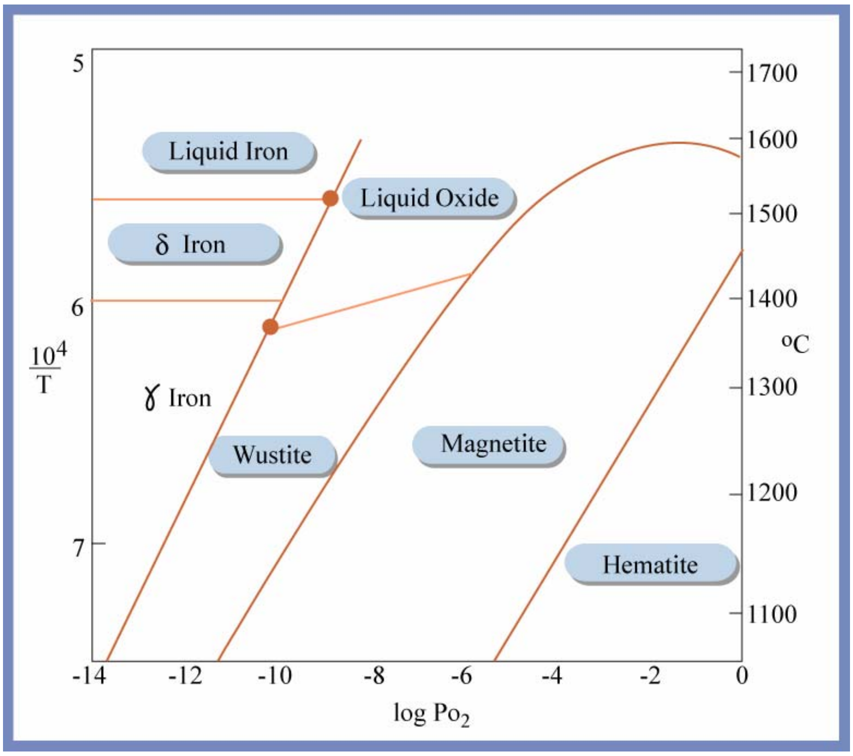
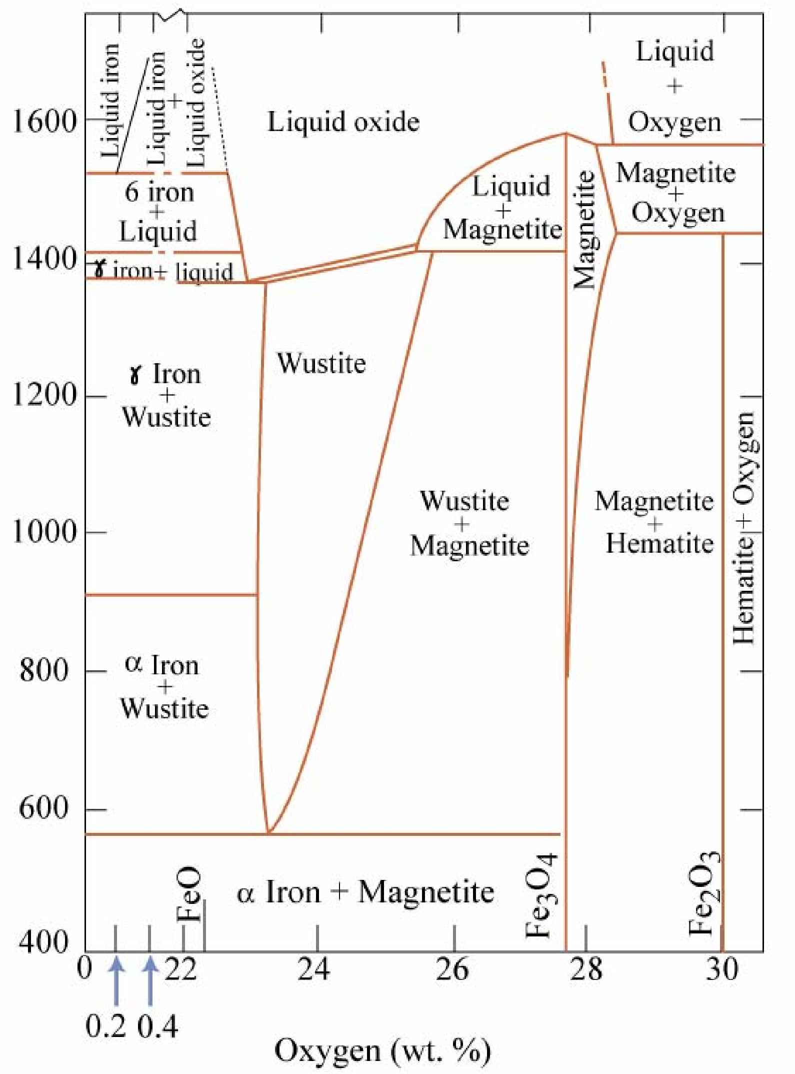
12.480

