Lab 4: Mohr Titration of Sodium in Pickles

Questions

1. Standard A: $\frac{0.1034 \text{ g NaCl}}{42.42 \text{ mL -24.30 mL}} \times \frac{1000 \text{ mL}}{1 \text{ L}} \times \frac{1 \text{ mol NaCl}}{58.443 \text{ g NaCl}} \times \frac{1 \text{ mol } AgNO_3}{1 \text{ mol NaCl}} = 0.09764 \text{ M } AgNO_3$

   Standard B: $\frac{0.0992 \text{ g NaCl}}{26.15 \text{ mL -9.18 mL}} \times \frac{1000 \text{ mL}}{1 \text{ L}} \times \frac{1 \text{ mol NaCl}}{58.443 \text{ g NaCl}} \times \frac{1 \text{ mol } AgNO_3}{1 \text{ mol NaCl}} = 0.100 \text{ M } AgNO_3$

   Standard C: $\frac{0.0982 \text{ g NaCl}}{43.52 \text{ mL -26.39 mL}} \times \frac{1000 \text{ mL}}{1 \text{ L}} \times \frac{1 \text{ mol NaCl}}{58.443 \text{ g NaCl}} \times \frac{1 \text{ mol } AgNO_3}{1 \text{ mol NaCl}} = 0.0981 \text{ M } AgNO_3$

   Average: $\overline{x} = \frac{\sum x_i}{N} = \frac{0.09764\text{M } AgNO_3 + 0.100\text{M } AgNO_3 + 0.0981\text{M } AgNO_3}{3} = 0.099 \text{ M } AgNO_3$

   Standard Deviation: s = $\sqrt{\frac{\sum (x_i - \overline{x})^2}{N-1}} =$

   $\sqrt{\frac{(0.09764 \text{ M } AgNO_3 - 0.099 \text{ M } AgNO_3)^2 + (0.100 \text{ M } AgNO_3 - 0.099 \text{ M } AgNO_3)^2 + (0.0981 \text{ M } AgNO_3 - 0.099 \text{ M } AgNO_3)^2}{3-1}} =$
   $0.001 \text{ M } AgNO_3$

2. Pickle Aliquot 1: $(30.37 \text{ mL - } 11.20 \text{ mL}) \times 0.099 \text{ M } AgNO_3 \times \frac{1 \text{ L}}{1000 \text{ mL}} \times \frac{1 \text{ mol Na}}{1 \text{ mol } AgNO_3} \times \frac{22.990 \text{ g Na}}{1 \text{ mol Na}} \times \frac{1000 \text{ mg}}{1 \text{ g}} = 43. \text{ mg Na}$

   Pickle Aliquot 2: $(20.58 \text{ mL - } 0.98 \text{ mL}) \times 0.099 \text{ M } AgNO_3 \times \frac{1 \text{ L}}{1000 \text{ mL}} \times \frac{1 \text{ mol Na}}{1 \text{ mol } AgNO_3} \times \frac{22.990 \text{ g Na}}{1 \text{ mol Na}} \times \frac{1000 \text{ mg}}{1 \text{ g}} = 44. \text{ mg Na}$

   Pickle Aliquot 3: $(40.27 \text{ mL - } 20.84 \text{ mL}) \times 0.099 \text{ M } AgNO_3 \times \frac{1 \text{ L}}{1000 \text{ mL}} \times \frac{1 \text{ mol Na}}{1 \text{ mol } AgNO_3} \times \frac{22.990 \text{ g Na}}{1 \text{ mol Na}} \times \frac{1000 \text{ mg}}{1 \text{ g}} = 44. \text{ mg Na}$

   Average: $\overline{x} = \frac{\sum x_i}{N} = \frac{43.\text{g Na} + 44.\text{g Na} + 44.\text{g Na}}{3} = 44 \text{ g Na}$

   Standard Deviation: s = $\sqrt{\frac{\sum (x_i - \overline{x})^2}{N-1}} =$

   $\sqrt{\frac{(43. \text{ g Na} - 44 \text{ g Na})^2 + (44. \text{ g Na} - 44 \text{ g Na})^2 + (44. \text{ g Na} - 44 \text{ g Na})^2}{3-1}} = 1 \text{ g Na}$

3. $\frac{43. \text{ mg Na}}{20.00 \text{ mL pickle water}} \times \frac{100.00 \text{ mL pickle water}}{1 \text{ pickle}} = 2.2 \times 10^2 \text{ mg Na / pickle}$

   $\frac{44. \text{ mg Na}}{20.00 \text{ mL pickle water}} \times \frac{100.00 \text{ mL pickle water}}{1 \text{ pickle}} = 2.2 \times 10^2 \text{ mg Na / pickle}$

