Standardization of NaOH

Note Title 3/18/2018

Objective: Determine normality of the NaOH solution you will use to find the mass of an H_2SO_4 (aq) unk. (60 pts.)

Lab Tools / Skills used: (3) Weighing by difference using analytical and top-loader balances; (2) Making a solution w/ a volumetric flask; (1) Titrating and Back-Titrating

Calculations / Equations: Net-ionic equations, Normality calc., Molarity Calc., titration & back-titration calc.

Procedure

NaOH soln

1L
0.09000 N
- make using GM NaOH
- exp to determine N to 4 s.f.

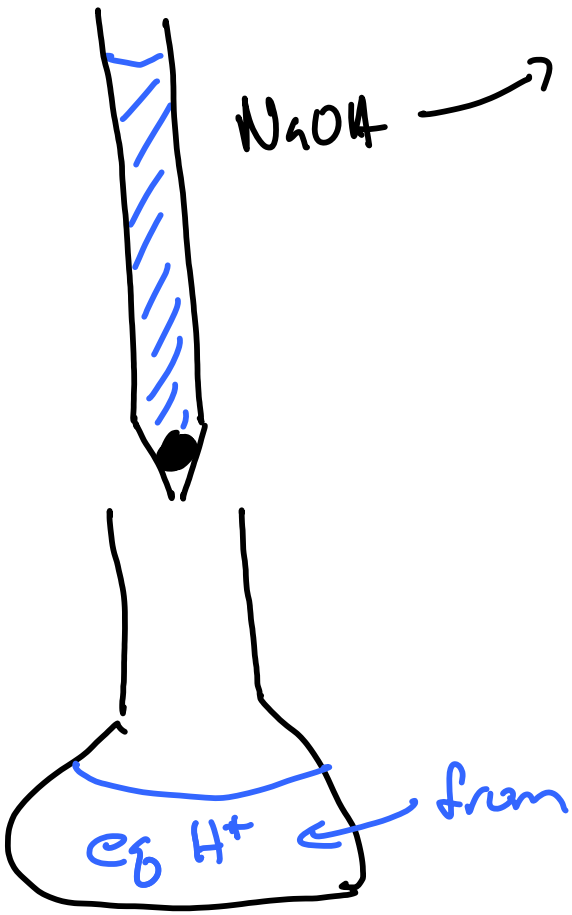
NaOH

= 0.09135 ± 26 N

H_2SO_4

$= \frac{\text{mol } H_2SO_4}{L}$

① Titration to find $NaOH$ Normality



from KHP (0.8516 g KHP)

Normality $NaOH$

$$= \frac{\text{eq } OH^-}{L}$$

← find from KHP

↳ measure from buret (volume of soln needed to deliver enough eq OH^- to react w/ eq H^+)

