

Chemical Essentials Handbook

Essentials & Storage Guidelines



Introduction

This handbook includes a selection of essential chemicals for analysis, synthesis, inorganic and life science applications, plus key information on safe storage, handling and packaging to support your chemistry.

Whatever your field of activity — industry, production, quality control, research, analysis or development — our team is available to provide you with the best service and support:

- Chemistry experience and expertise
- Large field sales force with highly experienced specialists to advise and support you
- Huge warehouse space ensures high product availability
- An experienced customer service team dedicated to making your contact with us easy and efficient.

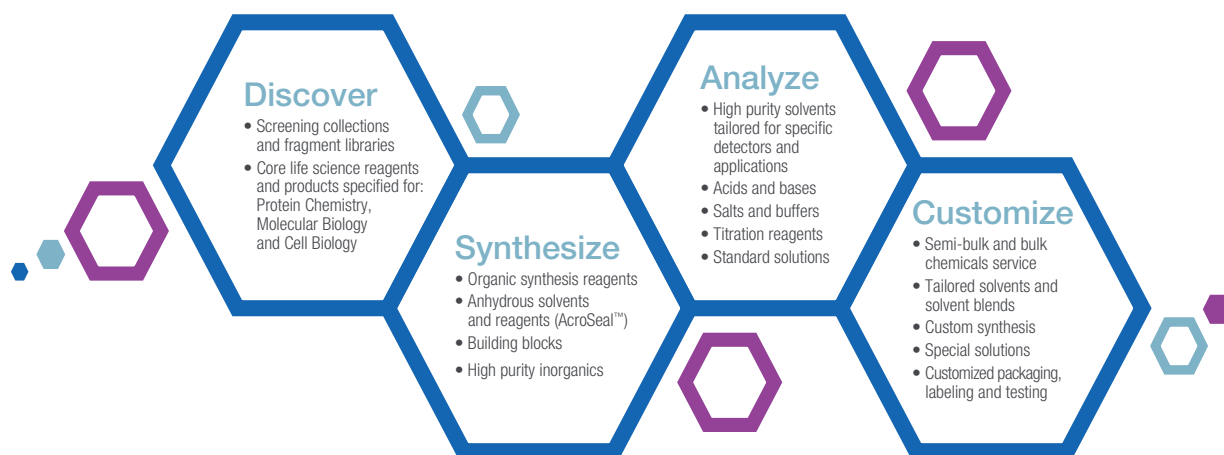


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Find the perfect chemicals for your discovery, synthesis and analysis

Our portfolio of brands and product grades offer a range of solutions for your chemistry applications.

Category/Application		Grades/Product Ranges	Description and Use		
Analysis (Pages 4-7)	Chromatography	Liquid Chromatography (LC)	HPLC	Suitable for routine separations and isocratic analysis	
			Optima™ Grade	Suitable for HPLC gradient	
			Optima LC-MS	Suitable for LC-MS and UHPLC-UV	
		Gas Chromatography (GC)	Thermo Scientific UHPLC-MS	Highest purity for UHPLC-MS	
			Pesticide	Suitable for GC with ECD or FID detector	
			GC Resolv™ Grade	Tested for high GC resolution up to ppb level of contaminants	
	Elemental Analysis	AAS	GC Headspace	Tested to ensure absence of Type 1, 2 and 3 volatiles	
			Certified ACS Plus	Acids analysis for metals in the very low parts per million (ppm) range	
		ICP-OES	Thermo Scientific™ ICP-OES	Acids analyzed for up to 36 metals in the low (ppb) range (1-50 ppb)	
			TraceMetal™ Grade	Acids analyzed for 55 metals in low to very low parts per billion (ppb) range	
	General Analytical Techniques	ICP-MS	Optima Grade	Acids analyzed for more than 65 metals in the parts per trillion (ppt) range	
			Karl Fischer Titration	Aqualine	Karl Fischer titration reagents
			Volumetric titration	Certified	Acid and base solutions suitable for precise titration
pH titration			Certified	Purity meets or exceeds minimum specifications	
Research (Pages 10-15)	Organic Synthesis	Other Analysis	Certified ACS	Meets American Chemical Society specifications	
		Building blocks Catalysts Deuterated products Extra dry solvents Functional reagents Organometallics Silica gel	High purity inorganics High purity metal products Precious metal compounds Anhydrous materials - Ultra Dry Reacton™ rare-earth products Fuel cells catalysts & compounds High purity materials for photovoltaics Nanoparticles		
Discovery (Pages 8-9)	Life Sciences	For Electrophoresis For Peptide Synthesis For Cell Biology For Molecular Biology For Proteomics and Genomics			
	Drug Discovery	Heterocyclic building blocks Screening libraries Fragment collections			
Production (Pages 21-23)	To support your scale up and production requirements all of our catalogue products are available in bulk and semi-bulk quantities				

Fisher Chemical and Thermo Scientific Products

Find the perfect chemicals for your analytical application

- Rigorous quality assurance and testing procedures throughout the production process ensure the lot-to-lot consistency required for reproducible results
- Fisher Chemical™ products come in a variety of innovative packaging options designed for safety, environmental protection, convenient handling and storage, and preservation of product integrity
- Fisher Chemical™ FisherPak™ Solvent Delivery systems, available in 19 L, 50 L, 200 L, and 1,350 L sizes, offer environmentally friendly solvent handling solutions for your applications, enhancing safety and improving productivity within your lab
- New - Thermo Scientific™ UHPLC-MS solvent designed to deliver the highest sensitivity, and Thermo Scientific™ ChromaCare™ Flush solution designed for both the start-up and maintenance of LC-MS instrumentation



Field	Application	Grade	Description and Use	
Chromatography	Liquid Chromatography	UHPLC-MS	Ultra high-purity solvents specifically qualified for UHPLC-MS instrumentation. Specification based on higher ionization efficiency to detect organic contaminants in full scan MS with the absence of an additive. Signal to noise specification greater than ten when measured with 250 ppt Propazine using MS/MS. Filtered at 0.1µm, packaged in borosilicate glass and tightened metal specifications minimizes metal ion adduct formation.	
		Optima™ LC-MS	Optima LC-MS grade products meet stringent purity requirements of LC-MS and UHPLC by addressing the need for minimal organic contamination with 0.1µm filtration to make particle free. Evaluated for 17 metal impurities at ppb concentrations for minimal metal mass adduct formation. High ionization efficiency to detect organic contaminants at 50 ppb max (positive) and 300 ppb max (negative) in full scan MS. Screened for UV- absorbing contaminants at every wavelength in the 200 to 400 nm range to afford smooth baselines and to reduce interferences.	
		Optima™ HPLC	For HPLC and spectrophotometry analysis. Solvents of extremely high purity, processed and submicron filtered for HPLC instruments. Meets ACS specifications.	
	Gas Chromatography		HPLC	Solvents qualified for routine liquid chromatography. Meets ACS specifications.
			GC Headspace	High purity solvents for accurate and reliable analysis of volatile organic compounds (VOCs) by gas chromatography headspace (GC-HS). Tested to ensure acceptable levels of Class I, II, and III VOCs to ensure low baselines.
			GC Resolv	Solvents for gas chromatography suitable for GC-FID, GC-ECD and/or GC-MS analysis. Tested to ensure low halogen content. Meets ACS specifications.
	Pesticide	Solvents for GC with electron capture detector (ECD), pesticide residue analysis. Meet or exceed ACS pesticide testing standards.		
Trace Elemental Analysis	ICP-MS	Optima Grade	Highest purity acids, bases and water specifically qualified for ultra trace elemental analysis by ICP-MS instrument. Ultra-pure quality tested for up to 65 parameters at 1-100 ppt level.	
	ICP-OES	TraceMetal™ Grade	TraceMetal grade qualified for trace elemental analysis by ICP instrument. Acids & reagents tested for up to 65 parameters at ppb levels.	
		ICP-OES	Acids tested for up to 35 metals in the low ppb range. Also meet ACS specifications.	
AAS	Certified ACS Plus	Acids that meet or exceed American Chemical Society specifications with up to 16 metals tested.		
General Analysis	Pharmaceutical and Food Processing Research	Pharmacopeia USP/NF/FCC/EP/BP/JP	Meet specifications of the United States Pharmacopeia, the National Formulary, the Food Chemicals Codex, the European Pharmacopeia and/or the British Pharmacopeia.	
	Routine analysis	Certified ACS	Reagent chemicals that meet or exceed the American Chemical society specifications.	
		Certified	Chemicals that meet published maximum impurity limits.	
	Spectrophotometry	Spectranalyzed	Solvents suitable for UV/Vis detectors for spectrophotometric analysis.	
	Titration	pH-Metry	Standardized buffer solutions certified for pH measurement. Ready to use, with an accuracy factor of ±0.02 pH at 20°C. Also available as concentrates.	
		Volumetry	Standard, ready-to-use solutions for volumetric analysis.	
Aqualine™ Karl Fischer	Aqualine™ Karl Fischer	Aqualine™ reagents are designed for water content analysis by Karl Fischer titration using volumetric or coulometric titration ensuring trouble free and fast results.		
Tissue processing, clinical or histology	Histology	Solvents and products that have been filtered and prepared for tissue processing and histology laboratory use.		
Lab Essentials	Cleaning, Manufacturing & General Lab use	Laboratory, Technical and Reagent	Chemicals of reasonable purity for situations where no official standard for quality or impurity levels exist.	

The Fisher Chemical product range includes 4,000 products. A selection of our most essential products from this range can be found in the list below.

Product Name	Cat. No.	Popular pack sizes
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UHPLC-MS: Thermo Scientific Ultra-pure solvents and Flush solution for high sensitivity LC-MS applications

Acetonitrile, UHPLC-MS grade	A956	1L, 4L
Methanol, UHPLC-MS grade	A458	1L, 4L
Water, UHPLC-MS grade	W8	1L
ChromaCare Instrument LC-MS Flush Solution	T11110	1L, 2.5L
ChromaCare Biologics LC-MS Flush Solution	MB124	1L, 2.5L

LC-MS Optima Grade: High purity solvents meet stringent requirements for LC-MS & UHPLC-UV

Acetonitrile, Optima LC-MS grade	A955	1L, 4L
Iso-propanol, Optima LC-MS grade	A461	1L, 4L
Methanol, Optima LC-MS grade	A456	1L, 4L
Water, Optima LC-MS grade	W6	1L, 4L

HPLC Optima Grade: Solvents for HPLC with Gradient

Acetone, Optima for HPLC and GC	A929	1L, 4L
Acetonitrile, Optima for HPLC and GC	A996	1L, 4L
Ethyl Acetate, Optima for HPLC and GC	E196	4L
Heptane, Optima for HPLC and GC	H360	1L, 4L
n-Hexane 95% for HPLC and GC/MS	H306	1L, 4L
Isopropanol, Optima for HPLC	A464	1L, 4L
Methanol, Optima for HPLC	A454	1L, 4L
Methylene Chloride, Optima for HPLC and GC/MS	D151	1L, 4L
Tetrahydrofuran, Optima for HPLC	T427	1L, 4L
Water, Optima for HPLC	W7	1L, 4L

HPLC grade: Solvents suitable for routine Liquid chromatography

Acetonitrile, HPLC and ACS grade	A998	1L, 4L
Ethyl Acetate, HPLC and ACS grade	E195	1L, 4L
Heptane, HPLC Grade approx. 96% n-Heptane	H350	1L, 4L
Hexanes, HPLC, mixture of isomers	H302	1L, 4L
Isopropanol, HPLC and ACS grade	A451	1L, 4L
Methanol, HPLC and ACS grade	A452	1L, 4L
Methylene Chloride HPLC and GC	D143	1L, 4L
Tetrahydrofuran, for HPLC, unstabilized	T425	1L, 4L
Water HPLC Grade	W5	1L, 4L

Solvents and reagents qualified for Gas chromatography

Acetone, GC Resolv	A928	4L
DMAC, N,N-Dimethylacetamide, GC Headspace	D160	1L
DMF, N,N-Dimethylformamide, GC Headspace	D133	1L
DMSO, Dimethyl Sulfoxide, GC Headspace	D139	1L
Ethyl Acetate, Pesticide grade	E191	4L
Ethyl Ether, Pesticide grade	E199	4L
Hexanes, GC Resolv	H307	4L
Iso-Octane, Pesticide grade	O297	4L
Methanol, GC Resolv	A457	4L
Methylene Chloride for GC-MS Unstabilized	D150	4L
Methylene Chloride, GC Resolv	D154	4L
NMP, N-Methyl-2-Pyrrolidone, GC Headspace	N140	1L
Sodium Sulfate Anhydrous, ACS Pesticide grade	S415	1kg, 10kg
Water, GC Headspace	W10	1L

View our full range of products, packaging options and pack sizes online.

Product Name	Cat. No.	Popular pack sizes
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Solvents, Certified ACS

Acetone, Certified ACS	A18	4L, 20L
Chloroform, Certified ACS, stabilized with ethanol	C298	4L, 20L
Cyclohexane, Certified ACS	C556	1L, 4L
Dimethylformamide, Certified ACS	D119	4L, 20L
1,4-Dioxane, Certified ACS	D111	500mL, 4L
Ethanol, 200 Proof, ACS, meets USP/EP analytical specifications	A409	4L, 20L
Ethyl acetate, Certified ACS	E145	4L, 20L
Ethyl ether, Certified ACS	E138	4L, 20L
Hexanes, Certified ACS	H292	4L, 20L
Methanol, Certified ACS	A412	4L, 20L
Methylene Chloride, stabilized, Certified ACS	D37	4L, 20L
Petroleum ether, Certified ACS	E139	4L, 20L
2-Propanol, Certified ACS	A416	4L, 20L
Toluene, Certified ACS	T324	4L, 20L

Acids & Reagents for Trace Elemental Analysis

Hydrochloric acid 32-35%, Optima, for ultra trace elemental analysis	A466	500mL, 2L
Hydrochloric acid 34-37%, Trace elemental, for trace elemental analysis	A508	500mL, 2.5L
Hydrochloric acid, ICP-OES grade for trace metal analysis	T00308	500mL, 2.5L
Hydrofluoric acid, Optima Grade, for ultra trace elemental analysis	A463	500mL, 1L
Hydrofluoric acid, Trace elemental, for trace elemental analysis	A513	500mL, 4L
Nitric acid 67-69%, Optima Grade, for ultra trace elemental analysis	A467	500mL, 2L
Nitric acid 67-69%, Trace elemental, for trace elemental analysis	A509	500mL, 2.5L
Nitric acid, ICP-OES grade for trace metal analysis	T00309	500mL, 4 x 2.5L
Sulfuric acid 93-98%, Optima Grade, for ultra trace elemental analysis	A468	500mL, 2L
Sulfuric acid 93-98%, Trace elemental, for trace elemental analysis	A510	500mL, 2.5L
Sulfuric acid, ICP-OES grade for trace metal analysis	T00311	500mL, 2.5L
Water, Optima Grade, for ultra trace elemental analysis	W9	1L, 2L

Acids & Bases, Certified ACS

Acetic acid glacial, Certified ACS Plus, low metal for AAS	A38	500mL, 6 x 2.5L
Ammonium hydroxide, Certified ACS Plus, low metal for AAS	A669	500mL, 6 x 2.5L
Formic acid, Certified ACS	A118	500mL, 4L
Hydrochloric acid, Certified ACS Plus, low metal for AAS	A144	500mL, 6 x 2.5L
Hydrofluoric Acid, Certified ACS	A147	3.8L
Nitric acid, Certified ACS Plus, low metal for AAS	A200	500mL, 3.8L x 2.5L
Perchloric Acid, 70%, Certified ACS	A229	500mL, 3.5L
Potassium hydroxide, Certified ACS, pellets	P250	500g, 3kg
Sodium hydroxide, Certified ACS, pellets	S318	500g, 3kg
Sulfuric acid, Certified ACS Plus, low metal for AAS	A300	500mL, 6 x 2.5L

Salts, Certified ACS or for HPLC

Ammonium acetate, Certified ACS	A637	500g, 10kg
Ammonium acetate, HPLC	A639	500g
Ammonium Carbonate, HPLC	A651	500g
Ammonium chloride, Certified ACS	A661	500g, 10kg
Potassium carbonate anhydrous, Certified ACS	P208	500g, 3kg
Potassium chloride, Certified ACS	P217	500g, 10kg
Potassium iodide, Certified ACS	P410	100g, 500g
Potassium phosphate monobasic, Certified ACS	P285	500g, 3kg
Sodium acetate trihydrate, Certified ACS	S209	3kg, 10kg
Sodium acetate anhydrous, Certified ACS	S210	500g
Sodium chloride, Certified ACS	S271	500g, 10kg
Sodium sulfate anhydrous, Certified ACS	S421	500g, 3kg

View our full range of products, packaging options and pack sizes online.

