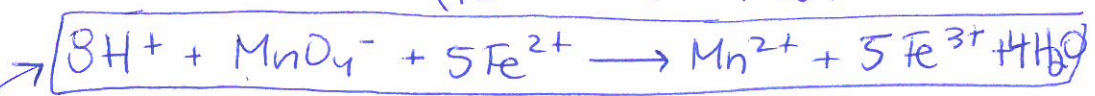
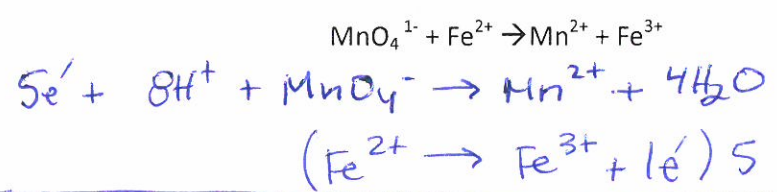


Name: Key
 Pd: _____ Date: _____

Chemistry 12 Lesson #7 Redox Titrations

Balance the following redox reaction (in acid solution):

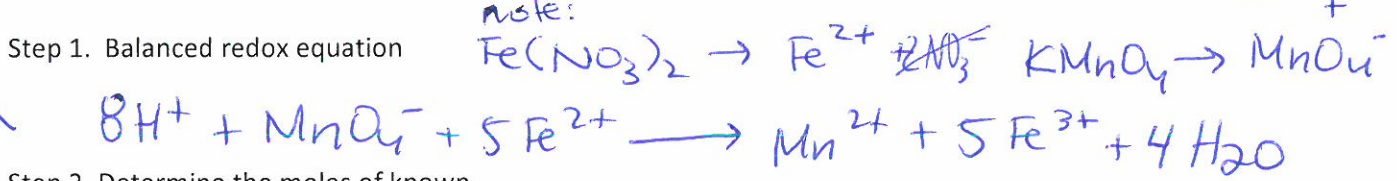


When MnO_4^{1-} is reduced to Mn^{2+} there is a colour change. MnO_4^{1-} is purple and Mn^{2+} is colourless. So in a titration the MnO_4^- undergoes reduction and becomes colourless. When you see the colour purple in the solution you have reached the equivalence point, and you STOP titrating.

Note: Spectator ions are chemical species that are present in a reaction but they do not participate. As an analogy, before you get you learn to drive your parents must bring you to your sporting events. They are there but they do not play in the game.

Examples: for this unit: $\text{K}^+ / \text{Cs}^+ / \text{Li}^+ / \text{Rb}^+ / \text{Na}^+$
 $\text{NO}_3^- / \text{SO}_4^{2-} / \text{F}^- / \text{Cl}^-$

When 20.0 mL of unknown concentration of $\text{Fe}(\text{NO}_3)_2$ is titrated with 15.25 mL of 0.100 M KMnO_4 (under acid conditions colour change is observed. What is the concentration of the $\text{Fe}(\text{NO}_3)_2$?



Step 2. Determine the moles of known

$$0.01525 \text{ L} \times 0.100 \text{ mol MnO}_4^- = 0.001525 \text{ mol MnO}_4^-$$

Step 3. Cross the mole bridge to determine moles of unknown

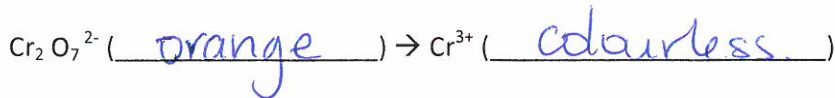
$$0.001525 \text{ mol MnO}_4^- \times \frac{5 \text{ mol Fe}^{2+}}{1 \text{ mol MnO}_4^-} \times \frac{1 \text{ mol Fe}(\text{NO}_3)_2}{1 \text{ mol Fe}^{2+}} = 0.007625 \text{ mol Fe}(\text{NO}_3)_2$$

Step 4. Calculate the unknown concentration

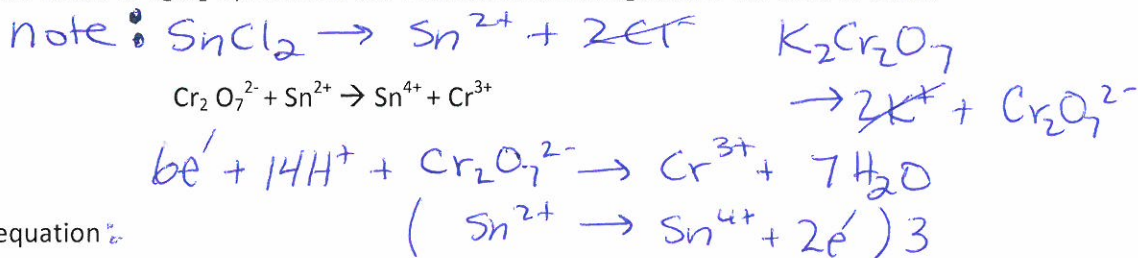


$$M = \frac{0.007625 \text{ mol Fe}(\text{NO}_3)_2}{0.0200 \text{ L}} \therefore \boxed{0.381 \text{ M Fe}(\text{NO}_3)_2}$$

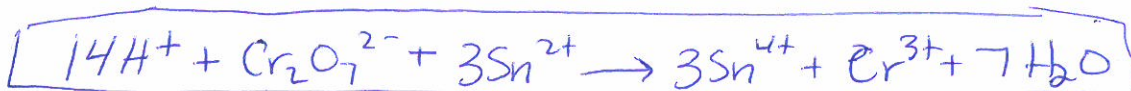
Another common substances used in redox titrations is the reduction of $\text{Cr}_2\text{O}_7^{2-}$ to Cr^{3+} under acid conditions.



A titration is performed with an unknown volume of a 0.50 M sample of SnCl_2 in an acidic solution. The titration requires 15.0 mL of 0.030 M $\text{K}_2\text{Cr}_2\text{O}_7$. What is the volume of the SnCl_2 used if the UNBALANCED redox reaction is:



Step 1. Balanced redox equation:



Step 2. Determine the moles of known

$0.0150 \text{ L} \times \frac{0.030 \text{ mol } \text{Cr}_2\text{O}_7^{2-}}{1 \text{ L}} = 0.00045 \text{ mol } \text{Cr}_2\text{O}_7^{2-}$

Step 3. Cross the mole bridge to determine moles of unknown

$4.5 \times 10^{-4} \text{ mol } \text{Cr}_2\text{O}_7^{2-} \times \frac{3 \text{ mol } \text{Sn}^{2+}}{1 \text{ mol } \text{Cr}_2\text{O}_7^{2-}} \times \frac{1 \text{ mol } \text{SnCl}_2}{1 \text{ mol } \text{Sn}^{2+}} =$

Step 4. Calculate the unknown volume



$h = \frac{0.00135 \text{ mol } \text{SnCl}_2}{0.50 \text{ M } \text{SnCl}_2}$

$= 0.0027 \text{ L or } 2.7 \text{ mL}$