Sample Calculation

mass KHP = 0.8516 g

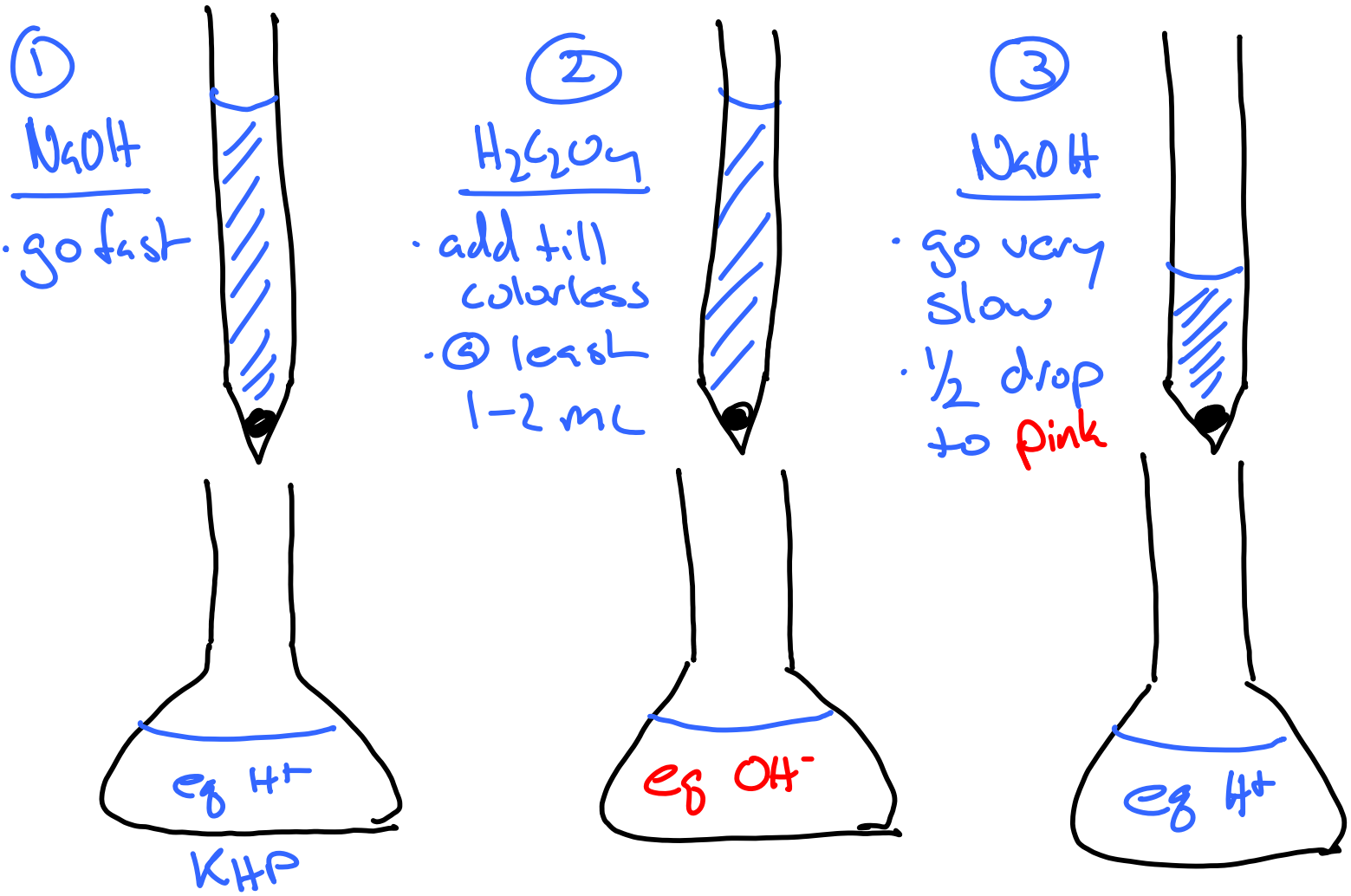
V_{NaOH} = 45.55 mL

$$0.8516\text{ g KHP} \left|\frac{1\text{ mol KHP}}{204.223\text{ g KHP}}\right|\frac{1\text{ eq } H^+}{1\text{ mol KHP}}\left|\frac{1\text{ eq } OH^-}{1\text{ eq } H^+}\right. =$$

$$= 0.004165\text{ eq } OH^-$$

$$\text{Normality} = \frac{0.004165\text{ eq } OH^-}{0.04555\text{ L}} = \underline{0.09154\text{ N}}$$

Titration w/ Back-Titration



- To find normality need eq OH^- that reacted with all of the eq H^+

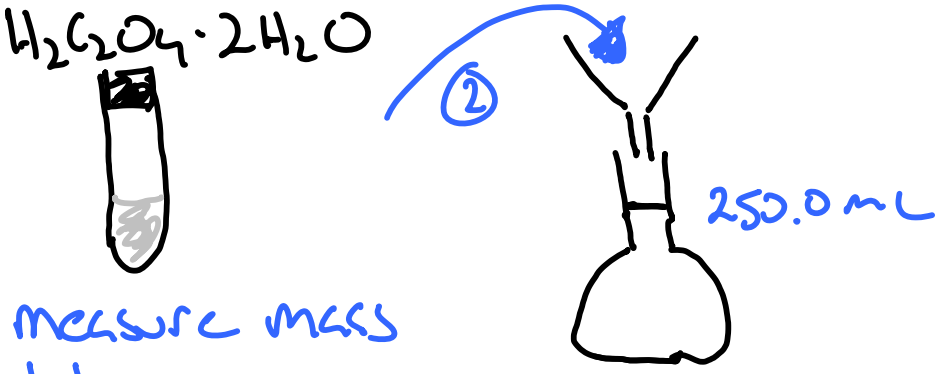
total eq OH^- = eq OH^- react w/ KHP + eq OH^- react w/ $H_2C_2O_4$

mass KHP (measure)

normality + Vol. (make solution)

