



*The wise choice*

# Inorganic Trace Analysis

Pure confidence





**Inorganic Trace Analysis, the measurement of trace concentrations of elements, is more and more commonly performed. The most used techniques include Atomic Absorption Spectroscopy (AAS) and Inductively Coupled Plasma (ICP).**

**Over the years, Scharlab has developed a whole range of products for this purpose, including standards and ultrapure acids, to guarantee optimum results when analysing inorganic traces by any of the above mentioned techniques.**

## Atomic Absorption Spectroscopy (AAS)

AAS uses absorption spectroscopy to assess the concentration of an analyte in a sample and requires standards with known analyte content to establish the relationship between the measured absorbance and the analyte concentration. Depending on the atomiser used (flame or graphite tube) AAS can be:

### Flame Atomic Absorption Spectroscopy (FAAS)

FAAS uses a flame to dissociate the sample into free atoms. After dissociation, light from a hollow cathode lamp passes through the cloud of atoms and those of interest absorb it at a characteristic wavelength. The amount of light absorbed will be directly proportional to the concentration of the element in the original sample.

The typical detection limits for this technique are around 10-100 ppb.

### Graphite Furnace Atomic Absorption Spectroscopy (GFAAS)

In GFAAS, the flame has been replaced by a graphite tube, which is heated to remove the solvents and matrix and dissociates the sample. Once it is totally atomised, the atoms are retained in the tube for a longer period of time, which makes the technique's sensitivity significantly higher than that of flame AAS. In this case, the detection limits are usually around 10-100 ppt.

Depending on the technique used, the standards and the quality of the acids needed for optimum results will be different.

## ICP

ICP is a technique used for elemental analysis which atomises and ionises the elements of a sample and combines with Optical Emission Spectroscopy (ICP-OES) or Mass Spectroscopy (ICP-MS) for its detection.

Unlike atomic absorption spectroscopy, which usually measures one single element at a time, ICP has the capacity to scan for various elements simultaneously.

### ICP-OES

Inductively coupled plasma optical emission spectroscopy (ICP-OES) is a type of emission spectroscopy that uses an argon plasma to atomise and ionise the sample. Once dissociated, the atoms or ions are excited and emit light of a characteristic wavelength. The intensity of this emission is used to calculate the concentration of the element in the sample.

Typical detection limits for this technique are around 1-10 ppb.

### ICP-MS

This technique also uses argon plasma to dissociate the sample into atoms and ions, but in this case the mass spectrometer detects the actual ions instead of the light they emit. Once extracted from the plasma, the ions continue to the mass spectrometer, where they are separated according to their atomic mass-charge ratio. In this case, detection limits are usually around 1-10 ppt.



## Scharlab Reagent grade Acids

This is the routine used grade for laboratory analytical work and comprises high quality chemicals for laboratory and specialised industrial use. Analytical reagents are in most cases ISO and ACS labelled.

Scharlab reagent grade acids are a competitive choice for inorganic trace analysis by FAAS.

- ◆ Up to 34 elements analysed.
- ◆ Available in 1 l and 2,5 l glass bottles and HDPE bottles, and the more concentrated acids are also in safe plastic-coated bottles.

Description	Art. No.
Acetic acid glacial, ExpertQ®, reagent grade, ACS ISO	<b>AC0353</b>
Hydrochloric acid, 37%, ExpertQ®, reagent grade, ACS, ISO	<b>AC0741</b>
Nitric acid, solution min. 65%, ExpertQ®, reagent grade, ISO Ph Eur	<b>AC1601</b>
Nitric acid 69,5%, ExpertQ®, reagent grade, ACS ISO	<b>AC1600</b>
Sulfuric acid 95-97%, ExpertQ®, reagent grade, ISO	<b>AC2067</b>

## Scharlab Reagent grade Acids with low mercury content

Mercury is a highly toxic contaminant that enters the human food chain through river and sea water. Mercury analysis of fish is performed by means of CVAAS (Cold Vapour Atomic Absorption Spectroscopy). Before the analysis, the samples are digested in mineral acids, which must be mercury-free.

Our low mercury content acids have a guaranteed maximum of 5 ppb of Hg, which is optimum for the determination of mercury.

- ◆ Up to 34 elements analysed, each of them has a guaranteed maximum of 500 ppb per element, most of them at levels between 10 and 50 ppb.
- ◆ Available in 1 l and 2,5 l glass bottles.
- ◆ Comply with ACS and ISO.

