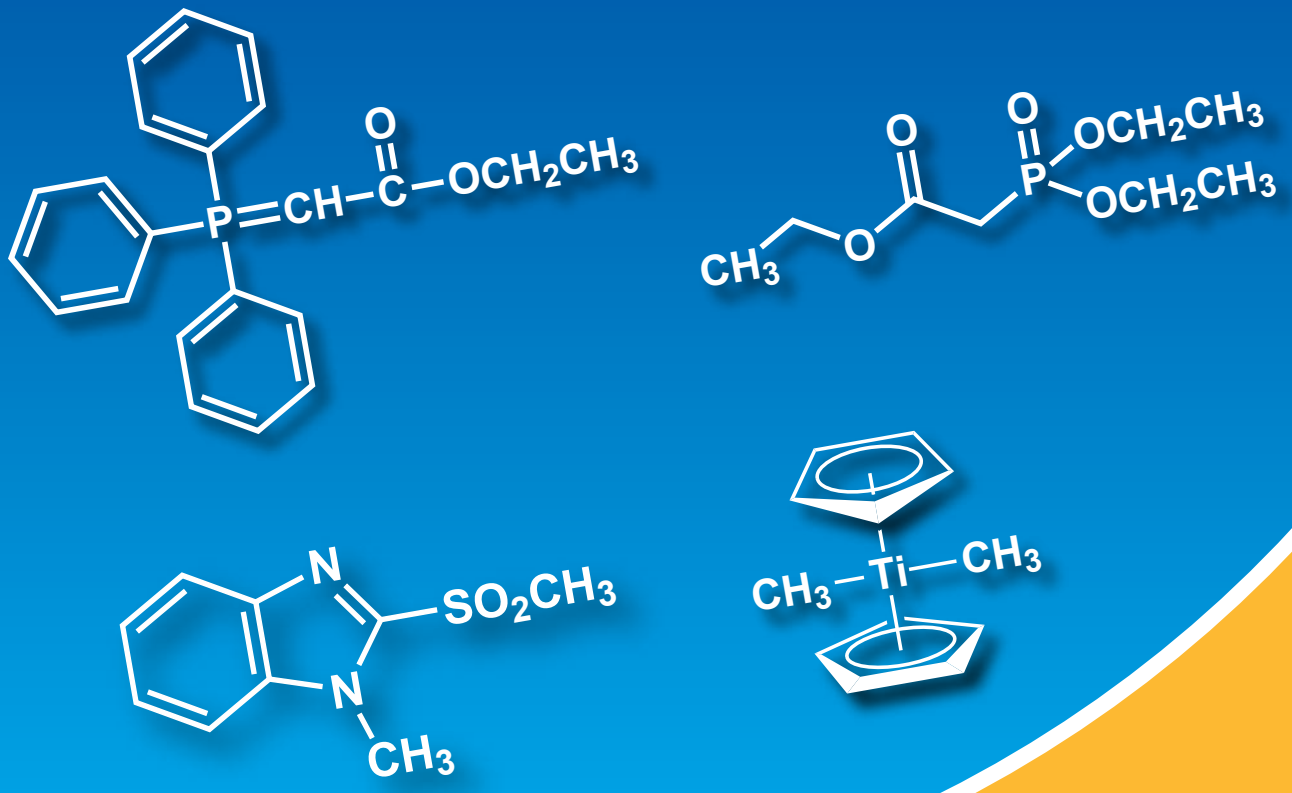
CHEMISTRY

Olefination



Wittig Reagents

Horner-Wadsworth-Emmons Reagents

Z-Selective Horner-Wadsworth-Emmons Reagents

Peterson Reaction Reagents

Julia-Kocienski Olefination Reagents

Titanium Reagents

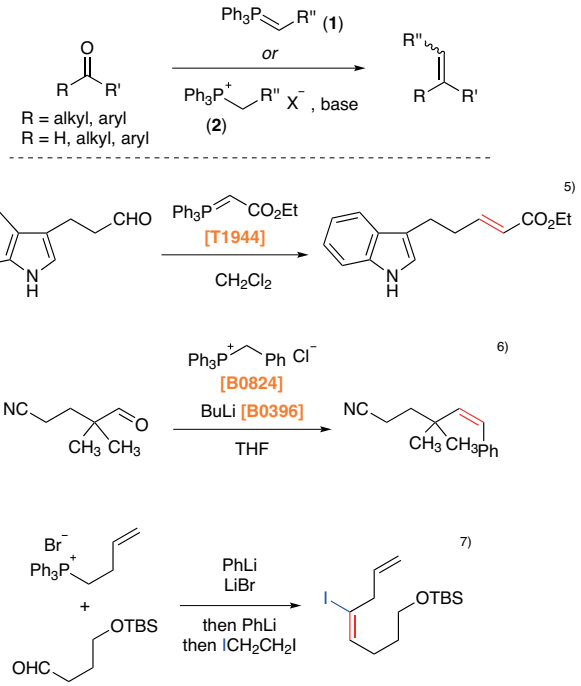
Olefination

Carbonyl olefination is one of the most fundamental conversions in organic synthesis and since the initial discovery, a wide variety of synthetic methods have been developed. In particular, synthetic methods that utilize 3rd row elements like phosphorus, silicon and sulfur atoms had received the most attention and success. Many of these transformations are classic named reactions; Peterson olefination (silicon), Julia and Julia-type (-Kocienski, -Lythgoe) (sulfur), and Horner-Wadsworth-Emmons (HWE) (phosphorus) to name a few. The most well-known carbonyl olefination reaction, The Wittig reaction, is also the most representative of the general synthetic method. A number of improved methods for it and the similar HWE reaction have been developed over the years due to their usefulness. Some of the new methods have easier work-up procedures and increased *E*/*Z* selectivity.[1] Furthermore, it is known that organotitanium compounds can convert esters and amides (which are typically unreactive under olefination conditions) which brought wider diversity and utility to olefinaitons.[2]

This brochure introduces a variety of building blocks for olefinations, sorted by their reactions.

