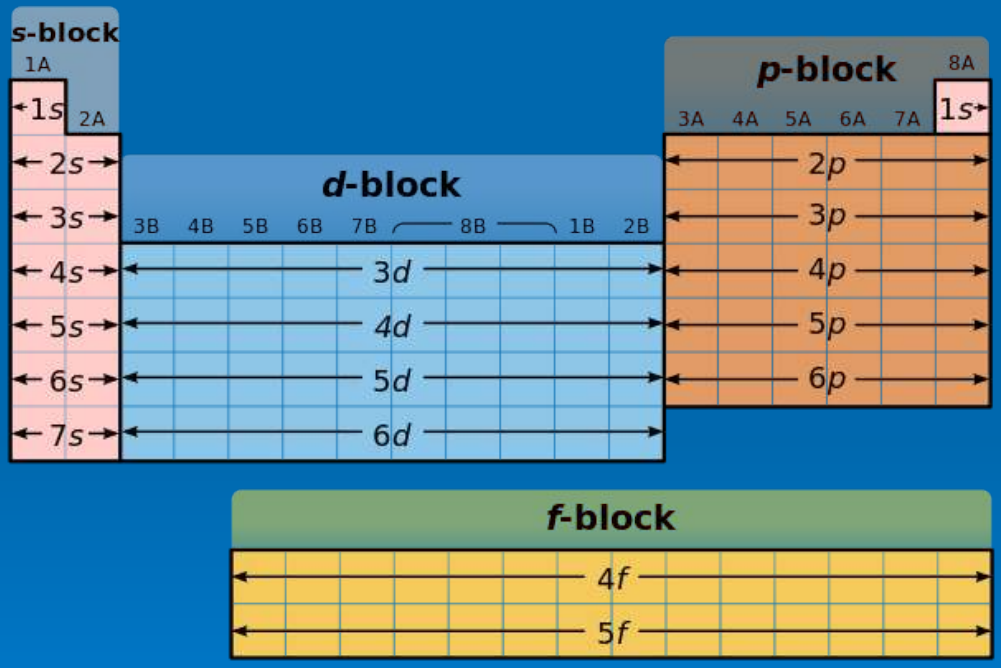
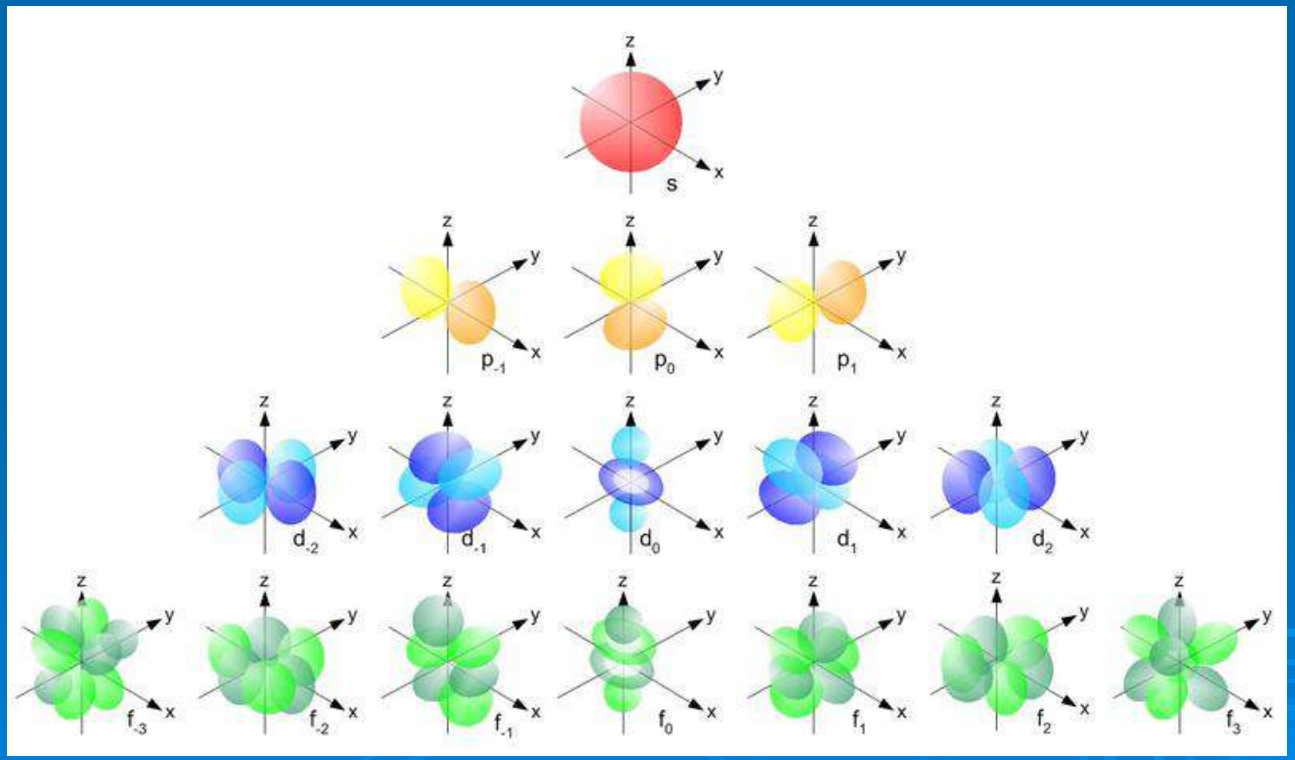
AP Chemistry
Chapter 6 and 7 Jeopardy



