Name KEY Redox titration problem sets

$$5H_2O_2 + 2KMnO_4 + 3H_2SO_4 \rightarrow 5O_2 + 2MnSO_4 + 8H_2O + K_2SO_4$$

(hydrogen peroxide) (potassium permanganate) (sulfuric acid) (oxygen) (manganese sulfate) (water) (potassium sulfate)

1. If it takes 10.0 mL of 0.025 M $KMnO_4$ to oxidize 1.00 mL of H_2O_2 solution, what is the % of H_2O_2 in the solution? (Assume the H_2O_2 solution has a density of 1.00 g/mL)

$$\frac{.025 \text{ mol}}{1 \text{ L solution}} \times .01 \text{ L} = .00025 \text{ mol } KMnO_4 \left| \frac{5 \text{ mol } H_2O_2}{2 \text{ mol } KMnO_4} \right| \frac{34.02 \text{ g } H_2O_2}{1 \text{ mol } H_2O_2}$$

$$= \frac{.021625 \text{ g } H_2O_2}{1.00 \text{ g solution}} \times 100 = 2.1\%$$

2. If it takes 14.85 mL of 0.025 M $KMnO_4$ to oxidize 1.00 mL of H_2O_2 solution, what is the % of H_2O_2 in the solution? (Assume the H_2O_2 solution has a density of 1.00 g/mL)

$$\frac{.025 \text{ mol}}{1 \text{ L solution}} \times .01485 \text{ L} = .00037125 \text{ mol } KMnO_4 \left| \frac{5 \text{ mol } H_2O_2}{2 \text{ mol } KMnO_4} \right| \frac{34.02 \text{ g } H_2O_2}{1 \text{ mol } H_2O_2}$$

$$= \frac{.031556 \text{ g } H_2O_2}{1 \text{ g solution}} \times 100 = 3.2\% \ H_2O_2$$

3. If it takes 24.25 mL of 0.10 M $KMnO_4$ to oxidize 3.00 mL of H_2O_2 solution, what is the % of H_2O_2 in the solution? (Assume the H_2O_2 solution has a density of 1.00 g/mL)

$$\frac{.10 \text{ mol } KMnO_4}{1 \text{ L solution}} \times .02425 \text{ L solution} = .002425 \text{ mol } KMnO_4 \left| \frac{5 \text{ mol } H_2O_2}{2 \text{ mol } KMnO_4} \right| \frac{34.02 \text{ g } H_2O_2}{1 \text{ mol } H_2O_2} =$$

$$= \frac{.20624 \text{ g } H_2O_2}{3.00 \text{ g solution}} \times 100 = 6.9\% \ H_2O_2$$

4. If it takes 8.65 mL of 0.20 M $KMnO_4$ to oxidize 2.00 mL of H_2O_2 solution, what is the % of H_2O_2 in the solution? (Assume the H_2O_2 solution has a density of 1.00 g/mL)

$$\frac{.20 \text{ mol } KMnO_4}{1 \text{ L solution}} \times .00865 \text{ L solution} = .00173 \text{ mol } KMnO_4 \left| \frac{5 \text{ mol } H_2O_2}{2 \text{ mol } KMnO_4} \right| \frac{34.02 \text{ g } H_2O_2}{1 \text{ mol } H_2O_2} =$$

$$= \frac{.147365 \text{ g } H_2O_2}{2.00 \text{ g Solution}} = 7.4\% \ H_2O_2$$

$$5H_2O_2 + 2KMnO_4 + 3H_2SO_4 \rightarrow 5O_2 + 2MnSO_4 + 8H_2O + K_2SO_4$$

(hydrogen peroxide) (potassium permanganate) (sulfuric acid) (oxygen) (manganese sulfate) (water) (potassium sulfate)

5. If it takes 5.00 mL of $KMnO_4$ solution to oxidize 1.00 mL of 30.0% hydrogen peroxide, what is the concentration (M) of the $KMnO_4$ solution? (Assume the H_2O_2 solution has a density of 1.00 g/mL)

$$\frac{30\text{ g } H_2O_2}{100\text{ ml solution}} \times 1.00\text{ ml solution} = .3\text{ g } H_2O_2 \left| \frac{1\text{ mol } H_2O_2}{34.02\text{ g } H_2O_2} \right. = .008818\text{ mol } H_2O_2$$

$$.008818\text{ mol } H_2O_2 \left| \frac{2\text{ mol } KMnO_4}{5\text{ mol } H_2O_2} \right. = .003527\text{ mol } KMnO_4 \Big/ .005\text{ L solution} = .705\text{ M } KMnO_4$$

6. If it takes 28.00 mL of $KMnO_4$ solution to oxidize 2.00 mL of 3.0% hydrogen peroxide, what is the concentration (M) of the $KMnO_4$ solution? (Assume the H_2O_2 solution has a density of 1.00 g/mL)

$$\frac{3\text{ g } H_2O_2}{100\text{ mL solution}} \times 2.00\text{ mL solution} = .06\text{ g } H_2O_2 \left| \frac{1\text{ mol } H_2O_2}{34.02\text{ g } H_2O_2} \right. = .0017636\text{ mol } H_2O_2$$

$$.0017636\text{ mol } H_2O_2 \left| \frac{2\text{ mol } KMnO_4}{5\text{ mol } H_2O_2} \right. = .00070546\text{ mol } H_2O_2 \Big/ .028\text{ L solution} = .025\text{ M } KMnO_4$$

A buret filled with a 0.025 M solution of $KMnO_4$ is used to titrate a hydrogen peroxide solution of unknown concentration. The data are shown below.

Molarity of $KMnO_4$ solution	0.025 M
Initial buret reading (mL)	10.00
Final buret reading (mL)	28.00
Volume of H_2O_2 solution in flask under buret (density = 1.00 g/mL)	1.40 mL

7. What is the % H_2O_2 in the hydrogen peroxide solution?

$$\frac{.025\text{ mol } KMnO_4}{1000\text{ ml solution}} \times 18.00\text{ mL solution} = .00045\text{ mol } KMnO_4 \left| \frac{5\text{ mol } H_2O_2}{2\text{ mol } KMnO_4} \right. = .001125\text{ mol } H_2O_2$$

$$.001125\text{ mol } H_2O_2 \left| \frac{34.02\text{ g } H_2O_2}{1\text{ mol } H_2O_2} \right. = .03827\text{ g } H_2O_2 \Big/ 1.40\text{ ml} \times 100 = 2.7\%\ H_2O_2$$