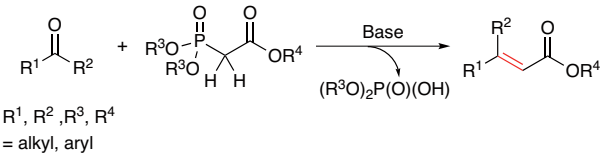
Wittig reaction

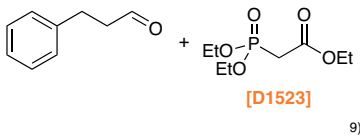
The Wittig reaction is the classical way to install an olefin group from a parent aldehyde or ketone and is frequently utilized in organic synthesis.[3] This reaction is incurred using a phosphonium ylide (**1**), which can exist as a stable compound, or can be generated from the salt form (**2**) *in situ* by treatment with base. Wittig reactions often provide the *Z*-olefin as the exclusive product, but varied conditions can provide the *E*-olefin product. For instance, Schlosser modification via adding phenyllithium at elevated temperatures can provide *E*-olefins selectively from unstablized ylides.[4,7]



Horner-Wadsworth-Emmons reaction

The Horner-Wadsworth-Emmons (HWE) reaction is a frequently used synthetic method to obtain substituted (di- and tri-) olefin products from aldehydes and ketones.[8] *E*-olefins are generally preferred over *Z*-olefins. Phosphonate esters are typically used with with strong bases. These produce reactive and stabilized phosphonium anions, which readily react with aldehydes and ketones. The given phosphonate byproducts are easily removed by extraction.





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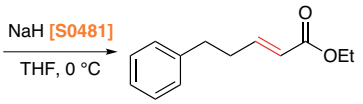
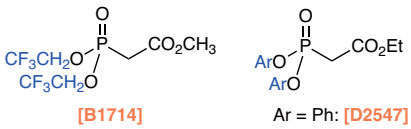


Z-Selective Horner-Wadsworth-Emmons reaction

The HWE reaction preferably gives *E*-olefins. As a result modifications have been developed to obtain *Z*-olefins. Gennari and Still have reported the first *Z*-selective HWE reaction using bis(2,2,2-trifluoroethyl) (methoxycarbonylmethyl)phosphonate [B1714].[10] Later, Ando developed diaryl phosphonoacetates such as D2547 and D2548 which are able to provide *Z*-α,β-unsaturated esters in high stereoselectivity.[11] This method uses quaternary ammonium hydroxides or DBU as the base, and it does not require any special experimental-equipment/-technique to conduct.



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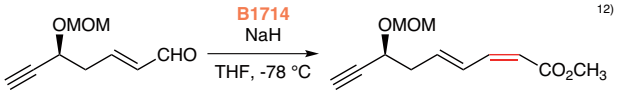

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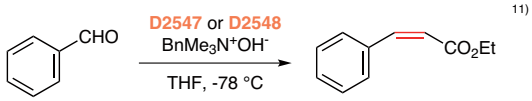
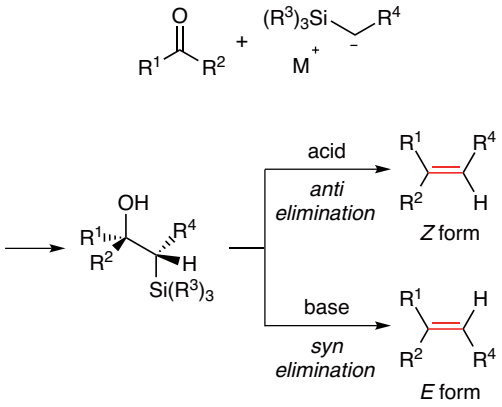
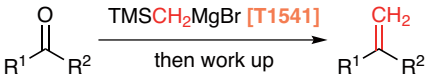
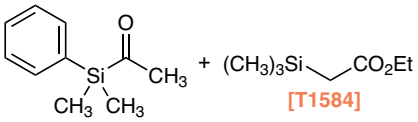


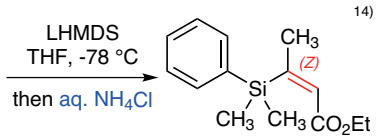
Peterson reaction

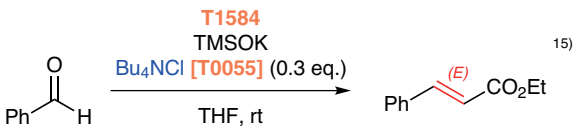
The Peterson reaction is a synthetic method that affords olefins by the addition of a α-silyl carbanion to aldehydes and ketones and successive treatment with acid or base.[13] This reaction has the advantage that a given olefin's stereochemistry can be adjusted by adding acid or base. When an acid is added to the adduct, the *Z*-olefin is given via *anti*-elimination of a silanol. However, when base is added, *syn*-elimination proceeds to provide *E*-olefins.







