Benjamin Bass

Lab 03

**Part I:**

1. Make a tetrahedral site out of oxygen’s.
   1. What other cations would fit in there nicely?

Al (black): 0.53-0.68

1. Make an octahedral site out of oxygens.
   1. What other cations would fit in there nicely?

Al, Fe3+, Fe2+, Mg2+, Ca2+

1. Make a cubic site out of oxygens.
   1. What other cations would fit in there nicely?

Fe3+, Fe2+, Mg2+, Ca2+, Na1+

1. How many oxygens would it take to surround a K+? 8 or 12.
   1. What coordination polyhedral is this?

Cube or cubic octahedron.

**Part II:**

1. Use the wooden balls (representing a non-specific element) to show the **hexagonal closest packing** structure. Make three layers in a sample tray. The pattern of repeating layers in this structure is: A-B-A-B
2. Use the wooden balls (representing a non-specific element) to show the **cubic closest packing** structure. Make three layers in a sample tray. The pattern of repeating layers in this structure is: A-B-C-A-B-C
3. Use the wooden balls (representing a non-specific element) to show the **body centered cubic closest packing** structure. Make three layers in a sample tray. The pattern of repeating layers in this structure is: ABA?
4. Which one is the densest, most closely packed arrangement?

Most dense is Hexagonal Closest Packing

**Part III:**

1. As a class we will use the white plastic polyhedral to build some simple mineral structures and think about what this means for the Si:O ration in a given mineral.
   1. Pyroxene chain:

1:3

* 1. Amphibole chain:

4:11

* 1. 6-fold cyclosiliate ring

1:6

1. Look at the two mineral models at the front of the room and answer the following questions. You should use a book to look up the chemical formula (don’t use the formula written on the tag)
   1. **K-Feldspar**
      1. What are the two structural sites in this mineral?

Tetrahedral, Ninefold

* + 1. Using the chemical formula, assign each cation to one of the two structural sites.

IXKIV(Al Si3O8)

* + 1. If 60% of 9-fold site is Na and 40% is K, what is structural formula of the feldspar?

IXNa.60K.40 IV(Si3O8)

* + 1. If you substitute the 40% K with 40% ca… what must also change in the tetrahedral site to maintain charge balance? Write the new structural formula.

IXNa.60Ca.40 (Al1.4Si2.6O8)

* 1. **Biotite**
     1. What are the three structural sites in the mineral?

IV, V, VI

* + 1. Using the chemical formula, assign each cation to one of the structural sites.

VIK, V(Mg, Fe), IV(Si6Al2O20(OH)4

* + 1. If the 6-fold site is filled with 30% Fe and 70% Mg and the 4-fold site is 50% Si and 50% Al, what is the structural formula of the mineral?

VIK, V(Mg.70, Fe.30), IV(Si3AlO20(OH)4

K(Fe.30Mg.70)3 (Al2Si2)O10(OH)2) ->Ca2+(Fe.30Mg.70)3 (Al3+2Si2)O10(OH)2

Balance it

= XIIK1+ } IVSi4+ -><- IVAl3+ + XIICa2+

Part IV:

Open CrystalViewre. Go to Examples, then Minerals to find minerals for the following questions.

1. Biotite Physical Model
   1. Where is this plane? It is the layer where the 12-fold ion coordination is.

It is the layer where the 12-fold ion coordination is.

1. Open the Calcite file
   1. To what chemical class does this mineral belong? Remember that the chemical class is defined by the dominant anion.

Carbonates

* 1. What are the two structural sites in the mineral?

Octahedral & 3-Fold

* 1. Using the chemical formula, assign each cation to a structural site.

CaCo3?

1. Open the galena file.
   1. To what chemical class does galena belong? Remember that the chemical class is defined by the dominant anion.

Sulphide

* 1. What kind of bonding is displayed in this mineral structure?

Ionic?

* 1. What is the coordination number of Pb2+

6-Fold

* 1. What type of packing does this mineral display?

Close Packed Cubic

1. There is a mineral called halite, open it.
   1. To what chemical class does halite belong?

Halides

1. Open Olivine File
   1. What are the two structural sites in olivine?

VI & IV

* 1. Using the chemical formula, assign each cation to one of the structural sites.

VIMg IVFe

* 1. If 60% of the octahedral sites are filled with Fe and 40% are filled with Mg, write the structural formula.

VIMg.60 IVFe.40

* 1. If there was some K in the system, where would it fit in the olivine? What is your hunch about how much K a typical olivine has?

KMg Fe SiO

I assume it has very little, naturally.

1. Open the garnet file.
   1. What are the three structural sites in garnet?

VI & IV

* 1. On your homework, you put all the Fe in your garnet into the 8-fold site. In this example, where in the Fe? What charge must this Fe have?

In the 6th site. , 3+

1. Open the quartz file.
   1. What is the structural site in quartz?

IV

* 1. Why do you think that quartz does not develop cleavage planes and instead displays only conchoidal fracture?

Because there are no clear lines between the molecules along which to cleave.