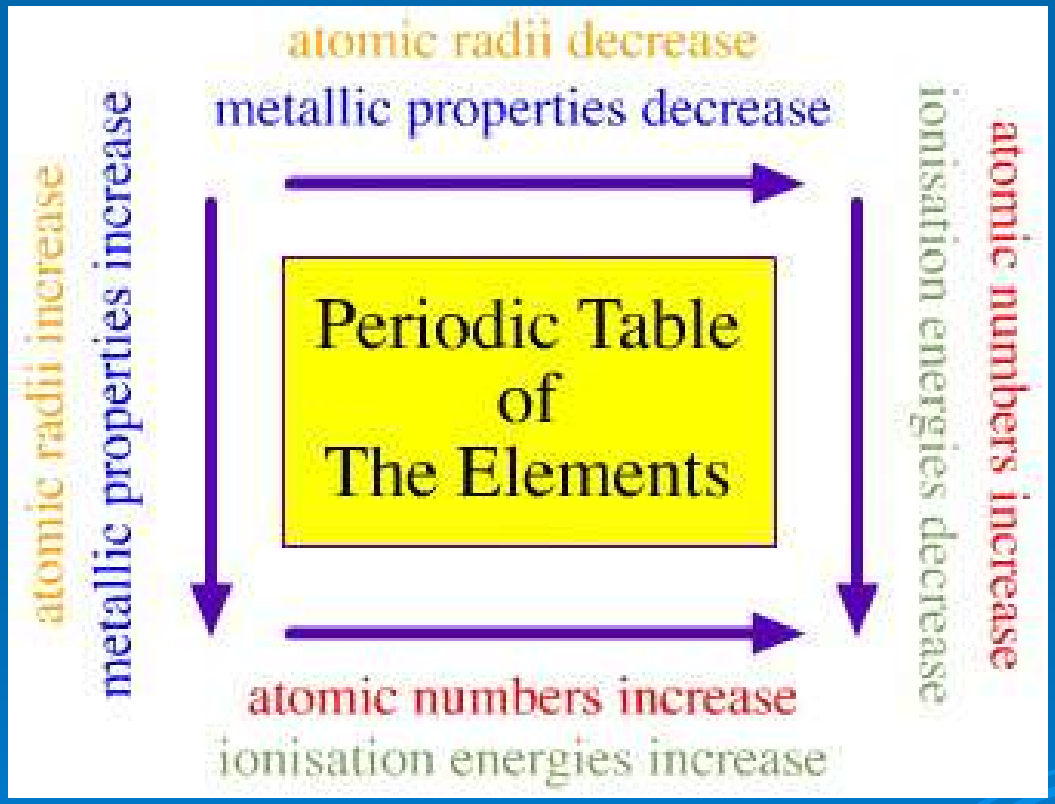
Jennie L. Borders

Round 1 – Chapter 6



Vocabulary	Waves	Energy	De Broglie	Quantum Numbers	Electron Config.
100	100	100	100	100	100
200	200	200	200	200	200
300	300	300	300	300	300
400	400	400	400	400	400
500	500	500	500	500	500