Description	Art. No.
Hydrochloric acid, 37%, ExpertQ®, reagent grade, ACS, ISO	<b>AC0730</b>
Nitric acid, min. 69,5%, ExpertQ®, reagent grade, ACS, ISO	<b>AC1607</b>
Nitric acid, solution min. 65% w/w, ExpertQ®, reagent grade, ISO	<b>AC1605</b>
Sulfuric acid, 95-98%, ExpertQ®, reagent grade, ACS, ISO	<b>AC2097</b>

## Scharlau AAS Standards

Used as external standards to calibrate AAS equipment, these must have a very accurate concentration.

Our AAS standards are manufactured using high purity elements and acids to guarantee optimum performance and reliable results. They all have a concentration of 1000 ppm of the element.

- ◆ Available in 100 and 500 ml HDPE bottles, with the exception of gold and mercury, which is available in glass bottles.
- ◆ All traceable to NIST and the number of the standard they are traceable to is available on each Certificate of Analysis.
- ◆ The Certificate of Analysis is always supplied with the product.
- ◆ Tested by gravimetric, volumetric or ICP methods.

Each standard contains the element dissolved in the most suitable matrix.

### Standard solutions 1000 mg/l Al for AA

ISO 17025  
COMPLIANCE

H																	He				
<b>Li</b> LI0061	Be															<b>B</b> BO0014	C	N	O	F	Ne
<b>Na</b> SO0006	<b>Mg</b> MA0012															<b>Al</b> AL0755	<b>Si</b> SI0013	P	S	Cl	Ar
<b>K</b> PO0106	<b>Ca</b> CA0177	Sc	<b>Ti</b> TI0365	<b>V</b> VA0072	<b>Cr</b> CR0223	<b>Mn</b> MA0112	<b>Fe</b> HI0305	<b>Co</b> CO0016	<b>Ni</b> NI0122	<b>Cu</b> CO0086	<b>Zn</b> CI0127	Ga	Ge	<b>As</b> AR0152	<b>Se</b> SE0012	Br	Kr				
Rb	<b>Sr</b> ES0178	Y	Zr	Nb	<b>Mo</b> MO0022	Tc	Ru	Rh	Pd	<b>Ag</b> PL0006	<b>Cd</b> CA0042	In	<b>Sn</b> ES0062	<b>Sb</b> AN0442	Te	I	Xe				
Cs	<b>Ba</b> BA0011	La	Hf	Ta	<b>W</b> TU0012	Re	Os	Ir	Pt	<b>Au</b> OR0058	<b>Hg</b> ME0112	Tl	<b>Pb</b> PL0106	<b>Bi</b> BI0131	Po	At	Rn				
Fr	Ra	Ac	Rf	Db	Sg	Bh	Hs	Mt	Ds	Rg	Cn	Nh	Fl	Mc	Lv	Ts	Og				

› Standards of elements not included in this table upon request.

## Ultratrace® Ultrapure Acids

Ultrapure reagents are needed in the digestion of solid samples prior to analysis using atomic spectroscopy methods such as ICP or AAS. These techniques have very low detection limits: parts per billion (ppb) or parts per trillion (ppt). It is crucial that the ultrapure acids are free of elements traces.

Scharlab offers **Ultratrace®**, a wide range of ppb-grade and ppt-grade ultrapure reagents for inorganic trace analysis. Ultratrace® comprises extremely pure acids and reagents in two grades:

### Ultratrace® ppb grade

#### Ultratrace® ppt grade

- ◆ Outstanding low metal content.
- ◆ Analytical results for more than 60 elements, determined using ICP-MS.
- ◆ Ultratrace® undergo a proprietary purification process.
- ◆ Products and bottles are manufactured under trace elemental clean conditions.



### Ultratrace® ppb grade

Our ppb grade comprises acids and ammonia, for optimum result when analysing inorganic traces.

- ◆ All of them certified at maximum element impurity levels of 1 part per billion (ppb).
- ◆ Available in 500 ml and 1 l bottles, and hydrochloric and nitric acid also in 2,5 l bottles.
- ◆ All packed in PE bottles with the exception of perchloric acid, which is packed in glass bottles.
- ◆ The PE bottles are lighter, safer and more suitable as they do not transfer any elemental impurities into the acids.

### Ultratrace® ppt grade

Our ppt grade line includes acids, ammonia, hydrogen peroxide and water.

- ◆ All of them certified at maximum element impurity levels of 100 part per trillion (ppt).
- ◆ All packaged in PTFE, PFA and FEP fluoropolymer bottles with the exception of ammonia and water, which are packed in PE bottles.
- ◆ Available in 250 ml and 500 ml bottles, and water in 1 l bottles.
- ◆ The PTFE, PFA and FEP fluoropolymer containers are optimum for maintaining the product in excellent condition during its shelf life.