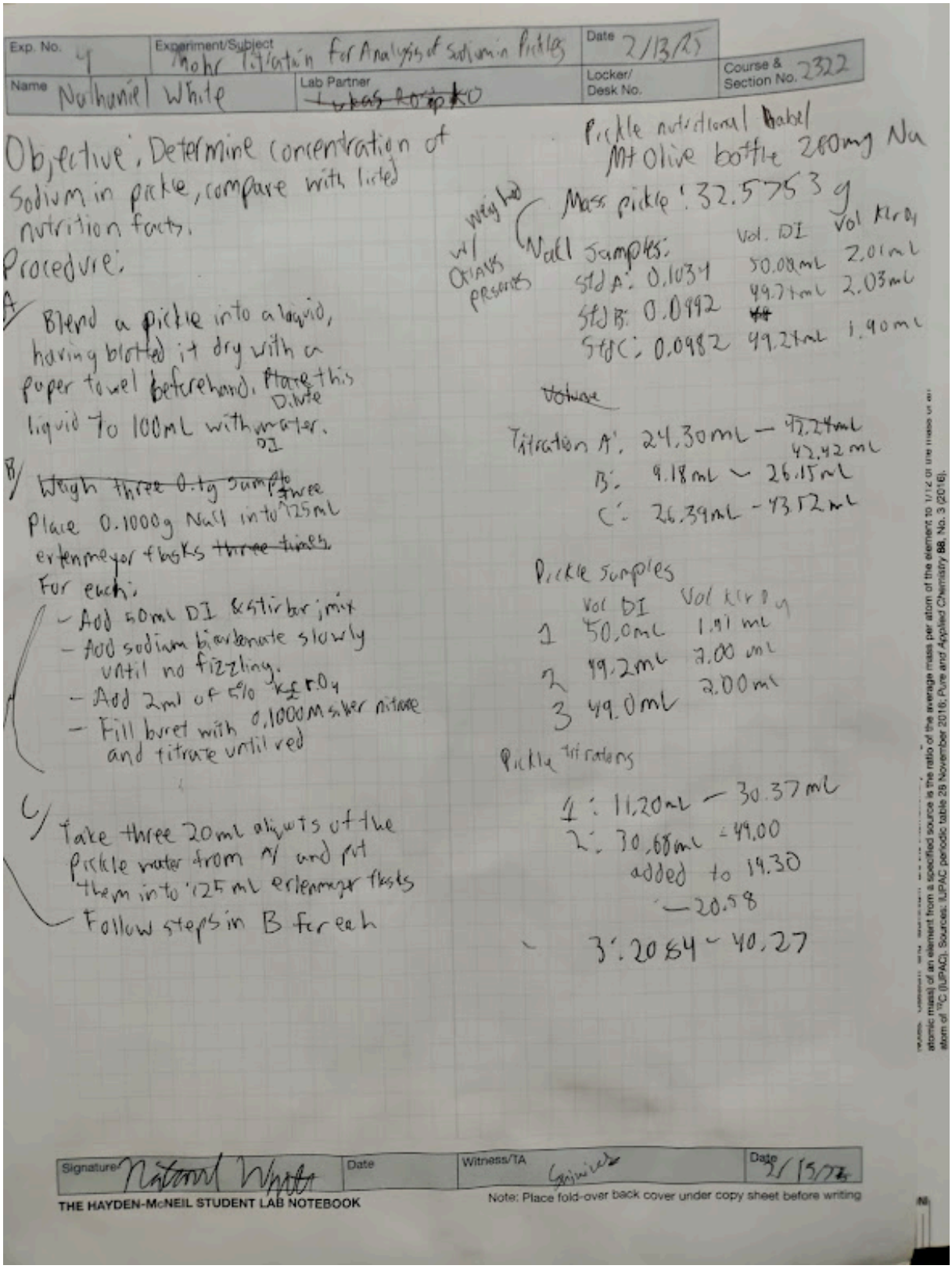
   $\frac{44. \text{ mg Na}}{20.00 \text{ mL pickle water}} \times \frac{100.00 \text{ mL pickle water}}{1 \text{ pickle}} = 2.2 \times 10^2 \text{ mg Na / pickle}$

   Average: 2.2×10^2 mg Na / pickle

   Standard Deviation: 0.0 mg Na / pickle

4. The weight of my pickle spear was 32.5753 g. I used a Mt Olive pickle spear, which has 260 mg of sodium. The 95% confidence interval for my data is limited to just $2.2 \times 10^2 - 2.2 \times 10^2$ mg since the precision of the measurements was lower than their deviation, so twice the standard deviation is still 0.

Lab Notebook



Exp. No. 4 | Experiment/Subject Mohr Titration for Analysis of Sodium in Pickles | Date 2/13/25

Name Nathaniel White | Lab Partner ~~Lukas Korpela~~ | Locker/Desk No. | Course & Section No. 2322

Objective: Determine concentration of sodium in pickle, compare with listed nutrition facts.

Procedure:

A/ Blend a pickle into a liquid, having blotted it dry with a paper towel beforehand. Place this liquid to 100mL with water. DI. Dilute

B/ ~~Weigh three 0.1g samples~~ Place 0.1000g NaCl into three 125mL erlenmeyer flasks ~~three times~~

For each:
- Add 50mL DI & stirbar, mix
- Add sodium bicarbonate slowly until no fizzling.
- Add 2mL of 5% K_2CrO_4
- Fill buret with 0.1000M silver nitrate and titrate until red

C/ Take three 20mL aliquots of the pickle water from A/ and put them into 125mL erlenmeyer flasks
- Follow steps in B for each

Pickle nutritional label: Mt Olive bottle 280mg Na

Mass pickle: 32.5753 g (weighed w/ brine preserved)

NaCl samples:

	Vol. DI	Vol titrant
Std A: 0.1034	50.08mL	2.01mL
Std B: 0.0992	49.7mL	2.03mL
Std C: 0.0982	49.2mL	1.90mL

~~Volume~~

Titration A: 24.30mL – ~~42.24mL~~ 42.42mL

B: 9.18mL – 26.15mL

C: 26.39mL – 43.52mL

Pickle samples

	Vol DI	Vol titrant
1	50.0mL	1.91mL
2	49.2mL	2.00mL
3	49.0mL	2.00mL

Pickle titrations

1: 11.20mL – 30.37mL

2: 30.68mL – 49.00

added to 19.30

– 20.58

3: 20.84 – 40.27

Signature: Nathaniel White | Date | Witness/TA: Gajivicz | Date 2/13/25

THE HAYDEN-McNEIL STUDENT LAB NOTEBOOK

Note: Place fold-over back cover under copy sheet before writing