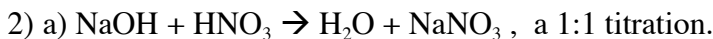
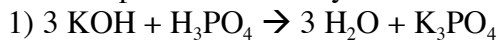


Practice problems 7b Key:



At equiv. point: # mol H^+ donated = # mol H^+ accepted

$$\text{Thus, \# mol HNO}_3 = \text{\# mol NaOH ; or } M_{\text{HNO}_3} V_{\text{HNO}_3} = M_{\text{NaOH}} V_{\text{NaOH}}$$

$$[\text{NaOH}] = M_{\text{NaOH}} = \frac{M_{\text{HNO}_3} V_{\text{HNO}_3}}{V_{\text{NaOH}}} = \frac{0.500\text{M}(20.0\text{mL})}{25.0\text{mL}} = 0.400\text{M}$$

$$\text{b) } [\text{HNO}_3]_{\text{excess}} = \frac{\text{mol HNO}_{3,\text{excess}}}{\text{total vol}} = \frac{M_{\text{HNO}_3} V_{\text{HNO}_3}}{V_{\text{HNO}_3} + V_{\text{NaOH}}} = \frac{(.500\text{M})(5.00\text{mL})}{(25.0\text{mL} + 25.0\text{mL})} = .0500\text{M}$$

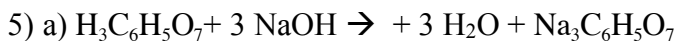
$$\begin{aligned} \text{c) } [\text{NaOH}]_{\text{remaining}} &= \frac{\text{mol NaOH}_{\text{remaining}}}{\text{total vol}} = \frac{n_{\text{NaOH, total}} - n_{\text{NaOH, reacted}}}{V_{\text{total}}} = \\ &= \frac{M_{\text{NaOH}} V_{\text{NaOH}} - M_{\text{HNO}_3} V_{\text{HNO}_3}}{V_{\text{HNO}_3} + V_{\text{NaOH}}} = \frac{.400\text{M}(25.0\text{mL}) - .500\text{M}(15.0\text{mL})}{(25.0\text{mL} + 15.0\text{mL})} = 0.0625\text{M} \end{aligned}$$

$$\text{3) a) } [\text{CaSO}_4] = \frac{0.209\text{g}}{0.100\text{L}} \frac{1\text{ mol}}{136.1\text{g}} = 0.0154\text{ M}$$

b) grams undissolved = 0.455 – grams dissolved

$$= .455 - (50.0\text{mL H}_2\text{O})(.209\text{g}/100\text{mL H}_2\text{O}) = 0.3505 = 0.351\text{g}$$

$$\text{4) } M_{\text{HCl}} = \frac{M_{\text{NaOH}} V_{\text{NaOH}}}{V_{\text{HCl}}} = \frac{.210\text{M}(16.5\text{mL})}{25.0\text{mL}} = 0.139\text{M}$$



b) at equiv pt: #mol H^+ donated = # mol H^+ accepted

$$\text{Or, \# mol H}_3\text{C}_6\text{H}_5\text{O}_7 \times 3 = \text{\# mol NaOH}$$

Or since $n=MV$: $3M_1V_1 = M_2V_2$ where 1 = citric acid, 2 = NaOH

$$\text{So } M_1 = \frac{M_2 V_2}{3V_1} = \frac{0.160\text{M}(28.4\text{mL})}{3(32.0\text{mL})} = 0.0473\text{M}$$

$$\text{c) \#g H}_3\text{C}_6\text{H}_5\text{O}_7 = 0.0320\text{L}(0.0473\text{mol/L})(192.1\text{g/mol}) = 0.291\text{g}$$

$$\text{d) } [\text{NaOH}] = \frac{(5.00\text{mL})(0.160\text{M})}{(32.0 + 28.4 + 5.00)\text{mL}} = 0.0122\text{M}$$