# Titration Example

This video will show you how to complete a titration calculation.

(slide transition)

First, we need to look at a problem. A 25 mL sample of acetic acid is titrated to the equivalence point with 19.35 mL of 0.200 M $Ba(OH)_2$. What is the concentration of the acetic acid solution? Because acid-base titrations are worked just like stoichiometry problems, the first thing we need to do is find the balanced chemical equation.

Let's get our reactants first. We have acetic acid plus barium hydroxide, and our products for a acid-base reaction are a salt and water. We'll go ahead and write our water portion, and now we need to figure out the formula of our salt. Well, the OH in $Ba(OH)_2$ was used to form the water, as well as the H in acetic acid. So what we have left are $CH_3COO$ and Ba. Remember that barium has a 2+ charge, which means that we need 2 acetate ions (which each have a 1- charge) for every barium atom, so that it is a neutral compound.

Now we need to balance the equation. First, we look at the acetate group, since we never break it up. And we see on the right that we have two acetate ions, but only one on the left, so I need to add a two in front of that. Now I can look at my hydrogen atoms (not counting those in the acetate ions, since those have already been counted); we have four total hydrogens on the left, but only two on the right, so we add a two in front of the water. There is one barium on each side, and two oxygens on each side. We now have a balance equation [ $2CH_3COOH(aq) + Ba(OH)_2(aq) \rightarrow 2H_2O(l) + (CH_3COO)_2Ba(aq)$ ], so we can proceed with our calculations.

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Whenever we're doing a stoichiometry problem, we always start with our known items; in this case, our barium hydroxide is our known. We have 19.35 mL $Ba(OH)_2$, which can be converted to liters; we also know that the molarity is 0.200 moles per liter. Since we have liters on top, we'll want liters on the bottom. Now comes our mole ratio: for every one mole of $Ba(OH)_2$, we have two moles of acetic acid. This gives us 0.00774 moles of acetic acid. It's always a good idea to set up the problem this way; many times students us $m_1v_1 = m_2v_2$ - however, that should **only** be used for dilutions. The mole ratio is often forgotten, resulting in the wrong answer, so always set these problems up as a stoichiometry problem, not a dilution problem.

Now we know the moles of acetic acid, and we know that the formula for molarity equals moles of solute over liters of solution, so I can plug that value in (0.00774), and on the bottom, I know that I started with 25 mL of solution, which must be converted to liters (.025 L). This gives 0.3096 M, which rounded to the correct number of sig figs (3) is 0.310 M.

If you have questions or need help with titration problems, talk to your TA, go to the Learning Center, or talk to the lab supervisor.