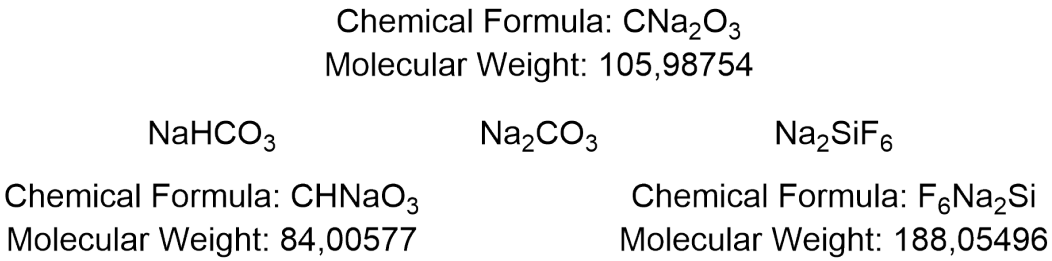
AE-413: Titration of Na2CO3 with NaHCO3 and vice versa

Date: 2025-01-08
Tags: pH AE Titration Calibration pH meter
Category: HTE
Status: Done
Created by: Alexander Eith

Reaction scheme/sample structure



Literature/reference experiments

Literature	/
Reproduction	/
Related experiment	AE-345: Titration of sodium hydrogen carbonate with Na2SiF6 Organisational - AE-412: Calibration of pH-Meter

Reagents

Name	CAS Number / Experiment Number	Inventory number	Amount [mmol]	$Mass_{theo}$ [mg]	$Mass_{exp}$ [mg]	Molar mass [g/mol]	Density (g/ml)	Volume [ml]
NaHCO3	144-55-8	/	15	1260.1	1259.23	84,007	/	/
Na2CO3	497-19-8	/	15	1589.8	1588.24	105.99	/	/
H2O	/	/	/	/	/	18.02	0.998	300

Procedure/observations

Date	Time	Step	Observations
07.01	14:30	NaHCO3 and Na2CO3 were weighted into seperate 15 mL snap on cap vials	

	15:15	To both water was added (approx. 15 mL each)	
		The vial were shaken and vortexed (Equipment - VWR® VV3, Vortex Mixer stage 4/6), till everything dissolved	
		The obtained solution were transferred into a 100 mL and 50 mL volumetric flask for each. The solution was splitt approx. 2 to 1 between the 100 mL and 50 mL flask	
		All volumetric flask were filled with Milli-Q water	
	- 15:25	The NaHCO3 solutions were combined in a 250 mL beaker, the Na2CO3 solutions were combined in a 150 mL beaker	For both 0.1 M solution were obtained
		Generel workflow for the titration: In a 50 mL snap on cap vial 10 mL of one solution was added using a 5 mL volumetric pipett. The solution was stirred at 550 rpm and the pH electrode was submerged. The other solution was added using a 25 mL burette (for exact amounts and recoded pH values see Analysis table)	
	15:40	The titration was done with Na2CO3 in the burette and NaHCO3 in the vial	-1 setup.jpg
	15:55	The titration was done with Na2CO3 in the burette and NaHCO3 in the vial	-2
	16:10	The titration was done with NaHCO3 in the burette and Na2CO3 in the vial	-3
	16:15	The titration was done with NaHCO3 in the burette and Na2CO3 in the vial	-4

Analysis

Date	Time	Sample name	Analysis method	Analytical device	Solvent	Raw Data	Processed Data	Interpretation

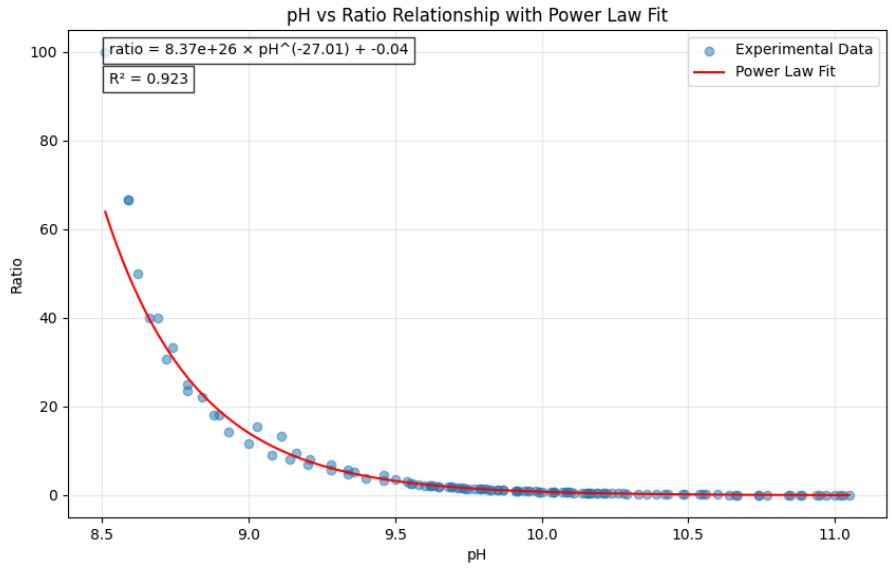
10.09	11:30	AE-345-1	pH	AE-344: Calibration of pH-Meter	H2O	raw data.jpg	AE-413.xlsx, AE-413-for_python.CSV	See Results or excel file
	13:20	AE-345-2	pH	AE-344: Calibration of pH-Meter	H2O	raw data.jpg	AE-413.xlsx, AE-413-for_python.CSV	
	14:05	AE-345-3	pH	AE-344: Calibration of pH-Meter	H2O	raw data.jpg	AE-413.xlsx, AE-413-for_python.CSV	
	14:40	AE-345-4	pH	AE-344: Calibration of pH-Meter	H2O	raw data.jpg	AE-413.xlsx, AE-413-for_python.CSV	

Results

Looks ok.

Example plot (obtained with AE-413-for_python.CSV): Figure_1.png

Used for plotting and fitting of power function: AE-413-c.py, gives good fit, first 20 data points are omitted



For calcualtion of ratio(NAHCO3/Na2CO3) at given pH:

AE-413-calc.py

can be used in range of 8.6 to 10.9, extreme values (pH = 8.4 and 11.1 can also be used)

Fit in good agreement (max. error of less than 0.1 pH units) compared to https://www.aatbio.com/resources/buffer-preparations-and-recipes/carbonate-bicarbonate-buffer-ph-9-2-to-1

0-6

Linked experiments

- AE-344: Calibration of pH-Meter

- AE-345: Titration of sodium hydrogen carbonate with Na2SiF6

Organisational - AE-412: Calibration of pH-Meter

Linked item

Equipment - VWR® VV3, Vortex Mixer

Attached files

AE-413-c-plot.png
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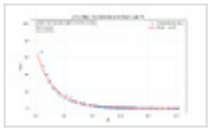

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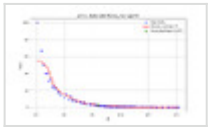

AE-413-a.py
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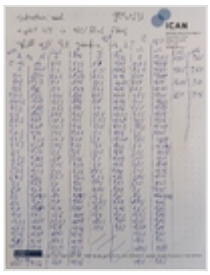

Unique eLabID: 20250108-4279404eae193749d3abb89950f86a8696efe672
Link: https://elab.water-splitting.org/experiments.php?mode=view&id=1613