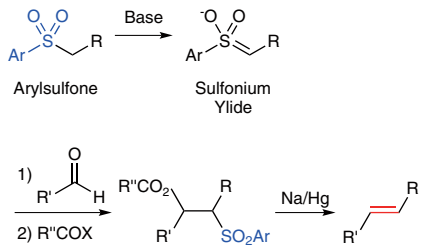




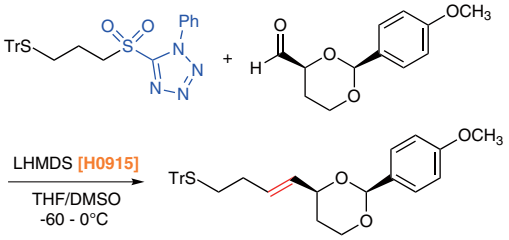
Julia-Lythgoe reaction

The Julia-Lythgoe reaction and its various sub-forms are useful synthetic methods to convert aldehydes to olefins using arylsulfones.[16] This reaction occurs in a stepwise manner to provide *E*-olefins; (1) addition of a sulfonamide to an aldehyde; (2) acylation of resulting hydroxyl group; (3) reduction with Na(Hg). Later, S. A. Julia and Kocienski's group refined the transformation to be conducted in one pot by using heteroaromatic sulfone moieties,[17,18] which are known as Modified Julia's. This method can be particularly useful in joining two complex fragments. Furthermore, Ando have reported the utility of **M2860** in Julia-Kocienski type methylenations.[19]

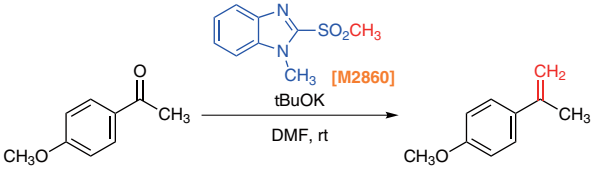
Standard Julia-Lythgoe Reaction[16]



Julia-Kocienski Reaction[20]

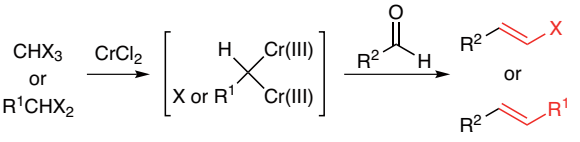


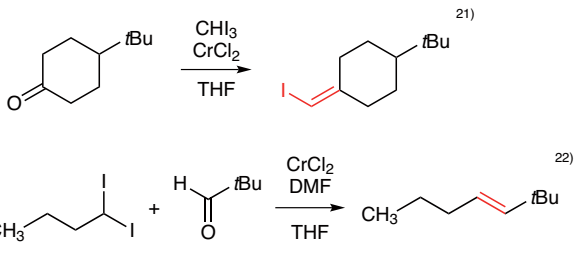
Julia-Kocienski Type Methylenation[19]



Takai-Utimoto reaction

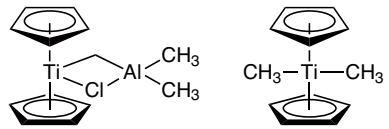
Takai and Utimoto have reported that a *gem*-dichromium reagent prepared from a haloform and chromium(II) chloride reacts with aldehydes to provide haloolefins.[21] This method is applicable to 1,1-dihalides[22] and utilized in elongation of alkyl chains and the construction of olefins with other functional groups. The haloolefins and functionalized olefins are particularly useful substrates, such as in cross-coupling reactions.





Olefination reactions using titanium reagents

Tebbe[23] and Petasis[24] reagents are representative organotitanium reagents used in carbonyl olefination which have been used for methylenation of various carbonyl compounds. Unlike other methylenation reagents which react with only aldehydes and ketones, organotitanium reagents can react with relatively inactive carbonyl groups such as esters and amides.



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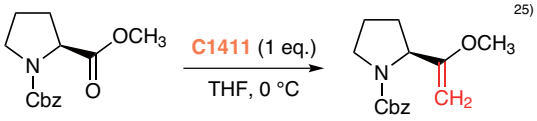

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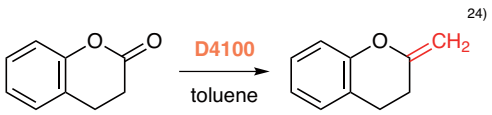
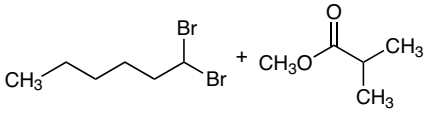
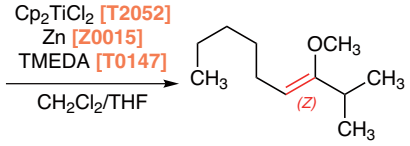


24)

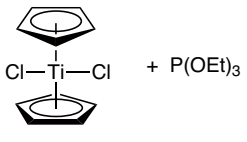
Besides the titanium compounds stated above, olefination utilizing the $RCHX_2$-$TiCl_4$-Zn system reported by Takai and Utimoto can also be used on carbonyl groups.[26] In this reaction, *Z*-olefins are given preferentially. Takeda's group have also reported more general olefinations of carbonyl compounds by the treatment of thioacetals or *gem*-dihalides and a titanocene(II) compound $Cp_2Ti[P(OEt)_3]_2$.[27]

Takai-Utimoto's Olefination System[26]





Takeda's Olefination System[27]



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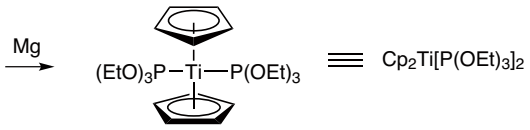
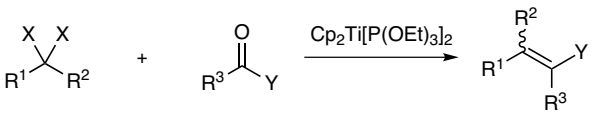
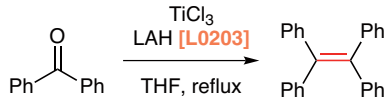




