Answer the following questions in the space provided. Use pencil only. Do not scribble over unwanted answers; erase carefully. Show all work. If you show only the numerical answer, and the answer is not exactly right, you get no partial credit. Correct set-up of problems gets 80-90% credit regardless of whether the arithmetic is correct. Circle final numerical answers.

1) (20 points)
   a) Write the complete charge balance equation for a solution of MgBr₂.

   b) Write the mass balance expression for a 0.2 M solution of HCN, which is a weak acid.

2) The solubility product constant for magnesium hydroxide, \( K_{sp} = 1.8 \times 10^{-11} \)?
   a) (10 points) Calculate the molar solubility of magnesium hydroxide.

   b) (5 points) Explain how the solubility of magnesium hydroxide would change if a solution of the salt was 0.1 M in NaCl. Discuss the effects in terms of activities and activity coefficients.
3) (20 points) Strontium oxalate, SrC$_2$O$_4$, is a sparingly soluble salt with $K_{sp} = 5 \times 10^{-8}$. Use the systematic method to set up to find the solubility of SrC$_2$O$_4$ in water. The pH is **NOT** fixed. In other words, you're not going to actually determine the solubility; you're just going to set up the problem and show that it can (or cannot) be solved. Now, be careful here. What is the nature of C$_2$O$_4^{2-}$? 


4) (10 points) Explain how you could solve the expression shown below using Excel.

\[ x^2 = 1 \times 10^{-4} (c - x) \]

5) (15 points) List five important characteristics of a primary standard material.
6) (20 points) Define, explain, or otherwise describe the following:
   a) secondary standard

   b) goal seek

   c) activity

   d) charge balance equation

   e) indicator