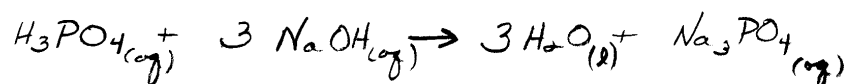


CHEM 210 – Titrations 1

① In a titration, 21.05 mL of a 0.175 M NaOH is required to fully titrate a 30.0 mL sample of phosphoric acid, H_3PO_4 .

A) Write the balanced equation for the reaction that takes place.



B) Is there a limiting reagent? Explain.

No - In a titration, just enough of the titrating solution is added to fully react with the titrant

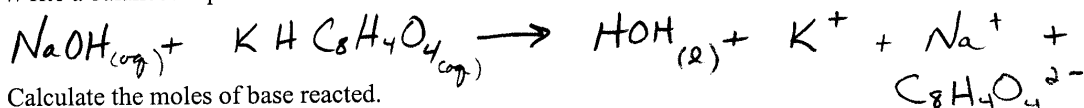
C) Calculate the molarity of the phosphoric acid solution.

$$\frac{21.05 \text{ mL} / 1000 \text{ mL NaOH}}{0.175 \text{ mol NaOH}} \times \frac{1 \text{ mol H}_3\text{PO}_4}{3 \text{ mol NaOH}} = 0.001228 \text{ mol H}_3\text{PO}_4$$

$$\frac{0.001228 \text{ mol}}{0.0300 \text{ L}} = \boxed{0.0409 \text{ M}}$$

② A student masses out 1.3009-g of potassium hydrogen phthalate (KHP). KHP has the formula $\text{KHC}_8\text{H}_4\text{O}_4$, where only the first hydrogen is acidic. The student dissolves the sample in about 25-mL of water and titrates the acid with sodium hydroxide solution. If 41.20 mL of NaOH solution are required:

A) Write a balanced equation for the reaction.



B) Calculate the moles of base reacted.

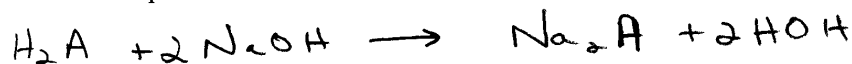
$$\frac{1.3009 \text{ g KHP}}{204.22 \text{ g KHP}} \times \frac{1 \text{ mol KHP}}{1 \text{ mol KHP}} \times \frac{1 \text{ mol NaOH}}{1 \text{ mol KHP}} = 0.0063701 \text{ mol}$$

C) Calculate the [NaOH].

$$[\text{NaOH}] = \frac{0.0063701 \text{ mol NaOH}}{0.04120 \text{ L soln}} = 0.1546 \text{ M}$$

③ The student then uses this standardized NaOH solution to determine the molar mass of an unknown diprotic acid. If a 1.015-g sample dissolved in (25-mL water) requires 22.62 mL of the NaOH solution to fully react with it:

A) Write a balanced equation for the reaction.



B) Calculate the moles of acid reacted.

$$\frac{0.02262 \text{ L NaOH}}{1 \text{ L soln}} \times \frac{0.1546 \text{ mol NaOH}}{1 \text{ L soln}} \times \frac{1 \text{ mol H}_2\text{A}}{2 \text{ mol NaOH}} = 0.001749 \text{ mol}$$

C) Calculate the molar mass of the acid.

$$\text{Molar mass} = \frac{1.015 \text{ g}}{0.001749 \text{ mol}} = 580.4 \text{ g/mol}$$