

# Analytical Volumetric Solutions & Indicators



## The Principle of Titrimetry

Titrimetry or measurement by titration includes a set of widely used analytical techniques, some of which have been in widespread use for almost 200 years. Volumetric titration dates back at least to the work of French chemist Gay-Lussac, who devised a method in 1835 to determine the purity of Silver, using standardised Sodium Chloride as the titrant.

The principle of all titrimetry involves the determination of the quantity of the reagent of known concentration (titrant), that is required to react completely with an unknown analyte. Volumetric titrimetry involves measuring the volume of the solution of known concentration (titrant) consumed, gravimetric titrimetry measures the mass of the reagent consumed and coulometric titration measures a direct electrical current of known magnitude that consumes the analyte. In coulometry, the time it takes to complete the electrochemical reaction, is the measurand.

An analytical volumetric solution (also called titrant, standard titrant or standard solution) is a reagent of known concentration that is added from a burette or other dispensing apparatus to a sample (analyte) until a reaction between the two liquids is judged to be complete. This completeness (end point) is usually observed in a manual titration by the production of a physical change read visually as the titrant is added to the analyte. Such a change may include an appearance, disappearance or change of colour or appearance/disappearance of turbidity (cloudiness). Nowadays, instruments are widely used to detect the end points by detection of any of several properties or characteristics of the analyte solution including colour, turbidity, temperature, refractive index, potential difference, current or conductivity. In simple terms titrimetry is broadly divided into two main classifications - manual and instrumental - irrespective of how the end point is detected. In the case of manual titrations, indicator, titrant or analyte change of colour is by far the most important method of end point detection. Therefore, the availability of a wide selection of indicators is an integral part of any offering of Analytical Volumetric Solutions. This compendium carries by far the most extensive offering of both indicators and titrants available in the market place. The end point in automatic titration is indicated most commonly by a change in potential of an electrode that responds to the concentration of the reagent or the analyte.

## Analysis by titration brings a large number of benefits to the analyst including the following:

- Relatively easy to perform (although high accuracy manual titration requires practice, dexterity, experience and sound judgement)
- Rapid, cheap and versatile
- Accurate, reproducible, traceable and comparable

Furthermore, titration reactions should exhibit defined stoichiometry, be quantitative, establish equilibrium that is definite and fast, and provide unambiguous results.

# Types of Titration Reactions

## Acid/Base reactions (also called neutralisation titrations)

These are used to determine either the amount of acid/base in an analyte or substances that can be converted to an acid/base. They may also sometimes be used to track the progress of chemical reactions that produce or consume hydrogen ions. The titrants are always strong acids or bases and include hydrochloric acid, perchloric acid, sulphuric acid, sodium hydroxide, potassium hydroxide and sometimes barium hydroxide. Weak acids or bases are not used because they react incompletely with the analyte. The colour indicator used in an acid base titration is a weak acid/base itself which in its undissociated form differs in colour from its conjugate acid or base form. Typical elements suitable to this type of titration method include carbon, nitrogen, chlorine, bromine and fluorine. Pretreatment of these elements converts the element to an inorganic acid or base that is then titrated. An example is nitrogen which occurs in a wide range of forms both organic, inorganic or as a constituent of biological materials. Therefore, a methodology for nitrogen measurement in amine groups such as the Kjeldahl method is extremely important in determining the protein content in grains, meats, and other human or animal foodstuffs. In addition to amines, others like esters and hydroxyl functional groups can also be determined. In addition, inorganic compounds such as carbonates, ammonium salts and several other NO<sub>x</sub> species can be determined.

## Fields of Application

- Acid content in wine, milk, ketchup, fruit juice (etc)
- Content of HCl, HNO<sub>3</sub>, H<sub>2</sub>SO<sub>4</sub>, NaOH, KOH
- Alkalinity determination in water
- TAN and TBN in petroleum products, edible or inedible oils and fats
- Determination of boric acid in cooling fluids of nuclear power stations
- Determination of free or total acidity in plating baths
- Determination of active ingredients in drugs or raw materials for the pharmaceutical industry
- Total nitrogen determination by Kjeldahl
- Wide range of inorganic, organic or biological species that possess inherent acidic or basic properties
- Use of chemical treatment that converts an analyte to an acid or base followed by titration with standardised strong acid or base

## Oxidation/Reduction Titrations

These titrations may be performed manually or potentiometrically. In manual titrations, if indicators are used, they change colour upon being oxidized or reduced, independently of the chemical nature of the titrant or analyte. Instead, they depend on changes in the electropotential of the oxidation reduction system. Examples of such indicators include:

- Iron (III) complexes of orthophenothrolines
- Starch solutions
- Potassium thiocyanate

The principle of this type of titration involves a reaction between an oxidising and reducing pair, e.g. titration of iron (II) with cerium (IV) sulphate

- **Oxidising agents (examples)**
  - Iodine (Iodometry), potassium dichromate, potassium permanganate, potassium bromate, cerium (IV) ammonium nitrate, cerium (IV) ammonium sulphate, cerium (IV) hydrogen sulphate, cerium hydroxide, chlorine
- **Reducing agents (examples)**
  - Sodium thiosulphate, oxalic acid, iron ammonium (II) sulphate (Mohr's salt), hydrogen peroxide, phenylarsine oxide (PAO), iron (II) ethylene diamine sulphate

## Fields of Application

- *Environment*
  - COD of water
  - Oxidation capacity of water by permanganate
- *Food and beverage*
  - Determination of free and total  $\text{SO}_2$  in water, wine, alcohol, dried fruit etc
- *Pharmaceuticals*
  - Vitamin C determination
  - Surface treatment
  - Titration of copper or tin using iodine
  - Titration of chromium (VI)
- *Petrochemicals*
  - Determination of water in hydrocarbons

## Complexometric Titrations

Complexometric reactions have many applications in chemical analysis and in science in general. Their use in titrimetry is a very important one of these applications. The reaction end point is detected either potentiometrically or manually using an indicator, whereby, a metal ion reacts appropriately with a ligand to form a complex. EDTA is the most widely used titrant in complexometric reactions although the use of other chemicals similar to EDTA are described in the literature; e.g. nitrilotriacetic acid. Generally, organic dyes that form complexes with metal ions to form chelates are used as indicators, a commonly used one being Eriochrome Black T. Methods have been developed, validated and published for detection or quantification of almost every metal in the periodic table with the exception of the Alkali metals using EDTA complexation. This includes methods for at least 40 metals developed in our metals laboratory in Reagecon, with more at development or validation stage.

