Sample Lab Notebook

PreLab: Title, Date, Objective, Materials, Procedure

Objective: In this experiment, we are going to titrate acetic acid and an unknown acid with NaOH to determine the equivalence point, $K_a$, pH, and molarity.

Materials: NaOH, buret, pH meter, buffers ($pH 7, 4$), beaker, volumetric pipet, DI water, pH electrode with stirrer, Kimwipes

Procedure:
- Acetic acid, unknown acid

**Procedure:**
- Begin rough titration with NaOH
- Allow NaOH to drip into the buret at slow steady rate
- Monitor the pH reading
- When there is a jump in reading of 2 units ($pH 4$ to $pH 6$), close buret & record volume of NaOH added
- This tells how much base is needed to reach equivalence point & allow to plan careful titration
- Anytime you move pH electrodes to new solutions, rinse it with a bit of $0.1M$ NaOH to rinse electrode at any time during titration
- Rinse buret w/ standardized NaOH solution, pipet $10.00mL$ acetic acid into clean $150mL$ beaker
- Add $25.30mL$ DI water
- Place electrode in beaker
- Take initial volume reading of buret
- Add NaOH in small increments for which you know accurate volume to precision of $0.02mL$
- The goal is to collect data points before, during, & after the equivalence point
- Around equivalence point, must add small additions of titrant
- Start by adding NaOH from buret in small increments, recording total volume added & pH after each addition, until pH 5.0 before approximated equiv point from rough titration
- Begin adding NaOH dropwise into solution
- Carefully monitor pH measurements
- It’s not necessarily to record a volume & pH for each drop UNLESS the pH begins changing by $\pm 0.1$. When large pH (4-1) occurs, record pH & volume
- As approach equiv. point, small increments in the volume of NaOH will result in large pH changes. END SLOWLY! (used plenty of points before & after eq pH)
- Once past the equivalence point, continue adding NaOH dropwise until pH levels off at final high volume
- Add at least 5 more mL (until at then) recording the pH & total volumes added for each mL
- Obtain unknown acid & repeat above procedure w/ 2 titrations

Kremer: $K_a=1.8 \times 10^{-5}$, $pK_a=4.74$
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In Lab & PostLab: Data, Results, Calculations, Graphs

Data

- Acetic acid - rough titration up to pH estimate:
  - Initial pH: 2.997
  - Initial volume: 0.000 mL

- Precise titration:
  - Initial volume: 0.000 mL
  - pH volume of base:
    - pH volume base
  - pH volume of base

- Unknown acid:
  - Initial volume: 0.000 mL
  - Estimated pH: 10.957

Results (from graphs):

- Acetic Acid
  - Equivalence volume: 9.410 mL
  - pKa equivalence volume: 4.87 mL
  - pH at equivalence point: 8.951
  - pKa: 4.75

- Unknown acid ka calc:
  - pKa = -log(ka)
  - 2.89 = -log(ka)
  - ka = 7.94 x 10^-5

- Error calculations:
  - Accepted:
  - x/100
  - Error:
    - 1.874 / 1.874 = 1.006
  - 4.71

- Ka, Ka-1:
  - Ka = 7.94 x 10^-5
  - Ka-1

- Unknown Acid #2 titrated with NaOH

Graphs:

- Acetic Acid titrated with NaOH
  - Volume of NaOH added (mL)
  - Percentage of titration

- Unknown Acid #2 titrated with NaOH
  - Volume of NaOH added (mL)
  - Percentage of titration