U2L10 Chemistry

Kitchen Table Titration Lab

2016-03-20

The purpose of this lab was to apply and extend our knowledge of titration and neutralization reactions. By using cabbage juice as a pH indicator, we can perform neutralization reactions to find the volume of one substance required to neutralize the pH of another. In this instance, a known concentration of vinegar and water, and baking soda and water were gradually mixed until an equivalence point of 7 pH was reached. The data from this experiment follows.

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| --- | --- | --- | --- |
| # Trial | # of drops of NaHCO3 | Volume of NaHCO3 (mL) | Volume of CH3COOH (mL) |
| 1 | 33 | 1.45 mL | 9.86 mL |
| 2 | 34 | 1.49 mL | 9.86 mL |
| 3 | 39 | 1.71 mL | 9.86 mL |
| **average** | 35.3 | 1.55 mL | 9.86 mL |

1. Write the balanced equation for the reaction of acetic acid (CH3COOH) and sodium bicarbonate (NaHCO3). What type of reaction(s) took place?
   1. CH3COOH + NaHCO3 →CH3COONa + H2O + CO2
   2. Decomposition reaction.
2. Calculate the number of moles in NaHCO3 that were required to neutralize the CH3COOH in the vinegar.
   1. 0.00155 \* (1.14 / 1.00) = 0.0017 mol
3. Calculate the molarity of the vinegar sample. (Don't forget to convert mL to L.)
   1. Moles of CH3COOH = (1.002g/mL \* 9.86 ml) \* (1 / 60.05) = 0.1645 mol
   2. Liters of solution = (9.86 mL + 1.55 mL) / 1000 = 0.0114 L
   3. Molarity = 0.1645 mol / 0.0114 L = 14.419 mol/L
4. Calculate the number of grams of CH3COOH in the vinegar.
   1. 1.002 g/mL \* 9.86 ml = 9.87 g
5. Calculate the percent of acetic acid in the vinegar. (The density of vinegar is 1.002 g/mL.)
   1. ((84.007 g/mol \* 0.0017 mol) / 9.87 g) \* 100 = 1.44 % CH3COOH
6. Is it possible for the equivalence point of a titration to not be at pH 7? Explain your answer.
   1. Yes, when titrating a weak acid with a strong base, more conjugate base exists than acid in solution at the equivalence point, resulting in a pH greater than 7.
7. What is the molarity of a CsOH solution if 30.0 mL of the solution is neutralized by 26.4 mL 0.25 *M* HBr solution?
   1. mol Hbr = 0.25 *M* \* 0.0264 L = 0.00660 mol
   2. CsOH : HBr = 1:1, therefore mol CsOH = 0.00660 mol
   3. molarity = 0.00660 mol / 0.0300 L = 0.220 mol/L