This methodology is regularly used to determine the concentration of divalent cations such as calcium, magnesium, copper, lead, zinc, cadmium, aluminium

## Fields of application

- *Environment*
  - Total hardness of water ( $\text{Ca}^{2+}$  and  $\text{Mg}^{2+}$ ).
- *Surface treatment*
  - Determination of  $\text{Cu}^{2+}$ ,  $\text{Ni}^{2+}$ ,  $\text{Pb}^{2+}$ ,  $\text{Zn}^{2+}$  in plating baths

## Precipitation Titrations

This analytical methodology is based on reactions that yield compounds of limited solubility. There is not a very wide range of precipitating agents that can be used gainfully in titrimetry and silver nitrate is by far the most important. These titrations, (also called argentometric titration) is where silver nitrate is used as the titrant. Silver nitrate can be used for determination of halides ( $\text{Cl}^-$ ,  $\text{I}^-$ ,  $\text{Br}^-$ ) and anions that behave like halides ( $\text{SCN}^-$ ,  $\text{CN}^-$ ,  $\text{CNO}^-$ ). It can also be used for determination of Mercaptans and organic materials that include Fatty Acids. Indicators typically used for precipitation titrations include sodium chromate, fluorescein and iron (III). A wide range of standardised silver nitrate titrants are available, some of which are standardised to specifically give a one to one equivalence with sodium chloride in various food stuffs.

## Fields of Application

- *Environment*
  - Determination of chloride in water
- *Food and beverage*
  - Determination of chloride in many finished products (cooked meats, dairy products, etc.)
- *Precious metals*
  - Determination of silver
- *Pharmaceuticals*
  - Titration of halides

## Analytical Volumetric Solutions

Description	Product No. 1L	Product No. 2.5L	Product No. 5L
Acetic acid 0.1M (0.1N)	CH20101		CH20105
Acetic acid 0.5M (0.5N)	CH20051		CH20055
Acetic acid 1.0M (1.0N)	CH21001		CH21005
Acetic acid 2.0M (2.0N)	CH22001		CH22005
Acetic acid 5.0M (5.0N)	CH25001		
Ammonia 0.1M (0.1N)	NH20101		NH20105
Ammonia 1.0M (1.0N)	NH21001		
Ammonia 2M in 1-Propanol	NH1P22001		NH1P22005
Ammonium Chloride 0.05M	NH4CL041		
Ammonium Chloride 0.1M	NHCL011		
Ammonium Hydroxide 0.5M	NH2051		
Ammonium Hydroxide 5M	NH32501		
Ammonium Hydroxide 6M	NH32601	NH326W	
Ammonium Iron (II) Sulphate 0.1M	NHS2011		
Ammonium Sulphate 0.5M (1.0N)	AS2051		AS2055
Ammonium Thiocyanate 0.05M (0.05N)		AT20050W	
Ammonium Thiocyanate 0.1M (0.1N)	AT2010F	AT2010W	
Ammonium Thiocyanate 1.0M (1.0N)	AT21F	AT21W	
Barium Chloride 0.05M (0.1N)	BACL20051		BACL20055
Barium Chloride 0.5M (1.0N)	BACL2051		BACL2055
Barium Chloride 1.0M (2.0N)	BACL2101		BACL2105
Barium Perchlorate 0.005M Alcoholic Solution	BACLO200051		
Benzethonium Chloride 0.004M (Hyamine 1622 Solution)	HY0041		HY0045
Benzethonium Chloride 0.04M (Hyamine 1622 Solution)	HY041		HY045
Boron Tribromide 1M in Dichloromethane		BDCMW	
Bromine (Bromate/Bromide) 0.05M (0.1N)	BR20101		BR20105
Bromine (Bromate/Bromide) 0.25M (0.5N)	BR20251		

