

Redox Titration Lab

Teacher Notes

Name _____ Partner _____ Date _____ Score _____

Purpose:

- To determine the concentration of an unknown $\text{KMnO}_{4(\text{aq})}$ solution.
- To develop skill with a burette:
- To understand the properties of a primary standard
- To experience colour change as a visible marker for the endpoint of a reaction

Materials: funnel, volumetric flask, beaker, Erlenmeyer flask, burette, burette brush, pipette, $\text{H}_2\text{SO}_{4(\text{aq})}$, $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}_{(\text{aq})}$, $\text{KMnO}_{4(\text{aq})}$

- Prelab: The $\text{KMnO}_{4(\text{aq})}$ will be the titrant. Write a balanced redox reaction. Be sure to include voltage



- ❖ Color of Excess reagent purple
- ❖ Color of limiting reagent lime green (colourless)
- ❖ Color at equivalence point pale pink & orange yellow
- ❖ Color at end point pink → purple

- Calculate the mass of iron (II) sulfate hepta hydrate that is required to make 0.10 L of 0.10 mol/L solution

- ❖ $N = c \times v$ $m = n \times M$
 $N = 0.10 \text{ L} \times 0.10 \text{ mol/L}$ $m = 0.01 \text{ mol} \times 278.06 \text{ g/mol}$
 $N = 0.010 \text{ mol}$ $m = 2.78 \text{ g}$

Procedure:

- ❖ Make the solution of iron (II) sulfate.
 - o Weigh out the correct mass of iron (II) sulfate.
 - o Dissolve it in 50 mL of the 5.0 mol/L acid solution provided. Use a BEAKER for this step (make 1 litre of 5.0 mol/L sulfuric acid) This means 280 mL of acid diluted to one litre with distilled water) This will be enough for 16 groups to use 50 mL of acid.
 - o Transfer the solution to a volumetric flask. Do sufficient rinsing with DISTILLED water
 - o Fill the volumetric flask to the 100 mL mark. Use distilled water and an eye dropper.
 - o Stopper and invert several times.
 - o Pour the solution out into a clean, dry beaker.
- ❖ Pipette 10 mL of the $\text{FeSO}_{4(\text{aq})}$ from the beaker into an Erlenmeyer flask. Be sure to place a white piece of paper under the flask. This will maximize the colors in the flask.
- ❖ Clean and prepare the burette for the excess reagent ($\text{KMnO}_{4(\text{aq})}$) that is provided. Be sure to use a funnel. Record the initial volume of the burette.
 - o **Unknown permanganate: make about 1.50 L of ~0.010 mol/L solution. Molar mass of potassium permanganate is 158.04 g/mol**
 - o **Do your calculations to be exact.**

Analysis of DATA

- Calculate concentration of the $\text{KMnO}_{4(\text{aq})}$
- Why is acidified $\text{KMnO}_{4(\text{aq})}$ a poor primary standard solution?

There is a downhill reaction between acidified permanganate ions and WATER. So once the solution is made, it will begin to decay on its own.

For this reason, the ACID must be kept separated from the permanganate ions so that the DESIRED reaction will take place.