Description	Art. No.
Acetic acid glacial Ultratrace®, ppb-trace analysis	<b>AC0358</b>
Ammonia, solution 20-22% Ultratrace®, ppb-trace analysis	<b>AM0269</b>
Hydrochloric acid, 37% Ultratrace®, ppb-trace analysis	<b>AC0780</b>
Hydrofluoric acid, 48% Ultratrace®, ppb-trace analysis	<b>AC1061</b>
Nitric acid, 69% Ultratrace®, ppb-trace analysis	<b>AC1617</b>
Perchloric acid, 70% Ultratrace®, ppb-trace analysis	<b>AC1761</b>
Sulfuric acid, 96% Ultratrace®, ppb-trace analysis	<b>AC2114</b>

Description	Art. No.
Acetic acid glacial Ultratrace®, ppt-trace analysis	<b>AC0359</b>
Ammonia, solution 20-22% Ultratrace®, ppt-trace analysis	<b>AM0272</b>
Hydrochloric acid, 35% Ultratrace®, ppt-trace analysis	<b>AC0781</b>
Hydrofluoric acid, 48% Ultratrace®, ppt-trace analysis	<b>AC1062</b>
Hydrogen peroxide, solution 30% w/w (110 vol) Ultratrace®, ppt-trace analysis	<b>HI0143</b>
Nitric acid, 69% Ultratrace®, ppt-trace analysis	<b>AC1618</b>
Sulfuric acid, 96% Ultratrace®, ppt-trace analysis	<b>AC2115</b>
Water Ultratrace®, ppt-trace analysis	<b>AG0016</b>



## Scharlau ICP Standards

Used as external standards for the calibration of ICP equipments. Due to its higher sensitivity the ICP technique requires standards of extremely high purity:

- ◆ Manufactured with ultra high purity elements and acids, Scharlau ICP standards guarantee optimum performance and reliable results.
- ◆ Our ICP standards are prepared starting from elements having a minimum purity of 99.99%, dissolved in ultrapure acids.
- ◆ Directly traceable to the NIST.
- ◆ Produced in an accredited ISO 17025 and ISO Guide 34 laboratory.
- ◆ Wide range of single element standards and also multi-element mixtures under request.
- ◆ Packed in 100 ml HDPE bottles, previously leached with acid, to ensure the absence of impurities.
- ◆ Translucent bottles: the remaining product is always visible.
- ◆ The Certificate of Analysis is always supplied with the product.
- ◆ Tested by gravimetric, volumetric or ICP methods.



All our ICP standards are made in aqueous matrix.

ICP, just like AAS, is not an absolute technique, so it needs standards of a known concentration of the element/s to be able to determine the concentration of the element present in the original sample.

### ICP Single Element Standards 1000 ppm ICP Standard solutions



H																	He				
Li LI0064	Be BE0346															B BO0018	C	N	O	F	Ne
Na SO0009	Mg MA0016															Al AL0754	Si SI0016	P FO0036	S SU0102	Cl	Ar
K PO0111	Ca CA0181	Sc ES0021	Ti TI0366	V VA0076	Cr CR0227	Mn MA0116	Fe HI0291	Co CO0014	Ni NI0126	Cu CO0081	Zn CI0129	Ga GA0036	Ge GE0072	As AR0156	Se SE0016	Br	Kr				
Rb RU0021	Sr ES0181	Y IT0011	Zr CI0256	Nb NI0071	Mo MO0024	Tc	Ru RU0063	Rh RO0023	Pd PA0066	Ag PL0008	Cd CA0045	In IN0088	Sn ES0066	Sb AN0445	Te TE0023	I	Xe				
Cs CE0108	Ba BA0016	La LA0081	Hf HA0011	Ta TA0201	W TU0016	Re RE0078	Os OS0056	Ir IR0011	Pt PT0006	Au OR0063	Hg ME0116	Tl TA0031	Pb PL0108	Bi BI0136	Po	At	Rn				
Fr	Ra	Ac	Rf	Db	Sg	Bh	Hs	Mt	Ds	Rg	Cn	Nh	Fl	Mc	Lv	Ts	Og				

La	Ce CE0038	Pr	Nd	Pm	Sm SA0211	Eu EU0052	Gd GA0011	Tb	Dy DI0301	Ho	Er ER0031	Tm	Yb IT0004	Lu LU0016
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## ICP Standards Single Element 10000 ppm ICP Standard solutions