## Analytical Volumetric Solutions

Description	Product No. 1L	Product No. 2.5L	Product No. 5L
Calcium Acetate 1.0M	CAAC2101		CAAC2105
Calcium Chloride 0.005M (0.01N)	CACL20051		CACL20055
Calcium Chloride 0.0125M (0.025N)	CACL2001251		CACL2001255
Calcium Chloride 0.02M (0.04N)	CACL20021		CACL20025
Calcium Chloride 0.01M (0.02N)	CACL20011		CACL20015
Calcium Chloride 1.0 M (2.0N)	CACL101		
Calcium Chloride 0.5M (1.0N)	CACL2051		CACL2055
Cerium IV sulphate 0.05M (0.05N)	CS20051		CS20055
Cerium IV sulphate 0.1M (0.1N)	CS2011		CS2015
Cerium IV sulphate 0.2M (0.2N)	CS20251		CS20255
Cerium IV sulphate 1.0M (1.0N)	CS2101		CS2105
Citric Acid 1.0M	CA1010		
Copper II Chloride 0.5M (0.5N)	CUCL2051		CUCL2055
Copper II Sulphate 0.1M (0.1N)	CUS02011		CUS02015
Copper II Sulphate 0.5M (0.5N)	CUS02051		CUS02055
Copper Sulphate Hydrate Solution 0.2g/l			CSPHOS15000
Cupric Solution 0.168M (0.168N)	CU201681		CU201685
Di-Potassium Oxalate 0.05M	KO20051		KO20055
EDTA (DiSodium Salt) 0.027M (0.054N)	EDB200271		
EDTA (DiSodium salt) 0.01M (0.02N)	ED20011		ED20015
EDTA (DiSodium salt) 0.1M (0.2N)	ED2011		ED2015
EDTA (DiSodium Salt) 0.002M (0.004N)	ED200021		ED200025
EDTA (DiSodium Salt) 0.01785M (0.0357N)	ED2003571		
EDTA (DiSodium Salt) 0.02M (0.04N)	ED20021		
EDTA (DiSodium Salt) 0.025M (0.05N)	ED200251		
EDTA (DiSodium Salt) 0.05M (0.10N)	ED20051		
Ferric Chloride 0.01M	F0011		
Formic Acid 0.1M			F20105
Hydrochloric Acid 0.01M (0.01N)	H20011		H20015
Hydrochloric Acid 0.02M (0.02N)	H20021		H20025
Hydrochloric Acid 0.027M (0.027N )	H200271		
Hydrochloric Acid 0.0357M (0.0357N)	H2003571		H2003575
Hydrochloric Acid 0.05M (0.05N)	H20051		H20055
Hydrochloric Acid 0.0714M (0.0714N)	H2007141		
Hydrochloric Acid 0.1M (0.1N)	H20101		H20105
Hydrochloric Acid 0.233M (0.233N)			H202335
Hydrochloric Acid 0.25M (0.25N)	H20251		H20255
Hydrochloric Acid 0.2M (0.2N)	H20201		H20205
Hydrochloric Acid 0.357M (0.357N)	H203571		H203575
Hydrochloric Acid 0.5M (0.5N)	H20501		H20505
Hydrochloric Acid 0.714M (0.714N )	H207141		

Description	Product No. 1L	Product No. 2.5L	Product No. 5L
Hydrochloric Acid 1.0M (1.0N)	H21001		H21005
Hydrochloric Acid 1.8M (1.8N)			H21805
Hydrochloric Acid 15%			RH15WW100
Hydrochloric Acid 2.0M (2.0N)	H22001		H22005
Hydrochloric Acid 2.7M (2.7N)	H22701		
Hydrochloric Acid 3.57M (3.57N)	H23571		H23575
Hydrochloric Acid 3.0M (3.0N)	H23001		H23005
Hydrochloric Acid 4.0M (4.0N)	H24001		H24005
Hydrochloric Acid 5.0M (5.0N)	H25001		H25005
Hydrochloric Acid 6.0M (6.0N)	H26001		H26005
Hydrochloric Acid 8.0M (8.0N)			H28005
Hydrochloric Acid 0.5167M (0.5167N)	H2051671		
Hydrochloric Acid 0.773M (0.773N)	H207331		
Hydrofluoric Acid 0.05N 0.05M (0.05N)	HF20051		HF20055
Iodine 0.01M (0.02N)	I2001F		
Iodine 0.005M (0.01N)	I20005F		
Iodine 0.02365M (0.0473N )	I20023F		
Iodine 0.025M (0.05N)	I20025F	I20025W	
Iodine 0.05M (0.1N)	I2005F	I2005W	
Iodine 0.5M (1.0N)	I2050F	I2050W	
Iron (II) Sulphate 0.1M (0.1N)	FES2011		
Iron (II) Sulphate 0.2M (0.2N)	FES2021		FES2025
Iron (III) Chloride 1.0M	FECL211		FECL215
Lactic Acid 0.1M	CH6011		
Lead (II) Acetate 0.05M	PBA20051		PBA20055
Lead (II) Acetate 0.5M	PBA2051		PBA2055
Lead (II) Nitrate 0.5M (1.0N)	PBN02051		PBN02055
Lead Nitrate 0.01M (0.02N)	PB20011		
Lead Nitrate 0.1M (0.2N)	PB2011		
Magnesium Chloride 0.01M (0.02N)	MG20011		MG20015
Magnesium Chloride 0.1M (0.2N)	MG2011		MG2015
Magnesium Sulphate 0.01M (0.01N)	MGS020011		
Magnesium Sulphate 0.09M (0.09N)	MS0091		
Magnesium Sulphate 0.1M (0.1N)	MGS02011		MGS02015
Manganese (II) Chloride 0.05M (0.05N)	MNCL20051		MNCL20055
Manganese (II) Chloride 0.5M (0.5N)	MNCL2051		MNCL2055
Mercury (I) Nitrate 0.1M (0.2N)	HGN2011		HGN2015
Mercuric (II) Nitrate 0.05M (0.1N)	HGN20051		
Mercury (II) Nitrate 0.01M (0.02N)	HGN20011		HGN20015
Mercury (II) Nitrate 0.01N (0.005M)	HGN200051		HGN200055
Methanolic Hydrochloric Acid 0.5N		MH2050	

