Problem Set 2: Atomic Structure: Isotopes, Ions, and Bonding

HCHE 111L: Introduction to Elementary Inorganic Chemistry

Due Date: Friday September 1st, 2017

Problem 1

Complete the following chart:

Symbol	# of protons	# of neutrons	# of electrons	Net Charge
	33	42		3+
$^{238}_{92}\mathrm{U}$				
	5	6		+1
$^{131}_{52}\mathrm{Te}$				
	75	111	77	
$^{20}_{9}\mathrm{F}^{2-}$				

Are any of these atoms isotopes? If so which ones?

Problem 2

Answer each of the following questions regarding atomic structure:

a) The isotope of plutonium used for nuclear fission is ^{238}Pu. Determine (a) the ratio of the number of neutrons in a ^{239}Pu nucleus to the number of protons and (b) the number of electrons in a single Pu atom.

b) The americium isotope ^{241}Am is used in smoke detectors. Describe the composition of a neutral atom of this isotope in terms of protons, neutrons, and electrons.

c) In 1982, the production of a single atom of $^{266}_{109}$Mt (meitnerium-266) was reported. Describe the composition of a neutral atom of this isotope in terms of protons, neutrons, and electrons.

Problem 3

Nitrogen (N) and silicon (Si) form two compounds with the following compositions:

Compound	Mass % N	Mass % Si
1	33.28	66.72
2	39.94	60.06

a) Compute the mass of silicon that combines with 1.000 g of nitrogen in each case.

b) Show that these compounds satisfy the law of multiple proportions. If the second compound has the formula Si_3N_4, what is the formula of the first compound.

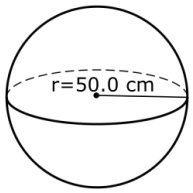
Problem 4

Use the following data in order to calculate the molar mass of naturally occuring sulfur

Isotope	Abundance	Mass(amu)
^{32}S	95.02%	31.972
^{33}S	0.75%	32.971
^{34}S	4.21%	33.968
^{36}S	0.02%	35.967

Problem 5

Consider a titanium (Ti) sphere with a radius of 50.0 cm, given that the density of titanium is 4.51 g/mL answer the following questions:



a) How many moles of Ti are present in the sphere?

b) How many atoms of Ti are present in the sphere?