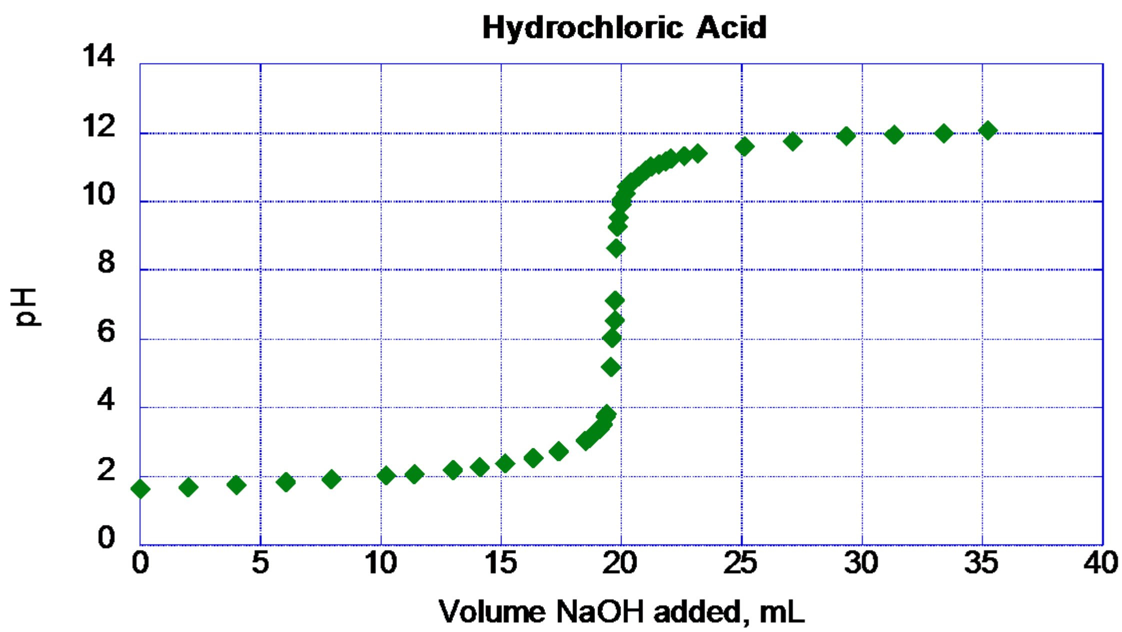
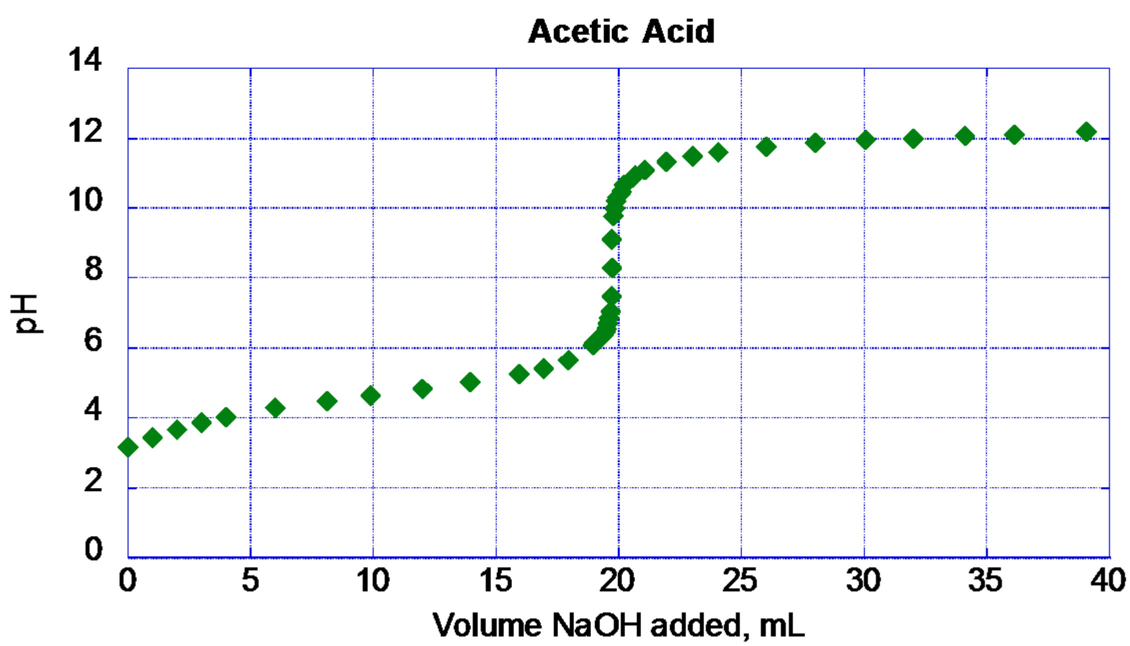
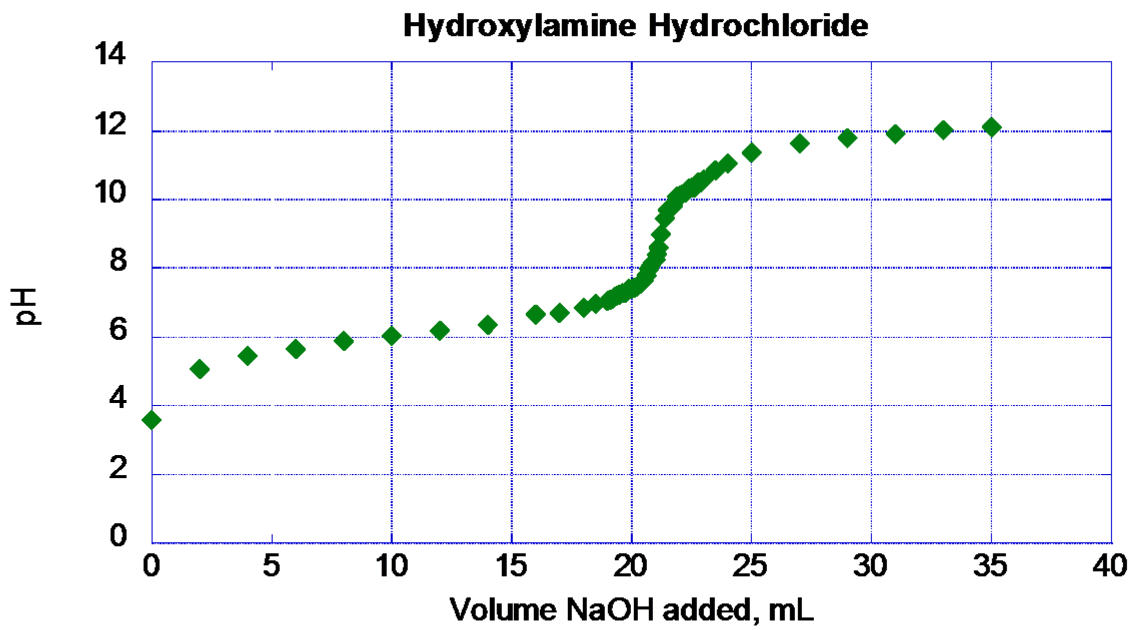
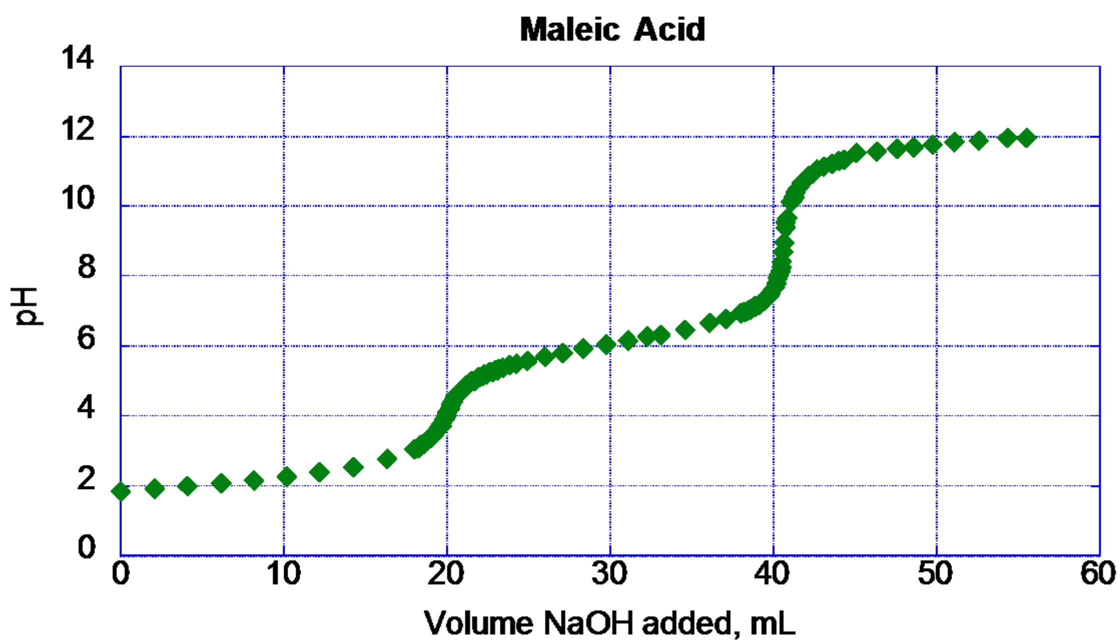