## Analytical Volumetric Solutions

Description	Product No. 1L	Product No. 2.5L	Product No. 5L
Morpholine 0.5N in Methanol		MD2050	
Nickle (II) Chloride 0.5M (0.5N)	NICL20051		NICL20055
Nitric Acid 0.01M (0.01N)	NO20011		
Nitric Acid 0.02M (0.02N)	NO20021		NO20025
Nitric Acid 0.1M (0.1N)	NO20101		NO20105
Nitric Acid 0.5% w/v Solution			N05WV5
Nitric Acid 1.0M (1.0N)	NO21001		NO21005
Nitric Acid 2.0M (2.0N)	NO22001		NO22005
Nitric Acid 4.0M (4.0N)	NO24001		NO24005
Nitric Acid 5.0M (5.0N)	NO25001		
Nitric Acid 6.0M (6.0N)	NO26001		
Nitric Acid 8.0M (8.0N)	NO28001		NO28005
Oxalic Acid 0.005M (0.01N)	OA200051		
Oxalic Acid 0.025M (0.05N)	OA200251		OA200255
Oxalic Acid 0.10M (0.2N)	OA2011		
Oxalic Acid 0.05M (0.1N)	OA20051		OA20055
Oxalic Acid 0.25M (0.5N)	OA20251		
Oxalic Acid 0.5M (1.0N)	OA2051		OA2055
Perchloric Acid 0.1N in 1.4 Dioxan	PD201F	PD201W	
Perchloric Acid 0.01M (0.01N) in Acetic Acid	P2001F		
Perchloric Acid 0.1M (0.1N) in Acetic Acid	P2010F	P2010W	
Perchloric Acid 0.5M (0.5N) in Acetic Acid	P2050F		
Phenylarsine Oxide 0.00564M	CH500561		
Phosphorous Tribromide 1M	PBR3DCM		
Potassium Biiodate 0.025N	HK2O0025F		
Potassium Biiodate 0.1N	HK2O01F		
Potassium Bromate 0.1M	KB201F		
Potassium Bromate/Bromide 0.0167M (0.1N)	KB20016F	KB20016W	
Potassium Bromide 0.5M	KBR205F		
Potassium Bromide 1M	KBR21F		
Potassium Chloride 0.01M (0.01N)	KCL20011		
Potassium Chloride 0.1M (0.1N)	KCL2011		
Potassium Chloride 0.2M (0.2N)	KCL2021		KCL2025
Potassium Chloride 0.5M (0.5N)	KCL2051		
Potassium Chloride 1.0M (1.0N)	KCL2101		KCL2105
Potassium Dichromate 0.02M (0.120N)	KC20021		
Potassium Dichromate 0.0208M (0.125N )		KC2002W	
Potassium Dichromate 0.0167M (0.1N)	KC20016F	KC20016W	
Potassium Dichromate 0.04M (0.24N)	KCR24F		
Potassium Dichromate 0.25M (1.5N)	KC20251		



Description	Product No. 1L	Product No. 2.5L	Product No. 5L
Potassium Dichromate 0.041M (0.25N)	KC20041F	KC20041W	
Potassium Dichromate 0.167M (1.0N)	KC2016F	KC2016W	
Potassium Dichromate 10mg/l	KC010F		
Potassium Dichromate 1870mg/l	KCR18701		
Potassium Ferricyanide 0.1M (0.1N)	KFE2011		KFE2015
Potassium Fluoride 20%			KF205
Potassium Fluoride 60% w/v			KF60
Potassium Hydrogen Phthalate 0.1M (0.1N)	PHP2011		PHP2015
Potassium Hydroxide 0.1N in Ethanol	ETKOH01F	ETKOH01W	
Potassium Hydroxide 0.1N in Methanol	MKOH01F	MKOH01W	
Potassium Hydroxide 0.05M (0.05N)	KOH20051		KOH20055
Potassium Hydroxide 0.1M (0.1N)	KOH20101		KOH20105
Potassium Hydroxide 0.223M (0.223N)			KOH202235
Potassium Hydroxide 0.23M (0.23N)			KOH20235
Potassium Hydroxide 0.5M (0.5N)	KOH20501		KOH20505
Potassium Hydroxide 0.5N in Ethanol	ETKOH05F	ETKOH05W	
Potassium Hydroxide 0.5N in Methanol	MKOH205F	MKOH205W	
Potassium Hydroxide 1.0M (1.0N)	KOH21001		KOH21005
Potassium Hydroxide 1.0M (1.0N) in Ethanol	ETKOH1F	ETKOH1W	
Potassium Hydroxide 1.0M (1.0N) in Methanol	MKOH1F	MKOH1W	
Potassium Hydroxide 10.0M (10.0N)	KOH2101		KOH2105
Potassium Iodate 0.0147M (0.08833N)		PI2008W	
Potassium Iodate 0.025M (0.15N)		PI20025W	
Potassium Iodate 0.01667M (0.1N)	PI20016F	PI20016W	
Potassium Iodate 0.05M (0.3N)	PI2005F	PI2005W	
Potassium Iodate/Iodide 0.00333M (0.02N)		PII2002W	
Potassium Iodide 0.1M (0.1N)	KI2011		KI2015
Potassium Iodide 1.0M (1.0N)	KI2101		KI2105
Potassium Iodide 1.8M (1.8N)		KI218W	
Potassium Iodide 3.0M (3.0N)	KI2301		KI2305
Potassium Permanganate 0.002M (0.01N)	PP20002F		
Potassium Permanganate 0.01M (0.5N)	PP2001F	PP2001W	
Potassium Permanganate 0.02M (0.1N)	PP2002F	PP2002W	
Potassium Permanganate 0.2M (1.0N)	PP2020F	PP2020W	
Potassium Thiocyanate 0.02M (0.02N)	KT2002F	KT2002W	
Potassium Thiocyanate 0.05M (0.05N)	KT2005F	KT2005W	
Potassium Thiocyanate 0.1M (0.1N)	KT201F	KT201W	
Potassium Thiocyanate 1.0M (1.0N)	KT210F	KT210W	
Silver Nitrate 0.0141M (0.0141N)		N20014W	
Silver Nitrate 0.0192M (0.0192N)	N20019F		



