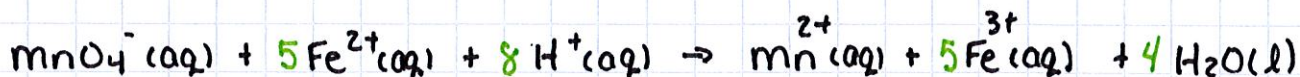


10. Titration - used to determine the concentration of a particular solute in a solution.

- involves combining a sample of the solution in question w/ another solution of known concentration.
- used w/ acid-base, precipitation, or redox reactions
- equivalence point - point at which stoichiometric equivalent quantities have reacted.

Ex) A sample of iron ore is dissolved in an acid and the iron is converted to  $\text{Fe}^{2+}$ . The sample is titrated with 47.20 mL of .02240 M  $\text{MnO}_4^-$  solution. The redox reaction is:



A. How many moles of  $\text{MnO}_4^-$  were added to the solution?

$$n = .02240 \text{ M} \cdot .04720 \text{ L} = .00106 \text{ mol } \underline{\text{MnO}_4^-}$$

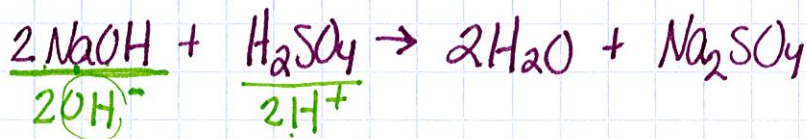
B. How many moles of  $\text{Fe}^{2+}$  were in the sample?

$$.00106 \text{ mol } \underline{\text{MnO}_4^-} \left( \frac{5 \text{ mol } \text{Fe}^{2+}}{1 \text{ mol } \text{MnO}_4^-} \right) = .00529 \text{ mol } \text{Fe}^{2+}$$

C. How many grams of iron were in the sample?

$$.00529 \text{ mol } \text{Fe}^{2+} \left( \frac{56 \text{ g}}{1 \text{ mol}} \right) = .296 \text{ g } \text{Fe}$$

Ex) what is the molarity of a sodium hydroxide solution if 48.0 mL is needed to neutralize 35.0 mL of .144 M  $\text{H}_2\text{SO}_4$ ?



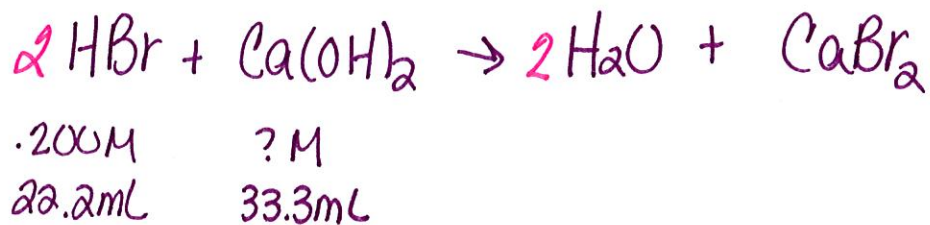
$$M_A V_A = M_B V_B$$

$$2M_B (48.0 \text{ mL}) = (\cancel{2} \cdot .144 \text{ M}) (35.0 \text{ mL})$$

$$M_B = \frac{.210}{2} = .105 \text{ M}$$

$$.00504 \text{ mol } \text{H}_2\text{SO}_4 \left( \frac{2 \text{ mol } \text{NaOH}}{1 \text{ mol } \text{H}_2\text{SO}_4} \right) = \frac{.0101 \text{ mol } \text{NaOH}}{.048 \text{ L}} = .210 \text{ M}$$

What is the molarity of  $\text{Ca}(\text{OH})_2$  needed if 33.3 mL is needed to neutralize 22.2 mL of .200 M HBr?



$$\begin{aligned} &= .00444 \text{ mol HBr} \left( \frac{1 \text{ mol Ca}(\text{OH})_2}{2 \text{ mol HBr}} \right) = \frac{.00222 \text{ mol Ca}(\text{OH})_2}{.0333 \text{ L}} \\ &= .0667 \text{ M} \end{aligned}$$

$$M_A V_A = M_B V_B$$

$$(.200 \text{ M})(22.2 \text{ mL}) = 2 M_B (33.3 \text{ mL})$$

$$.0667 \text{ M} = M_B$$