Redox Titrations

1. Which of the following could be used to determine the [Fe^{+2}] by a redox reaction?

   A. I_2 B. Cl^- C. Cu^{2+} D. MnO_4^- (acidified)

2. Which of the following could be used to determine the acidified [BrO_3^-] by a redox reaction?

   A. NO_3^- (acidified) B. I^- C. Cu^{2+} D. MnO_4^- (acidified)

3. Which of the following could be titrated using acidified MnO_4^- ions?

   A. Na^+ B. IO_3^- C. SO_4^{2-} D. H_2O_2

4. The titration of a $25.0\ mL$ $SnCl_2$ sample, in acidic solution, requires $14.4\ mL$ of $0.030\ M$ $K_2Cr_2O_7$. The balanced equation for the reaction is shown below:

   $$Cr_2O_7^{2-} + 14H^+ + 3Sn^{2+} \rightarrow 3Sn^{4+} + 2Cr^{3+} + 7H_2O$$

   What is the number of moles of $SnCl_2$ in the original sample?

   A. $1.4 \times 10^{-4}\ mol$ B. $4.3 \times 10^{-4}\ mol$ C. $1.3 \times 10^{-4}\ mol$ D. $5.2 \times 10^{-2}\ mol$

5. A $10.0\ mL$ water sample was analyzed for [Fe^{+2}] using a redox titration with acidified $KMnO_4$. The equation for the reaction is: $MnO_4^- + 5Fe^{2+} + 8H^+ \rightarrow Mn^{2+} + 5Fe^{3+} + 4H_2O$

   A $10.0\ mL$ sample was titrated with $12.5\ mL$ of $0.10\ M$ $KMnO_4$ solution. What is the [Fe^{+2}] in the water sample?

   A. $0.025\ M$ B. $0.13\ M$ C. $0.28\ M$ D. $0.63\ M$

Please do the following on a separate piece of paper.

6. Acidified potassium permanganate ($KMnO_4$) solution is often used in redox titrations. Permanganate reacts with Sn^{+2} as follows: $2MnO_4^- + 5Sn^{2+} + 16H^+ \rightarrow 2Mn^{2+} + 5Sn^{4+} + 8H_2O$

   A $10.0\ mL$ solution containing Sn^{+2} is titrated with $19.3\ mL$ of $0.10\ M$ $KMnO_4$. What is the [Sn^{+2}]?

7. In the process of extracting tin from a sample of ore, the tin is removed as Sn^{2+} ions. A titration requires $21.43\ mL$ of $0.0170\ M$ $K_2Cr_2O_7$ to reach the equivalence point with the Sn^{2+} in a $0.750\ g$ sample of the ore.

   $$3Sn^{2+} + Cr_2O_7^{2-} + 14H^+ \rightarrow 3Sn^{4+} + 2\ Cr^{3+} + 7H_2O$$

   Using the reaction above, calculate the percent mass of tin in the ore sample.

8. Consider the following redox reaction in acidic solution:

$$KMnO_4 + H_2O_2 + H_2SO_4 \rightarrow K_2SO_4 + MnSO_4 + H_2O + O_2$$

a. Balance the above redox reaction.

b. The above reaction was used for a redox titration. At the equivilence point $5.684 \times 10^{-4}\ mol$ $KMnO_4$ was required to titrate $5.00\ mL$ of H_2O_2 solution. Calculate $[H_2O_2]$.

9. A titration is performed to determine the $[Fe^{+2}]$ in $25.00\ mL$ of an $FeSO_4$ solution. It requires $22.52\ mL$ of $0.015\ M$ $KMnO_4$ to reach the equivilence point in which Mn^{+2} and Fe^{+3} are produced.

a. balance the redox reaction: $MnO_4^- + Fe^{2+} \rightarrow Mn^{2+} + Fe^{3+}$ (acidic)

b. Calculate the $[Fe^{+2}]$