## Analytical Volumetric Solutions

Description	Product No. 1L	Product No. 2.5L	Product No. 5L
Silver Nitrate 0.01M (0.01N) in Isopropyl Alcohol	PN20010F		
Silver Nitrate 0.01M (0.01N)	N20010F		
Silver Nitrate 0.01M (0.01N) in Methanol	MN20010F		
Silver Nitrate 0.025M (0.025N)	N20025F		
Silver Nitrate 0.0282M (0.0282N)		N20028W	
Silver Nitrate 0.02M (0.02N)	N20020F	N20020W	
Silver Nitrate 0.04M (0.04N)	N2004F	N2004W	N20045
Silver Nitrate 0.05M (0.05N)	N20050F	N20050W	
Silver Nitrate 0.085M (0.085N)		N20085W	
Silver Nitrate 0.1N in Methanol	MN2010F		
Silver Nitrate 0.1M (0.1N)	N20100F	N20100W	N201005
Silver Nitrate 0.1709M (0.1709N)	N201709F	N201709W	
Silver Nitrate 0.5M (0.5N)	N2050F		
Silver Nitrate 1.0M (1.0N)	N21000F	N21000W	
Sodium Acetate 0.2M	SA02F		
Sodium Acetate 0.3M	SA03MOLF1		
Sodium Acetate 2M	SA2F		
Sodium Arsenite 0.005M (0.01N)	SA200005F		
Sodium Arsenite 0.05M (0.1N)	SA2005F	SA2005W	
Sodium Arsenite 0.15M (0.3N)	SA2015F		
Sodium Borohydride 0.4 % in 0.05N NaOH	NABH404F		
Sodium Carbonate 0.05M (0.1N)	SC20051		SC20055
Sodium Carbonate 0.5M (1.0N)	SC20501		SC20505
Sodium Chloride 0.05M (0.05N)	NACL20051		NACL20055
Sodium Chloride 0.068M (0.068N)			NACL200685
Sodium Chloride 0.1M (0.1N)	NACL2011		NACL2015
Sodium Chloride Solution at 0.9% w/w	NACL09WW1		
Sodium Hydroxide (Low in Carbonate) 0.115M (0.115N)	S21151LC		
Sodium Hydroxide (Low in Carbonate) 0.5M (0.5N)	S20501LC		S20505LC
Sodium Hydroxide (Low in Carbonate) 1.0M (1.0N)	S21001LC		S21005LC
Sodium Hydroxide 0.01M (0.01N)	S20011		S20015
Sodium Hydroxide 0.02M (0.02N)	S20021		S20025
Sodium Hydroxide 0.05M (0.05N)	S20051		S20055
Sodium Hydroxide 0.111M (0.111N)	S20111		S20115
Sodium Hydroxide 0.1332M (0.1332N)	S2013321		
Sodium Hydroxide 0.156M (0.156N)	S215601		
Sodium Hydroxide 0.1M (0.1N)	S20101		S20105
Sodium Hydroxide 0.1M (0.1N) (Low in Carbonate)	S20101LC		S20105LC
Sodium Hydroxide 0.204M (0.204N)	S202041		
Sodium Hydroxide 0.25M (0.25N) 5L Bag In Box			SB20255

Description	Product No. 1L	Product No. 2.5L	Product No. 5L
Sodium Hydroxide 0.25M (0.25N)	S20251		S20255
Sodium Hydroxide 0.2M (0.2N)	S20201		S20205
Sodium Hydroxide 0.3125M (0.3125N)	S2031251		
Sodium Hydroxide 0.313M (0.313N) 5L Bag in Box			SB203135
Sodium Hydroxide 0.313M (0.313N)	S203131		S203135
Sodium Hydroxide 0.33M (0.33N)	S20331		
Sodium Hydroxide 0.35465M (0.35465N)	S2035461		S2035465
Sodium Hydroxide 0.4M (0.4N)	S20401		
Sodium Hydroxide 0.5M (0.5M)	S20501		S20505
Sodium Hydroxide 0.5M (0.5N) Bag in Box			SB20505
Sodium Hydroxide 0.6M (0.6N)			S2065
Sodium Hydroxide 0.714M (0.714N)	S207141		
Sodium Hydroxide 1.0M (1.0N) 5L Bag in Box			SB21005
Sodium Hydroxide 1.0M (1.0N)	S21001		S21005
Sodium Hydroxide 1.2M (1.2N)	S21201		SB21205
Sodium Hydroxide 1.666M (1.666N)	S216661		
Sodium Hydroxide 10M (10N)	S10001		S10005
Sodium Hydroxide 2.0M (2.0N)	S22001		S22005
Sodium Hydroxide 2.5M (2.5N)	S22501		S22505
Sodium Hydroxide 3.0M (3.0N)	S23001		S23005
Sodium Hydroxide 3.57M (3.57N)	S23571		S23575
Sodium Hydroxide 4M (4N)	S24001		
Sodium Hydroxide 5.0M (5.0N)	S25001		S25005
Sodium Hydroxide 5.0M (5.0N) from USP Grade Raw Material	S25001SP		
Sodium Hydroxide 6M (6N)	S26001		
Sodium Hydroxide Solution 20% w/v	S20WV1		
Sodium Lauryl (Dodecyl) Sulphate 0.02M (0.02N)	SLS0021		
Sodium Lauryl (Dodecyl) Sulphate 0.1M (0.1N)	SLS011		
Sodium Nitrite 0.1M (0.1N)	NANO011		
Sodium Nitrite 0.2M (0.2N)	NANO021		
Sodium Nitrite 0.5M (0.5N)	NANO051		NANO055
Sodium Nitrite 1M (1.0N)	NANO11		
Sodium Nitrite 4M (4.0N)	NANO041		
Sodium Oxalate 0.025M	NAC00251		
Sodium Oxalate 0.05M	NAX0051		
Sodium Oxalate 0.5M	NAC051		
Sodium Sulphite 5% Zero Dissolved Oxygen Solution	NAS51		NAS55
Sodium Thiocyanate 0.1M (0.1N)	NAT20101		NAT20105
Sodium Thiocyanate 1.0M (1.0N)	NAT21001		NAT21005

