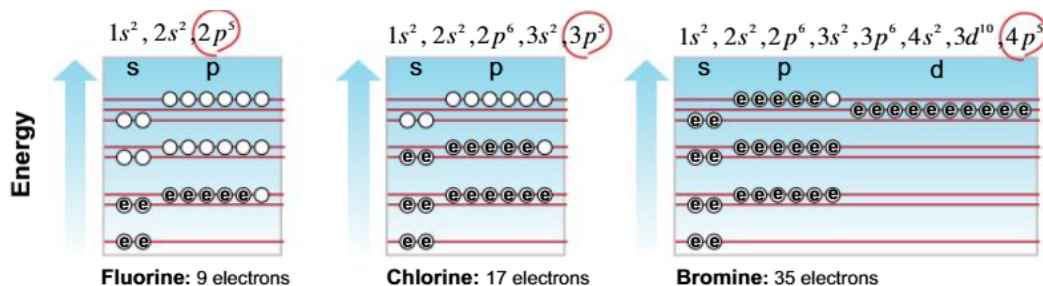
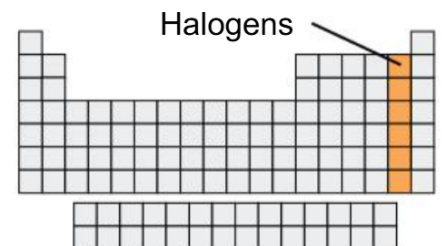
The Transition Metals:

- _____ of the periodic table
- Their reactivity is more complicated.
- The transition metals can lose a _____ of electrons in their outer shell. This causes them to have more than one charge option as a cation.
 - For example: Iron (Fe) can lose 2 or 3 electrons



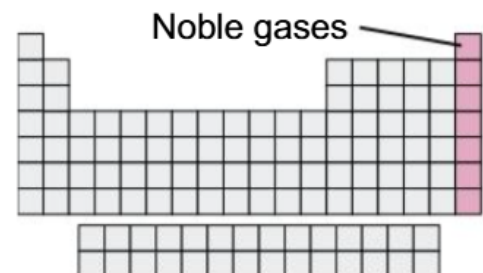
Group 17: Halogens

- Group 17 is called the _____
 - This group is made of _____ reactive nonmetals
 - In their pure forms they are found naturally in pairs (Cl_2 , F_2) to be more stable.
 - They _____ have a full outer shell, so they gain 1 electron to become stable
 - They become a _____

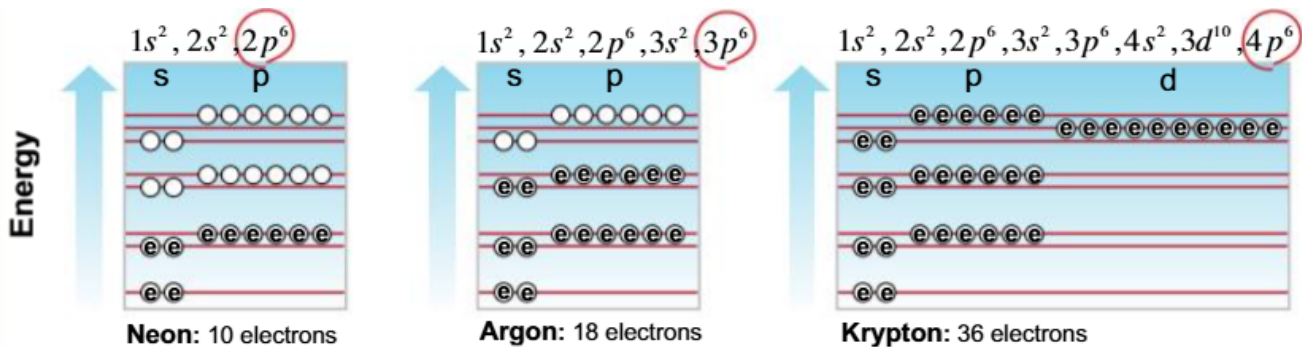


Group 18: Noble Gases

- Group _____ is called the Noble Gases
 - This group _____ chemically bond with other elements



- Looking at their electron configuration, why do you think they do not bond?