Product Name	Cat. No.	Popular pack sizes
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pH Buffer Solutions

Buffer Solution, pH 4.00, Certified	SB98	500mL, 1L
Buffer Solution, pH 4.00, Color-Coded Red, Certified	SB101	500mL, 4L
Buffer Solution, pH 7.00, Certified	SB108	500mL, 1L
Buffer Solution, pH 7.00, Color-Coded Yellow, Certified	SB107	500mL, 4L
Buffer Solution, pH 10.00, Certified	SB116	500mL, 1L
Buffer Solution, pH 10.00, Color-Coded Blue, Certified	SB115	500mL, 4L
Buffer Solution Color-Coded Multi-Pac	SB105	Contains one 500mL of each color coded solution

Karl Fischer Reagents and Standards

Aqualine™ Complete 5	AL2000	1L, 4L
Aqualine™ Complete 5K	AL2250R	1L
Aqualine™ Matrix K	AL2300R	1L
Aqualine™ Solvent	AL2100	1L, 2.5L
Aqualine™ Titrant 5	AL2200	1L
Aqualine™ Electrolyte AG (for coulometric titration)	AL2520	500mL
Aqualine™ Water Standard 1.0	AL2710	10 x 4mL ampules

Standard Volumetric Solutions and Concentrates

Ethylenediaminetetraacetic acid disodium salt solution 0.1M (0.2N), ready to use solution	SS412	1L
Hydrochloric acid solution 0.1M (0.1N), Certified	SA54	1L, 4L
Hydrochloric acid solution 1M (1N), Certified	SA48	1L, 4L
Hydrochloric acid concentrate, 10N, Certified	SA49	100mL
Potassium hydroxide solution 1M (1N), Certified	SP208	500mL
Potassium hydroxide solution 1M (1N) in methanol, Certified	SP220	1L
Silver nitrate solution 0.1M (0.1N), Certified	SS72	1L, 4L
Sodium hydroxide solution 0.1M (0.1N), Certified	SS276	1L, 4L
Sodium hydroxide solution 1M (1N), Certified	SS266	1L, 4L
Sodium hydroxide concentrate, 10N, Certified	SS267	100mL
Sodium thiosulfate solution 0.1M (0.1N), Certified	SS368	1L, 4L
Sulfuric acid solution 0.05M (0.1N), Certified	SA220	1L, 4L
Sulfuric acid solution 0.5M (1N), Certified	SA212	1L, 4L
Sulfuric acid concentrate, 10N, Certified	SA213	100mL

Ion Pair Reagents for HPLC

1-Decanesulfonic acid sodium salt, HPLC	D0030	25g, 100g
1-Heptanesulfonic acid sodium salt, HPLC	O3013	25g, 100g
1-Hexanesulfonic acid sodium salt, HPLC	O3072	25g, 100g
1-Octanesulfonic acid sodium salt, HPLC	O0028	25g, 100g
1-Pentanesulfonic acid sodium salt, HPLC	O3013	25g

Other sizes and concentrations are available

View our full range of products, packaging options and pack sizes online.

Fisher Bioreagents and Thermo Scientific Products

Find the perfect reagents for your discovery application

Vital Reagents for Life Science

- Designed for a wide range of molecular biology, protein chemistry, cell biology and microbiology applications
- High-purity products that meet stringent industry specifications for critical factors such as purity, water content, levels of contaminants and absence of DNase, RNase and protease activity
- Reagents are suitable for the designated technique



For more product choices and promotions, please visit fishersci.com/bioreagents

The Fisher Bioreagents™ product range includes approximately 1,000 products. A selection of our most essential products from this range can be found in the list below.

Product Name	Cat. No.	Example pack sizes
Core Life Science Reagents		
Bovine serum albumin, fraction V, cold-ethanol precipitated	BP1605	100g
Bovine serum albumin, fraction V, heat shock treated, suitable for immunological studies	BP1600	100g, 1kg
Chloroform, molecular biology grade, approx. 0.75% ethanol as a preservative	BP1145	1L
Dextran sulfate sodium salt, Thermo Scientific	J14489	100g
Dimethyl sulfoxide	BP231	100mL, 1L
Ethanol, Molecular Biology Grade	BP2818	100mL, 500mL
Ethylenediaminetetraacetic Acid (EDTA)	BP120	500mL, 1kg
Formamide, molecular biology	BP227	500mL
Formamide, super pure	BP228	100mL
Glycerol, molecular biology	BP229	1L, 4L
Glycerol, 99.0-101.0%, molecular biology grade, Ultrapure, Thermo Scientific	J16374	1L
Isopropanol, Molecular Biology Grade	BP2618	1L, 2.5L
Methanol, peroxide-free, sequencing	BP1105	1L, 4L
70% Molecular Biology Ethanol solution	BP8201	500mL, 1L
96% Molecular Biology Ethanol solution	BP8202	500mL, 1L
Paraformaldehyde solution, 4% in PBS, Thermo Scientific	J19943	1L
PBS Tablets	BP2944	100g
Phosphate buffered saline, 10X powder concentrate, white granular powder	BP665	2 each
Phosphate buffered saline, 10X solution	BP399	500mL, 1L
Sodium chloride (dry basis), >99.5%	BP358	1kg, 2.5kg
Sodium dodecyl sulfate, white powder, electrophoresis	BP166	100g, 500g
Tris base, white crystals or crystalline powder, molecular biology	BP152	500g, 1kg
Tris buffered saline, 10X Solution, pH 7.4, molecular biology	BP2471	100mL, 1L
L-Tryptophan, 98.5-101.5% (dry basis), Thermo Scientific	J22765	1kg
Tween 20	BP337	100mL, 500mL
Water, Biotech grade, sterile	BP2485	4L, 20L

View our full range of products, packaging options and pack sizes online.

Product Name	Cat. No.	Example pack sizes
Water, Molecular Biology Grade	BP2819	1L, 4L
Water, DNA grade	BP2470	1L
Water, for RNA work, DEPC-treated and nuclease-free, molecular biology	BP561	1L
Water, nuclease free	BP2484	50mL, 100mL
Dimethyl Formamide, Sequencing	BP1160	4L
Glacial Acetic Acid, Sequencing	BP1185	500mL
Peptone Powder	BP1420	500g
Tris Hydrochloride	BP153	1kg
Guanidine Hydrochloride	BP178	1kg

Protein and Nucleic Acid

Boric Acid	BP168	1kg
Agarose, broad separation range for DNA/RNA, genetic analysis grade	BP1356	100g
Agarose, low-EEO/multi-purpose, molecular biology grade	BP160	100g, 500g
Betaine, 5M Solution, Molecular Biology Grade, Ultrapure, Thermo Scientific	J77507	10mL
Dithiothreitol, white crystals or powder, for electrophoresis	BP172	5g, 25g
Ethidium bromide, 1% solution, molecular biology	BP1302	10mL
FastRUN™ Tris SDS PAGE Running Buffer, 10X	BP881	500mL, 1L
HEPES (Fine White Crystals) for Molecular Biology	BP310	500g, 1kg
MES, fine white crystals	BP300	100g
Methanol, peroxide-free, sequencing	BP1105	1L, 4L
MOPS (Fine White Crystals) for Molecular Biology	BP308	100g, 500g
Phenol, saturated, liquid, pH 6.6/7.9	BP1750I	400mL
Proteinase K, from Tritirachium album, DNase and RNase free	BP1700	50mg, 100mg
Sodium Dodecyl Sulfate (SDS), Micropellets	BP8200	100mL, 500mL
TEMED, Electrophoresis	BP150	20g
Tris-acetate-EDTA (TAE) solution 50X, DNase RNase and protease free	BP1332	1L, 4L
Tris-Borate-EDTA, 10X solution, electrophoresis	BP1333	1L
Triton X-100 for Electrophoresis	BP151	100mL, 500mL
Urea, molecular biology grade, Colorless-to-White Crystals or Crystalline powder	BP169	10g, 500g

Cell and Tissue Culture

Agar, Bacteriological, Ultrapure, Thermo Scientific	J10906	5lb
Agar, Granulated	BP9744	2kg, 5kg
Agar	BP1423	500g, 2kg
Ampicillin Sodium Salt, crystalline powder	BP1760	25g
D-Sucrose, molecular biology	BP220	1kg
Glycine, white crystals or crystalline powder	BP381	500g, 1kg
Isopropyl-8-D-thiogalactopyranoside, dioxane-free	BP1755	10g, 100g
Kanamycin Sulfate, white powder	BP906	5g
LB Agar, Miller	BP9724	500g, 2kg
LB Broth, Miller	BP9723	500g, 2kg
LB Broth, Lennox	BP9722	500g
LB Agar Miller Powder	BP1425	500g
Phosphate Buffered Saline, 10X solution	BP399	500mL, 1L
Puromycin Dihydrochloride	BP2956	100mg
Rapamycin	BP2963	1mg
Tryptone (Granulated)	BP9726	500g, 2kg
Vancomycin	BP2958	1g
Water, Microbial Cell Culture Grade	BP2820	500mL, 1L
Yeast Extract	BP1422	100g, 500g
Yeast Extract (Granulated)	BP9727	500g, 2kg

View our full range of products, packaging options and pack sizes online.

Acros Organics and Alfa Aesar Products

Find the perfect chemicals for your applied chemistry and organic synthesis applications

Together the Acros Organics™ and Alfa Aesar™ portfolio offers a range of solutions for organic synthesis labs engaged in research and development at any level, from basic research to drug discovery and development work, including collaborations that fall outside the traditional scope of organic chemistry.

We can support your chemistry with solutions to help with:

- Selecting starting materials
- Increasing yield
- Supporting scale up

The industry leading AcroSeal™ packaging system for dry solvents, organometallic compounds and air and moisture sensitive reagents features:

- Next-generation septum, which reseals even the most aggressive solvent/reagent and enables multiple puncture points
- Quadrant-style cap for a tight seal between septum and bottle

For more than 50 years, scientists have relied on Alfa Aesar™ high purity chemicals, metals and life science products for a variety of research and development applications, in sizes from gram-scale catalog items to semi-bulk and bulk production quantities.

With custom manufacturing capabilities to supply specialized items, Alfa Aesar and Acros Organics products support your research and development with:

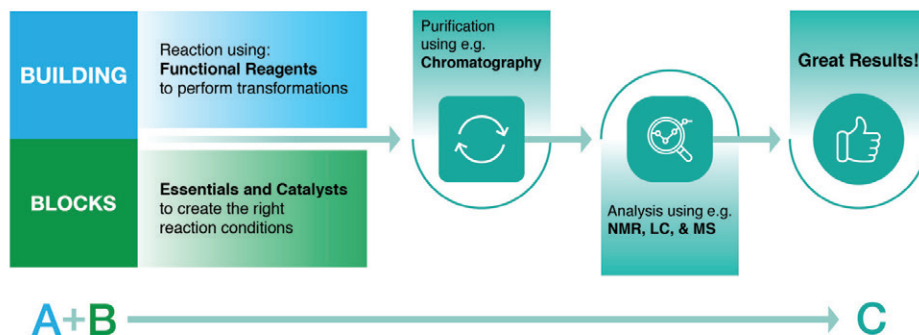
- High purity inorganics
- Catalysts, metals and materials
- Synthetic organic compounds
- Products for life science and analysis
- Custom manufacturing capabilities

Specifications for Chemical Synthesis

Pure	Basic specification, suitable for chemical synthesis and general laboratory work.
Extra pure	Extended specifications for exacting chemical synthesis.
For analysis ACS	The specification complies with the recommendations of the American Chemical Society.
Extra dry	Extra dry solvents with water content of 50 ppm or lower at the time of manufacture, filtered over 0.2µm PTFE filter and filled under inert gas.
Extra dry over molecular sieves	Extra dry solvents with water content of 50 ppm or lower at the time of manufacture, filled under inert gas and stored over molecular sieve for enduring shelf life.
For spectroscopy	The solvents show a very low absorption in the UV or IR spectrum and a high purity.
For NMR	Deuterium labeled compounds and solvents for NMR spectroscopy.

Together the Acros Organics and Alfa Aesar ranges include over 50,000 products. A selection of our most essential products can be found on the following pages.

[View our full range of products, packaging options and pack sizes online.](#)



Get Essential Reagents for Chemical Synthesis

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fishersci.ca/synthetic-reagents

Search for Chemicals by Structure

fishersci.com/structuresearch
fishersci.ca/structuresearch

Find the Right Organics for Your Work

fishersci.com/organics
fishersci.ca/organics

Product Name	CAS Number	Cat. No.	Pack Sizes
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Acids and Bases

Hydrogen chloride, 4N solution in 1,4-dioxane, AcroSeal™	7647-01-0	AC38836	100mL, 800mL
Nitric acid, for analysis, ca. 65% solution in water	7697-37-2	AC12466	500mL, 1L, 2.5L, 25L
Sulfuric acid, extra pure, fuming, 20-30% free SO ₃	8014-95-7	AC41997	25g, 500g, 2.5kg
Triethylamine, 99%, pure	121-44-8	AC15791	5mL, 100mL, 1L, 2.5L, 10L
Trifluoroacetic acid, 99%, extra pure	76-05-1	AC13972	25g, 100g, 500g, 1kg, 2.5kg, 10kg

Boronic acids

Bis(pinacolato)diboron, 98%	73183-34-3	AC33057	5g, 25g
4-Methoxy-3-pyridineboronic acid hydrate, 97%	1266615-79-5, 355004-67-0	AC37838	1g
Phenylboronic acid, 98+%, may contain varying amounts of anhydride	98-80-6	AC13036	10g, 50g
Quinoline-3-boronic acid, 97%	191162-39-7	AC36773	5g
4-(4,4,5,5-Tetramethyl-1,3,2-dioxaborolan-2-yl)aniline, 97%	214360-73-3	AC36638	1g, 5g
4-(4,4,5,5-Tetramethyl-1,3,2-dioxaborolan-2-yl)pyridine, 97%	181219-01-2	AC36751	1g, 5g

Catalysts

4-Dimethylaminopyridine, 99%	1122-58-3	AC14827	25g, 100g
Titanium(IV) isopropoxide, 98+%	546-68-9	AC19470	250mL, 1L

Catalysts - metal

1,1'-Bis(diphenylphosphino)ferrocene-palladium(II)dichloride dichloromethane adduct	95464-05-4	AC34868	1g, 5g
Bis(triphenylphosphine)palladium(II) chloride, 98%	13965-03-2	AC29925	2.5g, 5g
Hydrogen hexachloroplatinate(IV) hydrate, ACS reagent	26023-84-7	AC40501	1g, 5g
Hydrogen hexachloroplatinate(IV) hydrate, ca. 40% Pt	26023-84-7	AC19537	1g, 5g
Palladium(II) acetate, 47.5% Pd	3375-31-3	AC19518	1g, 2g
Platinum(II) acetylacetonate, 98%	15170-57-7	AC36935	1g, 5g
Platinum(IV) oxide, 83% Pt	1314-15-4	AC19532	1g, 5g
Potassium hexachloroplatinate(IV), ca. 40% Pt	16921-30-5	AC19535	1g, 5g
Rhodium(II) acetate dimer, anhydrous, ca 46% Rh	15956-28-2	AC26863	250mg, 1g
Ruthenium(III) chloride hydrate, 35 - 40% Ru	14898-67-0	AC19548	1g, 5g
Tetrakis(triphenylphosphine)palladium(0), 99%	14221-01-3	AC20238	1g, 5g
Tris(dibenzylideneacetone)dipalladium(0), 97%	51364-51-3	AC31877	500mg, 5g

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Catalysts - phase transfer

Hexadecyltrimethylammonium bromide, 99+%	57-09-0	AC22716	100g, 500g
Tetrabutylammonium hydrogen sulfate, 98%	32503-27-8	AC16838	25g, 100g
Tetrabutylammonium hydroxide, 1M solution in methanol	2052-49-5	AC21291	100mL, 800mL
Tetrabutylammonium hydroxide, 40 wt.% (1.5M) solution in water	2052-49-5	AC17661	50g, 250g
Tetraheptylammonium bromide, 99%	4368-51-8	AC21816	25g, 100g

Catalysts - solid supported

Palladium hydroxide on carbon, powder, unreduced, 20% Pd, moisture ca 60%	12135-22-7	AC19962	10g, 50g
Palladium on activated carbon, 10% Pd, (50% wet with water for safety), unreduced	7440-05-3	AC42298	10g, 25g
Palladium on activated carbon, 10% Pd, unreduced	7440-05-3	AC19503	10g, 50g
Palladium on calcium carbonate, poisoned with 3.5% lead, 5% Pd	7440-05-3	AC19507	10g, 50g
Platinum on activated carbon, 10% Pt, ca 0.50% moisture	7440-05-3	AC19524	1g, 10g
Platinum on activated carbon, 5% Pt	7440-05-3	AC19523	10g
Rhodium on alumina, 5% Rh, powder	7440-16-6	AC19957	5g, 25g

Cesium compounds

Cesium carbonate, 99.5%, for analysis	534-17-8	AC19204	25g, 100g
Cesium chloride, 99+%, for analysis	7647-17-8	AC18950	50g, 250g
Cesium fluoride, 99%, for analysis	13400-13-0	AC18951	25g, 100g

Chromatography

Aluminium oxide, neutral, Brockmann I, for chromatography, 50-200µm, 60A	1344-28-1	AC36668	1kg, 2.5kg
Dowex™ 1X8, 200-400 mesh, ion-exchange resin	11113-61-4	AC20301	100g, 500g, 2.5kg
Florisil™, 60-100 mesh, for column chromatography	1343-88-0	AC20545	500g, 1kg
Silica gel, for chromatography, 0.030-0.200 mm, 60 A	7631-86-9	AC41929	250g, 1kg
Silica gel, for chromatography, 0.035-0.070 mm, 60 A	7631-86-9	AC24036	1kg, 5kg
Silica gel, for chromatography, 0.060-0.200 mm, 60 A	7631-86-9	AC24037	1kg, 5kg
Silica gel, for column chrom., ultra-pure, 40-60µm, 60A	7631-86-9	AC36005	1kg, 5kg
Silica gel, for column chrom., ultra-pure, 60-200µm, 60A	7631-86-9	AC36006	250g, 1kg

Common Building Blocks

1-Hexene, 97%	592-41-6	AC21321	100mL, 1L, 2.5L, 25L
Glycolic acid, 99%	79-14-1	AC15451	25g, 100g, 500g, 2.5kg
Maleic anhydride, 99%, pellets	108-31-6	AC12524	25g, 1kg, 5kg, 25kg
Salicylaldehyde, 99%	90-02-8	AC13260	100g, 250g, 1kg, 5kg
Terephthalic acid, 99+%	100-21-0	AC18072	250g, 500g, 1kg, 5kg, 25kg