Description	Product No. 1L	Product No. 2.5L	Product No. 5L
Sodium Thiosulphate 0.0125M (0.0125N)	T2001251		
Sodium Thiosulphate 0.01M (0.01N)	T20011		T20015
Sodium Thiosulphate 0.025M (0.025N)	T200251		
Sodium Thiosulphate 0.02M (0.02N)	T20021		
Sodium Thiosulphate 0.0551M (0.0551N)	T2005511		T2005515
Sodium Thiosulphate 0.05M (0.05N)	T20051		T20055
Sodium Thiosulphate 0.1M (0.1N)	T20101		T20105
Sodium Thiosulphate 0.2M (0.2N)	T20201		T20205
Sodium Thiosulphate 0.5M (0.5N)	T20501		
Sodium Thiosulphate 1.0M (1.0N)	T21001		T21005
Sodium Thiosulphate 2.0M (2.0N)	T22001		
Sulphuric Acid 0.005M (0.01N)	SU200051		
Sulphuric Acid 0.01M (0.02N)	SU20011		SU20015
Sulphuric Acid 0.02M (0.04N)	SU20041		
Sulphuric Acid 0.025M (0.05N)	SU200251		
Sulphuric Acid 0.0416M (0.0832N)	SU2004161		SU2004165
Sulphuric Acid 0.05M (0.1N)	SU20051		SU20055
Sulphuric Acid 0.1M (0.2N)	SU20101		SU20105
Sulphuric Acid 0.1275M (0.255N)	SU2012751		SU2012755
Sulphuric Acid 0.128M (0.256N)			SU201285
Sulphuric Acid 0.13M (0.26N)	SU20131		SU20135
Sulphuric Acid 0.175M (0.350N)			SU20155
Sulphuric Acid 0.25M (0.5N)	SU20251		SU20255
Sulphuric Acid 0.319M (0.638N)	SU203191		SU203195
Sulphuric Acid 0.5M (1.0N)	SU20501		SU20505
Sulphuric Acid 0.9M (1.8N)	SU2091		SU2095
Sulphuric Acid 1.0M (2.0N)	SU21001		SU21005
Sulphuric Acid 2.0M (4.0N)	SU222001	SU2200J	
Sulphuric Acid 2.5M (5.0N)	SU22501		SU22505
Sulphuric Acid 3.0M (6.0N)	SU23001		SU23005
Sulphuric Acid 5.0M (10.0N)	SU25001		SU25005
Sulphuric Acid 5.0M (10.0N) Special Specific Preparation	SU2500-SP1		
Tetra Butylammonium Fluoride 1M in THF CA 5% Water		TBAF125	
Tetra Butylammonium Phosphate 0.5M conc in HPLC Grade water	TBAP1L		
Zinc Chloride 0.1M (0.1N)	ZNCL20101		ZNCL20105
Zinc Chloride 0.5M (0.5N)	ZNCL20501		ZNCL20505
Zinc Sulphate 0.02M (0.02N)	ZS021		
Zinc Sulphate 0.05M (0.05N)	ZNS000501		ZNSO00505
Zinc Sulphate 0.1M (0.1N)	ZS011		ZNSO0105

## Concentrated Volumetric Solutions

Each Ampoule is supplied in its own box, full instructions are printed on the box.

Description	Ampoule to make 1L
Acetic Acid 1.0M (1.0N)	CHC101L
Ammonia 0.1M (0.1N)	NH4C011L
Ammonia 1.0M (1.0N)	NH4C101L
Ammonium Thiocyanate 0.1M (0.1N)	NHTC011L
EDTA (DiSodium salt) 0.01M (0.02N)	EDC0011L
EDTA (DiSodium salt) 0.05M (0.05N)	ETC0051L
EDTA (DiSodium salt) 0.1M (0.2N)	EDC0101L
Hydrochloric Acid 0.1M (0.1N)	HC0101L
Hydrochloric Acid 0.2M (0.2N)	HC0201L
Hydrochloric Acid 0.5M (0.5N)	HC0501L
Hydrochloric Acid 1.0M (1.0N)	HC1001L
Iodine 0.005M (0.01N)	IC00051L
Iodine 0.025M (0.05N)	IC025G1L
Iodine 0.05M (0.1N)	IC0051GL
Nitric Acid 1.0M (1.0N)	NOC101L
Oxalic Acid 0.05M (0.1N)	OA20051L
Potassium Chloride 0.01M (0.01N)	KCL0101L
Potassium Permanganate 0.02M (0.1N)	PCO021GL
Silver Nitrate 0.0282M (0.0282N)	NC00281L
Silver Nitrate 0.1M (0.1N)	NC0101L
Sodium Hydroxide 0.1M (0.1N)	SC0101L
Sodium Hydroxide 0.5M (0.5N)	SC0501L
Sodium Hydroxide 1.0M (1.0N)	SC1001L
Sodium Thiosulphate 0.0125M (0.0125N)	TC00121L
Sodium Thiosulphate 0.1M (0.1N)	TC0101L
Sulphuric Acid 0.01M (0.02N)	SUC0011L
Sulphuric Acid 0.05M (0.1N)	SUC0051L
Sulphuric Acid 0.5M (1.0N)	SUC051L