② Making $H_2C_2O_4$ solution w/ Volumetric Flask

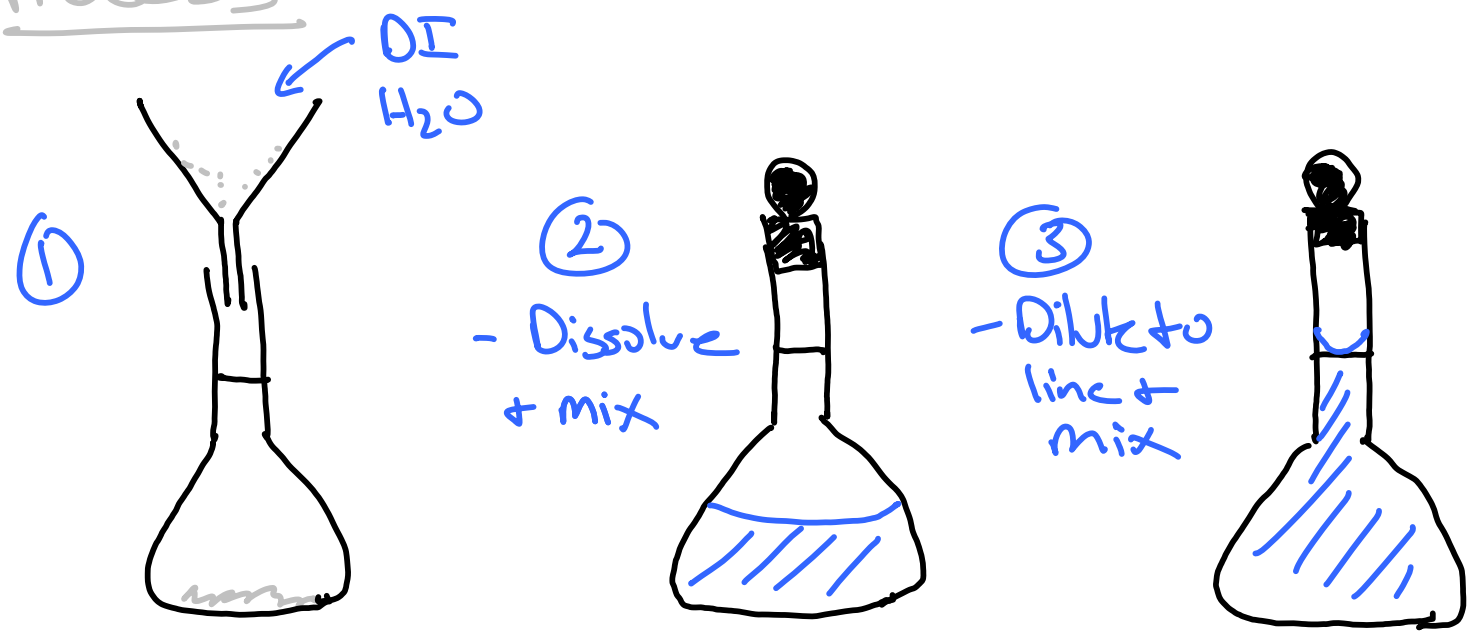
- read Chp 4 part II notes + GCN pg 5 before starting
- Volumetric flasks (t.c.) stored in front of class filled w/ DI H_2O



① measure mass t.t.

② measure mass t.t.