Deuterated solvents

Chloroform-d, for NMR, 99.8 atom % D	865-49-6	AC16625	50mL, 100mL
Chloroform-d, for NMR, 100 atom % D, packaged in 0.75 ml ampoules	865-49-6	AC32068	7.5mL
Chloroform-d, for NMR, 99.8 atom % D, AcroSeal™	865-49-6	AC42677	100mL
Chloroform-d, for NMR, 99.8 atom % D, stabilized with silver foil	865-49-6	AC35142	25mL, 100mL
Chloroform-d, for NMR, 99.8+ atom % D, contains 0.03 v/v% TMS	865-49-6	AC20956	25mL, 100mL
Deuterium oxide, for NMR, 99.8 atom % D	7789-20-0	AC16630	10mL, 100mL
Methanol-d4, for NMR, packaged in 0.75 ml ampoules, 99.8 atom % D	811-98-3	AC32075	7.5mL
Methanol-d4, for NMR, with 0.03% TMS, in 0.75 ml ampoules, 99.8 atom % D	811-98-3	AC35147	7.5mL
Methyl sulfoxide-d6, for NMR, 99.9 atom % D	2206-27-1	AC16629	10mL, 50mL
Methyl sulfoxide-d6, for NMR, packaged in 0.75 ml ampoules, 99.9 atom % D	2206-27-1	AC32077	7.5mL
Methyl sulfoxide-d6, for NMR, with 0.03% TMS, 99.9 atom% D	2206-27-1	AC35145	10mL, 25mL
Methyl sulfoxide-d6, for NMR, with 0.03% TMS, in 0.75 ml ampoules, 99.9 atom% D	2206-27-1	AC35254	7.5mL

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Dry solvents

Acetonitrile, 99.9+%, Extra Dry, AcroSeal	75-05-8	AC61022	100mL, 1L
N,N-Dimethylformamide, 99.8%, Extra Dry, AcroSeal	68-12-2	AC61032	100mL, 1L
Isopropanol, 99.8%, Extra Dry, AcroSeal	67-63-0	AC61043	100mL
Methanol, 99.9%, Extra Dry, AcroSeal	67-56-1	AC61040	100mL, 1L
Tetrahydrofuran, 99.85%, Extra Dry, stabilized, AcroSeal	1693-74-9	AC61091	100mL, 1L

Dry solvents - Extra Dry over Molecular Sieves

Dichloromethane, 99.8%, Extra Dry over Molecular Sieve, Stabilized, AcroSeal	75-09-2	AC34846	100mL, 1L
Diethyl ether, 99.5%, Extra Dry over Molecular Sieve, Stabilized, AcroSeal	60-29-7	AC36433	100mL, 1L
N,N-Dimethylformamide, 99.8%, Extra Dry over Molecular Sieve, AcroSeal	68-12-2	AC34843	100mL, 1L
1,4-Dioxane, 99.5%, Extra Dry over Molecular Sieve, stabilized, AcroSeal	123-91-1	AC36434	100mL, 1L
Methanol, 99.8%, Extra Dry over Molecular Sieve, AcroSeal	67-56-1	AC36439	100mL, 1L
Tetrahydrofuran, 99.5%, Extra Dry over Molecular Sieve, Stabilized, AcroSeal	109-99-9	AC34845	100mL, 1L

Drying Agents

N,O-Bis(trimethylsilyl)trifluoroacetamide, 98+%	25561-30-2	AC16800	25g, 100g
Boron trifluoride etherate, approx. 48% BF ₃	109-63-7	AC17456	25g, 100g
Calcium chloride, 96%, extra pure, powder, anhydrous	10043-52-4	AC34961	25g, 500g
Calcium hydride, ca. 93%, extra pure, 0-20 mm grain size, up to 15% powder	7789-78-8	AC19679	100g, 500g
1,1'-Carbonyldiimidazole, 97%	530-62-1	AC15181	10g, 25g
Diisopropyl azodicarboxylate, 94%	2446-83-5	AC32756	25g, 100g
Drierite™, with indicator, 10-20 mesh	7778-18-9	AC35001	500g, 2kg, 10kg
1,6-Hexanediamine, 99.5+%	124-09-4	AC12064	100g, 500g
Magnesium sulfate, 97%, pure, anhydrous	7487-88-9	AC41348	500g, 2.5kg
Molecular sieves 3A, 8 to 12 mesh	308080-99-1	AC19725	500g, 5kg, 25kg
Molecular sieves 4A, 8 to 12 mesh	70955-01-0	AC19727	500g, 5kg
Paraformaldehyde, 96%, extra pure	30525-89-4	AC41678	500g, 1kg
Potassium tert-butoxide, 98+%, pure	865-47-4	AC16888	100g, 500g
Silica gel orange, for drying purposes, non toxic grade, 2-5 mm	1327-36-2	AC39203	1kg, 5kg
Silica gel, for drying purposes, non-toxic grade, 3-6 mm	7631-86-9	AC35740	1kg, 5kg
Sodium azide, 99%, extra pure	26628-22-8	AC19038	100g, 500g
Sodium bis(trimethylsilyl)amide, pure, 2M solution in THF, AcroSeal	1070-89-9	AC27785	100mL, 800mL
Sodium cyanoborohydride, 95%	25895-60-7	AC16855	10g, 50g

Functional reagents - coupling reagents

Benzyl bromide, 98%	100-39-0	AC10587	100mL, 500mL
N,N'-Dicyclohexylcarbodiimide, 99%	538-75-0	AC11390	100g, 1kg
Trifluoromethanesulfonic anhydride, 98+%	358-23-6	AC17506	1mL, 50mL

Functional reagents - Grignard reagents

Isopropylmagnesium chloride - Lithium chloride complex, 1.3M solution in THF, AcroSeal	745038-86-2	AC38628	100mL, 800mL
Isopropylmagnesium chloride, 2.0M solution in THF, AcroSeal	1068-55-9	AC21285	100mL, 800mL
Methylmagnesium bromide, 3M solution in diethyl ether, AcroSeal	75-16-1	AC18354	100mL, 800mL
Methylmagnesium chloride, 3M (22 wt.%) solution in THF, AcroSeal	676-58-4	AC25256	100mL, 800mL
Vinylmagnesium bromide, 0.7M solution in THF, AcroSeal	1826-67-1	AC20939	100mL, 800mL
Vinylmagnesium chloride, 1.9M (16.5 wt.%) solution in THF, AcroSeal	3536-96-7	AC25259	100mL, 800mL

Functional reagents - halogenating agents

N-Bromosuccinimide, 99%	128-08-5	AC10745	100g, 500g
Diethylaminosulfur trifluoride, 95%	38078-09-0	AC21611	5g, 25g
Diiodomethane, 99+%, stabilized	64229	AC16983	25g, 100g
Hydrobromic acid, pure, ca. 48 wt% solution in water	10035-10-6	AC12317	1L, 2.5L
Iodine, 99.5%, extra pure, resublimed	7553-56-2	AC19656	100g, 500g
N-Iodosuccinimide, 98%	516-12-1	AC29957	10g, 100g
Oxalyl bromide, 98%	15219-34-8	AC15089	25g, 100g
Oxalyl chloride, 98%	79-37-8	AC12961	25g, 100g
Potassium fluoride, 99%, extra pure, anhydrous	7789-23-3	AC20135	25g, 1kg

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Functional reagents - organolithiums

n-Butyllithium, 1.6M solution in hexanes, AcroSeal	109-72-8	AC18127	100mL, 800mL
n-Butyllithium, 2.5M solution in hexanes, AcroSeal	109-72-8	AC21335	100mL, 800mL
tert-Butyllithium, 1.9M solution in pentane, AcroSeal	594-19-4	AC18128	100mL, 800mL
Lithium diisopropylamide, 2M sol. in THF/n-heptane/ethylbenzene, AcroSeal	4111-54-0	AC26883	100mL, 800mL
Methylolithium, 1.6 M sol. in diethyl ether (\pm 5% w/v), AcroSeal	917-54-4	AC18875	100mL, 800mL

Functional reagents - reagents in solution

Ammonia, ca. 7N solution in methanol	7664-41-7	AC13371	1L, 2.5L
Boron tribromide, 1M solution in methylene chloride	10294-33-4	AC19890	10mL, 100mL
Boron trichloride, 1M solution in methylene chloride, AcroSeal	10294-34-5	AC17668	100mL, 800mL
Boron trifluoride, 12% (1.5M) in methanol	373-57-9	AC40276	500g, 1kg
Hydrogen bromide, pure, 33 wt% solution in glacial acetic acid	37348-16-6	AC12318	500mL, 2.5L
Hydrogen chloride, pure, 2N solution in diethyl ether, AcroSeal	7647-01-0	AC36847	100mL, 800mL
Hydrogen chloride, pure, 5 to 6N solution in 2-propanol	7647-01-0	AC13370	1L, 2.5L
Propargyl bromide, 80 wt.% solution in toluene, stabilized	106-96-7	AC13148	50mL, 250mL
(Trimethylsilyl)diazomethane, 2M solution in hexanes	18107-18-1	AC38533	5mL, 25mL

General laboratory ancillaries

Activated charcoal, NORIT™ A SUPRA	7440-44-0	AC13434	250g, 1kg
Celite™ 545	68855-54-9	AC34967	500g, 2.5kg, 10kg
Glass wool	65997-17-3	AC38606	50g, 250g, 1kg
Hydrochloric acid, 0.1N Standardized Solution	7647-01-0	AA35644	1L, 4L, 20L
Sand, pure, 40-100 mesh	14808-60-7	AC37094	250g, 1kg, 5kg, 25kg
Sodium hydroxide, 1.0N Standardized Solution	1310-73-2	AA35629	1L, 2.5L, 4L, 5L, 10L, 20L, 25L
Sodium thiosulfate, 0.1N Standardized Solution	7772-98-7	AA35645	1L, 4L, 20L

High Purity Inorganics

Aluminum nitrate hydrate, Puratronic™, 99.999% (metals basis excluding Hg)	25838-59-9	AA10626	25g, 500g
Aluminum oxide, alpha-phase, 99.95% min (metals basis)	1344-28-1	AA42573	100g, 500g
Copper(II) oxide, Puratronic™, 99.995% (metals basis)	1317-38-0	AA10700	25g, 100g
Hydrogen tetrachloroaurate(III) trihydrate, ACS, 99.99% (metals basis), Au 49.0% min	16961-25-4	AA36400	1g, 5g
Indium(III) chloride, anhydrous, 99.999% (metals basis)	10025-82-8	AA11856	1g, 10g
Indium(III) sulfide, 99.995% (metals basis)	12030-24-9	AA44836	2g, 10g
Lead(II) iodide, ultra dry, 99.999% (metals basis)	10101-63-0	AA44314	5g, 25g
Palladium(II) chloride, 99.9% (metals basis), Pd 59.0% min	7647-10-1	AA11034	2g, 10g
Sodium chloride, Puratronic™, 99.999% (metals basis)	7647-14-5	AA10862	25g, 100g

Inorganics

Lithium sulfide, 99.9% (metals basis)	12136-58-2	AA12839	2g, 10g, 50g, 250g
Palladium(II) acetate, Pd 45.9-48.4%	3375-31-3	AA10516	1g, 5g, 25g
Phosphorus lump, red, Puratronic™, 99.999+% (metals basis)	7723-14-0	AA00248	1g, 10g, 50g
Silver nitrate, ACS, 99.9+% (metals basis)	7761-88-8	AA11414	5g, 25g, 100g, 500g, *6 x 500g
Silver sulfate, ACS, 98% min	10294-26-5	AA11417	25g, 100g
Sodium metaperiodate, 98%	7790-28-5	AA13798	10g, 100g, 500g, 2kg

Organozinc compounds

Allylzinc bromide, 0.5M in THF, packaged under Argon in resealable ChemSeal bottles	18925-10-5	AAH58012	50g
4-Cyanobutylzinc bromide, 0.5M in THF, packaged under Argon in resealable ChemSeal bottles	226570-68-9	AAH58897	50g
Cyclobutylzinc bromide, 0.5M in THF, packaged under Argon in resealable ChemSeal bottles	1019205-65-2	AAH58247	50g
Cyclohexylzinc bromide, 0.5M in THF, packaged under Argon in resealable ChemSeal bottles	7565-57-3	AAH58852	50g
Cyclopropylzinc bromide, 0.5M in THF, packaged under Argon in resealable ChemSeal bottles	126403-68-7	AAH58008	50g

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3-(Ethoxycarbonyl)propylzinc bromide, 0.5M in THF, packaged under Argon in resealable ChemSeal bottles	131379-39-0	AAH58023	50g
Isopropylzinc bromide, 0.5M in THF, packaged under Argon in resealable ChemSeal bottles	77047-87-1	AAH58536	50g
Phenylzinc bromide, 0.5M in THF, packaged under Argon in resealable ChemSeal bottles	38111-44-3	AAH58659	50g
2-Pyridylzinc bromide, 0.5M in THF, packaged under Argon in resealable ChemSeal bottles	218777-23-2	AAH58544	50g

Oxidation reagents

3-Chloroperoxybenzoic acid, 70-75%, balance 3-Chlorobenzoic acid and water	937-14-4	AC25579	25g, 100g
Dess-Martin periodinane, 15 wt.% solution in dichloromethane	87413-09-0	AC33311	10mL, 50mL
2,3-Dichloro-5,6-dicyano-1,4-benzoquinone, 98%	84-58-2	AC11330	10g, 100g
Hydrogen peroxide, for analysis, 35 wt.% solution in water, stabilized	7722-84-1	AC20246	500mL, 1L
Sodium hypochlorite, 13% active chlorine	7681-52-9	AC21925	500mL, 2.5L
Sodium periodate, 99%, for analysis	7790-28-5	AC19838	100g, 500g
Sodium peroxide, 96%	1313-60-6	AC20770	100g, 500g

Phosphine ligands

(±)-2,2'-Bis(diphenylphosphino)-1,1'-binaphthyl, 98%	98327-87-8	AC36864	1g, 5g
9,9-Dimethyl-4,5-bis(diphenylphosphino)xanthene, 98%	161265-03-8	AC37806	1g, 5g
Chlorodicyclohexylphosphine, 97%	16523-54-9	AC35329	1g, 5g
Triphenylphosphine, 99%	603-35-0	AC14042	250g, 1kg
Tris(2-carboxyethyl)phosphine hydrochloride, 98%	51805-45-9	AC36383	1g, 10g

Precious Metal Compounds and Catalysts

Dihydrogen hexachloroplatinate(IV) hydrate, 99.9% (metals basis)	26023-84-7	AA11051	1g, 5g
Gold(III) acetate, 99.9% (metals basis)	15804-32-7	AA39742	0.5g, 1g
Hydrogen tetrachloroaurate(III) hydrate, 99.9% (metals basis), Au 49% min	27988-77-8	AA12325	1g, 5g
Hydrogen tetrachloroaurate(III) trihydrate, ACS, 99.99% (metals basis), Au 49.0% min	16961-25-4	AA36400	1g, 5g
Palladium(II) chloride, 99.9% (metals basis), Pd 59.0% min	7647-10-1	AA11034	2g, 10g
Palladium(II) nitrate hydrate, 99.8% (metals basis), Pd 39% min	10102-05-3	AA11035	2g, 10g
Platinum(II) 2,4-pentanedionate, Pt 48.0% min	15170-57-7	AA10526	1g, 5g

Protection and deprotection of functional groups

Acetic anhydride, 99+%, pure	108-24-7	AC14949	1L, 2.5L
Benzoyl chloride, 99%, pure	98-88-4	AC10575	1L, 2.5L
Benzyl chloroformate, 97 wt%, stabilized	501-53-1	AC15294	100g, 500g
Chlorotrimethylsilane, 98%	75-77-4	AC11012	100mL, 250mL
2,2-Dimethoxypropane, 98+%	77-76-9	AC11563	500mL, 1L
9-Fluorenylmethyl chloroformate, 98%	28920-43-6	AC17094	5g, 25g
1,1,1,3,3,3-Hexamethyldisilazane, 98%	999-97-3	AC12058	100mL, 500mL
p-Toluenesulfonyl chloride, 99+%	98-59-9	AC13903	100g, 500g
Trimethylsilyl trifluoromethanesulfonate, 99%	27607-77-8	AC20944	10mL, 50mL

Pure Elements

Bromine liquid, 99.8%	7726-95-6	AA00905	25g, 250g
Cesium, 99.98% (metals basis)	7440-46-2	AA10146	1g, 5g
Gold shot, semi-spherical, 6.35mm (0.25in) & down, Premion™, 99.999% (metals basis)	7440-57-5	AA40317	1g, 5g
Gold wire, 0.2mm (0.008in) dia, 99.9% (metals basis)	7440-57-5	AA10195	1m, 5m
Gold wire, 14kt, red, 1.63mm (0.064in) dia, Au 58.3% min	7440-57-5	AA40328	10g, 25cm
Platinum gauze, 52 mesh woven from 0.1mm (0.004in) dia wire, 99.9% (metals basis)	7440-06-4	AA10283	25x25mm, 50x50mm
Silver wire, 2.0mm (0.08in) dia, annealed, 99.9% (metals basis)	7440-22-4	AA11435	50g, 250cm
Vanadium foil, 0.127mm (0.005in) thick, 99.8% (metals basis)	7440-62-2	AA13783	50x100g, 100x200mm