Round 2 – Chapter 7



Click to go to Round 2

Vocabulary 100

What is Hund's Rule?

Hund's Rule states that in degenerate sublevels (p, d, and f) the electrons are most stable when they are unpaired.

Vocabulary 200

What is the Pauli Exclusion Principle?

The Pauli Exclusion Principle states that no two electrons will have the same quantum numbers, so when 2 electrons occupy the same orbital, then they must have opposite spins.

Vocabulary 300

What is the Hiesenburg Uncertainty Principle and why is it irrelevant when referring to macroscopic objects?

The Hiesenburg Uncertainty Principle states that it is impossible to know both the location ad the speed (or momentum) of a particle. It does not apply to macroscopic objects because it is based on the formula $\lambda = h/mv$, and macroscopic objects have such a large mass that the uncertainly is extremely small.

Vocabulary 400

Why is the emission spectrum for hydrogen a line spectrum, and if hydrogen only has 1 electron, then how can more than one line exist?

The hydrogen spectrum is not continuous because energy is quantized, so electrons can inhabit only certain energy levels. There is more than one line because electrons of different hydrogen atoms are jumping to different levels.

Vocabulary 500

What is blackbody radiation, the photoelectric effect, and emission spectrum?

-Blackbody radiation is the phenomena that occurs when a heated object (metal) glows.

-The photoelectric effect is when light of sufficient energy shines on a metal surface and electrons are ejected.

-An emission spectrum is when a substance (gas) is heated until certain wavelengths of light are emitted from the movement of electrons.

Waves 100

Electromagnetic radiation travels through a vacuum at what speed?

3.0×10^8 m/s

Waves 200

What is the wavelength of light in meters that has a frequency of $1.20 \times 10^{13}\ s^{-1}$?

$c = \lambda v$ so $\lambda = c/v$

$$\lambda = \frac{3.0 \times 10^{8}\ m/s}{1.20 \times 10^{13}\ /s} = \mathbf{2.5 \times 10^{-5}\ m}$$

Waves 300

What is the frequency of electromagnetic radiation that has a wavelength of 0.53 angstroms?

$$0.53\ \text{A} \times \frac{1\text{m}}{1 \times 10^{10}\text{A}} = 5.3 \times 10^{-11}\text{m}$$

$c = \lambda v$ so $v = c/\lambda$

$$v = \frac{3.0 \times 10^{8}\ \text{m/s}}{5.3 \times 10^{-11}\text{m}} = \mathbf{5.66 \times 10^{18}\ Hz}$$

Waves 400

What is the wavelength of light in nm that has a frequency of $4.62 \times 10^{14}\ s^{-1}$?

$c = \lambda v$ so $\lambda = c/v$

$$\lambda = \frac{3.0 \times 10^{8}\ m/s}{4.62 \times 10^{14}\ /s} = 6.49 \times 10^{-7} m$$

$$6.49 \times 10^{-7} m \times \frac{1 \times 10^{9} nm}{1 m} = \mathbf{649nm}$$

Waves 500

Of the following, _____ has the shortest wavelength.

a. X-ray

b. Radio

c. Microwave

d. Ultraviolet

e. Infrared

Energy 100

The frequency of a photon that has an energy of 3.7×10^{-18} J is what?

$$E = h\nu \quad \text{so} \quad \nu = E/h$$

$$\nu = \frac{3.7 \times 10^{-18}\ \text{J}}{6.62 \times 10^{-34}\ \text{J}\cdot\text{s}} = \mathbf{5.58 \times 10^{15}\ Hz}$$