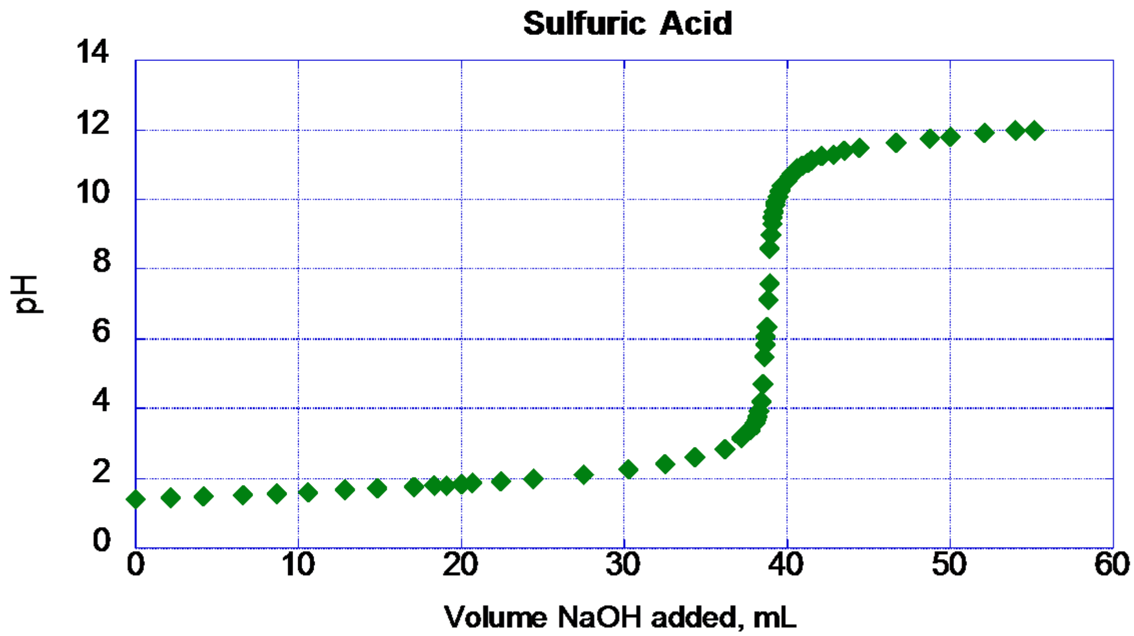
Figure S1. Representative titration curves from previous week's experiment. In each experiment, 20 mL of 0.1 M acid is added to a 400 mL beaker, with 100 mL of distilled water. The pH is monitored by a pH meter, and 0.1 M NaOH is delivered dropwise with a buret.

