

# Titer determination of NaOH and other strong bases

## Description

This application report describes the general procedure for the titer determination of NaOH and other aqueous strong bases like Potassium hydroxide. The procedure is also usable for strong bases like Potassium hydroxide and Tetrabutylammonium hydroxide in water-soluble organic solvents like alcohols. This procedure is usable for base solutions up to 3 mol/l.

The titer is a dimensionless number about 1 for correcting the indicated concentration. In the software of the titration devices and application reports from SI Analytics®, the term “Titer” describes the exact concentration in mol/l and not the dimensionless factor.

## Instruments

|                   |                                                    |
|-------------------|----------------------------------------------------|
| Titration         | TL 5000, TL 7000, TL 7750, TL 7800                 |
| Exchangeable Unit | WA 10, WA 20, WA 50                                |
| Electrode         | N 62, A 162 2M DIN ID, A 7780 1M-DIN-ID or similar |
| Cable             | L 1 A (only for electrodes with plug head)         |
| Lab accessoires   | Magnetic stirrer TM 235 or similar                 |
|                   | Glas beaker 150 ml                                 |

## Reagents

|                                                       |                                                                                        |
|-------------------------------------------------------|----------------------------------------------------------------------------------------|
| 1                                                     | NaOH solution from which the titer is to be determined                                 |
| 2                                                     | Distilled water                                                                        |
| 3                                                     | Potassiumhydrogenphthalate (KHPht) – certified reference material, volumetric standard |
| 4                                                     | Soda lime                                                                              |
| All reagents should be in analytical grade or better. |                                                                                        |

## Titration procedure

### Reagents

#### NaOH solution

NaOH is available as a ready-to-use solution.

Alkaline solutions quickly absorb  $\text{CO}_2$  from the air and thus become unusable. The solution must therefore be protected from  $\text{CO}_2$  with a  $\text{CO}_2$  absorbent such as soda lime. For this purpose, a dry tube filled with soda lime is placed on the storage bottle.

#### Potassium hydrogen phthalate

The KHPht volumetric standard is dried as described in the corresponding certificate of analysis.

#### Cleaning and storage of the electrode

Use distilled water for cleaning the electrode. For storage use the same electrolyte solution as used in the electrode or storage electrolyte solution L 911.

### Sample preparation

The amount of volumetric standard depends on the size of the burette and the concentration of the Base. The amount should be chosen so that about half of the burette volume is consumed. The most common is the 20 ml burette. The required quantity of KHPht can be estimated according to this rule of thumb:

$$W [g] = 2 * \text{Concentration} [mol/l]$$

For low concentrations (e.g. 0.01 mol/l), the required amount of reference material is very small and difficult to weigh. The following method is used: a larger quantity of KHPht ( $W_{\text{KHPht}}$ ) is weighed into a flask. For this purpose, 100 - 200 times the amount of distilled water ( $W_{\text{H}_2\text{O}}$ ) is weighed and the KHPht is dissolved in it. An aliquot of A is weighed out of this solution for titration. The amount of KHPht contained in it is calculated according to the following formula:

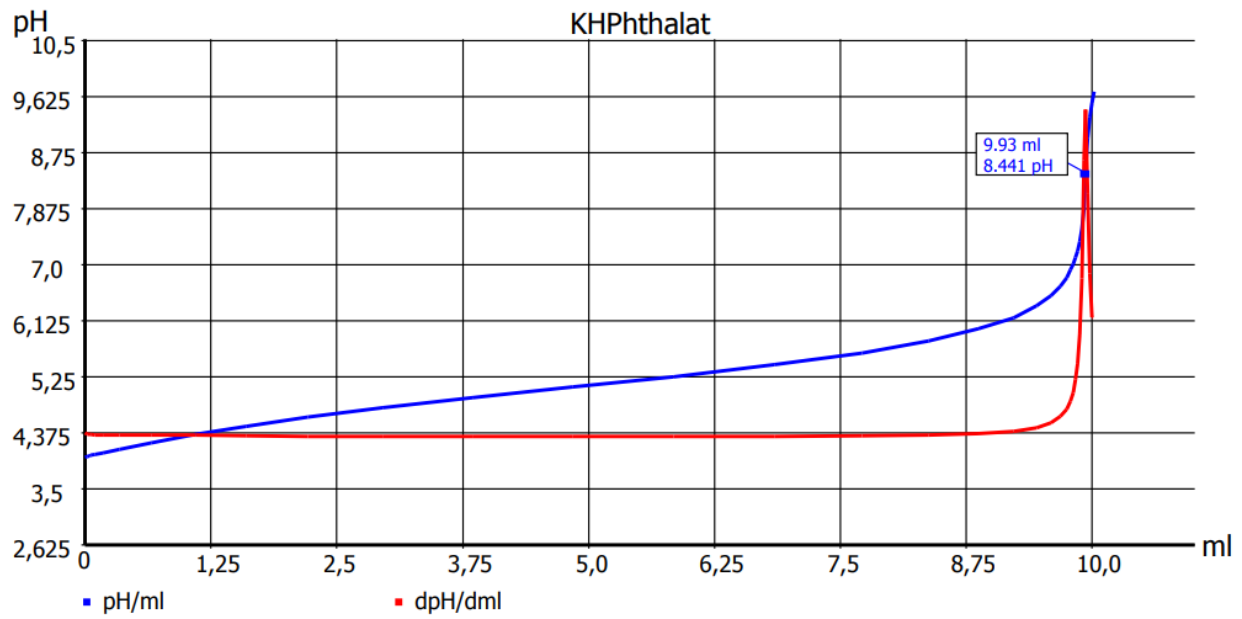
$$W [g] = \frac{W_{\text{KHPht}} [g]}{(W_{\text{KHPht}} [g] + W_{\text{H}_2\text{O}} [g])} * A [g]$$

To determine the titer of a 0.1 mol/l NaOH, about 0.2 g KHPht volumetric standard are weighed into a 150 ml beaker and made up to 60-80 ml with distilled water. When the KHPht is completely dissolved, it is titrated with the NaOH to an equivalence point.

If the specified assay of the volumetric standard is different from 100%, the weight for calculating the concentration must be corrected:

$$W = \frac{\text{Weight} * \text{specified assay \%}}{100}$$

## Titration parameter



|                         |                     |                      |           |
|-------------------------|---------------------|----------------------|-----------|
| Default method          | Titre NaOH          |                      |           |
| Method type             | Automatic titration |                      |           |
| Modus                   | Dynamic             |                      |           |
| Measured value          | pH                  |                      |           |
| Measuring speed / drift | Normal              | Minimum holding time | 2 s       |
|                         |                     | Maximum holding time | 15 s      |
|                         |                     | Measuring time       | 2 s       |
|                         |                     | Drift                | 20 mV/min |
| Initial waiting time    | 0 s                 |                      |           |
| Dynamic                 | Steep               | Max step size        | 1.0 ml    |
|                         |                     | Slope max ml         | 15        |
|                         |                     | Min. step size       | 0,02 ml   |
|                         |                     | Slope min. ml        | 230       |
| Damping                 | None                | Titration direction  | Increase  |
| Pretitration            | off                 | Delay time           | 0 s       |
| End value               | 12                  |                      |           |
| EQ                      | on                  | Slope value          | 700       |
| Max. titration volume   | 20 ml               |                      |           |
| Dosing speed            | 100%                | Filling speed        | 30 s      |

Calculation:

$$T \text{ [mol/l]} = \frac{W * F2}{(EQ - B) * M * F1}$$

|     |        |                                                      |
|-----|--------|------------------------------------------------------|
| B   | 0      | Blank value                                          |
| W   | man    | Weight of the sample [g]                             |
| F2  | 1000   | Conversion factor ml - l                             |
| EQ1 |        | Consumption of titrant until first Equivalence point |
| M   | 204,22 | Molecular mass                                       |
| F1  | 1      | Conversion factor                                    |

We recommend to write the exact concentration T to the Exchangable Unit (WA) automatically.