Energy 200

What is the wavelength of a photon that has an energy of 5.25×10^{-19} J?

$$E = h\nu \quad \text{so} \quad \nu = E/h$$

$$\nu = \frac{5.25 \times 10^{-19}\ \text{J}}{6.62 \times 10^{-34}\ \text{J}\cdot\text{s}} = 7.92 \times 10^{14}\ \text{Hz}$$

$$c = \lambda\nu \quad \text{so} \quad \lambda = c/\nu$$

$$\lambda = \frac{3.0 \times 10^{8}\ \text{m/s}}{7.92 \times 10^{14}\ \text{/s}} = \mathbf{3.79 \times 10^{-7}\ m}$$

Energy 300

What is the energy of a photon that has a wavelength of 9.0m?

$c = \lambda v$ so $v = c/\lambda$

$$v = \frac{3.0 \times 10^{8} \text{ m/s}}{9.0 \text{ m}} = 3.33 \times 10^{7} \text{ /s}$$

$E = hv$

$E = 6.626 \times 10^{-34} \text{ J·s} \times 3.33 \times 10^{7} \text{ /s} =$ **2.21×10^{-26} J**

Energy 400

What is the energy of a photon that has a wavelength of 12.3 nm?

$$12.3\ \text{nm} \times \frac{1\text{m}}{1 \times 10^{9}\ \text{nm}} = 1.23 \times 10^{-8}\text{m}$$

$$c = \lambda\nu \quad \text{so} \quad \nu = c/\lambda$$

$$\nu = \frac{3.0 \times 10^{8}\ \text{m/s}}{1.23 \times 10^{-8}\ \text{m}} = 2.44 \times 10^{16}\ /\text{s}$$

$$E = h\nu$$

$$E = 6.626 \times 10^{-34}\ \text{J}\cdot\text{s} \times 2.44 \times 10^{16}\ /\text{s} =$$

1.62×10^{-17} J

Energy 500

A mole of yellow photons of wavelength 527 nm has how many kJ of energy?

$$527\ \text{nm} \times \frac{1\text{m}}{1 \times 10^{9}\ \text{nm}} = 5.27 \times 10^{-7}\text{m}$$

$$c = \lambda v \quad \text{so} \quad v = c/\lambda$$

$$v = \frac{3.0 \times 10^{8}\ \text{m/s}}{5.27 \times 10^{-7}\ \text{m}} = 5.69 \times 10^{14}\ /\text{s}$$

$$E = hv$$

$$E = 6.626 \times 10^{-34}\ \text{J}\cdot\text{s} \times 5.69 \times 10^{14}\ /\text{s} = 3.77 \times 10^{-19}\ \text{J}$$

$$3.77 \times 10^{-19}\text{J} \times 6.02 \times 10^{23}\ \text{photons} = 2.27 \times 10^{5}\text{J}$$

$$2.27 \times 10^{5}\ \text{J} \times \frac{1\text{kJ}}{1000\ \text{J}} = \mathbf{227kJ}$$

De Broglie 100

What is the wavelength in meters of a 2.0 kg object moving at a speed of 50 m/s?

$$\lambda = h/mv$$

$$\lambda = \frac{6.626 \times 10^{-34}\ J \cdot s}{2.0kg \times 50m/s} = \mathbf{6.63 \times 10^{-36} m}$$

De Broglie 200

What is the wavelength in meters of a 25g object moving at a speed of 5.0 m/s?

$$25g \times \frac{1kg}{1000g} = 0.025kg$$

$$\lambda = h/mv$$

$$\lambda = \frac{6.626 \times 10^{-34}\ J \cdot s}{0.025kg \times 5.0m/s} = \mathbf{5.30 \times 10^{-33} m}$$

De Broglie 300

The wavelength of an electron is 8.7×10^{-11}m. The mass of the electron is 9.1×10^{-31}kg. What is the velocity in m/s?