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Reagents

Bromine, 99.6%, for analysis	7726-95-6	AC19666	25mL, 250mL, 1L
N-Bromosuccinimide, 99%	128-08-5	AA15922	250g, 1kg, 5kg
1,4-Diazabicyclo[2.2.2]octane, 98%	280-57-9	AA14003	25g, 100g, 500g
Hydrogen peroxide, for analysis, 35 wt.% solution in water, stabilized	7722-84-1	AC20246	500mL
Hydroxylamine, 50% aq. soln.	7803-49-8	AA22202	100mL, 500mL
Oxalyl chloride, 98%	79-37-8	AC12961	25g, 100g, 1kg, 2.5kg
Sodium borohydride, 98+%, powder	16940-66-2	AC18930	5g, 10g, 100g, 500g, 2.5kg
Sodium tetraphenylborate, ACS, 99.5% min	143-66-8	AA36430	2g, 10g, 50g
Sulfur trioxide-pyridine complex, 98%, active SO ₃ ca 48-50%	26412-87-3	AA12202	10g, 50g, 250g, 1kg

Reducing Agents

tert-Butylchlorodimethylsilane, 98%	18162-48-6	AC18393	25g, 100g
Hydrazine hydrate, 100% (Hydrazine, 64%)	10217-52-4	AC19671	100g, 500g
Hydroxylamine hydrochloride, 99+%	11/1/5470	AC27010	100g, 1kg
Iron, 99%, powder, -70 mesh (<212 micron)	7439-89-6	AC19781	100g, 500g
Sodium biphenyl, 20%w/w solution in diethylene glycol diethyl ether, offered as 20 x 15mL	5137-46-2	AC41942	300mL
Sodium hydride, 60% dispersion in mineral oil, in soluble bags	7646-69-7	AC18986	100g, 1kg
Sodium hydride, 60% dispersion in mineral oil, in soluble bags, in resealable cans	7646-69-7	AC33214	100g, 500g
Sodium hydrosulfite, ca. 85%, tech.	7775-14-6	AC16959	25g, 1kg
Sodium thiosulfate, 98.5%, extra pure, anhydrous	7772-98-7	AC20287	500g, 1kg
Triethylsilane, 99%	617-86-7	AC21292	25g, 100g
Triisopropylsilane, 98%	6485-79-6	AC21492	50g, 250g
Tri-n-butyltin hydride, 97%	688-73-3	AC21573	10g 50g
Zinc, 98+%, dust (stable acc. to UN classification class 4)	7440-66-6	AC19834	100g, 1kg

Reducing Agents - Aluminum hydrides and borohydrides

Borane-methyl sulfide complex, 94%, AcroSeal	13292-87-0	AC17706	100mL, 400mL
Borane-tetrahydrofuran complex, 1M solution in THF, Stabilized, AcroSeal	14044-65-6	AC17508	100mL, 400mL
Diisobutylaluminum hydride, 1.2M (20 wt%) solution in toluene, AcroSeal	1191-15-7	AC20108	100mL, 400mL
Lithium aluminum hydride, 95%, powder	16853-85-3	AC19032	10g, 25g
Sodium borohydride, 98+%, powder	16940-66-2	AC18930	100g, 500g
Sodium triacetoxyborohydride, 97%	56553-60-7	AC29182	25g, 100g

Salts

Ammonium iodide, ACS, 99.0% min	12027-06-4	AA11668	100g, 500g
Ammonium sulfate, 99.5%, for analysis	7783-20-2	AC20587	250g, 1kg, 5kg, 25kg
Lithium chloride, 99%, extra pure	7447-41-8	AC19337	5g, 1kg
Lithium chloride, ultra dry, 99.9% (metals basis)	7447-41-8	AA14540	10g, 50g, 250g
Potassium bromide, 99+%, for spectroscopy, IR grade	2/3/7758	AC20639	25g, 100g, 500g
Potassium fluoride, anhydrous, 99%	7789-23-3	AA14130	50g, 250g, 1kg
Sodium azide, 99%, extra pure	26628-22-8	AC19038	5g, 100g, 500g, 2.5kg
Sodium chloride, 99.5%, for analysis	7647-14-5	AC20779	1kg, 5kg, 25kg
Sodium sulfate, 99%, extra pure, anhydrous	7757-82-6	AC19664	25g, 1kg, 2.5kg, 5kg, 25kg

Solvents

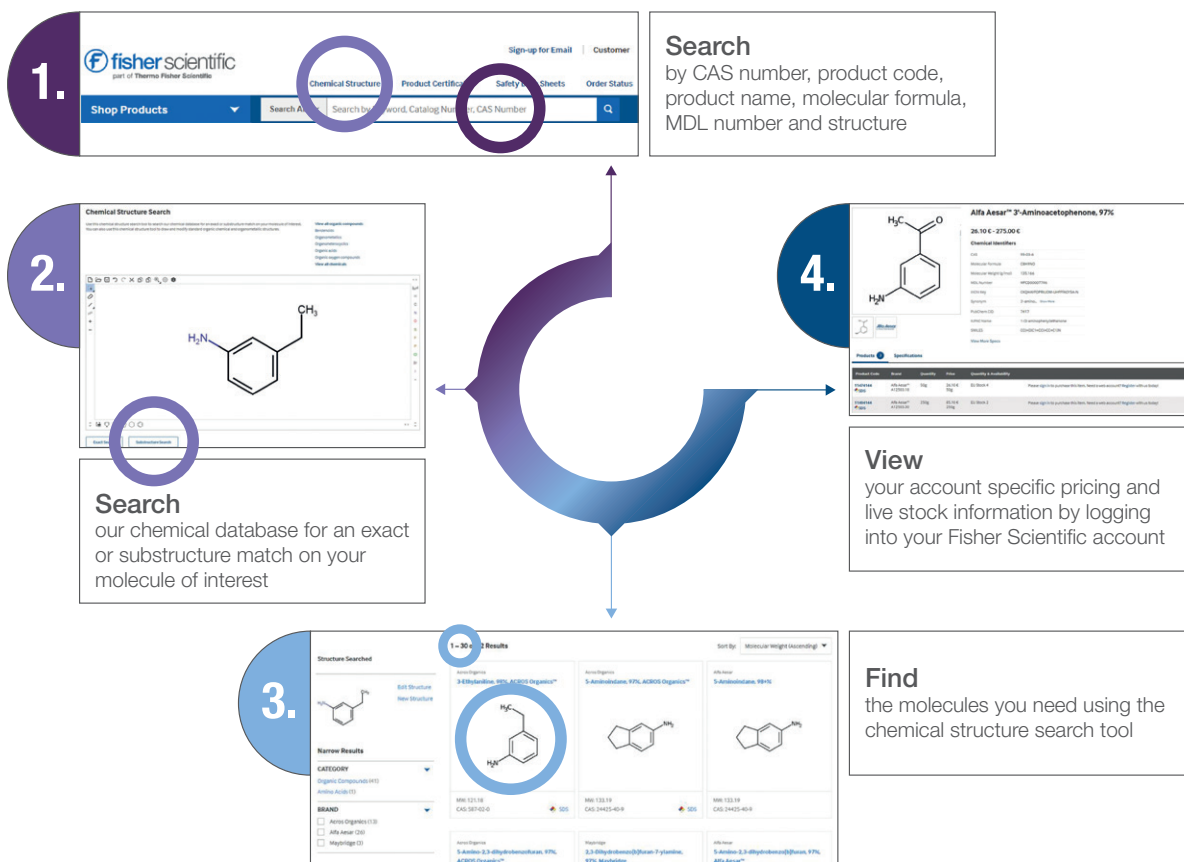
Acetone, 99.8%, Extra Dry, AcroSeal	67-64-1	AC32680	100mL, 1L
Acetonitrile, HPLC Grade, 99.7+% min	75-05-8	AA22927	1L, 4L
Dichloromethane, 99.8%, Extra Dry over Molecular Sieve, Stabilized, AcroSeal	75-09-2	AC34846	100mL, 500mL, 1L, 2.5L
Di-n-butyl ether, 99%	142-96-1	AA16305	500mL, 2.5L
1,4-Dioxane, 99.8%, Extra Dry, stabilized, AcroSeal	123-91-1	AC32689	100mL, 1L, 2.5L
Ethanol, Alcohol Reagent, anhydrous, denatured, ACS, 94-96%	64-17-5	AA33361	500mL, 1L
n-Hexane, 99+%, for analysis	110-54-3	AC16078	1L, 2.5L, 25L

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Product Name	CAS Number	Cat. No.	Pack Sizes
Methanol, Semiconductor Grade, 99.9% min	67-56-1	AA19393	1L, 4L
Methanol, ultrapure, HPLC Grade, 99.8+%	67-56-1	AA22909	1L, 4L
1-Propanol, ACS, 99.5+%	71-23-8	AA43848	500mL, 1L
2-Propanol, ACS, 99.5% min	67-63-0	AA36644	1L, 4L
Sulfolane, 99%	126-33-0	AA13466	250g, 1kg, 5kg,
Tetrahydrofuran, 99.5%, Extra Dry over Molecular Sieve, Stabilized, AcroSeal	109-99-9	AC34845	100mL, 500mL, 1L, 2.5L
Tetrahydrofuran, UV, HPLC Grade, 99.7+% min, unstab.	109-99-9	AA22904	1L, 4L
Toluene, 99.8+%, for analysis	108-88-3	AC17685	500mL, 1L, 2.5L, 5L, 25L
Trichloroethylene, ACS, 99.5% min, stab.	79-01-6	AA19401	500mL, 1L, 4L, *4 x 1L
Water, ultrapure, HPLC Grade	7732-18-5	AA22934	1L, 4L

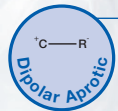
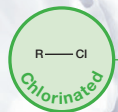
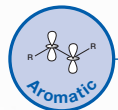
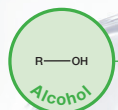
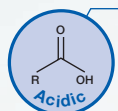
Chemical Structure Search Tool

As well as traditional 'text' methods of product search, try the chemical structure search tool to search our chemical database for an exact or substructure match on your molecule of interest. You can also use this chemical structure tool to draw and modify standard organic chemical and organometallic structures.



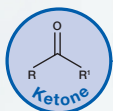
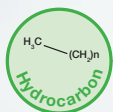
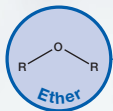
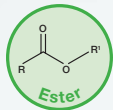
NMR Proton Shifts for Residual Solvent Impurities

Solvent Type



Solvent	Synonyms	Mol Wt	BP °C	Linear Formula	H-Signal	Multi	CDCl ₃	D ₂ O	CD ₃ OD	(CD ₃) ₂ SO	(CD ₃) ₂ CO	CD ₃ CN	C ₆ D ₆
Acetic Acid	Ethanoic acid	60.05	118	CH ₃ COOH	CH ₃	s	2.13	2.08	1.99	1.95	1.96	1.96	1.55
Formic Acid	Methanoic Acid	46.02	101	HCOOH	H	s	8.02	8.22	8.08	8.18	8.11	8.03	-
1-Butanol	<i>n</i> -Butanol / 1-Hydroxybutane / <i>n</i> -Butyl alcohol	74.12	117.6	CH ₃ (CH ₂) ₃ OH	CH ₃	t	0.94	0.91	0.93	0.86	0.90	0.91	-
					CH ₂ (3)	m	1.39	1.35	1.38	1.30	1.31-1.41	1.29-1.39	-
					CH ₂ (2)	m	1.56	1.53	1.51	1.39	1.44-1.52	1.42-1.49	-
2-Butanol	<i>sec</i> -Butanol / 2-Butyl alcohol / 2-Hydroxybutane	74.12	99	CH ₃ CH(OH)CH ₂ CH ₃	CH ₂ (1)	m	3.65	3.61	3.54	3.38	3.49-3.56	3.45-3.51	-
					CH ₃ (4)	t	0.93	0.84	0.91	0.83	0.89	0.88	-
					CH ₃ (1)	d	1.19	1.11	1.13	1.02	1.09	1.08	-
<i>tert</i> -Butanol	<i>t</i> -Butyl alcohol / 2-Methyl-2-propanol	74.12	83	(CH ₃) ₃ COH	CH ₂	m	1.48	1.42	1.44	1.32	1.33-1.47	1.33-1.42	-
					CH	m	3.73	3.71	3.63	3.49	3.56-3.66	3.54-3.62	-
					CH ₃	s	1.28	1.24	1.40	1.11	1.18	1.16	1.05
Ethanol	Ethyl alcohol	46.06	78	C ₂ H ₆ O	CH ₃	t	1.25	1.17	1.19	1.06	1.12	1.12	0.96
Ethylene Glycol	Ethane-1,2-diol / 1,2-Dihydroxyethane	62.06	196-198	HOCH ₂ CH ₂ OH	CH ₂	q	3.72	3.65	3.60	3.44	3.57	3.54	3.34
					CH	s	3.76	3.65	3.59	3.34	3.28	3.51	3.41
1-Hexanol	<i>n</i> -Hexanol / Hexyl alcohol / Caproic alcohol	102.18	156-157	CH ₃ (CH ₂) ₅ OH	CH ₃	t	0.86-0.93	0.88	0.87-0.94	0.86	0.88	0.89	-
					CH ₂ (3-5)	m	1.24-1.44	1.24-1.39	1.26-1.40	1.19-1.32	1.24-1.39	1.22-1.38	-
					CH ₂ (2)	m	1.52-1.61	1.50-1.59	1.48-1.57	1.36-1.44	1.45-1.55	1.43-1.51	-
					CH ₂ (1)	m	3.64	3.69	3.53	3.35-3.40	3.37	3.44-3.50	-
<i>iso</i> -Amyl alcohol	3-Methyl-1-butanol / <i>iso</i> -Pentyl alcohol	88.15	130	(CH ₃) ₂ CHCH ₂ CH ₂ OH	CH ₃	d	0.92	0.90	0.91	0.85	0.89	0.89	-
					CH ₂ CH	q	1.47	1.44	1.42	1.31	1.39	1.37	-
					CH	m	1.66-1.78	1.61-1.71	1.64-1.77	1.65	1.72	1.67	-
					CH ₂ OH	m	3.68	3.64	3.58	3.41	3.53-3.59	3.51	-
<i>iso</i> -Butanol	<i>iso</i> -Butyl alcohol / 2-Methyl-1-propanol	74.12	108	(CH ₃) ₂ CHCH ₂ OH	CH ₃	d	0.92	0.88	0.90	0.82	0.87	0.86	-
					CH	m	1.77	1.75	1.70	1.60	1.68	1.66	-
					CH ₂	m	3.41	3.38	3.30	3.15	3.26-3.34	3.25	-
Methanol	Methyl alcohol	32.04	64.7	CH ₃ OH	CH ₃	s	3.49	3.34	3.34	3.16	3.31	3.28	3.07
Pentanol	<i>n</i> -Amyl alcohol / Pentyl alcohol	88.15	137-139	CH ₃ (CH ₂) ₄ OH	CH ₃	t	0.91	0.88	0.92	0.86	0.89	0.90	-
					CH ₂ (3-4)	m	1.31	1.31	1.34	1.27	1.27-1.37	1.25-1.38	-
					CH ₂ (2)	m	1.58	1.55	1.53	1.41	1.45-1.55	1.43-1.52	-
					CH ₂ (1)	t	3.64	3.60	3.53	3.37	3.37	2.46	-
1-Propanol	<i>n</i> -Propanol / Propyl alcohol	60.10	97	CH ₃ CH ₂ CH ₂ OH	CH ₃	t	0.93	0.90	0.92	0.87	0.89	0.88	-
					CH ₂ (2)	m	1.60	1.55	1.54	1.45	1.44-1.55	1.43-1.52	-
					CH ₂ (1)	t	3.60	3.56	3.49	3.38	3.44-3.51	3.40-3.47	-
2-Propanol	IPA / Isopropanol / <i>iso</i> -Propyl alcohol	60.10	82	(CH ₃) ₂ CHOH	CH ₃	d	1.20	1.18	1.14	1.04	1.10	1.09	0.95
					CH	m	4.03	4.02	3.92	3.78	3.90	3.67	3.87
Anisole	Methoxybenzene / Methyl phenyl ether	108.14	154	C ₆ H ₅ OCH ₃	CH ₃	s	3.76	3.85	3.77	3.76	3.78	3.77	-
					CH (<i>o/p</i>)	m	6.93	7.06	6.90	6.93	6.88-6.95	6.89-6.98	-
					CH (<i>m</i>)	m	7.29	7.41	7.25	7.29	7.24-7.31	7.27-7.34	-
Benzene		78.11	80.09	C ₆ H ₆		s	7.37	7.44	7.33	7.37	7.36	7.37	7.15
Pyridine		79.10	115-116	C ₅ H ₅ N	CH (2)	m	8.62	8.52	8.53	8.58	8.58	8.57	8.53
					CH (3)	m	7.29	7.45	7.44	7.39	7.35	7.33	6.66
					CH (4)	m	7.68	7.87	7.85	7.79	7.76	7.73	6.98
Toluene	Methylbenzene	92.14	111	C ₆ H ₅ CH ₃	CH ₃	s	2.36	-	2.32	2.30	2.32	2.33	2.11
					CH (<i>o/p</i>)	m	7.17	-	7.16	7.18	7.10-7.20	7.10-7.30	7.02
					CH (<i>m</i>)	m	7.25	-	7.16	7.25	7.10-7.20	7.10-7.30	7.13
<i>p</i> -Xylene	1,4-Dimethylbenzene / <i>p</i> -Xylol	106.17	138	C ₆ H ₄ (CH ₃) ₂	CH ₃	s	2.30	2.30	2.26	2.24	2.26	2.27	-
					CH	s	7.06	7.18	7.02	7.05	-	-	-
Chloroform	Trichloromethane / Formyl trichloride	119.38	61	CHCl ₃	CH	s	7.26	-	7.88	8.32	8.02	7.58	6.15
1,2-Dichloroethane	EDC / Ethylene dichloride / Glycol dichloride	98.96	81-85	ClCH ₂ CH ₂ Cl	CH ₂	s	3.73	-	3.78	3.90	3.87	3.81	2.90
Dichloromethane	DCM / Methylene dichloride	84.93	39-40	CH ₂ Cl ₂	CH ₂	s	5.30	-	5.48	5.76	5.63	5.44	4.27
Acetonitrile	AcCN / Methyl cyanide / Cyanomethane	41.04	81-82	CH ₃ CN	CH ₃	s	2.10	2.06	2.03	2.07	2.05	1.96	1.55
Dimethylformamide	DMF / Formyldimethylamine	73.09	153	HCON(CH ₃) ₂	CH	s	8.02	7.91	7.98	7.95	7.96	7.92	7.63
					CH ₃	s	2.96	3.00	2.99	2.89	2.94	2.89	2.36
					CH ₃	s	2.88	2.86	2.85	2.73	2.78	2.77	1.86
Dimethyl sulfoxide	DMSO / Methyl sulfoxide / (Methylsulfinyl)methane	78.13	189	(CH ₃) ₂ SO	CH ₃	s	2.62	2.71	2.65	2.54	2.52	2.50	1.68

