VCL: 4-4: Predicting the Equivalence Point

Titrations provide a method of quantitatively measuring the concentration of an unknown solution. In an acid-base titration, this is done by delivering a titrant of known concentration into an analyte of known volume. To make a titration more efficient and more accurate, it is often important to be able to predict the equivalence point for the titration. In this assignment, you will be given 0.3000 M HCl and 0.3000 M NaOH, you will predict the equivalence point, and then perform the titration to check your prediction.

1. Start *Virtual ChemLab* and select *Predicting the Equivalence Point* from the list of assignments. The lab will open in the Titrations laboratory.

2. Click the *Lab Book* to open it. Click the *Buret Zoom View* window to bring it to the front. The buret is filled with 0.3000 M NaOH. The beaker has 25.00 mL of 0.3000 M HCl. The pH meter is turned on and has been calibrated. The indicator is bromocresol green.

3. *Predict what volume (mL) of 0.3000 M NaOH is required to titrate the 25.00 mL of 0.3000 M HCl to the equivalence point?*

4. *Perform the titration.* Click the **Save** button in the *Buret Zoom View* window so the titration data can be saved. The horizontal position of the orange handle is off for the stopcock. Open the stopcock by pulling down on the orange handle. The vertical position delivers solution the fastest with three intermediate rates in between. Turn the stopcock to one of the fastest positions. Observe the titration curve. When the blue line in the graph window (the pH curve) begins to turn up, double-click the stopcock to turn it off. Move the stopcock down one position to add volume drop by drop.

    There are two methods for determining the volume at the equivalence point: (1) Stop the titration (close the stopcock) when a color change occurs, and then click the **Stop** button in the *Buret Zoom View*. A blue data link will appear in the lab book. Click the blue data link to open the *Data View* window. Scroll down to the last data entry and record the volume at the equivalence point. OR (2) Add drops slowly through the equivalence point until the pH reaches approximately 12. Click the **Stop** button in the *Buret Zoom View*. A blue data link will appear in the lab book. Click the blue data link to open the *Data View* window. Click **Select All** button to copy and paste the data to a spreadsheet program. Plot the first derivative of pH vs. volume. The peak will indicate the volume of the equivalence point since this is where the pH is changing the most rapidly as the volume changes.

5. *What volume of 0.3000 M NaOH was required by the titration to reach the equivalence point?*

6. *Calculate the percent error of the predicted volume using the formula:*

$$\% \ Error = \frac{\left| your \ predicted \ answer - your \ actual \ answer \right|}{your \ predicted \ answer} \times 100$$

    % Error =

If you want to repeat the titration, click *Exit*, select this problem from the workbook again, and repeat the experiment.