Problem Set #2

Using the two diagrams for the system Fe-O on the next page, generate a P-T grid (expressed as log p_{O2} vs 1/T) for all the possible invariant points and univariant curves. Notice that the condensed equilibria in the top diagram are horizontal. This should guide you in constraining the slopes of other similar equilibria. Take the critical point between the two liquids on the T-X diagram as 1700 °C. Using the p_{O2} vs 1/T diagram as a base, fill in the rest of the equilibria besides the ones involving gas. You will want to extend the limits of p_{O2} vs 1/T in your diagram. The third page gives you a hint. There are 14 types of invariant points in this system. The tricks are to figure out these 14 equilibria. Some of them will be degenerate. The accompanying page shows the different types of degeneracies that you have to deal with. If you get stuck – there is a nice paper written in 1968 by Lindsley, Speidel and Nafziger on Fe-Si-O that should be helpful.

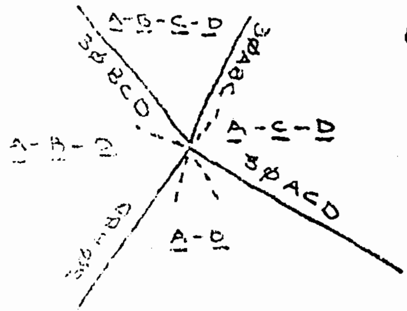




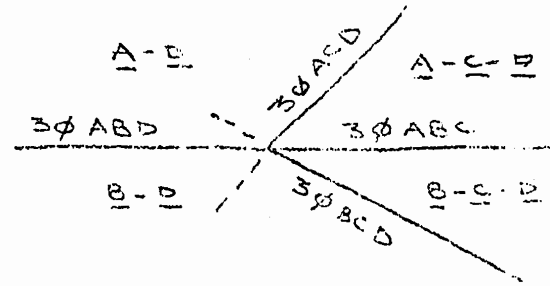
System Fe-Fe_1O_3; at a total pressure of one atmosphere.

Types of Invariant Points in the Fe-O Problem

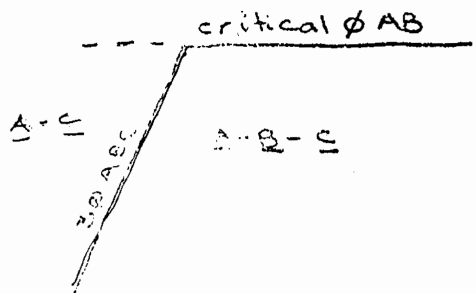
Type I General Quadruple Point (6)



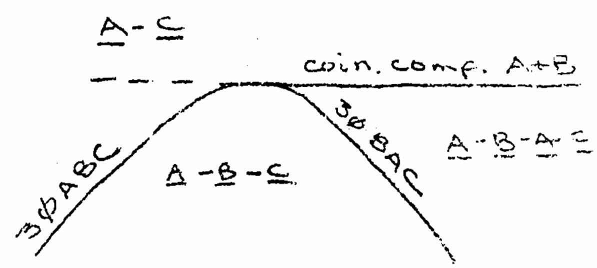
Type II Degenerate Quadruple (2)



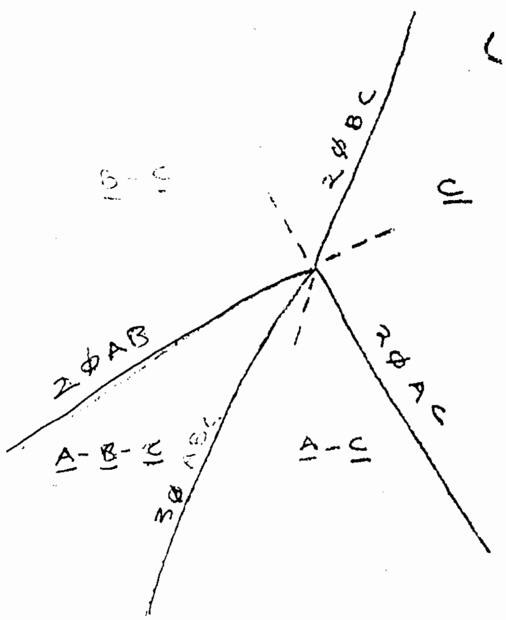
Type III Critical End Point (1)



Type IV Coincidence in Composition Line Meets Three Phase Equilibrium (2)



Type V 3φ Equilibrium Ends in One-Component Subsystem; only Phase A is a Pure Substance at all times (1)



Type VI 3φ Equilibrium Ends in One-Component Subsystem; Both Phases A and B are Pure Substances at All Times (2)