Solvent	Synonyms	Mol Wt	BP °C	Linear Formula	H-Signal	Multi	CDCl ₃	D ₂ O	CD ₃ OD	(CD ₃) ₂ SO	(CD ₃) ₂ CO	CD ₃ CN	C ₆ D ₆
<i>n</i> -Butyl acetate	1-Butyl acetate	116.16	126-127	CH ₃ CO ₂ (CH ₂) ₃ CH ₃	CH ₃ CH ₂	t	0.94	0.91	0.94	0.89	0.92	0.92	-
					CH ₂	m	1.38	1.37	1.39	1.32	1.32-1.43	1.31-1.42	-
					CH ₂	m	1.61	1.63	1.61	1.54	1.54-1.62	1.54-1.63	-
					CH ₃ CO	s	2.04	2.09	2.01	1.99	1.97	1.97	-
Ethyl acetate	EtOAc / Ethyl ethanoate / Acetoxyethane	88.11	75-78	CH ₃ CO ₂ C ₂ H ₅	CH ₃ CH ₂	t	1.26	1.24	1.24	1.18	1.20	1.20	0.92
					CH ₃ CO	s	2.05	2.07	2.01	1.99	1.97	1.97	1.65
					CH ₂	q	4.12	4.14	4.09	4.03	4.05	4.06	3.89
					CH ₂ CO	t	4.07	4.11	4.06	3.99	4.02	4.02	-
Ethyl formate	Ethyl methanoate / Formic acid ethyl ester	74.08	54	HCO ₂ C ₂ H ₅	CH ₃	t	1.29	1.29	1.27	1.24	-	-	-
					CH ₂	q	4.22	4.28	4.20	4.17	-	-	-
					CH	s	8.04	8.16	8.06	8.23	-	-	-
<i>iso</i> -Propyl acetate	iPrOAc / 1-Methyl ethyl acetate / 2-Propyl acetate	102.13	88.8	CH ₃ CO ₂ CH(CH ₃) ₂	(CH ₃) ₂ CH	d	1.23	1.25	1.22	1.17	1.19	1.19	-
					CH ₃ CO	s	2.02	2.07	1.99	1.96	1.94	1.94	-
					CH	m	4.99	4.98	4.95	4.86	4.91	4.91	-
Methyl acetate	Methyl ethanoate / Methyl acetic ester	74.08	57.4	CH ₃ CO ₂ CH ₃	CH ₃ CO	s	2.05	2.09	2.02	1.92	1.98	1.99	-
					OCH ₃	s	3.67	3.68	3.64	3.61	3.59	3.60	-
<i>n</i> -Propyl acetate	Acetic acid propyl ester / Propyl ethanoate	102.13	102	CH ₃ CO ₂ CH ₂ CH ₂ CH ₃	CH ₃ CH ₂	t	0.94	0.92	0.94	0.88	0.92	0.92	-
					CH ₂ CH ₃	m	1.65	1.65	1.64	1.57	1.61	1.61	-
					CH ₃ CO	s	2.05	2.09	2.02	2.00	1.98	1.98	-
					CH ₂ CO	t	4.02	4.06	4.01	3.95	3.97	3.97	-
<i>tert</i> -Butyl methyl ether	MTBE / 2-Methyl-2-methoxy propane	88.15	54-56	(CH ₃) ₃ COCH ₃	CCH ₃	s	1.19	1.22	1.15	1.11	1.19	1.14	1.07
					OCH ₃	s	3.22	3.24	3.20	3.08	3.13	3.13	3.04
Diethyl ether	Ether / Ethoxyethane	74.12	34.6	(CH ₃ CH ₂) ₂ O	CH ₃	t	1.20	1.17	1.17	1.09	1.11	1.12	1.11
1,2-Dimethoxyethane	DME / Dimethylglycol	90.12	84-86	CH ₃ OCH ₂ CH ₂ OCH ₃	CH ₃	s	3.40	3.37	3.35	3.24	3.28	3.28	3.24
					CH ₂	s	3.55	3.60	3.52	3.43	3.46	3.45	3.33
1,4-Dioxane	Diethylene ether / Diethylene dioxide	88.11	101	C ₄ H ₈ O ₂	CH ₂	s	3.71	3.75	3.66	3.57	3.59	3.60	3.35
Tetrahydrofuran	THF / Oxolane / Diethylene oxide	72.11	66	C ₄ H ₈ O	CH ₂	m	1.85	1.88	1.87	1.76	1.79	1.80	1.40
					CH ₂ O	m	3.76	3.74	3.71	3.60	3.63	3.64	3.57
Cyclohexane		84.16	81	C ₆ H ₁₂	CH ₂	s	1.43	-	1.45	1.40	1.43	1.44	1.40
<i>n</i> -Heptane	Heptane / Dipropyl methane	100.21	98	CH ₃ (CH ₂) ₅ CH ₃	CH ₃	t	0.89	-	0.90	0.86	0.88	0.89	-
					CH ₂	m	1.28	-	1.31	1.26	1.21-1.35	1.21-1.35	-
<i>n</i> -Hexane		86.18	69	CH ₃ (CH ₂) ₄ CH ₃	CH ₃	t	0.88	-	0.90	0.86	0.88	0.89	0.89
					CH ₂	m	1.26	-	1.29	1.25	1.28	1.28	1.24
Methylcyclohexane	MCH	98.19	101	CH ₃ CH(CH ₂) ₅	CH ₂ CH (ax)	m	0.82-0.93	-	0.82-0.94	0.80-0.90	0.87-0.93	0.88-0.94	-
					CH ₃	d	0.86	-	0.87	0.84	0.84	0.86	-
					CH ₂ (4) (ax)	m	1.06-1.17	-	1.09-1.20	1.04-1.14	1.07-1.17	1.08-1.18	-
					CH ₂ (3) (ax)	m	1.17-1.28	-	1.26	1.14-1.25	1.24	1.25	-
<i>n</i> -Pentane		72.15	36	CH ₃ (CH ₂) ₃ CH ₃	CH ₃	t	0.88	-	0.90	0.86	0.88	0.89	0.87
					CH ₂	m	1.27	-	1.29	1.27	1.27	1.29	1.23
					CH ₃	s	2.17	2.22	2.15	2.09	2.09	2.08	1.55
					CH ₂	m	1.32	1.30	1.32	1.24	-	-	-
2-Hexanone	2-Propanone / Dimethylketone	100.16	127	CH ₃ (CH ₂) ₃ COCH ₃	CH ₃	t	0.91	0.88	0.91	0.85	-	-	-
					CH ₂	m	1.56	1.53	1.53	1.43	-	-	-
					CH ₂ CO	t	2.42	2.56	2.47	2.41	-	-	-
					CH ₃ CO	s	2.13	2.21	2.12	2.07	-	-	-
Isobutyl methyl ketone	MIBK / 4-Methylpentan-2-one / Isopropylacetone	100.16	117.4	(CH ₃) ₂ CHCH ₂ COCH ₃	(CH ₃) ₂ CH	d	0.92	0.90	0.85	0.85	0.88	0.88	-
					CH	m	2.13	2.08	2.00	2.00	2.02-2.11	2.02-2.08	-
					CH ₃ CO	s	2.12	2.21	2.05	2.05	2.06	2.05	-
					CH ₂	d	2.30	2.43	2.28	2.28	2.31	2.29	-
Methyl ethyl ketone	MEK / Ethyl methyl ketone / 2-Butanone	72.11	80	C ₂ H ₅ COCH ₃	CH ₃ CH ₂	t	1.06	1.26	1.01	0.91	0.96	0.96	0.85
					CH ₃ CO	s	2.14	2.19	2.12	2.07	2.07	2.06	1.58
					CH ₂ CH ₃	q	2.46	3.18	2.50	2.43	2.45	2.43	1.81
Triethylamine	TEA / Diethylaminoethane	101.19	90	(C ₂ H ₅) ₃ N	CH ₃	t	1.03	0.99	1.05	0.93	0.96	0.96	0.96
					CH ₂	q	2.53	2.57	2.58	2.43	2.45	2.45	2.40
Formamide	Methanamide / Formic amide	45.04	210	HCONH ₂	CH	s	8.22	8.06	8.04	7.97	-	-	-
Grease	Long chain, linear aliphatic hydrocarbons				CH ₃	m	0.86	-	0.88	-	0.87	0.86	0.92
					CH ₂	br s	1.26	-	1.29	-	1.29	1.27	1.36
Silicone Grease	Poly(dimethylsiloxane)				CH ₃	s	0.07	-	0.10	-	0.13	0.08	0.29
Water		18.02	100	H ₂ O	H ₂ O	s	1.56	-	4.87	3.33	2.84	2.13	-



FisherLOCK Closures

Lock in Quality and Safety

Fisher Chemical™ and Fisher Bioreagents™ FisherLOCK™ caps place a patented tamper-evident secure seal applied during manufacturing to our amber glass bottles that holds the bottle's lips and preserves integrity of the chemical.

- **Easy release:** The outer shell of the cap is designed to make it effortless to open and readily reseal
- **The tamper-evident** interior ring is visible from various angles and offers resistance until the bottle is initially opened, ensuring product integrity without the drawbacks and complications of plastic seals
- **Color-coded bands** at the bottom of the cap match ChemAlert storage codes for easy hazard identification



Exclusive color-coded design provides storage guidelines



Red (R): Flammable. Store in area segregated for flammable reagents.



Blue (B): Health hazard. Toxic if inhaled, ingested or absorbed through skin. Store in secure area.



Yellow (Y): Reactive and oxidizing reagents. May react violently with air, water or other substances. Store away from flammable and combustible materials.



White (W): Corrosive. May harm skin, eyes, or mucous membranes. Store away from red-, yellow- and blue-coded reagents.



Gray (G): Presents no more than moderate hazard in any of the categories above. For general chemical storage.

EXCEPTION: Reagent incompatible with other reagents of the same color bar. Store separately.



The FisherLOCK Cap LOCKS IN quality, safety, reliability and convenience:

Quality

- Provides a tight, tamper-evident, secure seal
- Eliminates polyethylene glycol contamination that can occur with a plastic overseal

Safety

- Caps are designed to resist back-off during transport, reducing risk of leakage
- Color-coded rings indicate storage requirements and hazard categories and enhance proper recognition, handling and storage — even before the bottle is removed from the case

Reliability

- Rigorously tested for chemical compatibility
- Bottle threads are unchanged, allowing attachment of the opened bottle to standard equipment

Convenience

- Cap design facilitates correct initial torque application during manufacturing, thus eliminating caps that may be hard to open
- Larger ridges on the exterior of the cap make it easier to open
- Caps readily reseal after initial opening

Specialized Chemical Services

We Support Your Chemistry



Manufacturing



Tailored Specifications



Mixtures and Blends



Customized Packaging



Bulk and
Semi-bulk Chemicals



Custom Synthesis



Testing Services



Reduced waste



Sourcing Support

We enable our customers to optimize their own resources with our secure and validated global supply chain; global sourcing capabilities; and manufacturing, quality control and packaging expertise.

Our Specialized Chemical Services (SCS) team serves customers who require something different:

- Semi-bulk and bulk chemicals
- Tailored solvents and solvent blends
- Custom synthesis and special solutions
- Additional testing services
- Customized packaging and labeling



Bulk and Semi-Bulk Chemicals

The extensive catalog offering encompasses the Acros Organics™, Alfa Aesar™, Fisher Bioreagents™, Fisher Chemical™, Maybridge™ and Thermo Scientific™ brands. Any product from these brands is available in larger quantities to suit your semi-bulk and bulk requirements. We can secure and manage the supply of these products using either internal manufacturing or select partners worldwide through our extensive supply-chain network. Additional testing services can be provided on request.

Custom Blending Process

We can tailor make solvents to meet your specifications for your application. In addition, our dedicated solvent-mixing facilities are available to produce high-quality blends. Solvents are charged by weight, through a 0.2µm filter, by air-driven pump and/or by nitrogen pressure. Small amounts of solid and liquid additives are added via charge-ports. We can manufacture aqueous and non-aqueous solutions to match your specification.

Custom Synthesis

We have been custom manufacturing products for many years with production methods for over 8000 products in our extensive database. Whether you are looking to synthesize complex organic building blocks, ligands and precious metal catalysts, optimize your synthesis or develop a scalable route, we are able to provide the expertise and knowledge to support your project. Our diverse and flexible custom manufacturing capabilities support our customers' custom synthesis requirements from R&D through to full scale production, with quantities from gram to ton. Communication with our customers is a key priority for our dedicated custom synthesis team, who are on hand to provide bespoke support to customers throughout the development and manufacturing process. Our laboratories operate to ISO 9001 and 14001 accreditations.

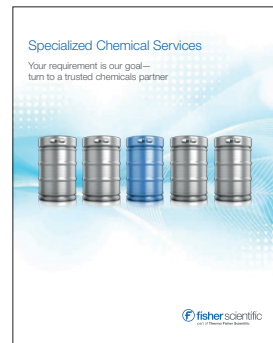
Request a quote at fishersci.com/bulkcustomchemicals

FisherPak Solvent Delivery System

The Fisher Chemical™ FisherPak™ Solvent Delivery System is an ideal choice for handling large quantities of high-purity solvents. Almost 200 lb. of glass and cardboard are eliminated by each 200 L FisherPak system (available in 19 L, 50 L, 200 L, and 1,350 L sizes). From lab to production scale, the FisherPak solution delivers solvents with enhanced safety and improved productivity.

The FisherPak Solvent Delivery System protects solvent purity throughout shipment, delivery, installation, and dispensing, offering:

- Pressurized Type 316 stainless steel electropolished containers with superior corrosion-resistance properties
- Stainless steel cover and tamper-evident closure
- An enclosed system that includes pumps and lines to minimize contamination of solvent during dispensing
- All containers dedicated to a specific customer and solvent at all times



Improves productivity

The FisherPak Solvent Delivery System helps to increase lab efficiency while reducing lab operating costs by:

- Reducing solvent testing
- Eliminating bottle rinsing
- Cutting disposal costs
- Providing a wide range of returnable containers to meet your needs
- Offering extra testing parameters, blending, and customized capabilities for mechanical, packaging, and logistics solutions

Enhances safety

The FisherPak system enables safe practices through:

- A unique combination of mechanical and manual controls to help protect the lab and the environment
- Its bottle-free, closed system that eliminates glass breakage and helps reduce the risk of spills and exposure to vapors
- Unique horizontal vapor venting for superior fire safety
- Secondary manual shut-off valves, in addition to isolation valves, incorporated into the quick-connect hardware
- Color-coded mechanical lockout connectors that help prevent improper hookups
- Compliance with Department of Transportation and NFPA 30 standards
- ASME (American Society of Mechanical Engineers) certification of returnable containers

Promotes environmentally friendly practices

The FisherPak system can help to reduce the amount of solid waste generated in your laboratory, thereby reducing environmental impact.

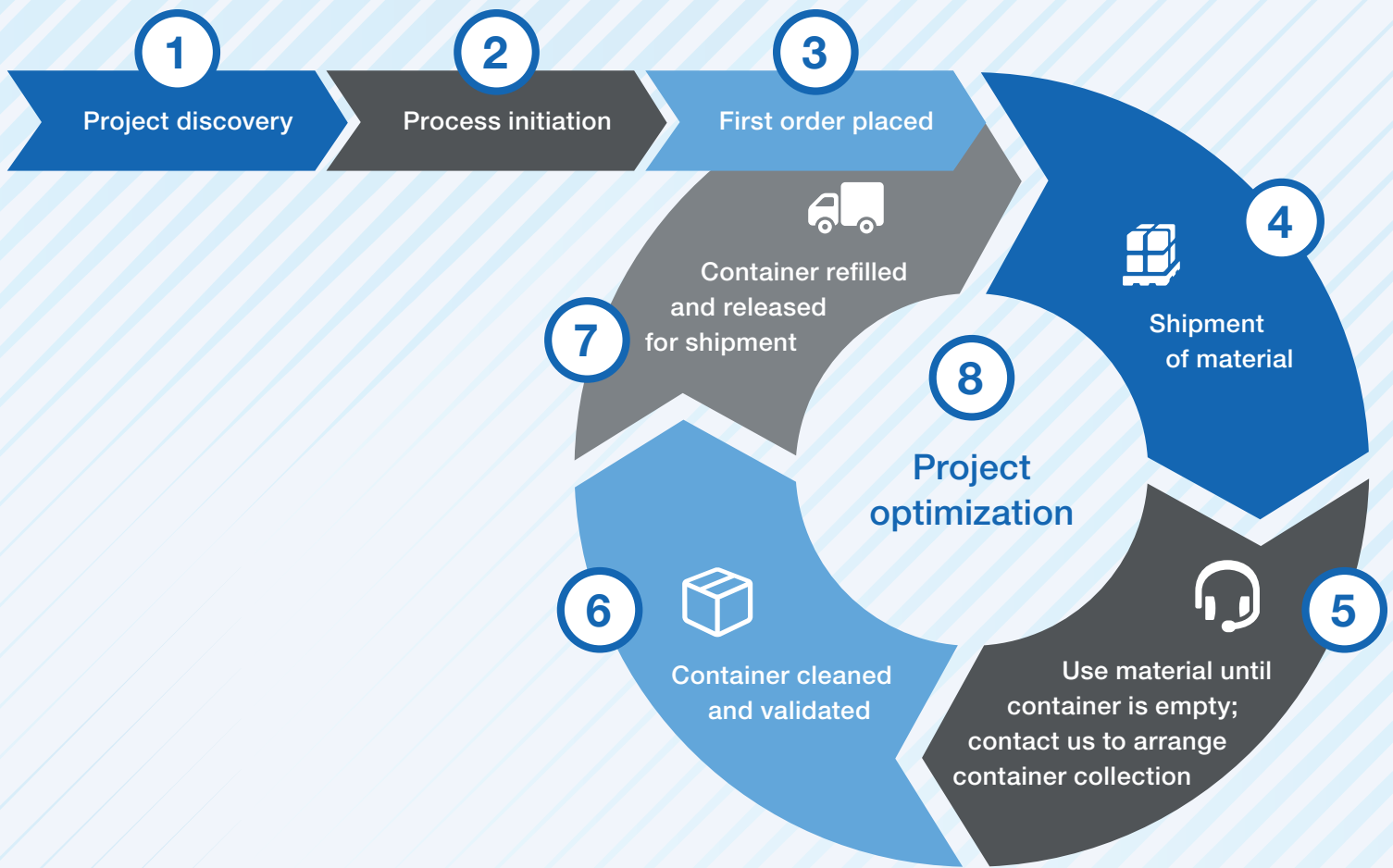
- A reusable 200 L FisherPak container replaces fifty 4 L bottles and packing material
- Flammable or toxic solvent liquids and vapors are not released into the surrounding air
- Empty FisherPak containers are cleaned and refilled by Thermo Fisher Scientific—there are no more bottles or associated risks



Find our dedicated support resources at fishersci.com/bulkcustomchemicals

How does the cycle work?

