

# Titration of Alkalinity p+m value (Temporary Hardness)

ENVIRONMENTAL SERIES



## Introduction

The alkalinity of water is a measure of its ability to neutralize acids. Alkalinity in natural waters is mainly caused by hydroxides, carbonates and bicarbonates.

Determination of the alkalinity (p and m value) in water in mmol/l by titration with 0.1 mol/l hydrochloric acid. The p value corresponds to the color change of phenolphthalein (pH 8.2), the m value corresponds to the color change of methyl orange (pH 4.3). At very low p and m values, a lower concentration hydrochloric acid may also be used.

This titration can also determine the temporary hardness of a water sample.



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Instruments	
TL 5000/TL 6000/7000/7750/7800	
Magnetic stirrer TM 235 or similar	
WA 20 Exchange Unit	
Electrode, Cable, and Electrolyte	
N 62 or A 7780 1M-DIN-ID, A 162 2M DIN ID or similar	
L1A (only for electrodes with plug head)	
Lab Accessories	
Glass beaker 150 ml	
Magnetic stirrer bar 30 mm	
Reagents	
1	Hydrochloric acid 0.1 mol/l
2	DIN Buffer pH 4.01
3	DIN Buffer pH 6.87
4	KCl solution 3 mol/l
All reagents should be in analytical grade or better.	



## Procedure

### Reagents

The titer determination of the HCl 0.1 mol/l is carried out as described in the application report "Titer determination of strong acids".

### Cleaning of the electrode

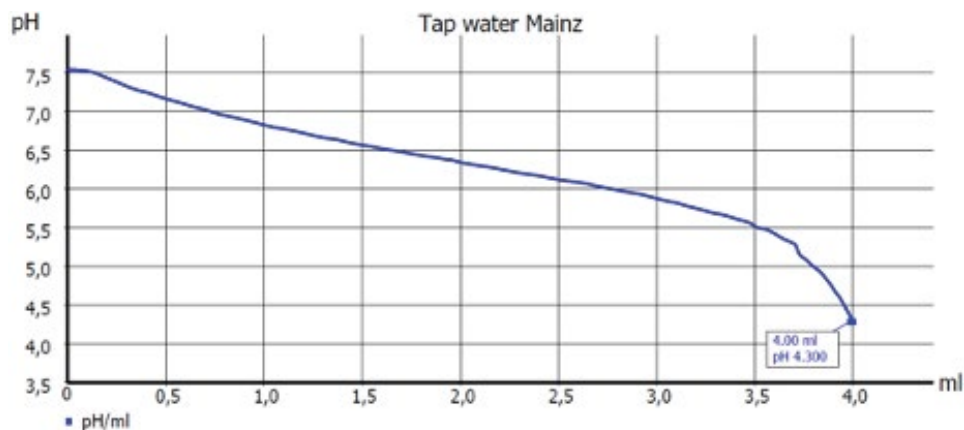
The electrode is cleaned with distilled water. Suitable for storage is KCl solution 3 mol/l or electrolyte solution L 911. Because this titration is done as an endpoint titration, the electrode must be calibrated periodically (at least weekly).

We recommend a 2-point calibration with the DIN buffers pH 4.01 and 6.87.

### Sample Preparation

100.00 ml of the sample are placed in a 150 ml beaker and then titrated with HCl 0.1 mol / l to the two endpoints pH 8.2 and pH 4.3.

Titration parameter - Sample Titration



Default Method - Alkalinity (p+m)			
Method type	Automatic titration		
Modus	Endpoint		
Measured Value	pH		
Measuring Speed / Drift	Normal	Minimum Holding Time	02 s
		Maximum Holding Time	15 s
		Measuring Time	02 s
		Drift	20 mv/min
Initial Waiting Time	5 s		
Step size	0.02 ml		
Dampening	None	Titration Direction	Decrease
Pretitration	off	Delay Time	0 s
Endpoint 1	8.20 pH	Delta Endpoint	1.0 pH
		Endpoint Delay	10 s
Endpoint 2	4.30 pH	Delta Endpoint	1.0 pH
		Endpoint Delay	10 s
Max. Titration Volume	20 ml		
Dosing Speed	15%	Filling Speed	30 s

**Calculation:**

Formula 1  $p - \text{Value [mmol/l]} = \frac{(EP1 - B) * T * M * F1}{V * F2}$

**Calculation:**

Formula 2  $m - \text{Value [mmol/l]} = \frac{(EP2 - B) * T * M * F1}{V * F2}$

EP1		Consumption of titrant at first end point
B	0	Blank Value
T	WA	Actual concentration of the titrant
M	1	Molecular weight
V	100	Volume of the sample
F1	10	Conversion factor
F2	0.01	Conversion factor

EP2		Consumption of titrant at first end point
B	0	Blank Value
T	WA	Actual concentration of the titrant
M	1	Molecular weight
V	100	Volume of the sample
F1	10	Conversion factor
F2	0.01	Conversion factor

If the carbonate hardness of a water is to be calculated in °dH, the calculation can be made according to formula 3\*.

**Calculation:**

Formula 3  $[^{\circ}dH] = \frac{(EP2 - B) * T * M * F1 * F3}{V * F2}$

EP2		Consumption of titrant at first end point
B	0	Blank Value
T	WA	Actual concentration of the titrant
M	1	Molecular weight
V	100	Volume of the sample
F1	10	Conversion factor
F2	0.01	Conversion factor
F3	2.804	Conversion factor

\* This calculation is only applicable if: 2\*p-value<m-value

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