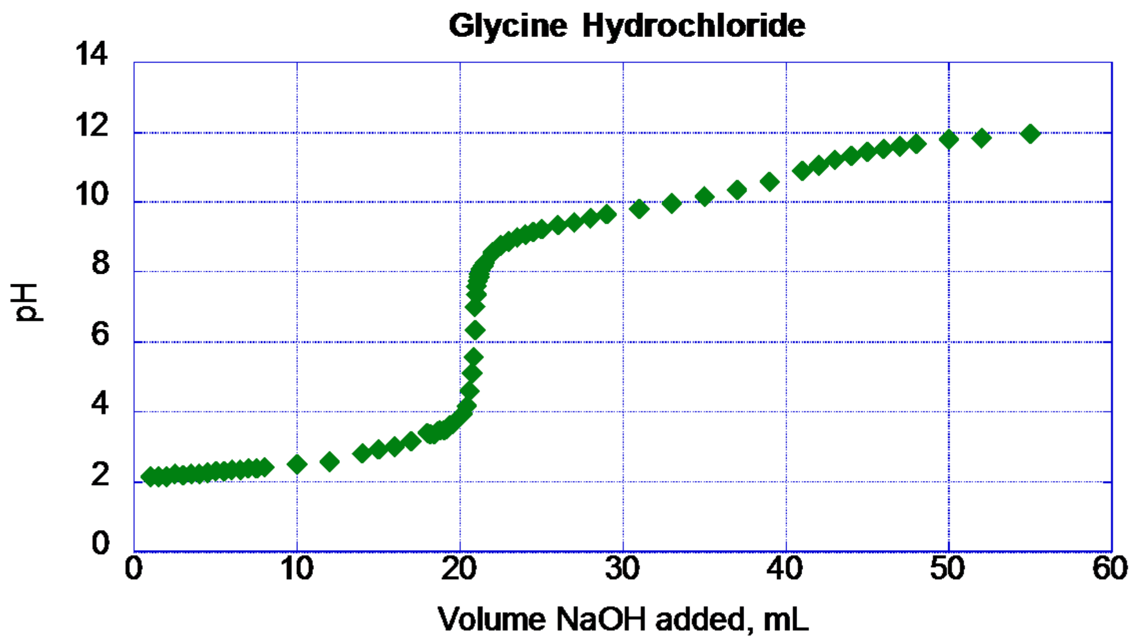





Hydroxylamine Hydrochloride
14
12
10
8
6
4
2
0
pH
0
5
10
15
20
25
30
35
40
Volume NaOH added, mL


Maleic Acid
14
12
10
8
6
4
2
0
pH
0
10
20
30
40
50
60
Volume NaOH added, mL


Sulfuric Acid
pH
Volume NaOH added, mL
0
2
4
6
8
10
12
14
0
10
20
30
40
50
60


Glycine Hydrochloride
pH
Volume NaOH added, mL
0
2
4
6
8
10
12
14
0
10
20
30
40
50
60

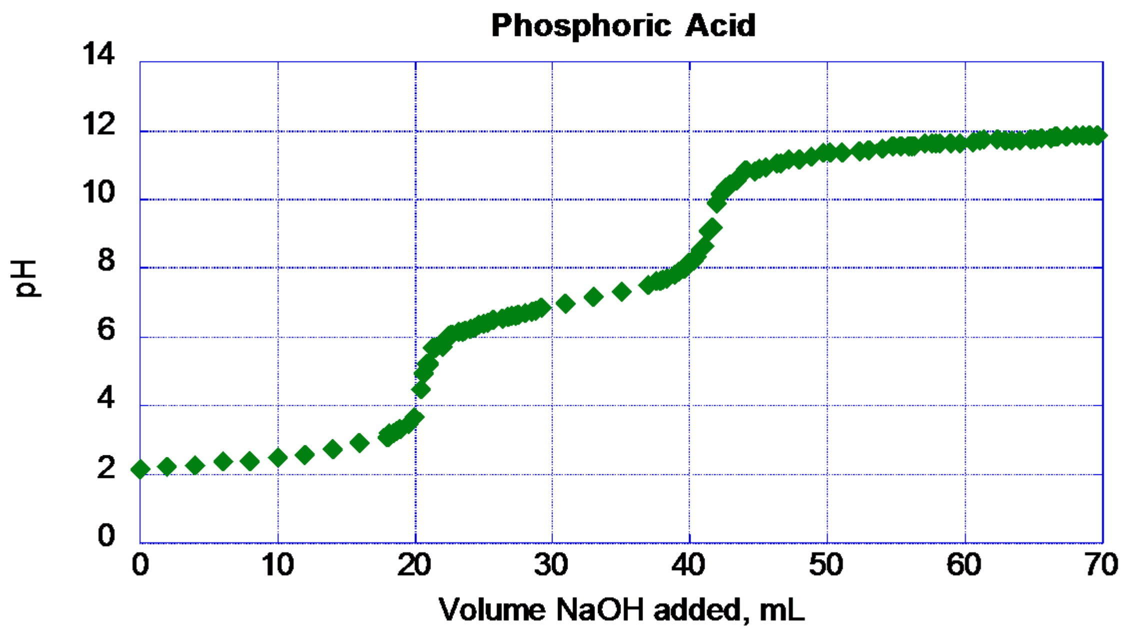

Phosphoric Acid
14
12
10
8
6
4
2
0
pH
0
10
20
30
40
50
60
70
Volume NaOH added, mL

Figure S2. Plot of pH as a function of molar ratio of conjugate base to acid for ammonia/ammonium (▲), Tris/TrisHCl (●), and acetate/acetic acid (■). Students create mixtures of 0.5 M acid and conjugate base solutions using volumetric glassware and measure the pH of the resulting solutions.