- 1 Project discovery—our team of specialists will assist in selecting the right drum type and accessories, and in calculating the necessary fleet size to meet your specific solvent and delivery requirements
- 2 Process initiation—rotation process defined and quote generated
- 3 First order placed
- 4 Shipment of material
- 5 Use material until container is empty; contact us to arrange container collection
- 6 Container cleaned and validated
- 7 Container refilled and released for shipment
- 8 Project optimization—usage and supply chain are monitored and adjusted to reflect changes in demand and/or logistics



What is GHS?









GHS = Globally Harmonized System of Classification and Labeling

- The GHS was created by the United Nations to create a single chemical classification system to communicate information to workers around the globe. The U.S. Occupational Safety and Health Administration (OSHA) revised its Hazard Communication Standard (HCS) to align with the GHS.



What's New?

The GHS pictograms on the labels have been updated. Each black-and-white drawing inside a red diamond border is used to identify a different type of hazard.

<p>GHS01 Exploding Bombs = Explosive, self reactive; heating may cause fire or explosion</p> 	<p>GHS02 Flame = Flammable, chemicals can catch fire easily and burst into flames</p> 	<p>GHS03 Flame Over Circle = Oxidizing, can react with other materials causing them to burn or explode</p> 
<p>GHS04 Gas cylinder = Gas under pressure: chemical can explode, rocket or harm health if the cylinder is heated, ruptured or leaking</p> 	<p>GHS05 Corrosion = Corrosive: may cause skin corrosion/ burns; eye damage; eat away clothing, working surfaces, and/ or metals</p> 	<p>GHS06 Skull and Crossbones = Toxic: highly poisonous material; can cause immediate and possibly serious health problems</p> 
<p>GHS07 Exclamation Mark = Other Hazard: irritant (skin and eye), skin sensitizer, acute toxicity, narcotic effects, respiratory tract irritant, harmful if swallowed, toxic if inhaled</p> 		<p>GHS08 Health Hazard = Specific health hazard including Carcinogenic; Mutagenic; Toxic for Reproduction: may cause asthma or damage to specific organs of the body</p> 

The GHS affects all of us, and the Fisher Scientific team has you covered. Training programs and materials, resources and products that comply with the new requirements are conveniently accessible right here.

For more information, go to: fishersci.com/ghs

Chemical Storage/Handling Recommendations

Chemical Incompatibility

Chemicals should react in the lab, not in the stockroom. The inadvertent mixing of inventory can produce toxic vapor/gas, fire or explosion. Stay safe in the storeroom; adhere to the following prescribed precautions and consult the chemical compatibility tables (below) for caustic combinations. For product specific information, refer to the Material Safety Data Sheet (MSDS) provided with purchase.

General Guidelines

- Protect eyes and skin: lab safety glasses with side shields, lab coats and closed-toe shoes must be worn for basic personal protection
- Safely space shelves and racks to accommodate the upright removal of the largest chemical container; prevent tipping and dripping with adequate clearance
- Identify and substitute safer chemical alternatives
- Keep hazardous materials away from heat and direct sunlight to prevent the degradation of chemicals and deterioration of storage containers and labels
- Do not store hazardous materials (except cleaners) under sinks
- Avoid chemical stockpiling; procure hazardous materials as needed
- Limit fume hood storage of hazardous materials
- Conduct periodic cleanouts to minimize accumulation of chemicals
- Keep all food (including gum), beverages, tobacco and open cosmetics outside the work area



Acids and Bases

Isolate acids:

- From reactive metals, including sodium, potassium and magnesium
- From sodium cyanide, iron sulfide, calcium carbide and other compounds that can react to produce toxic fumes/gases
- Place combustible organic carboxylic acids (i.e., acetic acid) in a flammable storage locker; store inorganic acids in acid storage cabinets
- Store acids and bases in air-tight containers with snug-fitting caps; avoid loose lids or glass stoppers; use vented caps when necessary to prevent over-pressurization
- Keep piranha etch and aqua regia in a fume hood at all times
- Use non-aluminum drip trays for aqueous sodium and potassium hydroxide solutions; isolate nitric acid when utilizing secondary containment
- Safely transfer containers of acid and base solutions using bottle carriers
- Never pour water into acid; slowly add the acid to the water and stir



Flammable and Combustible Liquids

- The main legislation for storing flammable liquids in Fire Resistant Cabinets in Europe is EN14470 Part 1. There are additional local country standards that exist which you should also be aware of
- The safe storage and handling of chemicals is essential in any volume, but generally you should consider whether the risk of the spread of fire is mitigated by using suitable fire resistant cabinets
- Anyone storing or planning to store highly flammable and/ or flammable liquids should pay particular attention to their local legislation

	Acids, Inorganic	Acids, Oxidizing	Acids, Organic	Alkalis (Bases)	Oxidizers	Poisons, Inorganic	Poisons, Organic	Water-Reactives	Organic Solvents
Acids, inorganic			X	X		X	X	X	X
Acids, oxidizing			X	X		X	X	X	X
Acids, organic	X	X		X	X	X	X	X	
Alkalis (bases)	X	X	X				X	X	X
Oxidizers			X				X	X	X
Poisons, inorganic	X	X	X				X	X	X
Poisons, organic	X	X	X	X	X	X			
Water-reactives	X	X	X	X	X	X			
Organic solvents	X	X		X	X	X			

X indicates incompatibility between two chemical product groups. Incompatible products should not be stored in close proximity.

Chemical Incompatibilities table

Chemical	Store Separately From
Acetic acid	Chromic acid, nitric acid, perchloric acid, peroxides, permanganates and other oxidizers
Acetone	Concentrated nitric and sulfuric acid mixtures, and strong bases
Acetylene	Chlorine, bromine, copper, fluorine, silver, mercury
Alkali metals	Water, carbon tetrachloride or other chlorinated hydrocarbons, carbon dioxide, halogens
Ammonia, anhydrous	Mercury, chlorine, calcium hypochlorite, iodine, bromine, hydrofluoric acid
Ammonium nitrate	Acids, metal powders, flammable liquids, chlorates, nitrites, sulfur, finely divided organic or combustible materials
Aniline	Nitric acid, hydrogen peroxide
Arsenic materials	Any reducing agent
Azides	Acids
Bromine	Ammonia, acetylene, butadiene, butane, methane, propane (or other petroleum gases), hydrogen, sodium carbide, turpentine, benzene, finely divided metals
Calcium oxide	Water
Carbon (activated)	Calcium hypochlorite, all oxidizing agents
Carbon tetrachloride	Sodium
Chlorates	Ammonium salts, acids, metal powders, sulfur, finely divided organic or combustible materials
Chromic acid and chromium trioxide	Acetic acid, naphthalene, camphor, glycerol, glycerin, turpentine, alcohol, flammable liquids in general
Chlorine	Same as Bromine
Chlorine dioxide	Ammonia, methane, phosphine, hydrogen sulfide
Copper	Acetylene, hydrogen peroxide
Cumene hydroperoxide	Acids, organic or inorganic
Cyanides	Acids
Flammable liquids	Ammonium nitrate, chromic acid, hydrogen peroxide, nitric acid, sodium peroxide, halogens
Hydrocarbons	Fluorine, chlorine, bromine, chromic acid, sodium peroxide
Hydrocyanic acid	Acids
Hydrofluoric acid	Ammonia, aqueous or anhydrous bases and silica
Hydrogen peroxide	Copper, chromium, iron, most metals or their salts, alcohols, acetone, organic materials, aniline, nitromethane, flammable liquids
Hydrogen sulfide	Fuming nitric acid, other acids, oxidizing gases, acetylene, ammonia (aqueous or anhydrous), hydrogen
Hypochlorites	Acids, activated carbon
Iodine	Acetylene, ammonia (aqueous or anhydrous), hydrogen
Mercury	Acetylene, fulminic acid, ammonia
Nitrates	Sulfuric acid
Nitric acid (concentrated)	Acetic acid, aniline, chromic acid, hydrocyanic acid, hydrogen sulfide, flammable liquids, flammable gases, copper, brass, any heavy metals
Nitrites	Acids
Nitroparaffins	Inorganic bases, amines
Oxalic acid	Silver, mercury
Oxygen	Oils, grease, hydrogen; flammable liquids, solids, or gases
Perchloric acid	Acetic anhydride, bismuth and its alloys, alcohol, paper, wood, grease and oils
Peroxides, organic	Acids (organic or mineral), avoid friction, store cold
Phosphorus (white)	Air, oxygen, alkalis, reducing agents
Potassium	Carbon tetrachloride, carbon dioxide, water
Potassium chlorate and perchlorate	Sulfuric and other acids, alkali metals, magnesium and calcium
Potassium permanganate	Glycerin, ethylene glycol, benzaldehyde, sulfuric acid
Selenides	Reducing agents
Silver	Acetylene, oxalic acid, tartaric acid, ammonium compounds, fulminic acid
Sodium	Carbon tetrachloride, carbon dioxide, water
Sodium nitrite	Ammonium nitrate and other ammonium salts
Sodium peroxide	Ethyl or methyl alcohol, glacial acetic acid, acetic anhydride, benzaldehyde, carbon disulfide, glycerin, ethylene glycol, ethyl acetate, methyl acetate, furfural
Sulfides	Acids
Sulfuric Acid	Potassium chlorate, potassium perchlorate, potassium permanganate (or compounds with similar light metals: sodium, lithium, etc.)
Tellurides	Reducing agents

(From Manufacturing Chemists' Association, Guide for Safety in the Chemical Laboratory, pp. 215–217, Van Nostrand)

Chemical Resistance and Physical Properties of Plastics

Resin Codes

ECTFE: Ethylene- chlorotrifluoroethylene copolymer	PFA: Perfluoroalkoxy
ETFE: Ethylenetetrafluoroethylene	PMMA: Polymethyl methacrylate
FEP: Fluorinated ethylene propylene	PMP: Polymethylpentene
FLPE: Fluorinated high-density polyethylene	PP: Polypropylene
FLPP: Fluorinated polypropylene	PS: Polystyrene
HDPE: High-density polyethylene	PSF: Polysulfone
LDPE: Low-density polyethylene	PTFE: Polytetrafluoroethylene
NYL: Nylon (polyamide)	PUR: Polyurethane
PPCO: Polypropylene copolymer	PVC: Polyvinyl chloride
PC: Polycarbonate	PVDF: Polyvinylidene fluoride
PETG: Polyethylene terephthalate copolyester	TPE: Thermoplastic elastomer
PK: Polyketone	XLPE: Cross-linked high-density polyethylene

Do not store strong oxidizing agents in plastic labware except if made of FEP, PFA or PTFE. Other plastics will become brittle after prolonged exposure.

Do not place plastic labware directly in a flame or on a hotplate unless specified.

Use these charts as a reference only. They are recommendations, not guarantees, of fitness for particular uses. Test materials under actual conditions before using them for your applications.

Chemical Resistance Summary

Classes of substances; temperature 68°F (20°C)	ECTFE/ETFE	FEP/PTFE/PFA	FLPE	HDPE/XLPE	LDPE	NYL	PC	PETG	PK	PMMA	PMP	PP/PPCO	PS	PSF	PUR	PVC	PVDF	TPE†
Acids, weak or dilute	E	E	E	E	E	F	E	E	E	G	E	E	E	E	G	E	E	E
Acids†, strong or concentrated	G	E	E	E	E	N	N	N	G	N	E	E	F	G	F	E	E	F
Alcohols, aliphatic	E	E	E	E	E	N	G	E	G	N	E	E	E	G	F	E	E	E
Aldehydes	E	E	G	G	G	F	F	N	E	G	G	G	N	F	G	N	E	N
Bases	E	E	F	E	E	F	N	N	G	F	E	E	E	E	N	E	E	E
Esters	E	E	E	G	G	E	N	N	E	N	G	G	N	N	N	N	G	N
Hydrocarbons, aliphatic	E	E	E	G	F	E	F	E	E	G	F	G	N	G	E	E	E	N
Hydrocarbons, aromatic	E	E	E	G	F	E	N	N	E	N	F	F	N	N	N	N	E	N
Hydrocarbons, halogenated	E	E	G	F	N	G	N	N	E	N	N	F	N	N	N	N	N	N
Ketones	G	E	E	G	G	E	N	N	E	N	F	G	N	N	N	N	N	N
Oxidizing agents, strong	F	E	F	F	F	N	N	N	G	N	F	F	N	G	N	G	G	N

E = Excellent resistance

No damage after 30 days of constant exposure.

G = Good resistance

Little or no damage after 30 days of constant exposure.

F = Fair resistance

Some effect after 7 days of constant exposure.

Depending on the material, the effect may be cracking, crazing, loss of strength or discoloration. Solvents may cause softening, swelling, and permeation losses with PA, PP, PMP, LDPE and HDPE; the solvent effects on these materials are normally reversible.

N = Not recommended

Not recommended for continuous use. Immediate damage may occur. Depending on the material, the effect will be severe cracking, crazing, loss of strength, discoloration, deformation, dissolution or permeation loss.

† For oxidizing acids, see table entry "Oxidizing agents, strong." ‡ TPE gaskets

Solvent Miscibility

	Acetone	Acetonitrile	Carbon tetrachloride	Chloroform	Cyclohexane	1,2 Dichloroethane	Dichloroethane	Diethyl ether	Dimethylformamide	Dimethylsulfoxide	1,4 Dioxane	Ethanol	Ethyl acetate	Heptane	Hexane	Methanol	Methyl-tert-butyl ether	Pentane	Propan-1-ol	Propan-2-ol	Tetrahydrofuran	Toluene	2, 2, 4, Trimethylpentane	Water		
Acetone																										
Acetonitrile																										
Carbon tetrachloride																										
Chloroform																										
Cyclohexane		●																								
1,2 Dichloroethane																										
Dichloroethane																										
Diethyl ether																										
Dimethylformamide					●										●											
Dimethylsulfoxide					●			●																		
1,4 Dioxane																										
Ethanol																										
Ethyl acetate																										
Heptane																										
Hexane		●							●	●																
Methanol		●			●				●	●																
Methyl-tert-butyl ether														●	●											
Pentane		●							●	●							●									
Propan-1-ol																										
Propan-2-ol																										
Tetrahydrofuran																										
Toluene																										
2, 2, 4, Trimethylpentane		●							●	●																
Water			●	●	●	●	●	●	●	●			●	●	●		●	●					●	●		

● indicates that solvents are not miscible

Chemical Resistance of Labware Materials

How to Use This Chart

Use This Chart as a General Guide Only.

Test each chemical before storing in labware.

The first letter of each pair represents the resistance rating at 20°C; the second at 50°C.

E = Excellent resistance

No damage after 30 days of constant exposure.

G = Good resistance

Little or no damage after 30 days of constant exposure.

F = Fair resistance

Some effect after 7 days of constant exposure. Depending on the material, the effect may be cracking, crazing, loss of strength or discoloration. Solvents may cause softening, swelling, and permeation losses with PA, PP, PMP, LDPE and HDPE; the solvent effects on these materials are normally reversible.

N = Not recommended

Not recommended for continuous use. Immediate damage may occur. Depending on the material, the effect will be severe cracking, crazing, loss of strength, discoloration, deformation, dissolution or permeation loss.

Examples

EE = Acetic Acid, 50% - LDPE gives excellent resistance at both 20°C and 50°C.

GF = n-Amyl acetate - PPE/PPCO gives good resistance at 20°C but resistance is reduced to fair at 50°C.

Warning!

Do not store strong oxidizing agents in plastic containers except those made of FEP, PFA or PTFE.

Other plastics will become brittle after prolonged exposure.