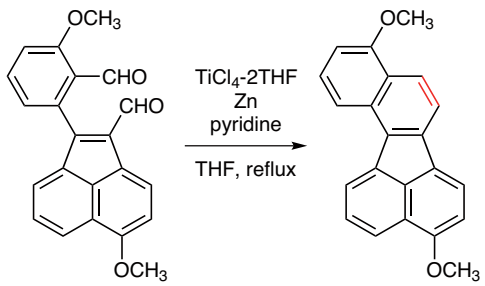
X = SPh, Cl, Br Y = H, R^4, OR^4, SR^4

The McMurry coupling is another well-known olefination method using titanium reagents.[28] This reaction can be applied to heterocoupling and an intramolecular olefination as well as homocoupling and the construction of medium and large sized rings utilizing.[29] Olefinations using organotitanium compounds have unique features and reactivity, and have been used for many years.

Original McMurry Coupling[28]



McMurry Type Ring Closure[29]



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Wittig Reagents

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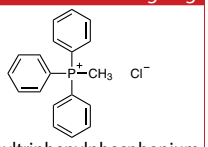

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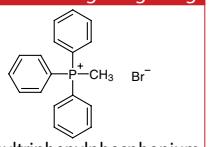

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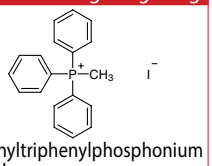

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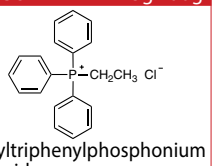

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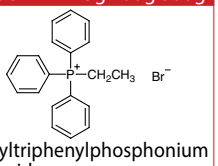

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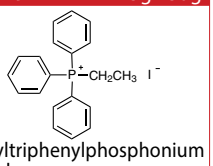

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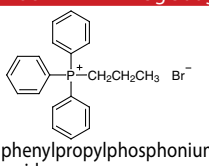

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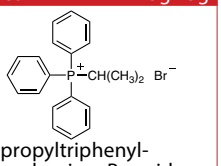

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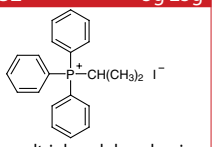
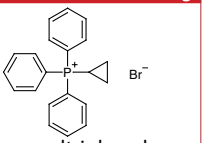


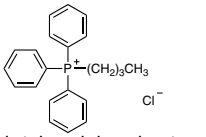
Isopropyltriphenylphosphonium Iodide
CAS RN: 24470-78-8

C1378 5g



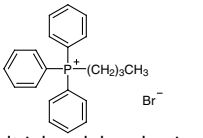
Cyclopropyltriphenyl-phosphonium Bromide
CAS RN: 14114-05-7

B5730 25g



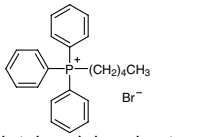
Butyltriphenylphosphonium Chloride
CAS RN: 13371-17-0

B0970 25g 250g



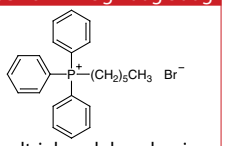
Butyltriphenylphosphonium Bromide
CAS RN: 1779-51-7

A0862 25g



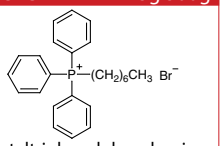
Amyltriphenylphosphonium Bromide
CAS RN: 21406-61-1

H0540 25g 100g 500g



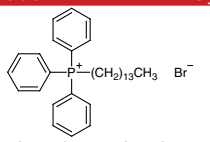
Hexyltriphenylphosphonium Bromide
CAS RN: 4762-26-9

H0545 25g 500g



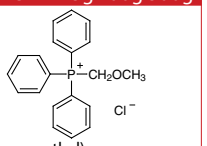
Heptyltriphenylphosphonium Bromide
CAS RN: 13423-48-8

T1506 25g



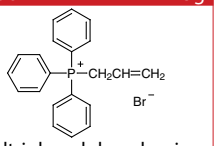
Triphenyl(tetradecyl)-phosphonium Bromide
CAS RN: 25791-20-2

M0828 25g 100g 500g



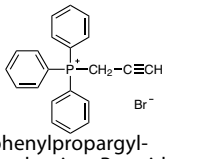
(Methoxymethyl)-triphenylphosphonium Chloride
CAS RN: 4009-98-7

A1007 25g



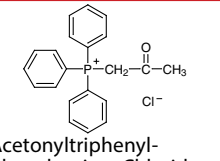
Allyltriphenylphosphonium Bromide
CAS RN: 1560-54-9

P1438 5g 25g



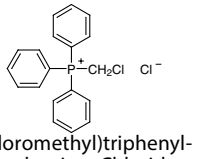
Triphenylpropargyl-phosphonium Bromide
CAS RN: 2091-46-5

A1305 25g



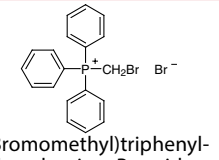
Acetonyltriphenyl-phosphonium Chloride
CAS RN: 1235-21-8

C1009 5g 25g



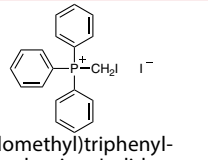
(Chloromethyl)triphenyl-phosphonium Chloride
CAS RN: 5293-84-5