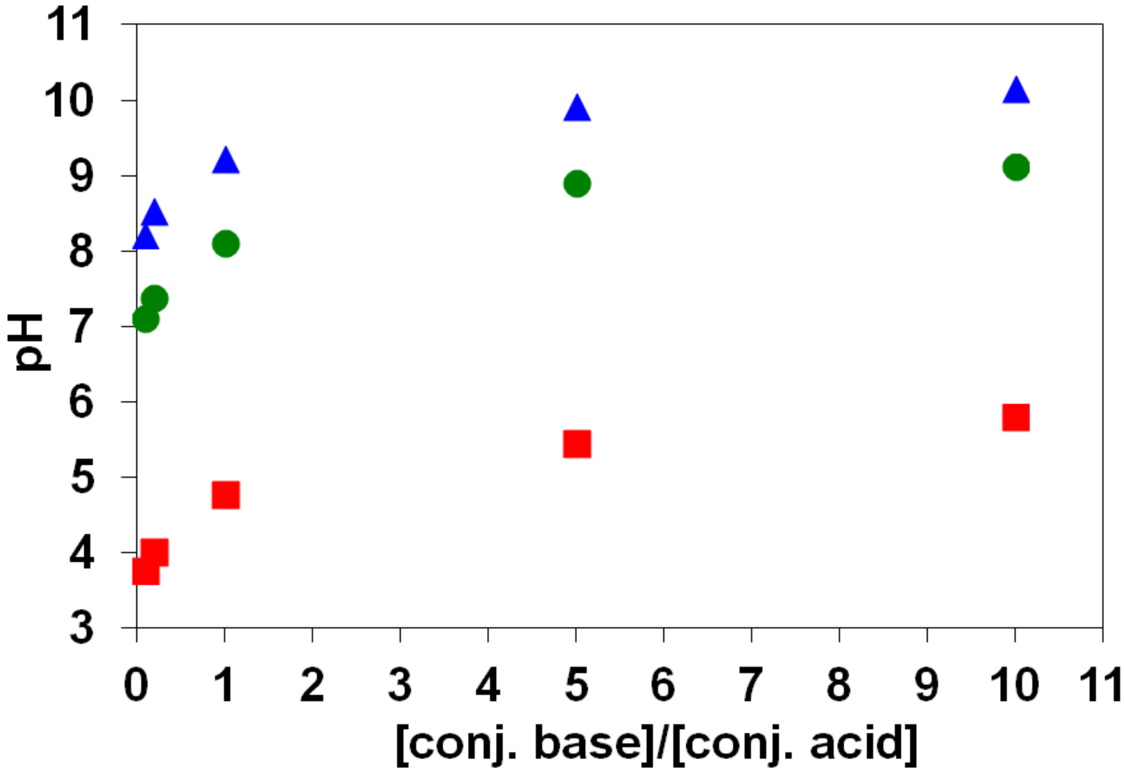


Figure S3. Representative student data showing the addition of concentrated HCl or NaOH to a stoichometric mixture of acetic acid/acetate (top graph, ■), TrisHCl/Tris (bottom graph, ●) or distilled water (◆). Students make two separate 20 mL solutions by combining 10 mL of 0.5 M acid and 10 mL of 0.5 M conjugate base. They measure the pH of each solution, then add 10 mL of 0.1 M HCl to one solution and 10 mL of 0.1 M NaOH to the other, mix, and measure the pH again. They also add 10 mL of 0.1 M HCl to 20 mL of water in one beaker, and 10 mL of 0.1 M NaOH in another beaker, and measure the pH of each.