H																	He
Li LI0065	Be BE0347											B BO0015	C	N	O	F	Ne
Na SO0011	Mg MA0017											Al AL0756	Si SI0014	P FO0037	S SU0104	Cl	Ar
K PO0103	Ca CA0183	Sc ES0022	Ti TI0361	V VA0073	Cr CR0224	Mn MA0113	Fe HI0292	Co CO0017	Ni NI0124	Cu CO0082	Zn CI0131	Ga GA0037	Ge GE0073	As AR0154	Se SE0013	Br	Kr
Rb RU0022	Sr ES0183	Y IT0012	Zr CI0257	Nb NI0072	Mo MO0026	Tc	Ru RU0064	Rh	Pd PA0067	Ag PL0009	Cd CA0043	In IN0089	Sn ES0067	Sb AN0443	Te TE0024	I	Xe
Cs CE0109	Ba BA0013	La LA0082	Hf HA0012	Ta TA0202	W TU0013	Re RE0079	Os OS0057	Ir IR0012	Pt PT0007	Au OR0059	Hg ME0117	Tl TA0032	Pb PL0109	Bi BI0132	Po	At	Rn
Fr	Ra	Ac	Rf	Db	Sg	Bh	Hs	Mt	Ds	Rg	Cn	Nh	Fl	Mc	Lv	Ts	Og
		La	Ce CE0039	Pr PR0012	Nd NE0065	Pm	Sm SA0212	Eu EU0053	Gd GA0012	Tb	Dy DI1302	Ho	Er ER0032	Tm	Yb IT0005	Lu LU0017	

## ICP Multielement Standards



Description	Art. No.
ICP multielement calibration standard solution, 26 elements	<b>MU0111</b>
ICP multielement calibration standard solution, 9 elements	<b>MU0112</b>
ICP multielement calibration standard solution, 16 elements	<b>MU0113</b>
ICP multielement calibration standard solution, 4 elements	<b>MU0114</b>

### Custom-made ICP standards

We offer the possibility of supplying multi-element standards for ICP-OES and ICP-MS according to customer needs, produced in an ISO 17025 and ISO 17034 accredited laboratory.

Do not hesitate to contact [helpdesk@scharlab.com](mailto:helpdesk@scharlab.com) or your commercial agent to receive more information.

## Ultrapure Acids: Ordering information

		Description	Packaging	Art. No.
ppb grade	Ultrapure®	Acetic acid glacial Ultrapure®, ppb-trace analysis	500 ml	<b>AC03580500</b>
		Ammonia, solution 20-22% Ultrapure®, ppb-trace analysis	500 ml	<b>AM02690500</b>
		Hydrochloric acid, 37% Ultrapure®, ppb-trace analysis	500 ml	<b>AC07800500</b>
			1 l	<b>AC07801000</b>
		Hydrofluoric acid, 48% Ultrapure®, ppb-trace analysis	2,5 l	<b>AC07802500</b>
			500 ml	<b>AC10610500</b>
		Nitric acid, 69% Ultrapure®, ppb-trace analysis	500 ml	<b>AC16170500</b>
			1 l	<b>AC16171000</b>
		Perchloric acid, 70% Ultrapure®, ppb-trace analysis	2,5 l	<b>AC16172500</b>
			500 ml	<b>AC17610500</b>
ppt grade	Ultrapure®	Sulfuric acid, 96% Ultrapure®, ppb-trace analysis	500 ml	<b>AC17610500</b>
		Sulfuric acid, 96% Ultrapure®, ppt-trace analysis	1 l	<b>AC21141000</b>
		Acetic acid glacial Ultrapure®, ppt-trace analysis	250 ml	<b>AC03590250</b>
		Ammonia, solution 20-22% Ultrapure®, ppt-trace analysis	250 ml	<b>AM02720250</b>
		Hydrochloric acid, 35% Ultrapure®, ppt-trace analysis	250 ml	<b>AC07810250</b>
			500 ml	<b>AC07810500</b>
		Hydrofluoric acid, 48% Ultrapure®, ppt-trace analysis	1 l	<b>AC07811000</b>
			250 ml	<b>AC10620250</b>
		Hydrogen peroxide, solution 30% w/w (110 vol) Ultrapure®, ppt-trace analysis	250 ml	<b>HI01430500</b>
			500 ml	<b>AC16180250</b>
Nitric acid, 69% Ultrapure®, ppt-trace analysis	500 ml	<b>AC16180500</b>		
	1 l	<b>AC16181000</b>		
Sulfuric acid, 96% Ultrapure®, ppt-trace analysis	250 ml	<b>AC21150250</b>		
	500 ml	<b>AC21150500</b>		
		Water Ultrapure®, ppt-trace analysis	1 l	<b>AG00161000</b>

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