Process



eq H^+ (using $H_2C_2O_4 \cdot 2H_2O_{(s)}$ + 250.0 mL flask)

$$0.4815\ g\ H_2C_2O_4 \cdot 2H_2O \left| \frac{1\ mol\ H_2C_2O_4 \cdot 2H_2O}{126.066104\ g\ H_2C_2O_4 \cdot 2H_2O} \right| \frac{2\ eq\ H^+}{1\ mol\ H_2C_2O_4 \cdot 2H_2O} =$$

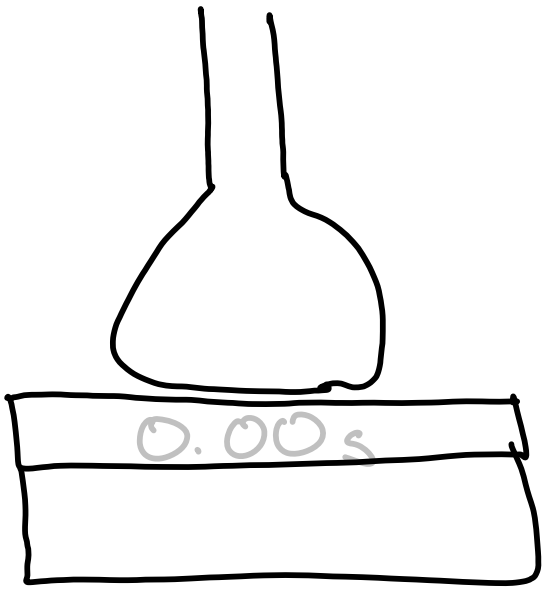
$$= 0.00763815\ eq\ H^+$$

$$\text{Normality} = \frac{0.007638{,}85 \text{ eq H}^+}{0.2500 \text{ L}}$$

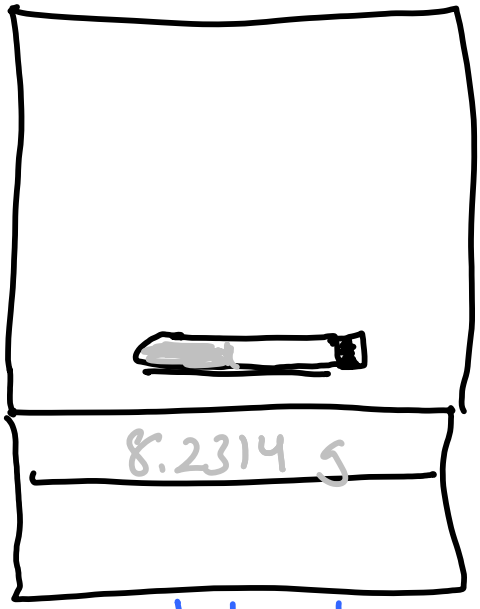
$$= 0.030551{,}54 \text{ N}$$

③ Weighing KHP samples by difference

- want 0.6 – 0.8 g KHP (known to 4 s.f.)



Top-loader Balance



Analytical Balance

① Measure mass of t.t. w/ KHP on analytical balance (record)

② Tare flask on top-loader balance

③ Dispense KHP until top-loader reads 0.60 – 0.80 g (do not record)

④ Measure mass of t.t w/ KHP on analytical balance (record)

⑤ Calculate mass KHP dispensed

Sample Calculation titration w/ back-titration

KHP

mass = 0.7968 g

$H_2C_2O_4$ (0.03055'54 N)

Vdel = 1.87 mL

$NaOH$

Vdel = 43.21 mL

eq OH^- react w/ KHP

$$0.7968\ g\ KHP \left| \frac{1\ mol\ KHP}{204.223'60\ g\ KHP} \right| \frac{1\ eq\ H^+}{1\ mol\ KHP} \left| \frac{1\ eq\ OH^-}{1\ eq\ H^+} \right. =$$

$$= 0.003901'60\ eq\ H^+$$

eq OH^- react w/ $H_2C_2O_4$

$$1.87\ mL \left| \frac{1\ L}{1000\ mL} \right| \frac{0.03055'54\ eq\ H^+}{L} \left| \frac{1\ eq\ OH^-}{1\ eq\ H^+} \right. =$$

$$= 0.00005713'85\ eq\ OH^-$$

Total eq OH^- & normality

$$\text{total eq } OH^- = 0.003901'60\ \frac{eq\ OH^-}{} + 0.00005713'85\ \frac{eq\ OH^-}{}$$

$$= 0.003958'74\ eq\ OH^-$$

$$\text{Normality} = \frac{0.003958\overline{74}\ \text{eq}^{OH^-}}{0.04321\ L}$$

$$= \underline{\underline{0.09161\overline{63}\ N}}$$