$$\lambda = h/mv \quad \text{so} \quad v = h/\lambda m$$

$$\lambda = \frac{6.626 \times 10^{-34}\ \text{J}\cdot\text{s}}{8.7 \times 10^{-11}\text{m} \times 9.1 \times 10^{-31}\text{kg}} =$$

8.37×10^{6}m/s

De Broglie 400

At what speed in m/s must a 10.0mg object be moving to have a wavelength of 3.3×10^{-41}m?

$$10\text{mg} \times \frac{1\text{g}}{1000\text{mg}} \times \frac{1\text{kg}}{1000\text{g}} = 1 \times 10^{-5}\text{kg}$$

$\lambda = h/mv$ so $v = h/\lambda m$

$$v = \frac{6.626 \times 10^{-34}\ \text{J}\cdot\text{s}}{3.3 \times 10^{-41}\text{m} \times 1 \times 10^{-5}\text{kg}} =$$

2.01×10^{12} m/s

De Broglie 500

What is the wavelength of a car with a mass of 1.0×10^3kg traveling at 75 km/hr?

$$75 \frac{\text{km}}{\text{hr}} \times \frac{1\text{hr}}{3600\text{s}} \times \frac{1000\text{m}}{1\text{km}} = 20.83 \text{ m/s}$$

$$\lambda = h/mv$$

$$\lambda = \frac{6.626 \times 10^{-34} \text{ J}\cdot\text{s}}{1 \times 10^3\text{kg} \times 20.83\text{m/s}} =$$

3.18×10^{-38}m

Quantum Numbers 100

Which of the following sets of quantum numbers is not possible?

a. 2, 0, 0

b. 2, 1, -1

c. 3, 1, -1

d. 1, 1, 1

e. 3, 2, 1

Quantum Numbers 200

Which of the following is an appropriate set of quantum numbers?

a. 2, 2, -1, -½

b. 1, 0, 0, ½

c. 3, 3, 3, ½

d. 5, 4, -5, ½

e. 3, 3, 3, -½

Quantum Numbers 300

What are the correct quantum numbers for the highest electron in bromine?

Br ($35e^-$)

$[Ar]\ 3d^{10}4s^24p^5$

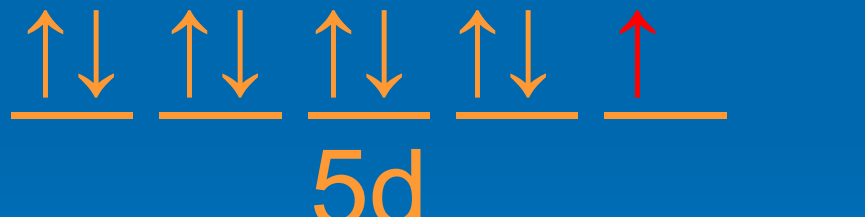
4, 1, 1, ½

Other accepted answers would be quantum numbers for any of the 4p electrons.

Quantum Numbers 400

What are the quantum numbers for the last electron in gold when it is not rearranged?

Au (79 e^-)



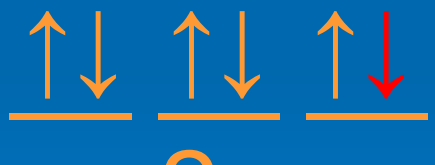
5, 2, 2, ½

Other accepted answers would be quantum numbers for any of the 5d electrons.

Quantum Numbers 500

What are the quantum numbers for the highest electron in a nitrogen ion?

N^{3-} (10 e^-)



2, 1, 1, -½

Other accepted answers would be quantum numbers for any of the 2p electrons.

Electron Configuration 100

What is the noble gas configuration for a ground state silver atom?

Ag (47 e^-)

$[Kr]4d^9 5s^2$

Electron Configuration 200

Which one of the following configurations depicts an excited oxygen atom?

a. $1s^2 2s^2 2p^2$

b. $1s^2 2s^2 2p^2 3s^2$

c. $1s^2 2s^2 2p^1$

d. $1s^2 2s^2 2p^4$

e. $[He]2s^2 2p^4$

Electron Configuration 300

What element has a valence configuration of $4s^1$?

