



Calibration of an Acidic Solution

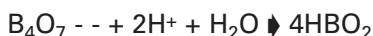
Reagent preparation

In aqueous media, 2 acids are mainly used as titrants: HCl (concentrated commercial solution is around 12M) or H₂SO₄ (18M or 36N). It is also possible to use HNO₃ (concentrated commercial solution is nearly 12.8M). To prepare 1000 ml of 0.1 eq/l strong acid solution, dilute X ml of concentrated acid (see table) in 200 ml of distilled water and, by means of a volumetric flask, dilute to 1000 ml. **CAUTION:** These operations are highly exothermic. Observe laboratory safety regulations.

Acid	Conc.% w/w	Density g/l	Conc. M (mol/l)	X = Vol (ml)
HNO ₃	60%	1.35	12.8	7.8
H ₂ SO ₄	96%	1.83	18	2.8
HCl	37%	1.18	12	8.3

Standard preparation

To calibrate acid solution, use analytical grade Na₂B₄O₇·10 H₂O as standard (molecular weight 381.4 g/mol); it reacts with H⁺ ions according to



A 0.1 eq/l borax solution contains 0.05 mol/l (or 1/20 mol/l) of borax. To prepare 1000 ml of 0.1 eq/l of standard, weigh exactly 19.070 g of analytical grade Na₂B₄O₇·10 H₂O and dilute to 1000 ml with a volumetric flask.

Electrode and reagents

pHC2401-8 Combined pH Electrode (part no. E16M336)

Freshly distilled water

0.1 eq/l borax standard solution

IUPAC Series pH standards pH 4.005 (part no. S11M002) and pH 10.012 (part no. S11M007)

End Point titration settings

Burette volume:	25 ml
Stirring speed:	400 rpm
Working mode:	pH
Number of end points:	1
End point:	5.10 pH
Stirring delay:	10 seconds
Minimum speed:	0.2 ml/min
Maximum speed:	6.0 ml/min
Proportional band:	3.0 pH
End point delay:	5 seconds

Direction:	Decreasing pH
Sample unit:	ml
Standard amount:	20
Standard conc.:	0.1 eq/l
Result:	eq/l

Procedure

Prepare the titration system with a 25 ml burette and 0.1 eq/l acid solution as titrant.

Calibrate the pHC2401-8 electrode using IUPAC standards.

Do not forget to fill the reagent bottle absorption chamber with absorbent.

Pipette exactly 20 ml of borax 0.1 eq/l.

Complete to 100 ml with distilled water.

Dip electrode and delivery tip in the solution.

Start method by pressing the RUN key.

Results

The result is expressed as eq/l concentration and based on the following formula:

$$\text{Vol}(\text{acid sol}) * \text{C}(\text{acid sol}) = \text{Vol}(\text{borax sol}) * \text{C}(\text{borax sol})$$

The calibration result can be accepted if 5 determinations give a result with a relative standard deviation of less than 0.5%.

Notes

a) Using a solution as standard, it is best to use a standard concentration close to the titrant concentration.

This allows closed volumes for titrant and standard. For the best result accuracy, pipette a standard volume corresponding to a delivered titrant volume greater than 50% of the used burette cylinder.

b) The application note uses a 25 ml cylinder capacity. If you use a 5 or 10 ml cylinder for the burette, pipette 5 ml of standard and modify the method as follows:

Predose: 2 ml
Maximum volume: 8 ml

c) It is possible to calibrate an acid titrant by weighing an amount of borax. With a 25 ml burette cylinder capacity. Exactly weigh approximately 380 mg of borax.

In the STANDARD screen ENTER

Standard unit: mg
Standard amount: xx.x
Concentration unit: %
Concentration: 100
(or purity of the
standard)
Molecular weight: 381.4

And in the RESULT screen ENTER

Result: eq/l

For HCl or HNO₃ (result in eq/l or mol/l)

Coefficients: 1 Standard + 2 Titrant

For H₂SO₄ (result in eq/l)

Coefficients: 2 Standard + 2 Titrant

For H₂SO₄ (result in mol/l)

Coefficients: 1 Standard + 1 Titrant