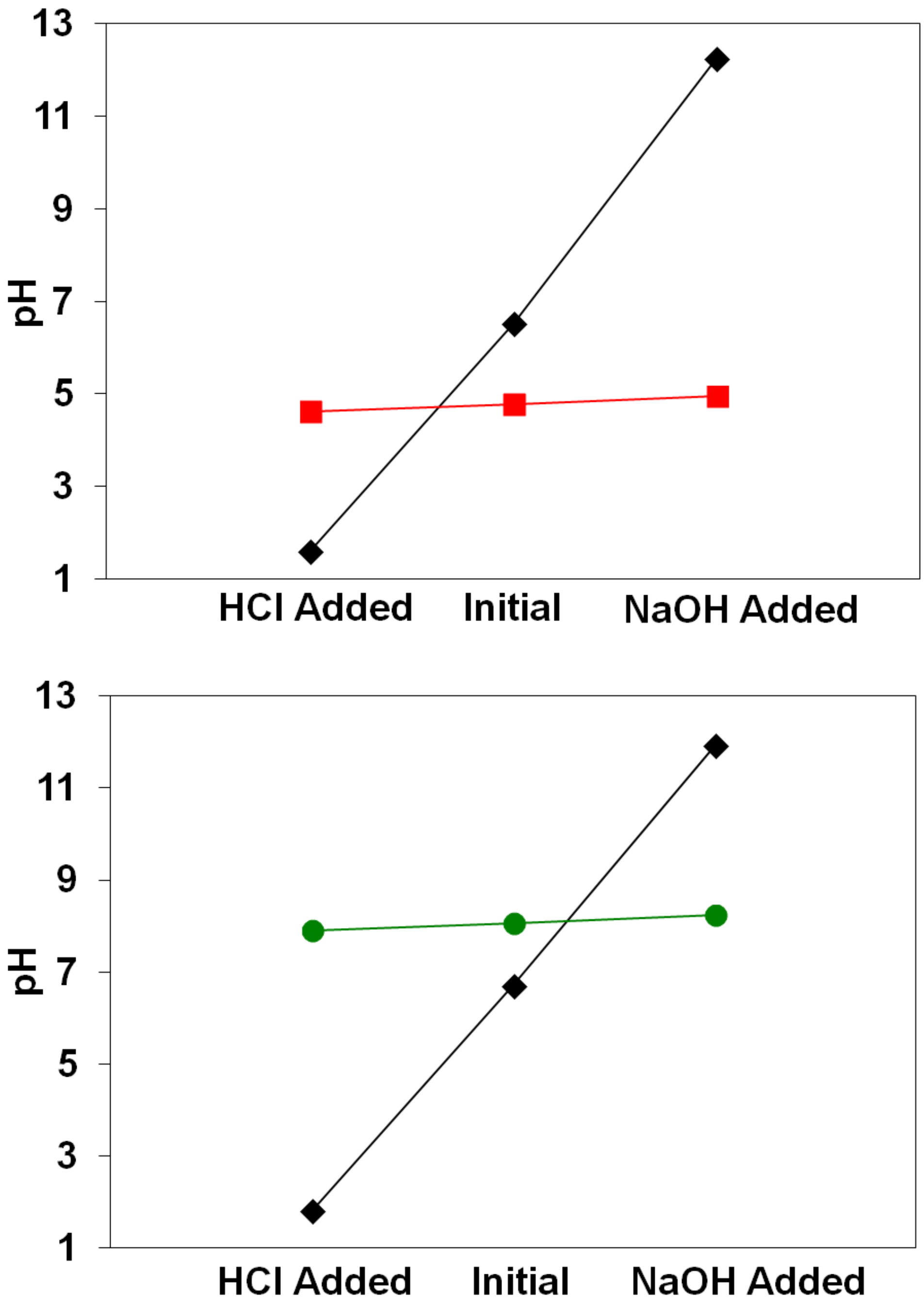


Figure S4. Representative student data showing the influence of dilution on a solution of a) top graph, acetic acid/acetate (▲), acetate (●) or acetic acid (■), or b) bottom graph, TrisHCl/Tris (▲), Tris (●) or TrisHCl (■). Students add 10 mL of 0.5 M acid to 10 mL of 0.5 M conjugate base and mix. They pipet 5 mL of this solution into a 50 mL volumetric flask and bring to volume with water. They transfer this solution to a beaker, and repeat the 10-fold dilution. The same two dilutions are performed with the 0.5 M acid and 0.5 M conjugate base solutions, and the pH of each solution is measured with the pH meter.