B1206 5g 25g



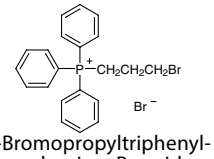
(Bromomethyl)triphenyl-phosphonium Bromide
CAS RN: 1034-49-7

I1179 1g 5g



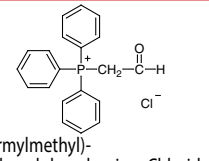
(Iodomethyl)triphenyl-phosphonium Iodide
CAS RN: 3020-28-8

B1208 25g



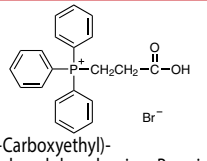
3-Bromopropyltriphenyl-phosphonium Bromide
CAS RN: 3607-17-8

F0331 5g 25g



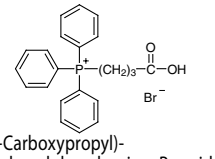
(Formylmethyl)-triphenylphosphonium Chloride
CAS RN: 62942-43-2

C3309 5g 25g



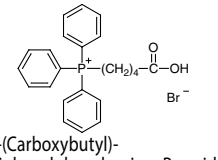
(2-Carboxyethyl)-triphenylphosphonium Bromide
CAS RN: 51114-94-4

C1635 25g



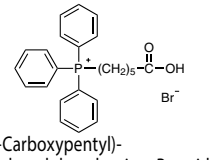
(3-Carboxypropyl)-triphenylphosphonium Bromide
CAS RN: 17857-14-6

C1061 25g 250g



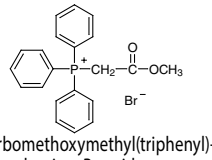
4-(Carboxybutyl)-triphenylphosphonium Bromide
CAS RN: 17814-85-6

C3113 5g



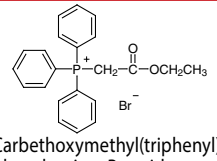
(5-Carboxypentyl)-triphenylphosphonium Bromide
CAS RN: 50889-29-7

M1326 25g



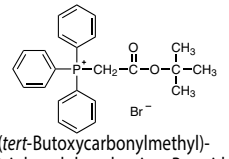
Carbomethoxymethyl(triphenyl)-phosphonium Bromide
CAS RN: 1779-58-4

E0407 25g 250g



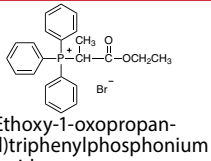
Carbethoxymethyl(triphenyl)-phosphonium Bromide
CAS RN: 1530-45-6

B3928 25g



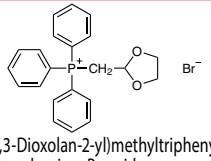
(*tert*-Butoxycarbonylmethyl)-triphenylphosphonium Bromide
CAS RN: 59159-39-6

E1300 5g 25g



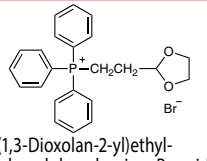
(1-Ethoxy-1-oxopropan-2-yl)triphenylphosphonium Bromide
CAS RN: 30018-16-7

D2164 5g 25g



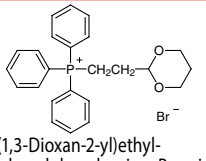
(1,3-Dioxolan-2-yl)methyltriphenyl-phosphonium Bromide
CAS RN: 52509-14-5

D2056 5g 25g



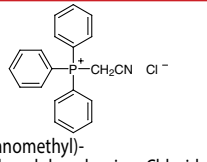
2-(1,3-Dioxolan-2-yl)ethyl-triphenylphosphonium Bromide
CAS RN: 86608-70-0

D1655 5g 25g



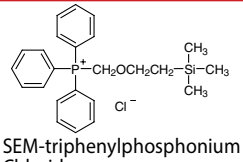
2-(1,3-Dioxan-2-yl)ethyl-triphenylphosphonium Bromide
CAS RN: 69891-92-5

C1739 25g 100g



(Cyanomethyl)-triphenylphosphonium Chloride
CAS RN: 4336-70-3

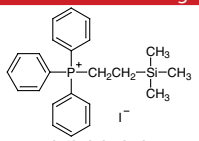
T1458 5g 25g



SEM-triphenylphosphonium Chloride
CAS RN: 82495-75-8

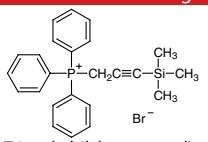
Please inquire for pricing and availability of listed products to our local sales representatives.

T1510 1g 5g



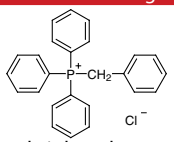
(2-Trimethylsilylethyl)-triphenylphosphonium Iodide
CAS RN: 63922-84-9

T1498 1g 5g



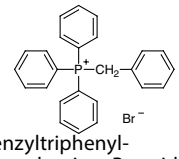
(3-Trimethylsilyl-2-propynyl)-triphenylphosphonium Bromide
CAS RN: 42134-49-6

B0824 25g 500g



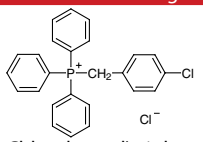
Benzyltriphenyl-phosphonium Chloride
CAS RN: 1100-88-5

B2025 25g



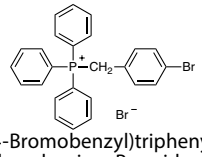
Benzyltriphenyl-phosphonium Bromide
CAS RN: 1449-46-3

C1581 5g 25g



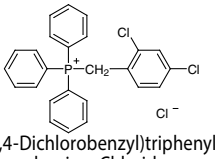
(4-Chlorobenzyl)triphenyl-phosphonium Chloride
CAS RN: 1530-39-8

