

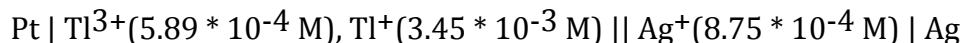
### Problem Set #3

Chem M3LC - Fall 2016.

\*You do not need a spreadsheet to complete any of these questions.

#### Question 1 – Electrochemistry

Consider the following electrochemical cell:



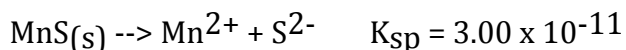
- Write down the two half cell reactions (as reductions) and the overall reaction for this electrochemical cell.
- Calculate the potential that you would expect to measure across this electrochemical cell. Assume room temperature and use  $(0.0592/n) \cdot \log(x)$  for your Nernst Equations.
- Is this cell electrolytic or galvanic?

#### Question 2 – EDTA Titrations

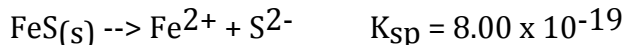
Calculate  $\text{pNi}$  ( $= -\log[\text{Ni}^{2+}]$ ) at the equivalence point of a titration of 50.00 ml of  $1.75 \times 10^{-3} \text{ M Ni}^{2+}$  by a  $1.75 \times 10^{-3} \text{ M EDTA}$  solution. Both solutions are buffered to a pH of 10.0, where the alpha fraction for  $\text{Y}^{4-}$  is 0.355. For the  $\text{NiY}^{2-}$  complex,  $\log K_f = 18.62$ .

#### Question 3 – Precipitation Separation

$\text{MnS}$  is a sparingly soluble solid in aqueous solution:



$\text{FeS}$  is also a sparingly soluble solid in aqueous solution:



Consider a solution that has both  $\text{Mn}^{2+}$  and  $\text{Fe}^{2+}$  each at a concentration of 1.00 mM. We can separate these two varying the pH because the sulfide ion ( $\text{S}^{2-}$ ) is the dianion of the diprotic acid  $\text{H}_2\text{S}$  ( $\text{pK}_1 = 7.01$  ;  $\text{pK}_2 = 13.89$ ). Given a total sulfide concentration of 0.100 M, find the following:

- a) At what pH will  $\text{FeS(s)}$  begin to precipitate?
- b) At what pH will  $\text{MnS(s)}$  begin to precipitate?
- c) What is the  $[\text{Fe}^{2+}]$  in solution at the pH you calculate in part b? What percentage of the  $\text{Fe}^{2+}$  remains in solution at that pH?