## Indicator Solutions

Product No.	Description	Pack Size
ALRED01	Alizarine Red Solution 125ml	125ml
ALREDH	Alizarine Red Solution 500ml	500ml
AZVIO01	Azo Violet Indicator, 0.1% (w/v) Alcoholic Solution	125ml
1012602	Bromocresol Green - Methyl Red Mixed Indicator	100ml
BRCGM05	Bromocresol Green Indicator, 0.04% (w/v) in Methanol	500ml
BRCG0105	Bromocresol Green Indicator, 0.1% (w/v) Aqueous Solution	500ml
BRCG010125	Bromocresol Green Indicator, 0.1%	125ml
BRCGIPA0105	Bromocresol Green Indicator, 0.1% (w/v) in IPA	500ml
BRCG105	Bromocresol Green Indicator, 1% (w/v) Aqueous Solution	500ml
BRCG05	Bromocresol Green Indicator, 0.04%	500ml
BRCG1501	Bromocresol Green Indicator, 1%	100ml
BRPBB02M05	Bromocresol Purple - Bromothymol Blue Mixed Indicator 0.2% (w/v) in Methanol	500ml
BRP01M05	Bromocresol Purple Indicator, 0.1 % (w/w) in Methanol	500ml
BRP0105	Bromocresol Purple Indicator, 0.1% (w/v) Aqueous Solution	500ml
BRP0405	Bromocresol Purple Indicator, 0.4% (w/v) Aqueous Solution	500ml
BRP1M05	Bromocresol Purple Indicator, 1 % (w/w) in Methanol	500ml
BRP105	Bromocresol Purple Indicator, 1% (w/v) Aqueous Solution	500ml
1012701	Bromocresol Purple Indicator Solution 0.04%	100ml
BRBPIPA05	Bromophenol Blue Indicator, 0.04% (w/v) in Isopropyl Alcohol	500ml
BRBP00505	Bromophenol Blue Indicator, 0.05% Aqueous Solution	500ml
BRBP0105	Bromophenol Blue Indicator, 0.1% (w/v) Aqueous Solution	500ml
BRBPIPA0105	Bromophenol Blue Indicator, 0.1% (w/v) in Isopropyl Alcohol	500ml
BRPB040125	Bromophenol Blue Indicator 0.4%	125ml
BRBP0405	Bromophenol Blue Indicator, 0.4% Aqueous Solution	500ml
BRBP0125	Bromophenol Blue Indicator, 0.04% Aqueous Solution	125ml
BRBP05	Bromophenol Blue Indicator, 0.04% Aqueous Solution	500ml
BRTH00205	Bromothymol Blue Indicator, 0.02% (w/v) Aqueous Solution	500ml
BRTHIPA00205	Bromothymol Blue Indicator, 0.02% (w/v) in Isopropyl Alcohol	500ml
BRTHIPA00405	Bromothymol Blue Indicator, 0.04% (w/v) in Isopropyl Alcohol	500ml
BRTH040125	Bromothymol Blue Indicator 0.4%	125ml
BRTH040250	Bromothymol Blue Indicator 0.4%	250ml
BRTH0125	Bromothymol Blue Indicator, 0.04%	125ml
BRTH025	Bromothymol Blue Indicator, 0.04%	250ml
BRTH05	Bromothymol Blue Indicator, 0.04%	500ml
CALM00505	Calmagite Indicator, 0.05% (w/v) Aqueous Solution	500ml
CALM0105	Calmagite Indicator, 0.1% (w/v) Aqueous Solution	500ml
CALM0605	Calmagite Indicator, 0.6% (w/v) Aqueous Solution	500ml
CALM105	Calmagite Indicator, 1%	500ml
CAUB0105	Caustic Blue Indicator, 0.1% (w/v) Aqueous Solution	500ml

Product No.	Description	Pack Size
CPR05	Chlorophenol Red Indicator, 0.04%	500ml
COR105	Congo Red Indicator 0.1%	500ml
COR01005	Congo Red Indicator 0.1% (w/v) Aqueous Solution	500ml
COR01001	Congo Red Indicator 0.1% (w/v) Aqueous Solution	1L
COR1005	Congo Red Indicator, 1% (w/v) Aqueous Solution	500ml
CRER0405	Cresol Red Indicator, 0.04% (w/v) Aqueous	500ml
CRER205	Cresol Red Indicator, 0.2% (w/v) Aqueous	500ml
CVSOLN011	Crystal Violet Indicator, 0.1% (w/v) in Glacial Acetic Acid, for Non Aqueous Titrations	100ml
CVSOLN021	Crystal Violet Indicator, 0.2% (w/v) in Glacial Acetic Acid, for Non Aqueous Titrations	100ml
CVSOLN1	Crystal Violet Indicator 1% in Glacial Acetic Acid	100ml
1022901	Crystal Violet Solution (Non-aqueous indicator)	100ml
DPC05	Diphenylcarbazone 0.1%	500ml
DPCBRBP05	Diphenylcarbazone-Bromophenol Blue Mixed Indicator	500ml
EOW00051	Eosin Y TS, 0.5% (w/v) Aqueous Solution, Adsorption Indicator for Argentometric Titrations	1L
EOW0011	1% Eosin Y in Purified water	1L
EOW0015	1% Eosin Y in Purified water	5L
EBB05	Indicator Solution Erichrome Blue Black R	500ml
EBB1	Indicator Solution Erichrome Blue Black R	1L
EBB5	Indicator Solution Erichrome Blue Black R	5L
EBB10	Indicator Solution Erichrome Blue Black R	10L
EBTT05	Eriochrome Black T Indicator in Triethanolamine, Water Hardness Indicator	500ml
EBTNACL105	Eriochrome Black T Indicator, 1% (w/w) in Sodium Chloride	500ml
EBTNACL0205	Eriochrome Blue Black R Indicator, 0.2% (w/w) in Sodium Chloride	500ml
ETVIO1M05	Ethyl Violet Indicator, 0.1% w/v in 50% Methanol	500ml
FS010105	Fehlings Solution No. 1	500ml
FS0101	Fehlings Solution No. 1	1L
FS01015	Fehlings Solution No. 1	2.5L
FS010205	Fehlings Solution No. 2	500ml
FS0102	Fehlings Solution No. 2	1L
FS01025	Fehlings Solution No. 2	2.5L
FEAL11	Indicator Solution Ferric Alum	1L
1037702	European Pharmacopoeia Reagent Ferric Ammonium Sulphate R2	1L
PFS1	Indicator Solution Ferroin Indicator	100ml
FEI0011	Ferroin Indicator, 0.01 Molar	1L
FEI00251	Ferroin Indicator, 0.025 Molar	1L
TB04F	Indicator Thymol Blue Alcoholic Solution 0.04%	500ml
TB08F	Indicator Thymol Blue, 0.08% (w/v) in Methanol	1L