CHEMICAL	LDPE	HDPE	PP/PPCO	PMP	FEP/PTFE/PFA	ECTFE/ETFE	PC	PVC	PSF	PVDF	PS	NYL	Stainless Steel	Glass	Ceramic
Acetaldehyde	GN	GF	GN	GN	EE	GF	FN	GN	NN	EE	NN	EG	EE	EE	EE
Acetamide, sat.	EE	EE	EE	EE	EE	EE	NN	NN	NN	—	EE	EE	EE	EE	EE
Acetic acid, 5%	EE	EE	EE	EE	EE	EE	EG	EG	GG	EE	GG	NN	EE	EE	EE
Acetic acid, 50%	EE	EE	EE	EE	EE	EG	EG	EG	GG	EE	GG	NN	EE	EE	EE
Acetone	NN	NN	EE	EE	EE	GF	NN	NN	NN	NN	NN	EE	EE	EE	EE
Acetonitrile	EE	EE	FN	FN	EE	EE	NN	NN	NN	NN	NN	EE	EG	EE	EE
Acrylonitrile	EE	EE	FN	FN	EE	EG	NN	NN	NN	GF	NN	EG	EG	EE	EE
Adipic acid	EG	EE	EE	EE	EE	EE	EG	GG	—	EE	EF	EG	EE	EE	EE
Alanine	EE	EE	EE	EE	EE	EE	NN	NN	NN	—	EE	EG	—	—	—
Allyl alcohol	EE	EE	EE	EG	EE	EE	GF	GF	GF	—	GF	NN	EE	EG	EG
Aluminum hydroxide	EG	EE	EG	EG	EE	EE	FN	EG	GG	EE	GG	EE	EE	NN	EE
Aluminum salts	EE	EE	EE	EE	EE	EE	EG	EE	EE	EE	GG	NN	GG	EE	EE
Amino acids	EE	EE	EE	EE	EE	EE	EE	EE	EE	EE	EE	EG	—	—	—
Ammonia	EE	EE	EE	EE	EE	EE	NN	EG	GF	EE	GF	FF	EE	EE	EE
Ammonium acetate, sat.	EE	EE	EE	EE	EE	EE	EE	EE	EE	EE	EE	EG	EG	EE	EE
Ammonium glycolate	EG	EE	EG	EG	EE	EE	GF	EE	GG	EE	EE	GG	—	—	—
Ammonium hydroxide, 5%	EE	EE	EE	EE	EE	EE	FN	EE	GG	EE	EF	GF	EE	EE	EE
Ammonium hydroxide, 30%	EG	EE	EG	EG	EE	EE	NN	EG	GG	EE	GF	FN	EE	EE	EE
Ammonium oxalate	EG	EE	EG	EG	EE	EE	EE	EE	EE	EE	EE	GF	EE	EE	EE
Ammonium salts	EE	EE	EE	EE	EE	EE	EG	EG	EE	EE	GG	NN	EE	EE	EE
n-Amyl acetate	GF	EG	GF	GF	EE	EE	NN	NN	NN	EE	NN	EE	EE	EE	EG
Amyl chloride	NN	FN	NN	NN	EE	EE	NN	NN	NN	EE	NN	EG	EG	EE	EE
Aniline	EG	EG	GF	GF	EE	GN	FN	NN	NN	EF	NN	GF	EG	EE	EE
Benzaldehyde	EG	EE	EG	EG	EE	EF	FN	NN	FF	EE	NN	EG	GG	EE	EE
Benzene	FN	NN	GF	GF	EE	EG	NN	NN	NN	EE	NN	EE	GG	EE	EE
Benzoic acid, sat.	EE	EE	EG	EG	EE	EE	EG	EG	FF	EE	GG	NN	EG	EE	EE
Benzyl acetate	EG	EE	EG	EG	EE	EG	FN	NN	NN	—	NN	EG	GG	EE	EE
Benzyl alcohol	NN	FN	NN	NN	EE	EE	NN	GF	NN	EE	NN	NN	GG	EE	EE
Bromine	NN	FN	NN	NN	EE	EG	FN	GN	NN	EE	NN	NN	EE	EG	GG
Bromobenzene	NN	FN	NN	NN	EE	GN	NN	NN	NN	EE	NN	EG	GG	GG	GG
Bromoform	NN	NN	NN	NN	EE	GF	NN	NN	NN	EE	NN	FF	GG	EE	EE
Butadiene	NN	FN	NN	NN	EE	EE	NN	FN	NN	EE	NN	FF	GG	EE	EE
n-Butyl acetate	GF	EG	GF	GF	EE	EG	NN	NN	NN	EE	NN	EE	GG	EE	EE
n-Butyl alcohol	EE	EE	EE	EG	EE	EE	GF	GF	GF	EE	EG	NN	EE	EE	EE
sec-Butyl alcohol	EG	EE	EG	EG	EE	EE	GF	GG	GF	EE	GG	NN	EE	EE	EE
tert-Butyl alcohol	EG	EE	EG	EG	EE	EE	GF	EG	GF	EE	EE	NN	EE	EE	EE
Butyric acid	NN	FN	NN	NN	EE	EE	FN	GN	GG	EE	NN	FN	GG	EE	EE
Calcium hydroxide, conc.	EE	EE	EE	EE	EE	EE	NN	EE	GG	EE	GG	NN	GG	NN	EE
Calcium hypochlorite, sat.	EE	EE	EE	EG	EE	EE	FN	GF	EE	EE	GF	NN	EE	EE	EE
Carbazole	EE	EE	EE	EE	EE	EE	NN	NN	NN	—	EE	EE	—	—	—
Carbon disulfide	NN	NN	NN	NN	EE	EF	NN	NN	NN	EE	NN	EG	EE	EE	EE
Carbon tetrachloride	FN	GF	GF	NN	EE	EE	NN	GF	NN	EE	NN	EE	GG	EE	EE
Cedarwood oil	NN	FN	NN	NN	EE	EG	GF	FN	FF	EE	NN	EG	—	—	—
Cellosolve acetate	EG	EE	EG	EG	EE	EG	FN	FN	NN	EG	NN	EE	GG	EE	EE
Chlorine, 10% in air	GN	EF	GN	GN	EE	EE	EG	EE	NN	EE	FN	NN	FF	EE	EE
Chlorine, 10% (moist)	GN	GF	FN	GN	EE	EE	GF	EG	NN	EE	NN	NN	FF	EE	EE
Chloroacetic acid	EE	EE	EG	EG	EE	EE	FN	FN	NN	E-	GN	NN	GG	EE	EE
p-Chloroacetophenone	EE	EE	EE	EE	EE	EE	NN	NN	NN	—	NN	EG	—	—	—
Chloroform	FN	FN	GF	NN	EE	GF	NN	NN	NN	EE	NN	FF	EE	EE	EE
Chromic acid, 10%	EE	EE	EE	EE	EE	EE	GF	EG	NN	EE	EE	NN	GG	EE	EE
Chromic acid, 50%	EE	EE	GF	GF	EE	EE	FN	EF	NN	EG	FF	NN	FF	EE	NN
Cinnamon oil	NN	FN	NN	NN	EE	EG	GF	NN	FF	—	NN	GF	EE	—	—
Citric acid, 10%	EE	EE	EE	EE	EE	EE	EG	GG	EE	EE	EG	NN	GG	EE	EE
Cresol	NN	FN	FN	NN	EE	EG	NN	NN	NN	EE	NN	NN	EE	EE	EE
Cyclohexane	FN	FN	FN	NN	EE	EG	EG	GF	NN	EE	NN	EE	EE	EE	EE
DeCalin	GF	EG	GF	FN	EE	EE	NN	EG	NN	—	NN	EE	—	—	—
o-Dichlorobenzene	FN	FF	FN	FN	EE	EF	NN	NN	NN	EE	NN	EG	GG	EE	EE
p-Dichlorobenzene	FN	GF	GF	GF	EE	EF	NN	NN	NN	EE	NN	EG	GG	EE	EE
Diethyl benzene	NN	FN	NN	NN	EE	EG	FN	NN	NN	—	NN	EE	GG	EE	EE
Diethyl ether	NN	FN	NN	NN	EE	EG	NN	FN	NN	EG	NN	EE	GG	EE	EE
Diethyl ketone	NN	NN	GG	GF	EE	GF	NN	NN	NN	NN	NN	EE	GG	EE	EE
Diethyl malonate	EE	EE	EE	EG	EE	EE	FN	GN	FF	EG	NN	EE	—	—	—
Diethylene glycol	EE	EE	EE	EE	EE	EE	GF	FN	GG	EE	GG	EE	EE	EE	EE
Diethylene glycol ethyl ether	EE	EE	EE	EE	EE	EE	FN	FN	FF	—	NN	EE	EE	EE	EE
Dimethyl formamide	EE	EE	EE	EE	EE	GG	NN	FN	NN	NN	NN	FN	GF	EE	EE
Dimethylsulfoxide	EE	EE	EE	EE	EE	EG	NN	NN	NN	—	EG	EE	EE	EE	EE
1,4-Dioxane	GF	GG	GF	GF	EE	EF	GF	FN	GF	NN	NN	EF	GG	EE	EE
Dipropylene glycol	EE	EE	EE	EE	EE	EE	GF	GF	GG	—	EE	EE	—	—	—
Ether	NN	FN	NN	NN	EE	EG	NN	FN	NN	EG	NN	EE	EE	EE	EE
Ethyl acetate	EE	EE	EE	FN	EE	EE	NN	NN	NN	NN	NN	EE	GG	EE	EE
Ethyl alcohol (absolute)	EG	EE	EG	EG	EE	EE	EG	EG	EG	EE	FN	NN	EE	EE	EE
Ethyl alcohol, 40%	EG	EE	EG	EG	EE	EE	EG	EE	EG	EE	GF	NN	EE	EE	EE
Ethyl benzene	FN	GF	FN	FN	EE	GF	NN	NN	NN	—	NN	EE	GG	—	—
Ethyl benzoate	FF	GG	GF	GF	EE	EG	NN	NN	NN	NN	NN	EE	—	—	—
Ethyl butyrate	GN	GF	GN	FN	EE	EG	NN	NN	NN	NN	NN	EE	EG	—	—
Ethyl chloride, liquid	FN	FF	FN	FN	EE	EE	NN	NN	NN	EE	NN	GF	EE	EE	EE
Ethyl cyanoacetate	EE	EE	EE	EE	EE	EE	FN	FN	FF	NN	GN	GF	—	—	—
Ethyl lactate	EE	EE	EE	EE	EE	EE	FN	FN	FF	NN	FN	EG	—	—	—
Ethylene chloride	GN	GF	FN	NN	EE	EE	NN	NN	NN	EE	NN	EG	GG	EE	EE
Ethylene glycol	EE	EE	EE	EE	EE	EE	GF	EE	EE	EE	EE	EE	GG	EE	EE
Ethylene glycol methyl ether	EE	EE	EE	EE	EE	EE	FN	FN	FF	—	NN	EE	—	—	—
Ethylene oxide	FF	GF	FF	FN	EE	EE	FN	FN	EE	EE	NN	EE	GG	EE	EE
Fluorides	EE	EE	EE	EE	EE	EE	EE	EE	EE	EE	GG	EE	—	—	—
Fluorine	FN	GN	FN	FN	EG	EF	GF	EG	NN	—	NN	NN	EG	EE	—
Formaldehyde, 10%	EE	EE	EE	EG	EE	EE	EG	GF	GF	EE	FN	GF	EE	EE	EE

CHEMICAL	LDPE	HDPE	PP/PPCO	PMP	FEP/PTFE/ PFA	ECTFE/ETFE	PC	PVC	PSF	PVDF	PS	NYL	Stainless Steel	Glass	Ceramic
Formaldehyde, 40%	EG	EE	EG	EG	EE	EE	EG	GF	GF	EE	NN	GF	EE	EE	EE
Formic acid, 3%	EG	EE	EG	EG	EE	EE	EG	GF	GG	EE	EG	NN	GG	EE	EE
Formic acid, 50%	EG	EE	EG	EG	EE	EE	EG	GF	GG	EE	FF	NN	GG	EE	EE
Formic acid, 98 to 100%	EG	EE	EG	EF	EE	EE	EG	FN	FF	EE	FF	NN	GG	EE	EE
Freon™ TF	EG	EG	EG	FN	EE	EG	GF	GF	EG	EE	FN	—	EE	EE	EE
Fuel oil	FN	GF	EG	GF	EE	EE	EG	EE	EG	EE	NN	EE	EE	EE	EE
Gasoline	FN	GG	GF	GF	EE	EE	FF	GN	FF	EE	NN	EE	EE	EE	EE
Glacial acetic acid	EG	EE	EG	EG	EE	EE	NN	EG	FN	EG	NN	NN	EG	EE	EE
Glycerine	EE	EE	EE	EE	EE	EE	EE	EE	EE	EE	EE	EE	EE	EE	EE
n-Heptane	FN	GF	FF	FF	EE	EE	EG	GF	EG	EE	NN	EE	EE	EE	EE
Hexane	NN	GF	GF	FN	EE	EE	FN	GN	EG	EE	NN	EE	EE	EE	EE
Hydrochloric acid, 1 to 5%	EE	EE	EE	EG	EE	EE	EE	EE	EE	EE	EE	NN	NN	EE	EE
Hydrochloric acid, 20%	EE	EE	EE	EG	EE	EE	GF	EG	EE	EE	EE	NN	NN	EE	EE
Hydrochloric acid, 35%	EE	EE	EG	EG	EE	EE	NN	GF	EE	EE	FF	NN	NN	EE	EE
Hydrofluoric acid, 4%	EG	EE	EG	EG	EE	EE	GF	GF	EE	GF	NN	NN	NN	—	—
Hydrofluoric acid, 48%	EE	EE	EE	EE	EE	EE	NN	GF	FN	EE	NN	NN	NN	NN	NN
Hydrogen peroxide, 3%	EE	EE	EE	EE	EE	EE	EE	EE	EE	EE	EG	NN	GG	EE	EG
Hydrogen peroxide, 30%	EG	EE	EG	EG	EE	EE	EE	EE	EE	EE	EG	NN	GG	EE	EG
Hydrogen peroxide, 90%	EG	EE	EG	EG	EE	EE	EE	EG	EE	—	EG	NN	GG	EE	EG
Isobutyl alcohol	EE	EE	EE	EG	EE	EE	EG	EG	EG	EE	GG	NN	EE	EE	EE
Isopropyl acetate	GF	EG	GF	GF	EE	EG	NN	NN	NN	—	NN	EE	GG	EE	EE
Isopropyl alcohol	EE	EE	EE	EE	EE	EE	EE	EG	EE	EE	EG	NN	GG	EE	EE
Isopropyl benzene	FN	GF	FN	NN	EE	EG	NN	NN	NN	—	NN	EG	—	—	—
Kerosene	FN	GG	GF	GF	EE	GF	EE	EE	GF	EE	NN	EE	EE	EE	EE
Lactic acid, 3%	EG	EE	EG	EG	EE	EE	EG	GF	EE	EG	GG	NN	GG	EE	EE
Lactic acid, 85%	EE	EE	EG	EG	EE	EG	EG	GF	EE	GF	GG	NN	GG	EE	EE
Methoxyethyl oleate	EG	EE	EG	EG	EE	EE	FN	NN	NN	—	NN	EG	—	—	—
Methyl alcohol	EE	EE	EE	EE	EE	EE	GF	EF	GF	EE	FN	NN	EE	EE	EE
Methyl ethyl ketone	NN	NN	EG	NN	EE	GF	NN	NN	NN	NN	NN	EE	EE	EE	EE
Methyl isobutyl ketone	NN	NN	GF	FF	EE	GF	NN	NN	NN	GN	NN	EE	GG	EE	EE
Methyl propyl ketone	GF	EG	GF	FF	EE	EG	NN	NN	NN	NN	NN	EE	EE	—	—
Methylene chloride	FN	FN	FN	FN	EE	GG	NN	NN	NN	NN	GF	GG	EE	EE	EE
Mineral oil	GN	EE	EE	EG	EE	EE	EG	EG	EE	EE	EE	EE	EE	EE	EE
Nitric acid, 1 to 10%	EE	EE	EE	EE	EE	EE	EG	EG	EF	EE	GN	NN	EE	EE	EE
Nitric acid, 50%	GN	GN	FN	GN	EE	EE	GF	GF	GF	EG	NN	NN	EG	EG	NN
Nitric acid, 70%	FN	GN	NN	GF	EE	EE	NN	FN	NN	GF	NN	NN	GG	EE	NN
Nitrobenzene	NN	FN	NN	NN	EE	EG	NN	NN	NN	EN	NN	FF	GG	EE	EE
n-Octane	EE	EE	EE	EE	EE	EE	GF	FN	GF	EE	NN	EE	EE	EE	EE
Orange oil	FN	GF	GF	FF	EE	EE	FF	FN	FF	EE	NN	GF	EE	EE	EE
Ozone	EG	EE	EG	EE	EE	EE	EG	EG	EE	EE	FF	EG	EG	—	—
Perchloric acid	GN	GN	GN	GN	GF	EG	NN	GN	NN	EE	GF	NN	FF	EE	EE
Perchloroethylene	NN	NN	NN	NN	EE	EE	NN	NN	NN	EE	NN	EE	EG	EE	EE
Phenol, crystals	GN	GF	GN	FG	EE	EE	NN	FN	FF	EE	NN	NN	GG	EE	EE
Phosphoric acid, 1 to 5%	EE	EE	EE	EE	EE	EE	EE	EE	EE	EE	GG	NN	NN	EE	EE
Phosphoric acid, 85%	EE	EE	EG	EG	EE	EE	EG	EG	EE	EE	EG	NN	NN	EE	EE
Pine oil	GN	EG	EG	GF	EE	EG	GF	FN	FF	EE	NN	GF	EE	—	—
Potassium hydroxide, 1%	EE	EE	EE	EE	EE	EE	FN	EE	EE	EE	GG	FF	EG	GF	GF
Potassium hydroxide, conc.	EE	EE	EE	EE	EE	EE	NN	EG	EE	EG	GG	FF	EG	NN	NN
Propane gas	NN	FN	NN	NN	EE	EE	FN	EG	FF	EE	NN	FF	GF	NN	NN
Propylene glycol	EE	EE	EE	EE	EE	EE	GF	FN	GG	—	EE	EE	GG	EE	EE
Propylene oxide	EG	EE	EG	EG	EE	FN	GF	FN	GG	FN	NN	EE	EE	—	—
Resorcinol, sat.	EE	EE	EE	EE	EE	EE	GF	FN	NN	—	GF	NN	—	—	—
Resorcinol, 5%	EE	EE	EE	EE	EE	EF	GF	GN	NN	—	GF	NN	—	—	—
Salicylaldehyde	EG	EE	EG	EG	EE	EN	GF	FN	FF	EG	NN	EG	—	—	—
Salicylic acid, powder	EE	EE	EE	EG	EE	EE	EG	GF	EE	EE	EE	EG	GG	EE	EE
Salicylic acid, sat.	EE	EE	EE	EE	EE	EE	EG	GF	EE	EE	EG	NN	GG	EE	EE
Salt solutions, metallic	EE	EE	EE	EE	EE	EE	EE	EE	EE	EE	GG	FF	EG	—	—
Silver acetate	EE	EE	EE	EE	EE	EE	EG	GG	EE	EE	GG	FF	—	—	—
Silver nitrate	EG	EE	EG	EE	EE	EE	EE	EG	EE	EE	GF	NN	GG	EE	EE
Sodium acetate, sat.	EE	EE	EE	EE	EE	EE	EG	GF	EE	EE	GG	FF	GG	EE	EE
Sodium hydroxide, 1%	EE	EE	EE	EE	EE	EE	FN	EE	EE	EE	GG	EE	GG	GE	GE
Sodium hydroxide, 50% to sat.	GG	EG	EE	EE	EE	EE	NN	NN	EG	EG	EE	GF	GF	NN	NN
Sodium hypochlorite, 15%	EE	EE	GF	EE	EE	EE	GF	EE	EE	EE	EE	NN	NN	EE	EG
Stearic acid, crystals	EE	EE	EE	EE	EE	EE	EG	EG	GG	EE	EG	EF	EG	EE	EE
Sulfuric acid, 1 to 6%	EE	EE	EE	EE	EE	EE	EE	EG	EE	EE	EG	NN	FN	EE	EG
Sulfuric acid, 20%	EE	EE	EG	EG	EE	EE	EG	EG	EE	EE	EG	NN	NN	EE	GG
Sulfuric acid, 60%	EG	EE	EG	EG	EE	EE	GF	EG	EE	EE	GN	NN	NN	EE	NN
Sulfuric acid, 98%	GG	GG	FN	GG	EE	EE	NN	GN	NN	EG	NN	NN	NN	EE	NN
Sulfur dioxide, liq., 46 psi	NN	FN	NN	NN	EE	EG	GN	FN	GG	EE	NN	NN	FN	NN	NN
Sulfur dioxide, wet or dry	EE	EE	EE	EE	EE	EE	EG	EG	GG	GE	FN	NN	FN	EE	EE
Sulfur salts	FN	GF	FN	FN	EE	EG	FN	NN	GG	GF	NN	NN	—	—	—
Tartaric acid	EE	EE	EE	EE	EE	EE	EG	EG	EE	EE	GG	FF	FF	EE	EE
Tetrahydrofuran	FN	GF	GF	FF	EE	GF	NN	NN	NN	FN	NN	EE	EE	EE	EE
Thionyl chloride	NN	NN	NN	NN	EE	EE	NN	NN	NN	—	NN	NN	NN	EE	EE
Toluene	FN	GG	GF	FF	EE	EE	FN	NN	NN	EE	NN	EE	EE	EE	EE
Tributyl citrate	GF	EG	GF	GF	EE	EG	NN	FN	FF	EF	NN	EG	—	—	—
Trichloroethane	NN	FN	NN	NN	EG	NN	NN	NN	NN	—	NN	EE	GG	EE	EE
Trichloroethylene	NN	FN	NN	NN	EE	EG	NN	NN	NN	EE	NN	EE	GG	EE	EE
Triethylene glycol	EE	EE	EE	EE	EE	EE	EG	GF	EE	—	EG	EE	—	—	—
Tripropylene glycol	EE	EE	EE	EE	EE	EE	EG	GF	EE	—	EE	EE	—	—	—
Turpentine	FN	GG	GF	FF	EE	EE	FN	GF	NN	EE	NN	EE	EE	EE	EE
Undecyl alcohol	EF	EG	EG	EG	EE	EG	GF	EF	FF	EE	GG	EE	—	—	—
Urea	EE	EE	EE	EG	EE	EE	NN	GN	FF	EE	EG	EE	GG	EE	EE
Vinylidene chloride	NN	FN	NN	NN	EE	GF	NN	NN	NN	EE	NN	NN	GG	—	—
Xylene	GN	GF	FN	FN	EE	EG	NN	NN	NN	EE	NN	EE	GG	EE	EE
Zinc stearate	EE	EE	EE	EE	EE	EE	EE	EG	EE	EE	EE	EE	EE	EE	EE

