Handout

Redox Titration

- Part 1: To determine the percentage of H_2O_2 in aqueous solution
- Part 2: To determine the percentage of ascorbic acid in vitamin C

Principles

Concept of redox reaction

take 5e$^-$, oxidizer

$$\overset{+7}{2MnO_4^-} + 5\,H_2\overset{-1}{O_2} + 6H^+ \rightarrow 2\,Mn^{2+} + 5\overset{0}{O_2} + 8H_2O$$

give 1e$^-$, reducer

Procedures For Part 1

- Rinse the buret with $KMnO_4$, 5 ml each time, three times
- Fill the buret with 0.02M $KMnO_4$, record the initial volume in ml
- Mass of empty flask ____g

Procedure (Con.)

- Mass of flask + 20-22 drops H_2O_2 ___g
- Add 75 ml H_2O and 10 ml 6 M H_2SO_4 into the flask
- Titrate the H_2O_2 solution with $KMnO_4$ with constant swirling.

Procedure (Con.)

- Endpoint- the pink color persist for at least 30 seconds, record the final volume in ml
- Repeat two more times

Procedures for Part 2

- Rinse the buret with I_2 solution 3 times, 5 ml each time.
- Fill the buret with 0.05M I_2 solution record the initial volume in ml
- Mass of weighing paper ______g
- Pulverize half vitamin C tablet.
- Mass of weighing paper + sample__g

Procedure (Con.)

- Pour the sample into the flask
- Add 75 ml H_2O and 5 ml starch indicator
- Titrate with I_2 solution until the dark blue color persist for 30 or more seconds, record the final volume in ml
- Repeat two more times

Reminders

- Read the volume from the top of the meniscus
- No indicator is needed for part 1
- Put white piece of paper under the flask.
- Swirl the flask when you do the titration
- Put any unused solutions in waste container on side shelf

Calculations for Part 1

$2MnO_4^- + 5\ H_2O_2 + 2H^+ \rightarrow\ 2Mn^{2+} + 5O_2 + 8H_2O$

- moles of MnO_4^- = $\dfrac{\text{molarity(0.02M) x volume(ml)}}{\text{1000(mL/L)}}$

- moles of H_2O_2 = moles of MnO_4^- x $\dfrac{5}{2}$

Calculation(Con.)

- gram of H_2O_2 = moles of H_2O_2 x 34.01 (MW of H_2O_2)

- % H_2O_2 = $\dfrac{\text{gram of } H_2O_2 \text{ x } 100\%}{\text{sample mass}}$

- sample mass (gram) = weight of (flask + 20-22 drops of H_2O_2) - weight of flask

Calculations for Part 2

- $C_6H_8O_6 + I_2 \rightarrow C_6H_6O_6 + 2H^+ + 2I^-$

- moles of I_2 = $\dfrac{\text{molarity (0.05M) x volume(mL)}}{\text{1000(mL/L)}}$

- moles of $C_6H_8O_6$ = moles of I_2

- grams of $C_6H_8O_6$ = moles of $C_6H_8O_6$ x 176.13 (MW of $C_6H_8O_6$)

Calculation(Con.)

- $\%C_6H_8O_6 = \frac{\text{grams of } C_6H_8O_6}{\text{weight of sample}} \times 100\%$

- weight of sample (gram)

  $= W_{\text{sample+weighing paper}} - W_{\text{weighing paper}}$