B5241 5g 25g



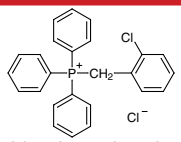
(4-Bromobenzyl)triphenyl-phosphonium Bromide
CAS RN: 51044-13-4

D2907 5g 25g



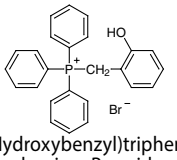
(2,4-Dichlorobenzyl)triphenyl-phosphonium Chloride
CAS RN: 2492-23-1

C1759 25g



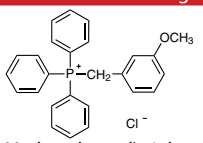
(2-Chlorobenzyl)triphenyl-phosphonium Chloride
CAS RN: 18583-55-6

H1240 5g



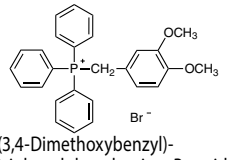
(2-Hydroxybenzyl)triphenyl-phosphonium Bromide
CAS RN: 70340-04-4

M2463 1g 5g



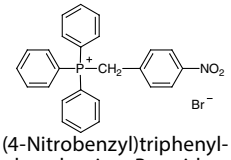
(3-Methoxybenzyl)triphenyl-phosphonium Chloride
CAS RN: 18880-05-2

D4072 5g



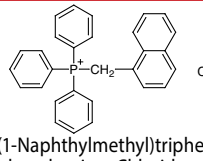
(3,4-Dimethoxybenzyl)-triphenylphosphonium Bromide
CAS RN: 70219-09-9

N0701 25g



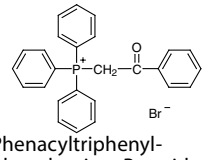
(4-Nitrobenzyl)triphenyl-phosphonium Bromide
CAS RN: 2767-70-6

N0700 5g 25g



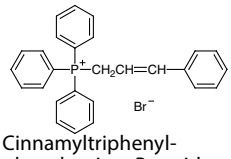
(1-Naphthylmethyl)triphenyl-phosphonium Chloride
CAS RN: 23277-00-1

P1182 25g



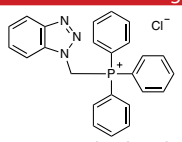
Phenacyltriphenyl-phosphonium Bromide
CAS RN: 6048-29-9

C1286 25g



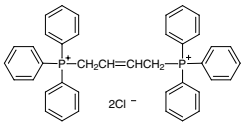
Cinnamyltriphenyl-phosphonium Bromide
CAS RN: 7310-74-9

B4486 1g 5g



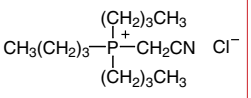
[(1*H*-Benzotriazol-1-yl)methyl]-triphenylphosphonium Chloride
CAS RN: 111198-09-5

B2286 5g



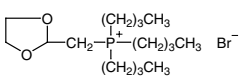
trans-2-Butene-1,4-bis(triphenyl-phosphonium Chloride)
CAS RN: 106423-29-4

C1442 10g 25g



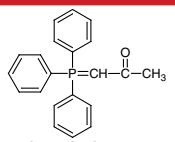
Tributyl(cyanomethyl)-phosphonium Chloride
CAS RN: 82358-61-0

T2718 5g



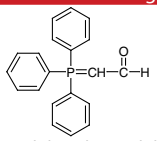
Tributyl(1,3-dioxolan-2-ylmethyl)phosphonium Bromide
CAS RN: 115754-62-6

A1439 25g



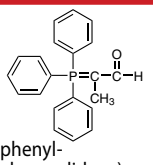
(Acetylmethylene)-triphenylphosphorane
CAS RN: 1439-36-7

T2001 5g 25g



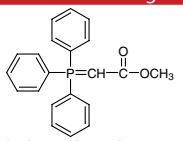
(Triphenylphosphoranylidene)-acetaldehyde
CAS RN: 2136-75-6

T4314 1g



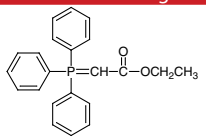
2-(Triphenyl-phosphoranylidene)propanal
CAS RN: 24720-64-7

T1363 25g 100g



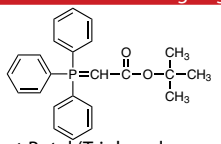
Methyl (Triphenyl-phosphoranylidene)acetate
CAS RN: 2605-67-6

T1944 25g 250g



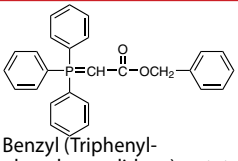
Ethyl (Triphenyl-phosphoranylidene)acetate
CAS RN: 1099-45-2

B3877 5g 25g



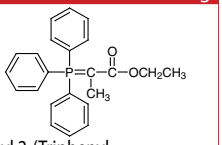
tert-Butyl (Triphenyl-phosphoranylidene)acetate
CAS RN: 35000-38-5

P2980 5g 25g



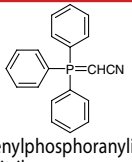
Benzyl (Triphenyl-phosphoranylidene)acetate
CAS RN: 15097-38-8

C1641 5g



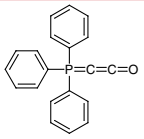
Ethyl 2-(Triphenyl-phosphoranylidene)propionate
CAS RN: 5717-37-3

T1958 5g 25g



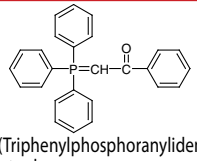
(Triphenylphosphoranylidene)-acetonitrile
CAS RN: 16640-68-9