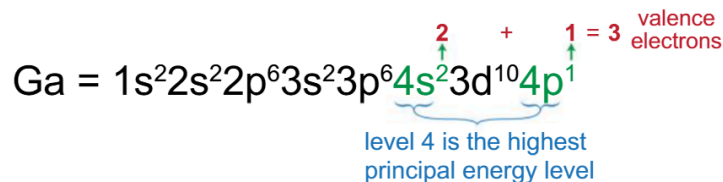
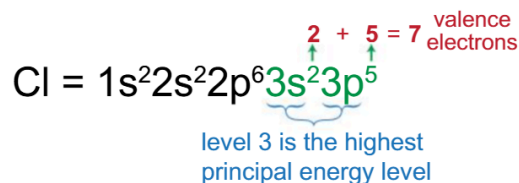
6.3 Valence Electrons

Valence Electrons:

- Electrons in the _____ orbital (_____ energy level)
 - They define the _____ properties and behavior of elements
 - They are used for a _____.
- THE _____ ELEMENTS 1A-8A (all but the transition metals)
 - All the elements in the _____ group (column) in the main group elements have the _____ number of valence electrons.
 - All _____ elements would have _____ valence electron.
 - The transition metals _____ follow a pattern for valence electrons.

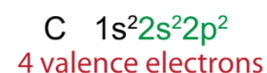
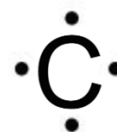
1		2		Valence electrons										3	4	5	6	7	8																
1A		2A		Main group elements										3A		4A	5A	6A	7A	8A															
1	H 1.0079 hydrogen											2	He 4.0028 helium																						
3	Li 6.941 lithium	4	Be 9.0122 beryllium	Transition metals (valence electrons vary)										5	B 10.811 boron	6	C 12.011 carbon	7	N 14.007 nitrogen	8	O 15.999 oxygen	9	F 18.998 fluorine	10	Ne 20.180 neon										
11	Na 22.990 sodium	12	Mg 24.305 magnesium	13	Al 26.982 aluminum	14	Si 28.086 silicon	15	P 30.974 phosphorus	16	S 32.065 sulfur	17	Cl 35.453 chlorine	18	Ar 39.948 argon																				
19	K 39.098 potassium	20	Ca 40.078 calcium	21	Sc 44.956 scandium	22	Ti 47.867 titanium	23	V 50.942 vanadium	24	Cr 51.996 chromium	25	Mn 54.938 manganese	26	Fe 55.845 iron	27	Co 58.933 cobalt	28	Ni 58.693 nickel	29	Cu 63.546 copper	30	Zn 65.41 zinc	31	Ga 69.723 gallium	32	Ge 72.61 germanium	33	As 74.922 arsenic	34	Se 78.96 selenium	35	Br 79.904 bromine	36	Kr 83.80 krypton
37	Rb 85.468 rubidium	38	Sr 87.62 strontium	39	Y 88.906 yttrium	40	Zr 91.224 zirconium	41	Nb 92.906 niobium	42	Mo 95.94 molybdenum	43	Tc (98) technetium	44	Ru 101.07 ruthenium	45	Rh 102.91 rhodium	46	Pd 106.42 palladium	47	Ag 107.87 silver	48	Cd 112.41 cadmium	49	In 114.82 indium	50	Sn 118.71 tin	51	Sb 121.76 antimony	52	Te 127.60 tellurium	53	I 126.90 iodine	54	Xe 131.29 xenon
55	Cs 132.91 cesium	56	Ba 137.33 barium	71	Lu 174.97 lutetium	72	Hf 178.49 hafnium	73	Ta 180.95 tantalum	74	W 183.84 tungsten	75	Re 186.21 rhenium	76	Os 190.23 osmium	77	Ir 192.22 iridium	78	Pt 195.08 platinum	79	Au 196.97 gold	80	Hg 200.59 mercury	81	Tl 204.38 thallium	82	Pb 207.2 lead	83	Bi 208.98 bismuth	84	Po (209) polonium	85	At (210) astatine	86	Rn (222) radon

- Valence Electrons can also be determined by electron _____ by looking at the _____ energy level and counting the electron _____.



Lewis Dot Diagrams:

- Show the _____ electrons as dots surrounding the element symbol
- There can be up to _____ dots (electrons) in a diagram
- Valence electrons are shown because they are the ones used in _____.
- These diagrams will be used in the next chapter when we discuss bonding.
- Draw the Lewis Dot Diagram for the following:



Ca:	Li:	Br:
O:	P:	Ne:
Cl:	Al:	Rb: