

### 1.1.11 Acid consumption (alkalinity, p- und m-value) acid capacity up to pH 8.2 or 4.3

#### Reagents

Activated carbon

Phenolphthalein, 0.0375 % (alcoholic)

Methyl orange, 0.1 %

Hydrochloric acid, 0.1 N

#### Procedure

- Titrate 100 ml of the water sample decolourised with activated carbon, if necessary after adding 0.5 ml phenolphthalein solution, with 0.1 N hydrochloric acid until decolourisation (used ml of 0.1 N hydrochloric acid = p-value, acid capacity up to pH 8.2)
- After addition of 0.1 ml methyl orange solution keep titrating with 0.1 N hydrochloric acid until colour change from yellow to yellowy-brown (total usage in ml 0.1 N hydrochloric acid = m-value, acid capacity up to pH 4.3)

#### Calculation

Due to different change ranges (phenolphthalein: pH 8.2-10.0; methyl orange: pH 3.0-4.4) plus the fact that carbonates titrated against phenolphthalein are only detected to one half (the change takes place during transition into hydrogen carbonate) the carbonate and hydrogen carbonate content can be calculated from the p-value and m-value as well as the hydroxide content with the aid of the following calculation table and the equivalent.

a) By means of calculation table

Titration result		The examined sample contains (meq/l):		
		Hydroxide	Carbonate	Hydrogen carbonate
if	p = 0	0	0	m
	2 p < m	0	2 p	m - 2 p
	2 p = m	0	2 p	0
	2 p > m	2 p - m	2 (m - p)	0
	p = m	m	0	0

#### Specification of the results

In meq/l with one decimal

b) By means of the equivalent (based on the calculation table)

*Carbonates,  $\text{CO}_3^{2-}$  (mg/l) = 0.1 N hydrochloric acid (ml) × 30*

*Hydrogen carbonates,  $\text{HCO}_3^-$  (mg/l) = 0.1 N HCl (ml) × 61*

*Bound carbon dioxide,  $\text{CO}_2$  (mg/l) = 0.1 N HCl (ml) × 22*

#### *Specification of the results*

In mg/l without decimals

#### *Remarks*

During titration the innate colouration of water has a disturbing impact; it needs to be eliminated by treatment with activated carbon.

#### *Note*

Order number: 1.11109, Reagent set with titrating pipette, E. Merck, Darmstadt, Germany

#### *Literature*

1. P-Sch, S. 361
2. Merck, Darmstadt: Die Untersuchung von Wasser ([www.merck.de](http://www.merck.de))