GEOL3010 Mineral Stoichiometry Problem Set 4

1. For the following mineral chemical analyses, determine the mineral formula. Express cation formulae to three decimal places for a specific (integer) number of anions (oxygens). Example $(Mg_{0.891}Fe_{0.109})Si_{1.000}O_3$

a.

Oxide	Wt%	MWOx	Moles Oxide	Moles Cation	Moles Oxygen
SiO_2	42.7	60.086	0.7106	0.7106	1.4213
MgO	57.3	40.312	1.4214	1.4214	1.4214
	100.00				2.8427

Mole ratios Mg: Si: O = 2: 1: 4

Mg_2SiO_4

b.

Oxide	Wt%	MWOx	Moles Oxide	Moles Cation	Moles Oxygen
SiO_2	68.74	60.086	1.1440	1.1440	2.2881
Al_2O_3	19.44	101.963	0.1907	0.3813	0.5720
Na_2O	11.81	61.9796	0.1905	0.3811	0.1905
	100.00				3.0506

Mole ratios Na: Al: Si: O = 1: 1: 3: 8

$NaAlSi_3O_8$

c.

Oxide	Wt%	MWOx	Moles Oxide	Moles Cation	Moles Oxygen
SiO_2	52.65	60.086	0.8762	0.8762	1.7525
FeO	11.65	71.8464	0.1622	0.1622	0.1622
MgO	11.13	40.312	0.2761	0.2761	0.2761
CaO	24.57	55.96	0.4391	0.4391	0.4391
	100.00				2.6298 x 2.2815=6

$Ca(Mg_{.63}Fe_{.37})Si_2O_6$

GEOL3010 Mineral Stoichiometry Problem Set 2

2. The mineral pyrope is the magnesian end-member of the garnets. It has the chemical formula $Mg_3Al_2Si_3O_{12}$. Express this as weight percents of the appropriate oxides.

Oxide	Mols PFU	MWOx	Grams Oxide	Wt% Oxide
SiO2	3.0	60.086	180.258	44.71
Al2O3	1.0	101.963	101.963	25.29
MgO	3.0	40.312	120.936	30.00
			403.157	100.00

b. Complete crystalline solution exists between pyrope and almandine ($Fe_3Al_2Si_3O_{12}$). Garnet compositions are commonly expressed as mole percents of the end-members. A garnet that is 37mol% almandine and 63mol% pyrope may be abbreviated Pyr63Alm37. Express this composition as weight percentages of the appropriate oxides. (Is the iron ferrous (+2) or ferric (+3)? First, write out the formula!)

Formula: Mg_1.89_ Fe_1.11_ Al_2___ Si_3__ O_{12}

Oxide	Mols PFU	MWOx	Grams Oxide	Wt% Oxide
SiO_2	3.0	60.086	180.258	41.14
Al_2O_3	1.0	101.963	101.963	23.27
FeO	1.11	71.8464	79.749	18.20
MgO	1.89	40.312	76.190	17.39
			438.160	100.00