

Chemistry 225 Semester 01-2012

Homework for Submission #5

Answer the following questions on lined paper and submit them for marking on or before 6 pm on Tuesday 10th April in the chemistry drop box. Use only one side of the paper. Only answers showing full working can attract full marks. Express your answer to the correct number of significant figures where appropriate. Homeworks showing evidence of copying will attract zero marks.

- 1) a) Explain the difference between *solubility* and *solubility product*. (4 marks)
- b) Write the chemical equation for the dissolution, and the expression for the solubility product, for each of the following: (6 marks)
 - i) MnCO_3
 - ii) $\text{Hg}(\text{OH})_2$
 - iii) $\text{Ca}_3(\text{PO}_4)_2$

- 2) Given that the solubility product of PbBr_2 is 4.0×10^{-5} . Calculate:
 - a) the molar solubility of PbBr_2 in water and (3 marks)
 - b) the solubility of PbBr_2 (in water) in g per 100 ml of solution. (2 marks)
 - c) the molar solubility of PbBr_2 in 0.10 M sodium bromide solution. (3 marks)

- 3) Write balanced half-equations to represent the oxidation and reduction reactions when acidified potassium dichromate solution is added to potassium iodide solution. The products include chromium(III) ions and iodine. Combine the half equations to produce a balanced net ionic equation. (6 marks)

- 4) The following is a list of some standard electrode potentials at 298K.

<i>HALF-CELL</i>	<i>E^o/Volt</i>
$\text{Zn}^{2+}(\text{aq}) \mid \text{Zn}(\text{s})$	-0.7618
$\text{Cu}^{2+}(\text{aq}) \mid \text{Cu}(\text{s})$	+0.3419
$\text{Fe}^{3+}(\text{aq}) \mid \text{Fe}^{2+}(\text{aq})$	+0.771
$\text{I}_2(\text{s}) \mid \text{I}(\text{aq})$	+0.5355
$\text{Ni}^{2+}(\text{aq}) \mid \text{Ni}(\text{s})$	-0.257
$\text{Sr}^{2+}(\text{aq}) \mid \text{Sr}(\text{s})$	-2.889
$\text{Sn}^{4+}(\text{aq}) \mid \text{Sn}^{2+}(\text{aq})$	+0.151
$\text{Cu}^{2+}(\text{aq}) \mid \text{Cu}^+(\text{aq})$	+0.153

The above potentials are measured relative to the electrode potential for the *standard* hydrogen half-cell: $\text{Pt}(\text{s}) \mid \text{H}^+(\text{aq}) \mid \text{H}_2(\text{g})$ at 25°C.

- a) What exactly is meant by the term *standard* in this context? What is the pH is such a half-cell? (3 marks)
- b) Consider the cell:

$$\text{Pt}(\text{s}) \mid \text{Fe}^{2+}(\text{aq}, 1\text{M}), \text{Fe}^{3+}(\text{aq}, 1\text{M}) \parallel \text{Zn}^{2+}(\text{aq}, 1\text{M}) \mid \text{Zn}(\text{s})$$
 - c) Write down the chemical equation which corresponds to this cell diagram. (1 mark)
 - d) Calculate the e.m.f. of the cell. (2 marks)
 - e) Calculate the equilibrium constant for the reaction. (2 marks)
 - f) Write down a balanced equation for the reaction *actually occurring* in the cell. (Make sure that you have the correct *direction* of reaction) and state which electrode is the cathode. (1 mark)
 - g) Calculate the e.m.f. of the cell when all concentrations are reduced to $1.0 \times 10^{-3}\text{M}$. (2 marks)