Effects of Chemicals on Labware

Chemicals may affect the weight, strength, color, dimensions, flexibility and surface appearance of labware. The basic models of interaction that cause these changes are:

- (1) chemical attack on the polymer chain, with resultant reduction in physical properties, including oxidation; reaction of functional groups in or on the chain; and depolymerization;
- (2) physical change, including absorption of solvents, resulting in softening and swelling of the plastic; permeation of solvent through the plastic; or dissolution in a solvent; and
- (3) stress-cracking from the interaction of a “stress-cracking agent” with molded-in or external stresses.

The reactive combination of compounds of two or more classes may cause a synergistic or undesirable chemical effect. Other factors affecting chemical resistance include: temperature, pressure, internal or external stresses (such as centrifugation), and length of exposure to and concentration of the chemical. As temperature increases, resistance to attack decreases.



Warning!

The plastic resin information in these tables, excluding stainless steel, glass and ceramic, has been provided by the Thermo Scientific™ Nalgene™ team and is reprinted with their permission. It should be used ONLY as a guide for selecting labware for testing.

Test the labware for 72 hours under expected or proposed conditions of use BEFORE putting into service. Test with care to avoid injury or property damage.

Thermo Fisher Scientific does not warrant (neither express nor imply) that the information in these tables is accurate or complete.

Physical Constants

Name and symbol	Value and units
Velocity of light, c	2.997902×10^{10} cm/s
Planck constant, h	6.62377×10^{27} erg s/molecule
Avogadro constant, N	6.02380×10^{23} molecule/mol
Faraday constant, F	96,493.1 C/equivalent
Absolute temperature of ice point, T (°C)	273.15 K
Pressure-volume product for 1 mol of gas at 0°C and zero pressure (PV) $P=0$; $T=0^\circ\text{C}$	2271.16 J/mol
Gas constant	
$P=0$	8.31469 J/mol°
$R=(PV) T=0^\circ\text{C}$ T (°C)	1.98726 cal/mol°
Boltzmann constant	1.38031×10^{16} erg/molecule°
$k=R/N$	11.96171 Jcm/mol
Constant relating wave number and energy $Z=Nhc$	2.858917 cal cm/mole
Standard atmosphere, atm	1,013,250 dynes/cm ²
Thermocalorical calorie	4.1840 J (exact)

Common Conversion Factors

Parts per Million	Parts per Billion	Percent
10,000 ppm	10,000,000 ppb	1.0%
1,000 ppm	1,000,000 ppb	0.1%
100 ppm	100,000 ppb	0.01%
10 ppm	10,000 ppb	0.001%
1 ppm	1,000 ppb	0.0001%
0.1 ppm	100 ppb	0.00001%
0.01 ppm	10 ppb	0.000001%

Glossary of Elemental Forms

Below are descriptions of the standard elemental forms used on Alfa Aesar products.

Form	Description
Bar	A rectangular or cylindrical piece of material
Cubes	Uniform sized, cubic shaped pieces of material
Disc	A cylindrical piece of material with a diameter much larger than the thickness
Felt	Compressed, porous, nonwoven fabric
Fiber	A pure monofilament form of solid material having an extremely high length to diameter ratio
Flake	Powder with a flat, irregular shape
Foil	A thin sheet of pure material, 0.025mm-2mm
Gauze	A wire cloth material consisting of wires of a pure material woven into a grid having consistent openings
Granules	Uniform, amorphous pieces of material
Ingot	A cast, usually rectangular piece of material
Lump	A solid piece of amorphous material, larger than a granule
Mossy	Pieces formed by dropping molten metal into water
Needles	Uniform, elongated pieces of material
Pellets	Somewhat regular shaped pieces of material
Pieces	Solid pieces of material, larger than a granule
Plate	A sheet of fabricated pure material >2mm thick
Powder	Solid material with a very small particle size
Ribbon	A thin width of foil, offered in rolls of varying length
Rod	A uniform strand of a pure material having a diameter ≥ 2.0 mm
Shot	Spherical to semi-spherical pieces of material of varying sizes
Slugs	Short cylindrical pieces of material of varying lengths and diameters
Spheres	Uniform sized, spherical pieces of material
Splatter	Pieces formed by dropping molten metal onto a cooling surface
Sputtering target	A disc of high purity material used as an atomic sputtering source for ion bombardment
Sponge	Pieces with a high surface area resulting from complex surface morphology
Thin foil	A very thin sheet of unsupported pure material 1.1-24.0 micron thick
Tubing	A uniform strand of a pure material having a hollowed core
Turnings	Small concentric shavings machined from a larger form
Ultrathin foil	An extremely thin sheet of pure material, supported or unsupported ≤ 1 micron thick
Wire	A uniform strand of a pure material having a diameter ≤ 2.0 mm
Yarn	A parallel collection of a definite number of fiber strands, usually three to several hundred

Periodic Table of Elements



key

ATOMIC NUMBER: 1
ELECTRONEGATIVITY: 2.1
ELEMENT SYMBOL: H
HYDROGEN: 1.008
RELATIVE ATOMIC MASS: 1.008
ELEMENT NAME: HYDROGEN
ELECTRONIC STRUCTURE: 1s¹

filing of electrons: s, p, d, f

1	2	10	18	36	54	86	118	
1 H HYDROGEN 1.008	2 He HELIUM 4.003							
3 Li LITHIUM 6.94	4 Be BERYLLIUM 9.012	10 Ne NEON 20.18						
11 Na SODIUM 22.99	12 Mg MAGNESIUM 24.31	17 Cl CHLORINE 35.45			18 Ar ARGON 39.95			
19 K POTASSIUM 39.10	20 Ca CALCIUM 40.08	35 Br BROMINE 79.90				36 Kr KRYPTON 83.79		
37 Rb RUBIDIUM 85.47	38 Sr STRONTIUM 87.62	85 At ASTATINE (210)					86 Rn RADON (222)	
55 Cs CAESIUM 132.9	56 Ba BARIUM 137.3	117 Ts TENNESINE (294)					118 Og OGANESSON (294)	
87 Fr FRANCIUM (223)	88 Ra RADIUM (226)							
lanthanides								
58 Ce CERIUM 140.1	59 Pr PRASEODYMIUM 140.9	60 Nd NEODYMIUM 144.2	61 Pm PROMETHIUM (145)	62 Sm SAMARIUM 150.4	63 Eu EUROPIUM 152.0	64 Gd GADOLINIUM 157.2	65 Tb TERBIUM 158.9	
90 Th THORIUM 232	91 Pa PROTACTINIUM 231	92 U URANIUM 238	93 Np NEPTUNIUM (237)	94 Pu PLUTONIUM (244)	95 Am AMERICIUM (243)	96 Cm CURIUM (247)	97 Bk BERKELIUM (247)	
actinides								
66 Dy DYSPROSIUM 162.5	67 Ho HOLMIUM 164.9	68 Er ERBIUM 167.3	69 Tm THULIUM 168.9	70 Yb YTTERIUM 173.0	71 Lu LUTETIUM 175.0	103 Lr LAWRENCIUM (262)		
98 Cf CALIFORNIUM (285)	99 Es EINSTEINIUM (282)	100 Fm FERMIUM (277)	101 Md MEANEVIUM (288)	102 No NOBELIUM (289)	103 Lr LAWRENCIUM (262)			
111 Rg ROENTGIUM (282)	112 Cn COPERNICIUM (285)	113 Nh NIHONIUM (286)	114 Fl FLEROVIUM (289)	115 Mc MOSCOWIUM (288)	116 Lv LIVERMORIUM (293)	117 Ts TENNESINE (294)	118 Og OGANESSON (294)	
109 Mt METIUM (278)	110 Ds DARMSTADIUM (281)	111 Rg ROENTGIUM (282)	112 Cn COPERNICIUM (285)	113 Nh NIHONIUM (286)	114 Fl FLEROVIUM (289)	115 Mc MOSCOWIUM (288)	116 Lv LIVERMORIUM (293)	
108 Hs HASSIUM (277)	109 Mt METIUM (278)	110 Ds DARMSTADIUM (281)	111 Rg ROENTGIUM (282)	112 Cn COPERNICIUM (285)	113 Nh NIHONIUM (286)	114 Fl FLEROVIUM (289)	115 Mc MOSCOWIUM (288)	
76 Os OSMIUM 190.2	77 Ir IRIDIUM 192.2	78 Pt PLATINUM 195.1	79 Au GOLD 197.0	80 Hg MERCURY 200.5	81 Tl THALLIUM 204.38	82 Pb LEAD 207.2	83 Bi BISMUTH 209.0	
75 Re RHENIUM 186.2	76 Os OSMIUM 190.2	77 Ir IRIDIUM 192.2	78 Pt PLATINUM 195.1	79 Au GOLD 197.0	80 Hg MERCURY 200.5	81 Tl THALLIUM 204.38	82 Pb LEAD 207.2	
43 Tc TECHNETIUM (98)	44 Ru RUTHENIUM 101.1	45 Rh RHODIUM 102.9	46 Pd PALLADIUM 106.4	47 Ag SILVER 107.9	48 Cd CADMIUM 112.4	49 In INDIUM 114.8	50 Sn TIN 118.7	
42 Mo MOLYBDENUM 95.94	43 Tc TECHNETIUM (98)	44 Ru RUTHENIUM 101.1	45 Rh RHODIUM 102.9	46 Pd PALLADIUM 106.4	47 Ag SILVER 107.9	48 Cd CADMIUM 112.4	49 In INDIUM 114.8	
24 Cr CHROMIUM 52.00	25 Mn MANGANESE 54.94	26 Fe IRON 55.85	27 Co COBALT 58.93	28 Ni NICKEL 58.69	29 Cu COPPER 63.55	30 Zn ZINC 65.39	31 Ga GALLIUM 69.72	
23 V VANADIUM 50.94	24 Cr CHROMIUM 52.00	25 Mn MANGANESE 54.94	26 Fe IRON 55.85	27 Co COBALT 58.93	28 Ni NICKEL 58.69	29 Cu COPPER 63.55	30 Zn ZINC 65.39	
13 Al ALUMINIUM 26.98	14 Si SILICON 28.09	15 P PHOSPHORUS 30.97	16 S SULFUR 32.06	17 Cl CHLORINE 35.45	18 Ar ARGON 39.95	39 K POTASSIUM 39.10	40 Ca CALCIUM 40.08	
12 Mg MAGNESIUM 24.31	13 Al ALUMINIUM 26.98	14 Si SILICON 28.09	15 P PHOSPHORUS 30.97	16 S SULFUR 32.06	17 Cl CHLORINE 35.45	39 K POTASSIUM 39.10	40 Ca CALCIUM 40.08	
5 B BORON 10.81	6 C CARBON 12.01	7 N NITROGEN 14.01	8 O OXYGEN 16.00	9 F FLUORINE 19.00	10 Ne NEON 20.18	11 Na SODIUM 22.99	12 Mg MAGNESIUM 24.31	
4 Be BERYLLIUM 9.012	5 B BORON 10.81	6 C CARBON 12.01	7 N NITROGEN 14.01	8 O OXYGEN 16.00	9 F FLUORINE 19.00	10 Ne NEON 20.18	11 Na SODIUM 22.99	
1 H HYDROGEN 1.008	2 He HELIUM 4.003	3 Li LITHIUM 6.94	4 Be BERYLLIUM 9.012	5 B BORON 10.81	6 C CARBON 12.01	7 N NITROGEN 14.01	8 O OXYGEN 16.00	
9 F FLUORINE 19.00	10 Ne NEON 20.18	11 Na SODIUM 22.99	12 Mg MAGNESIUM 24.31	13 Al ALUMINIUM 26.98	14 Si SILICON 28.09	15 P PHOSPHORUS 30.97	16 S SULFUR 32.06	
35 Br BROMINE 79.90	36 Kr KRYPTON 83.79	37 Rb RUBIDIUM 85.47	38 Sr STRONTIUM 87.62	39 K POTASSIUM 39.10	40 Ca CALCIUM 40.08	41 Sc SCANDIUM 44.96	42 Ti TITANIUM 47.88	
85 At ASTATINE (210)	86 Rn RADON (222)	87 Fr FRANCIUM (223)	88 Ra RADIUM (226)	89 Ac ACTINIUM (227)	90 Th THORIUM 232	91 Pa PROTACTINIUM 231	92 U URANIUM 238	
117 Ts TENNESINE (294)	118 Og OGANESSON (294)	119 Uue UNUNENNIUM (295)	120 Uub UNUBIUM (296)	121 Uut UNUNTRIUM (297)	122 Uuq UNUNQUADRIUM (298)	123 Uuq UNUNQUADRIUM (298)	124 Uuq UNUNQUADRIUM (298)	

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