T2565 1g 5g



Bestmann Ylide
CAS RN: 15596-07-3

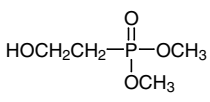
T2002 1g 5g



2-(Triphenylphosphoranylidene)-acetophenone
CAS RN: 859-65-4

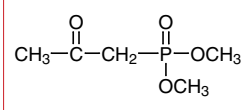
Horner-Wadsworth-Emmons Reagents

H0779 5g



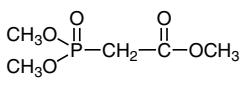
Dimethyl (2-Hydroxyethyl)-phosphonate
CAS RN: 54731-72-5

O0208 5g 25g



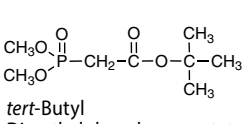
Dimethyl (2-Oxopropyl)-phosphonate
CAS RN: 4202-14-6

P1265 25g 250g



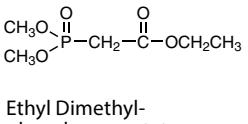
Diethyl Carboxy-methylphosphonate
CAS RN: 5927-18-4

B5094 5g 25g



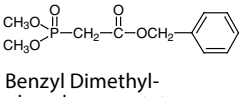
tert-Butyl Dimethylphosphonoacetate
CAS RN: 62327-21-3

E1160 25g



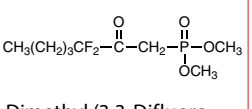
Ethyl Dimethyl-phosphonoacetate
CAS RN: 311-46-6

B2815 1g 5g



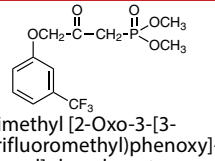
Benzyl Dimethyl-phosphonoacetate
CAS RN: 57443-18-2

D5176 200mg 1g



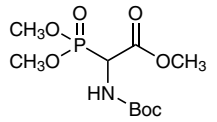
Dimethyl (3,3-Difluoro-2-oxoheptyl)phosphonate
CAS RN: 50889-46-8

D4397 1g



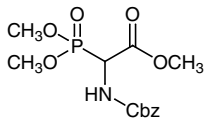
Dimethyl [2-Oxo-3-[3-(trifluoromethyl)phenoxy]-propyl]phosphonate
CAS RN: 54094-19-8

B4011 1g 5g



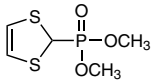
N-Boc-2-phosphonoglycine Trimethyl Ester
CAS RN: 89524-98-1

C2440 1g 5g



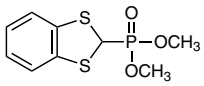
N-Cbz-2-phosphonoglycine Trimethyl Ester
CAS RN: 88568-95-0

D3981 1g 5g



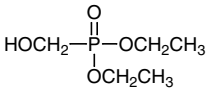
Dimethyl 2-(1,3-Dithiole)-phosphonate
CAS RN: 133113-76-5

D3992 1g



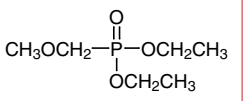
Dimethyl 1,3-Benzodithiol-2-ylphosphonate
CAS RN: 62217-35-0

D3813 25g 100g



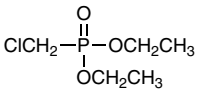
Diethyl (Hydroxymethyl)-phosphonate
CAS RN: 3084-40-0

D3873 5g 25g



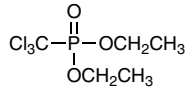
Diethyl (Methoxymethyl)-phosphonate
CAS RN: 32806-04-5

D4588 1g 5g



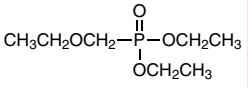
Diethyl (3-Bromopropyl)-phosphonate
CAS RN: 3167-63-3

D4607 5g 25g



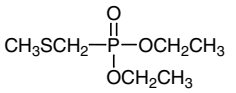
Diethyl (Trichloromethyl)-phosphonate
CAS RN: 866-23-9

D5095 5g 25g



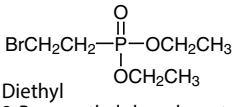
Diethyl (Ethoxymethyl)-phosphonate
CAS RN: 10419-80-4

M1208 5g 25g



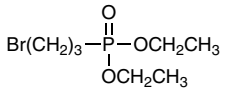
Diethyl (Methylthiomethyl)-phosphonate
CAS RN: 28460-01-7

B1781 5g 25g



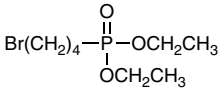
Diethyl 2-Bromoethylphosphonate
CAS RN: 5324-30-1

D4434 1g 5g



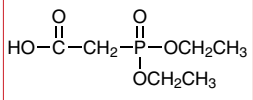
Diethyl (3-Bromopropyl)-phosphonate
CAS RN: 1186-10-3

D6296 1g 5g



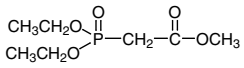
Diethyl (4-Bromobutyl)-phosphonate
CAS RN: 63075-66-1

D3080 5g 25g



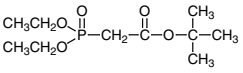
2-(Diethoxyphosphoryl)-acetic Acid
CAS RN: 3095-95-2

D2873 5g 25g



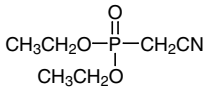
Methyl Diethylphosphonoacetate
CAS RN: 1067-74-9

B2814 1g 5g



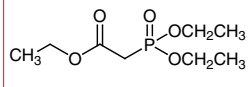
tert-Butyl Diethylphosphonoacetate
CAS RN: 27784-76-5