K

Electron Configuration 400

The valence shell of the element X contains 2 electrons in a 5s subshell. Below that shell, element X has a partially filled 4d subshell. What type of element is X?

transition metal

Electron Configuration 500

What is the condensed configuration for Polonium?

Po (84 e^-)

$1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^6 4d^{10} 4f^{14} 5s^2 5p^6 5d^{10} 6s^2 6p^4$

Z_{eff}	Radius	Ionization Energy	Electro-negativity	Electron Affinity	Metals vs. Nonmetals
200	200	200	200	200	200
400	400	400	400	400	400
600	600	600	600	600	600
800	800	800	800	800	800
1000	1000	1000	1000	1000	1000

Z_{eff} 200

What is the effective nuclear charge?

The attraction of the positively charged nucleus for a negatively charged electron that takes into account the shielding effect of the core electrons.

Z_{eff} 400

Which of the following has the greater effective nuclear charge, calcium or chlorine?

Cl

Z_{eff} 600

What is the formula for calculating effective nuclear charge and what do the variables mean?

$$Z_{eff} = Z - S$$

Z = nuclear charge

S = shielding (core electrons)

Z_{eff} 800

Explain the trend for effective nuclear charge going across a period.

Z_{eff} increases as you move across a period because electrons are being added to the same energy level so there is not added shielding, but protons are being added to the nucleus, so the nuclear charge is increasing.

Z_{eff} 1000

Explain the trend for effective nuclear charge going down a group.

Z_{eff} increases slightly as you move down a group because the nuclear charge greatly increases as we move down a group and as electrons are added to higher and higher energy levels that are farther from the nucleus, they are less capable of shielding the valence electrons.

Radius 200

Explain the trend for atomic radius as you move down a group.

Atomic radius increases as you move down a group because electrons are added to higher energy levels that are further away from the nucleus.

Radius 400

Explain the trend for atomic radius as you move across a period.

Atomic radius decreases as you move across a period because electrons are being added to the same energy level and Z_{eff} increases meaning that more protons are being added. The larger nuclear charge allows the nucleus a greater attraction to pull the electrons closer.

Radius 600

Put the following in order of increasing radius: K^+, Cl^-, Ca^{2+}, and S^{2-}.

Ca^{2+}, K^+, Cl^-, S^{2-}

Radius 800

Explain the trend for ionic radius as you move down a group.

Ionic radius increases as you move down a group because each time you move down, a new larger energy level is added that is farther from the nucleus.

Radius 1000

Explain the trend for ionic radius as you move across a period.

Cations are on the left side of the periodic table and lose valence electrons. Anions are on the right side of the periodic table and gain electrons. When moving from left to right in the cations, elements lose one more electron than the previous element but also gain one proton. Since cations lose electrons they are smaller than their parent atom and the protons pull the remaining electrons in. As more electrons are lost when moving left to right the increases nuclear charge causes the ionic radius to decrease.

Radius 1000 (con't)

Explain the trend for ionic radius as you move across a period.

Anions are larger than their parent atoms due to electron-electron repulsions from added electrons. Between cations and anions, there is an increase in ionic size. When moving from left to right in the anions, elements gain one less electron than the previous element. Since the electrons are being added to the same energy level but no protons are being added, electron-electron repulsions cause the electrons to spread out. As fewer electrons are added, this repulsion is smaller resulting in a decreases from left to right for anions. Overall, ionic radius decreases as you move across a period.

Ionization Energy 200

What is ionization energy?

Ionization energy is the energy needed to remove one electron from a gaseous atom.

Ionization Energy 400

Which element has the higher ionization energy, fluorine or bromine?

Fluorine

Ionization Energy 600

An element is on the third row of the periodic table and has the following ionization energies, what is the element?

$I_1 = 578$ $I_2 = 1817$ $I_3 = 2745$ $I_4 = 11{,}577$

Al

Ionization Energy 800

Explain the trend of ionization energy going down a group.

