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1 a) What is the wt% Mn in a steel melt at 1650 C covered with a slag containing 45 wt% CaO, 10 wt% MgO, 20 wt% SiO_2, 2.5 wt% MnO, and 2.5 wt% FeO?
   b) If all the Mn were in the steel, it would total 0.1 %. If the slag/metal mass ratio is 0.2, what would be the final [%Mn]?

2. Write the chemical reaction for the removal of P from steel by oxidation and show how one would obtain an expression for a pseudo equilibrium constant (or partition constant) as a function of slag composition.

3. Si and steelmaking
   a) Draw
      i) a silica network with no basic components
      ii) a silica network with added basic components
   b) Discuss the absence of any [%Si]/(%Si) figures (data) for basic steelmaking reactions in the text. Include in your discussion why such a partition would be available as K_{Si} for reduction in the Blast Furnace but not for steelmaking basic processes.

4. When adding ferrochrome to produce stainless steel, would it be helpful to have
   a) high or low (%FeO)?
   b) large or small slag mass?

5. Derive a distribution expression of your own choosing that shows [%Mn]/(%Mn) variation with [C]. Be certain to include some discussion on how slag basicity affects the distribution. Note: the text states the ratio is related to $\sqrt{\%C}$. Discuss this statement with your proposed partition constant. (Scoring is based on your thinking rather than agreement with the text.)

6. Sulfur
   a) Write the reaction showing sulfur's distribution between slag and iron melt.
   b) A 1040 steel melt at 1600 °C in equilibrium with $\underline{O}$ and a P_{CO} at 1 atm according to the reaction

$$\underline{C} + \underline{O} = CO_{(g)} \quad K = 500$$

   Show how to determine (estimate) [%S] when the slag/steel mass ration is 0.1 and the slag basicity is 3.

7. Comparing the Standard Gibbs energies of formation of Mg, Ca, and Mn silicates in the Table 2.1 suggests that the activity coefficients of MgO, CaO, and MnO would have what relative values (all the same; $\gamma_{CaO} > \gamma_{MnO} > \gamma_{MgO}$; $\gamma_{MgO} > \gamma_{CaO} > \gamma_{MgO}$; etc) and WHY?