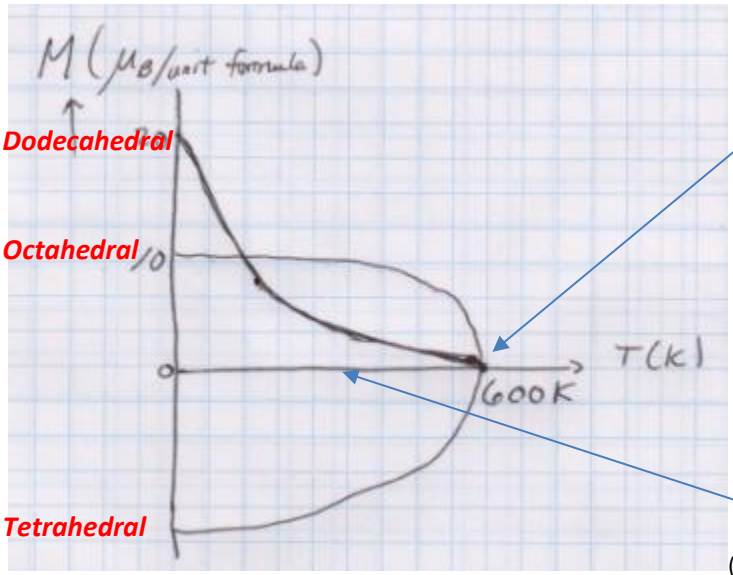
#12: Magnetics Question

1) (1 pt) Iron garnets ($X_3Fe_2Fe_3O_{12}$) are known for their excellent high frequency susceptibility. Why?
They are insulators so there are no eddy currents.

2) (2 pt) Rare-earth ($RE_xFe_2Fe_3O_{12}$) iron garnets have compensation temperatures at which their net magnetization is zero, and these compensation temperatures are below the Curie temperature. The cations (in order shown) are in three types of sublattices: dodecahedral, octahedral, and tetrahedral. Below is a graph of the magnetizations of each sublattice vs T.
   a. Identify which sublattice is which.
   b. Identify the Curie temperature
   c. Find the compensation temperature.
   d. Explain why the shapes of each sublattice curve. ***There is more exchange in octehdral and tetrahedral sublattices than dodecahedral, so there is less temperature dependence until T_{Curie}.***

(M in μ_B/unit formula)



T_{Curie}

Tcompensation is where $M_D+M_O+M_T=0$ at ~3000K
~10+ ~4+ ~-14= 0 μ_B

(T in Kelvin)

3) (1 pt) The anisotropy constants of garnet are:
K_1 = -3.95 kerg/cm^3
K_2 = -3.0 kerg/cm^3
Draw a polar plot of the crystal anisotropy E as a function of direction in the (001) plane of garnet. ***$E= K_o + K_1/4(\sin^2 2\theta)$ see below***