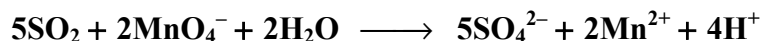


Chem 2 AP Homework #4-6: Problems pg. 155-156 #4.90-4.96 (even)

- 90 Explain why potassium permanganate ( $\text{KMnO}_4$ ) and potassium dichromate ( $\text{K}_2\text{Cr}_2\text{O}_7$ ) can act as internal indicators in redox titrations.

The  $\text{MnO}_4^-$  and  $\text{Cr}_2\text{O}_7^{2-}$  ions both change colors when reduced, so their color in the reaction flask acts as an indicator of their presence when they are just in excess.

- 92 The concentration of  $\text{SO}_2$  in air can be determined by titrating against a standard permanganate solution as follows:

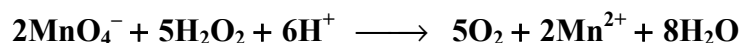


Calculate the number of grams of  $\text{SO}_2$  in a sample of air if 7.37 mL of 0.00800 M  $\text{KMnO}_4$  solution are required for the titration.

$$? \text{ mol KMnO}_4 = 7.37 \text{ mL} \times \frac{0.00800 \text{ mol KMnO}_4}{1000 \text{ mL soln}} = 5.90 \times 10^{-5} \text{ mol KMnO}_4$$

$$5.90 \times 10^{-5} \text{ mol KMnO}_4 \times \frac{5 \text{ mol SO}_2}{2 \text{ mol KMnO}_4} \times \frac{64.07 \text{ g SO}_2}{1 \text{ mol SO}_2} = \boxed{9.45 \times 10^{-3} \text{ g SO}_2}$$

- 94 The concentration of hydrogen peroxide can be determined by titration against a standardized potassium permanganate solution in acidic medium:



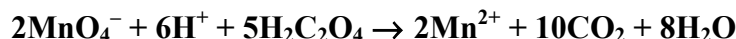
If 36.44 mL of a 0.01652 M  $\text{KMnO}_4$  solution are required to oxidize 25.00 mL of a  $\text{H}_2\text{O}_2$  solution, calculate the molarity of the  $\text{H}_2\text{O}_2$  solution.

$$? \text{ mol KMnO}_4 = 36.44 \text{ mL} \times \frac{0.01652 \text{ mol KMnO}_4}{1000 \text{ mL soln}} = 6.020 \times 10^{-4} \text{ mol KMnO}_4$$

$$? \text{ mol H}_2\text{O}_2 = 6.020 \times 10^{-4} \text{ mol KMnO}_4 \times \frac{5 \text{ mol H}_2\text{O}_2}{2 \text{ mol KMnO}_4} = 1.505 \times 10^{-3} \text{ mol H}_2\text{O}_2$$

$$\text{Molarity of H}_2\text{O}_2 = \frac{1.505 \times 10^{-3} \text{ mol H}_2\text{O}_2}{0.02500 \text{ L}} = \boxed{0.06020 \text{ M}}$$

- 96 If 24.0 mL of 0.0100 M  $\text{KMnO}_4$  solution is needed to titrate 1.00 g of a sample of  $\text{H}_2\text{C}_2\text{O}_4$  (oxalic acid) to the equivalence point by the following reaction:



what is the percent by mass of  $\text{H}_2\text{C}_2\text{O}_4$  in the sample?

$$? \text{ mol KMnO}_4 = 24.0 \text{ mL} \times \frac{0.0100 \text{ mol KMnO}_4}{1000 \text{ mL soln}} = 2.40 \times 10^{-4} \text{ mol KMnO}_4$$

$$? \text{ g H}_2\text{C}_2\text{O}_4 = 2.40 \times 10^{-4} \text{ mol KMnO}_4 \times \frac{5 \text{ mol H}_2\text{C}_2\text{O}_4}{2 \text{ mol KMnO}_4} \times \frac{90.04 \text{ g H}_2\text{C}_2\text{O}_4}{1 \text{ mol H}_2\text{C}_2\text{O}_4} = 0.0540 \text{ g H}_2\text{C}_2\text{O}_4$$

$$\text{mass \%} = \frac{0.0540 \text{ g}}{1.00 \text{ g}} \times 100\% = \boxed{5.40\% \text{ H}_2\text{C}_2\text{O}_4}$$