

Report Guideline for Experiment 4 (Titrations and Indicators)

Pre-lab Report is due at the beginning of the lab section. Refer to laboratory syllabus for the due date of the post-lab report. Pre-lab and Post-lab MUST be written inside your lab notebook (with the exception of graphs)

The REVISED PROCEDURES for this experiment are supplemented as handouts. Make sure you read the revised procedures before writing the reports.

Pre-lab Guideline

- (I) Introduction
- (II) Procedure in Flowchart Format (*use the REVISED PROCEDURES!!*)
- (III) Reference
- (IV) MSDS information (**refer to the MSDS handout for details**)

The following chemicals will require you to use the MSDS database on the Web (see Lecture Syllabus):

Sulfuric Acid (0.2N or 0.1M)

Note: In MSDS, select the site that gives you the MSDS information closest to the concentration listed above for each individual chemical.

You should record the following MSDS information in your notebook for the chemicals listed above.

(Printouts directly from the Web pages will NOT be accepted!!)

- (a) Product Name
- (b) Chemical Formula
- (c) Formula Weight
- (d) Melting Point; Boiling Point and Density
- (e) Health Hazard Data (**summarize in your own words**)
- (f) Spill and Disposal procedures (**summarize in your own words**)

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Pre-lab Guideline (Continue)

(V) Complete study questions #1 & #2 (see bottom of page 58 & 59):

Read page 56-58 BEFORE you start working on your prelab.

NOTE: For question 2(b), you may assume that **BOTH** protons dissociate completely.

Useful mathematical relationship for pH and pOH:
 $\text{pH} = -\log[\text{H}^+]$ and $\text{pOH} = -\log[\text{OH}^-]$. $\text{pH} + \text{pOH} = 14$.

(VI) Set up BLANK data table (*Use a NEW page for this part!*)

READ the procedures and set up the necessary data tables for the experiment.

Report Guideline for Experiment 4 (Titrations and Indicators)**Post-lab MUST be written inside your lab notebook****Post-lab Guideline - This is an INDIVIDUAL report****(I) Data**

- Organize your data for **ALL** the trials into a table format (i.e. recopy your data which you collected during the lab period into your post-lab report).

(II) Data Analysis & Discussions

(i) Assuming that the sulfuric acid has a concentration of 0.2000N, calculate the equivalence point volume for the titration. **Show ALL your work.**

Note: Do not concern too much about the "concept" of the equation that I outlined below. At this point, simply use the appropriate experimental data and calculate the concentration of the unknown acid for different indicator titration. We will discuss acid base equilibrium later on in the quarter.

Note: At the equivalence point, the number of equivalents of acid equal to the number of equivalents of base (please also read the example on page 57 of the manual):

$$N_A \times V_A = N_B \times V_B$$

where A stands for acid and B stands for base.

N_A = Concentration of the acid in normality; N_B = Concentration of the base in normality

V_A = Volume of the acid requires to titrate to the end point

N_B = Volume of base use in titration

(ii) Based on your experimental data, estimate the equivalence point pH for **EACH** of the indicator titration by choosing the volume that is **CLOSEST** to what you obtained in (i). What can you conclude?

(iii) Based on your experimental data, calculate the normality of the sulfuric acid for **EACH** of the indicator titration at the volume that you chose in (ii). **Show ALL your work.**

(iv) Calculate the normality of the sulfuric acid for **EACH** of the indicator at the *end point* (only need to consider the FIRST color change) of the titration. **Show ALL your work.**

(v) Based on your results that you obtained in (iv), which one of the three indicators is the **BEST** indicator for this experiment? **Explain.** For comparison purposes, you may assume the **theoretical concentration of the sulfuric acid is 0.2000N.**