

Titer determination of strong acids

Description

This application report describes the general procedure for the titer determination of aqueous strong acids like Hydrochloric acid, Sulfuric acid, Perchloric acid and Nitric acid. The procedure is also usable for strong acids in water-soluble organic solvents like alcohols. It is not suitable for titer determination of Perchloric acid in Glacial acetic acid.

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 or higher
Exchangeable Unit	WA 20 (TL 7XXX)
Electrode	N 62 or A 7780 NTC30 DIN N, A 162 2M-DIN-ID or similar
Cable	L 1 A (only for electrodes with plug head)
Stirrer	Magnetic stirrer TM 235 (TM 50 for TL 5000) or similar
Lab accessoires	Glas beaker 150 ml
	Magnetic stirrer bar 30 mm

Reagents

1	the acid from which the titer is to be determined
2	Distilled water
3	Tris(hydroxymethyl)-aminomethan (TRIS) – certified reference material, volumetric standard
4	KCl solution 3 mol/l
All reagents should be in analytical grade or better.	

Titration procedure

Reagents

The TRIS volumetric standard is dried as described in the corresponding certificate of analysis, mostly 24h at room temperature over drying agent.

The distilled water has to be free of CO₂ or Carbonate. In order to remove any CO₂, the water is briefly boiled and allowed to cool down in a covered container.

Cleaning and storage of the electrode

Use distilled water for cleaning the electrode. For storage use KCl solution 3 mol/l or electrolyte solution L 911.

Sample preparation

The amount of volumetric standard depends on the size of the burette and the concentration of the acid. 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 TRIS can be estimated according to this rule of thumb:

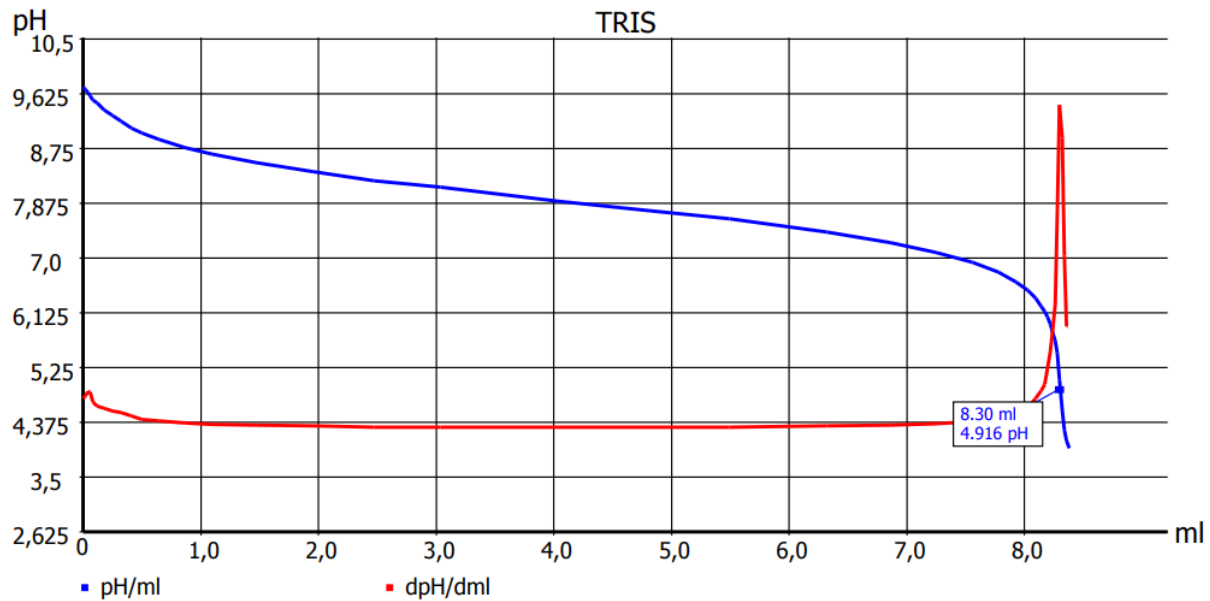
$$W [g] = \text{Concentration} [mol/l]$$

To determine the titer of a 0.1 mol/l acid, about 0.12 g TRIS volumetric standard are weighed into a 150 ml beaker with an accuracy of 0.1 mg and filled up to 80 ml with distilled, CO₂-free water. When the TRIS is completely dissolved, the acid is titrated to an EQ.

If the specified assay of the volumetric standard is significantly 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 HCl		
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	Decrease
Pretitration	off	Delay time	0 s
End value	2.5		
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	121,136	Molecular mass
F1	1	Conversion factor

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

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