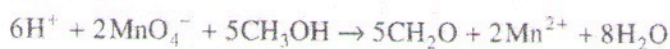


Redox Practice (Titrations)

Short Answer - write your response in the space provided.
Express your answer in correct sig figs & units where appropriate.

1. A technician tests the concentration of methanol, CH_3OH , in diluted windshield washer fluid using a redox titration. A 25.00 mL sample is titrated with 14.50 mL of 0.0200 M KMnO_4 . Determine the concentration of methanol in the sample given the following redox reaction:

K^+ is spectator



(3 marks)

① Balanced reaction: ✓

② Convert known to moles:

$$0.0200 \frac{\text{mol MnO}_4^-}{\text{L}} \times 0.01450 \text{ L} = 0.00029 \text{ mol MnO}_4^-$$

③ Stoich to unknown:

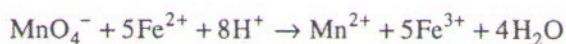
$$0.00029 \text{ mol MnO}_4^- \times \frac{5 \text{ mol CH}_3\text{OH}}{2 \text{ mol MnO}_4^-} = 0.000725 \text{ mol CH}_3\text{OH}$$

④ $[\text{CH}_3\text{OH}]$ in mol/L

$$\frac{0.000725 \text{ mol CH}_3\text{OH}}{0.02500 \text{ L}} = \frac{0.0290 \text{ M}}{(3 \text{ S.F.})}$$

2.

An impure sample of iron was dissolved in acid. The Fe^{2+} in this solution was titrated with 0.0210 M KMnO_4 . Use the following data table and redox equation to determine the moles of Fe^{2+} in the sample. (3 marks)



TRIAL	VOLUME KMnO_4
1	37.26 mL
2	35.18 mL
3	35.22 mL

$$\begin{aligned} \text{avg. } \Delta \text{ volume} &= \frac{35.18 \text{ mL} + 35.22 \text{ mL}}{2} \\ &= 35.20 \text{ mL KMnO}_4^- \end{aligned}$$

① Balanced Reaction: ✓

② moles known:

$$0.0210 \frac{\text{mol}}{\text{L}} \text{MnO}_4^- \times 0.03520 \text{ L} = 0.0007392 \text{ mol MnO}_4^-$$

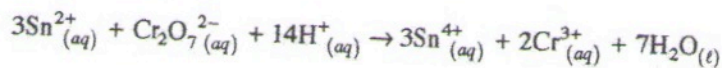
③ Stoich:

$$0.0007392 \text{ mol MnO}_4^- \times \frac{5 \text{ mol Fe}^{2+}}{1 \text{ mol MnO}_4^-} = 0.003696 \text{ mol Fe}^{2+}$$

④ moles Fe^{2+} : ✓

$$0.00370 \text{ moles Fe}^{2+} \\ \text{(3 s.f.)}$$

3. 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 $\text{K}_2\text{Cr}_2\text{O}_7$ to reach the equivalence point with the Sn^{2+} in a 0.750 g sample of the ore.



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

(4 marks)

$$\begin{aligned} \% \text{ mass} &= \frac{\text{g Sn}^{2+}}{\text{g tin ore sample}} \times 100 \\ &= \frac{?}{0.750 \text{ g}} \times 100 \end{aligned}$$

① Balanced reaction: ✓

② moles known:

$$0.0170 \frac{\text{mol Cr}_2\text{O}_7^{2-}}{\text{L}} \times 0.02143 \text{ L} = 0.00036431 \text{ mol Cr}_2\text{O}_7^{2-}$$

③ Stoich to get moles Sn^{2+}

$$0.00036431 \text{ mol Cr}_2\text{O}_7^{2-} \times \frac{3 \text{ mol Sn}^{2+}}{1 \text{ mol Cr}_2\text{O}_7^{2-}} = 0.00109... \text{ mol Sn}^{2+}$$

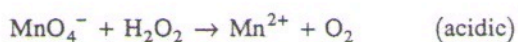
④ grams Sn^{2+} ?

$$0.00109... \text{ mol Sn}^{2+} \times \frac{118.7 \text{ g Sn}^{2+}}{1 \text{ mol Sn}^{2+}} = 0.1297... \text{ g}$$

$$\% \text{ mass} = \frac{0.1297... \text{ g Sn}^{2+}}{0.750 \text{ g ore}} \times 100$$

$$= 17.3 \% \text{ (3 S.F.)}$$

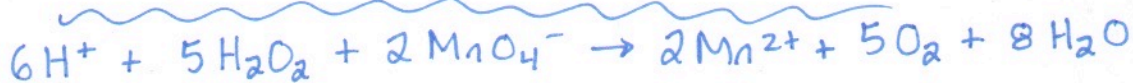
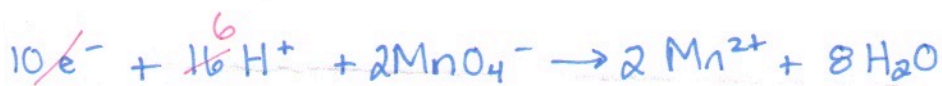
4. Consider the following redox reaction in acidic solution:



a) Write a balanced equation for the above reaction.

(4 marks)

Tip (get half reactions from data table then just make # e⁻ equal)



b) The above reaction was used for a redox titration. At the equivalence point 5.684×10^{-4} mol KMnO_4 was required to titrate 5.00 mL of H_2O_2 solution. Calculate the $[\text{H}_2\text{O}_2]$.

(2 marks)

① Balanced Reaction ✓ ② moles known ✓

③ stoich to moles unknown

$$5.684 \times 10^{-4} \text{ mol MnO}_4^- \times \frac{5 \text{ mol H}_2\text{O}_2}{2 \text{ mol MnO}_4^-} = 0.001421 \text{ mol H}_2\text{O}_2$$

④ $[\text{H}_2\text{O}_2]$ in mol/L

$$= \frac{0.001421 \text{ mol H}_2\text{O}_2}{0.00500 \text{ L}}$$

$$= 0.2842 \text{ M}$$

$$\begin{aligned} \text{Answer} &= [\text{H}_2\text{O}_2] \\ &= 0.284 \text{ M} \\ & \quad (3 \text{ s.f.}) \end{aligned}$$