Ionization energy is the energy needed to remove an electron from a gaseous atom. Ionization energy decreases as you move down a group because you add larger energy levels which are farther from the nucleus. There is also increases shielding from a larger core of electrons. As a valence electron is farther from the nucleus and shielded by more electrons, it takes less energy to remove it because the nucleus has less of a pull.

Ionization Energy 1000

Explain the trend for ionization energy as you move across a period.

Ionization energy is the energy needed to remove one electron from a gaseous atom. As you move across a period, electrons are added to the same energy level and protons are added to the nucleus. Since electrons are added to the same energy level, there is no increases shielding. Since protons are added to the nucleus, the effective nuclear charge increases, so it takes more energy to remove an electron.

Electronegativity 200

What is electronegativity?

Electronegativity is the attraction of an atom in a compound for an electron.

Electronegativity 400

Which element is more electronegative, silicon or chlorine?

Cl

Electronegativity 600

Which element is more electronegative, nitrogen or gallium?

N

Electronegativity 800

Explain the trend for electronegativity as you move down a group.

Electronegativity is the attraction of an atom in a compound for an electron. As you move down a group, electrons are added to larger energy levels that are more shielded and farther from the nucleus. Since the electrons shared or transferred in a compound are valence shell (outer energy level) electrons, the nucleus down not have much attraction due to increased shielding and distance.

Electronegativity 1000

Explain the trend for electronegativity as you move across a period.

Electronegativity is the attraction of an atom in a compound for an electron. As you move across a period, electrons are added to the same energy level, so there is no increased shielding, but protons are added to the nucleus. Since there is an increase in nuclear charge with constant shielding, Z_{eff} increases. Since effective nuclear charge increases, the nucleus has more attraction fro the valence electrons, so the is more attraction for the valence electrons from another atom in order to gain a full octet.

Electron Affinity 200

What is the definition of electron affinity?

Electron affinity is the attraction of a gaseous atom for one extra electron.

Electron Affinity 400

Which element has the lower electron affinity, iodine or tin?

Sn

Electron Affinity 600

Which element has the higher electron affinity, sulfur or lead?

S

Electron Affinity 800

Explain the trend for electron affinity going across a period.

Electron affinity is the attraction of a gaseous atom for one extra electron. As you move across a period, electrons are added to the same energy level so shielding does not change. Protons are also added so the nuclear charge increases. Since nuclear charge increases and shielding remain constant, effective nuclear charge increases, so the attraction of the nucleus for the electrons increases. Electron affinity increases as you move across a period.

Electron Affinity 1000

Explain the trend for electron affinity going down a group.

Electron affinity is the attraction of a gaseous atom for one extra electron. As you go down a group, electrons are added to larger energy levels that are farther from the nucleus. This increases the shielding because it increases the amount of core electrons. Since the valence electrons are at a further distance from the nucleus with increased shielding, the nucleus has a lower attraction for the added electrons. Electron affinity decreases as you move down a group.

Metals vs. Nonmetals 200

Can noble gases from compounds? If so, which one(s)?

Yes, Xe and recently Ar.

Metals vs. Nonmetals 400

What are the colors of the first four halogens?

F = pale yellow
Cl = yellow-green
Br = reddish-brown
I = dark gray (purple vapors)

Metals vs. Nonmetals 600

Compare two physical characteristics of alkali metals and alkaline earth metals.

Alkali metals are soft and have low melting points. Alkaline earth metals are hard and have higher melting points.

Metals vs. Nonmetals 800

Explain how hydrogen can exist in 2 groups.

Hydrogen belongs in the alkali metals group (group 1) because it tends to form a +1 charge and has 1 valence electron, but it can also belong in the halogens group (group 17) because it can form a -1 charge and it only needs one more valence electron to have a complete octet.

Metals vs. Nonmetals 1000

List 5 characteristics of metals and nonmetals.

Metals	Nonmetals
Solids (except Hg)	Most are gases
Ductile	Brittle
Malleable	Poor conductors
Good conductors	Anions
Cations	Oxides are acidic
Oxides are basic	Reduced easily
Oxidized easily	