GEO 2303
February 5, 2008
Due: February 13, 2008

PROBLEM SET #2

1. Place these compounds in order of increasing ionic character:
   HF, H_2S, H_2O, HCl, HBr

2. What kind of coordination would you expect in SiO_2? FeS? CO_2?

3. If an Olivine has 25.37 weight % Mg and 14.57 weight % Fe, what are the mole fractions of Forsterite (Mg_2SiO_4) and Fayalite (Fe_2SiO_4) in this mineral?

4. The ionic radius of iron in Aegirine ($NaFeSi_2O_6$) is not the same as the ionic radius of iron in Hypersthene ($FeSiO_3$). Suggest an explanation for this.

5. Why is the coordination number of potassium in silicate minerals often higher than the coordination number of sodium?

6. Use Goldschmidt's rules to determine if Sr^{2+} could substitute for Ca^{2+} in Calcite (coordination #6) and Aragonite (coordination #8).

7. U^{4+} commonly substitutes for Zr^{4+} in Zircon, but Pb does not. Deduce the valence of Pb in magma from this observation.

8. What is the area of a trapezoid with the following dimensions: (propagate the error.)

   Top: 0.750±0.001 m
   Base: 1.500±0.001 m
   Height: 0.500±0.002 m

(continued on back)

9. You are attempting to date a mineral using the Rb-Sr method of dating. Given that the measured $^{87}Sr/^{86}Sr$ ratio is 0.955 ± 0.001 and its $^{87}Rb/^{86}Sr$ ratio is 62.5 ± 1.9, calculate the age of this mineral and the associated uncertainty using the following age equation,

$$t = \frac{\left(^{87}Sr/_{86}Sr\right) - \left(^{87}Sr/_{86}Sr\right)_i}{\lambda\left(^{87}Rb/_{86}Sr\right)}$$

where t is the time elapsed since the mineral formation, λ is the decay constant of ^{87}Rb, and $(^{87}Sr/^{86}Sr)_i$ is the initial $^{87}Sr/^{86}Sr$ ratio. Assume that $(^{87}Sr/^{86}Sr)_i = 0.704$ and $\lambda = 1.42 \times 10^{-11}\ y^{-1}$. You will need to propagate the error in the measured ratios to obtain the error in the age.