## Indicator Solutions

Product No.	Description	Pack Size
INDCA05	Indicator Indigo Carmine	500ml
FEA25	Indicator Solution Iron Alum (Volhard)	250ml
MGI00505	Indicator Malachite Green, 0.05% (w/v) Aqueous Solution	500ml
MBTHI00505	MBTH Indicator, 0.05%	500ml
MBTHI0505	MBTH Indicator, 0.5% (w/v) Aqueous Solution	500ml
MCP00405	Indicator m-Cresol Purple, 0.04% (w/v) Aqueous	500ml
MCP0105	Indicator m-Cresol Purple, 0.1% (w/v) Aqueous	500ml
MCP05	Indicator m-Cresol Purple, 0.4%	500ml
MTPSI01	Indicator Metalphthalein-Screened RS	100ml
MOXCI05	Indicator Methyl Orange - Xylene Cyanol Indicator Solution	500ml
MTR050125	Indicator Methyl Orange 0.1%	125ml
MTR05025	Indicator Methyl Orange Alcoholic Solution 0.1%	250ml
M004F	Indicator Methyl Orange 0.04%	500ml
MPRIPA1505	Indicator Methyl Purple, in dilute IPA (15% v/v)	500ml
MTR060125	Indicator Methyl Red 0.1%	125ml
MTR06025	Indicator Methyl Red Alcoholic Solution 0.1%	250ml
1055102	Methyl Red Indicator Solution 0.02%	100ml
MTBLU0050250	Indicator Methylene Blue, 0.05%	250ml
MTBLU010250	Indicator Methylene Blue, 0.1%	250ml
MTBLU10250	Indicator Methylene Blue 1%	250ml
PR045	Indicator Phenol Red 0.04% Solution	500ml
PR105	Indicator Phenol Red 0.1% (w/v) Aqueous Solution	500ml
PR505	Indicator Phenol Red 0.5% (w/v) Aqueous Solution	500ml
PR1005	Indicator Phenol Red 1% (w/v) Aqueous Solution	500ml
1063601	Phenol Red Indicator Solution	100ml
IPT01J	Indicator Phenolphthalein 0.1%	100ml
IPT01D	Indicator Phenolphthalein 0.1%	250ml
IPT01H	Indicator Phenolphthalein 0.1%	500ml
IPT01F	Indicator Phenolphthalein 0.1%	1L
IPT02H	Indicator Phenolphthalein 0.2%	500ml
IPT05H	Indicator Phenolphthalein 0.5%	500ml
IPT05F	Indicator Phenolphthalein Alcoholic Solution 0.5%	1L
IPT05W	Indicator Phenolphthalein Alcoholic Solution 0.5%	2.5L
IPT10125	Indicator Phenolphthalein 1%	125ml
IPT1025	Indicator Phenolphthalein 1%	250ml
IPT10H	Indicator Phenolphthalein 1%	500ml
IPT10F	Indicator Phenolphthalein 1%	1L
IPT10F-D	Indicator Phenolphthalein 1% (in IMS and HDPE bottle)	1L
IPT10W	Indicator Phenolphthalein Alcoholic Solution 1.0%	2.5L
IPT201	Indicator Solution Phenolphthalein 2% in Ethanol	1L
IPT205	Indicator Solution Phenolphthalein 2% in Ethanol	5L



Product No.	Description	Pack Size
IPT2025	Indicator Solution Phenolphthalein 2% in Ethanol	25L
IPT16W	Indicator Phenolphthalein 1.6%	2.5L
PCS5	Indicator Solution Potassium Chromate 5%	500ml
MOS05	Indicator Screened Methyl Orange Alcoholic Solution 0.1%	500ml
ST105	Starch Solution 1%	500ml
ST1001	Starch Solution 1%	1L
ST205	Starch Indicator 2%	500ml
ST0055	Starch Indicator, 0.05% (w/v)	500ml
ST0101	Starch Indicator 0.1%	1L
ST0205	Starch Indicator, 0.2% (w/v) Aqueous Solution	500ml
ST0255	Starch Indicator, 0.25% (w/v) Aqueous Solution	500ml
ST0305	Starch Indicator, 0.3% (w/v)	500ml
ST0505	Starch Indicator 0.5% (w/v)	500ml
ST0505P	Starch Indicator, with 0.5% Potassium Iodide	500ml
ST505P	Starch Indicator, with 5% Potassium Iodide	500ml
SO0405	Indicator Sulfo Orange, 0.04%	500ml
SO405	Indicator Sulfo Orange, 0.4%	500ml
SO0105	Indicator Sulfo Orange, 0.1% (w/v) (Tropaeolin O) Aqueous Solution	500ml
1090701	Thymolphthalein 0.05% Indicator Solution	100ml
UN1005	Universal Indicator Solution	50 mL
UN101	Universal Indicator Solution	100ml
UN105	Universal Indicator Solution	500ml
UN10025	Universal Indicator Solution	2.5L
UNB1010	Universal Indicator Solution	10L
UN1025	Universal Indicator Solution	25L
VANG5H	Van Gieson Stain 500ml	500ml
TAIND0250	TA Indicator - Phenolphthalein Free	250ml
TAIND0500	TA Indicator - Phenolphthalein Free	500ml
TAIND1000	TA Indicator - Phenolphthalein Free	1L
TASHI010	Indicator Solution for Mixed Sulphur	100ml
TASHI025	Tashiro Indicator (Methyl Red/Methylene Blue in Ethanol)	250ml
TASHI050H	Tashiro Indicator (Methyl Red/Methylene Blue in Ethanol)	500ml
TASHI100F	Tashiro Indicator (Methyl Red/Methylene Blue in Ethanol)	1L
THPH010125	Thymolphthalein Indicator 0.1%	125ml
TECMXI01	Tecator Mixed Indicator	100ml
ADW	Indicator Acid Decolouriser	2.5L
KR01	Indicator Kovac's Indole Reagent	100ml
PAN0125	PAN Indicator 0.1%	125ml