C1430 5g 25g



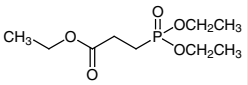
Diethyl Cyanomethylphosphonate
CAS RN: 2537-48-6

D1523 25g 100g 500g



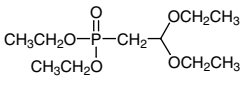
Triethyl Phosphonoacetate
CAS RN: 867-13-0

D1524 25g 250g



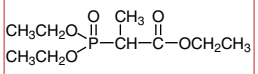
Triethyl 3-Phosphonopropionate
CAS RN: 3699-67-0

D2423 5g 25g



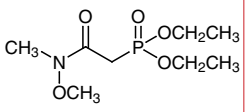
Diethyl 2,2-Diethoxyethylphosphonate
CAS RN: 7598-61-0

T2135 5g 25g



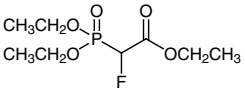
Triethyl 2-Phosphonopropionate
CAS RN: 3699-66-9

D3708 1g 5g



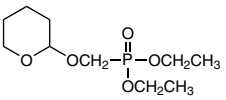
Diethyl (*N*-Methoxy-*N*-methylcarbamoylmethyl)-phosphonate
CAS RN: 124931-12-0

F0340 1g 5g



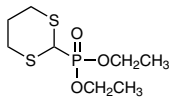
Triethyl 2-Fluoro-2-phosphonoacetate
CAS RN: 2356-16-3

D4611 200mg 1g



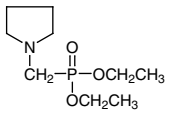
Diethyl [(Tetrahydropyran-2-yloxy)methyl]phosphonate
CAS RN: 71885-51-3

D4074 5g



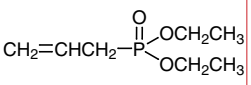
Diethyl (1,3-Dithian-2-yl)-phosphonate
CAS RN: 62999-73-9

P1258 5g



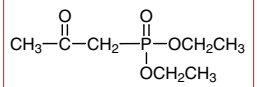
Diethyl 1-Pyrrolidinemethylphosphonate
CAS RN: 51868-96-3

D3069 1g 5g



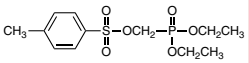
Diethyl Allylphosphonate
CAS RN: 1067-87-4

D3174 5g 25g



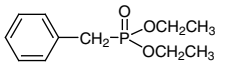
Diethyl (2-Oxopropyl)-phosphonate
CAS RN: 1067-71-6

D4968 25g



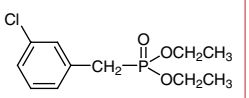
Diethyl (*p*-Toluenesulfonyloxymethyl)phosphonate
CAS RN: 31618-90-3

B1795 25g



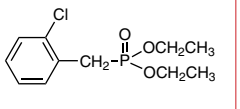
Diethyl Benzylphosphonate
CAS RN: 1080-32-6

C1595 1g 5g



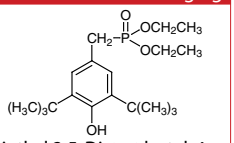
Diethyl (3-Chlorobenzyl)-phosphonate
CAS RN: 78055-64-8

D5265 1g 5g



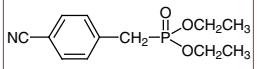
Diethyl (2-Chlorobenzyl)-phosphonate
CAS RN: 29074-98-4

D2967 1g 5g



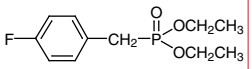
Diethyl 3,5-Di-*tert*-butyl-4-hydroxybenzylphosphonate
CAS RN: 976-56-7

D3323 5g 25g



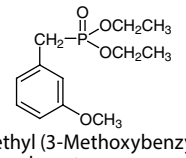
Diethyl (4-Cyanobenzyl)-phosphonate
CAS RN: 1552-41-6

D3324 5g 25g



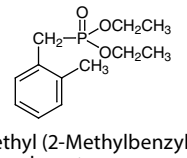
Diethyl (4-Fluorobenzyl)-phosphonate
CAS RN: 63909-58-0

D3326 5g 25g



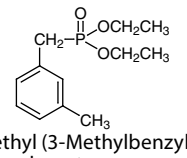
Diethyl (3-Methoxybenzyl)-phosphonate
CAS RN: 60815-18-1

D3327 5g 25g



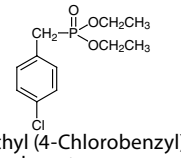
Diethyl (2-Methylbenzyl)-phosphonate
CAS RN: 62778-16-9

D3328 5g 25g



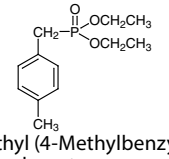
Diethyl (3-Methylbenzyl)-phosphonate
CAS RN: 63909-50-2

D3335 5g 25g



Diethyl (4-Chlorobenzyl)-phosphonate
CAS RN: 39225-17-7

D3336 5g 25g



Diethyl (4-Methylbenzyl)-phosphonate
CAS RN: 3762-25-2

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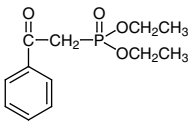
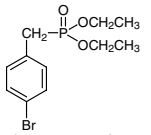
D3339 1g 5g



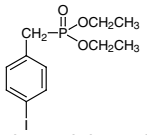
Diethyl Phenacylphosphonate
CAS RN: 3453-00-7

D3688 5g 25g



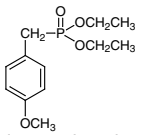
Diethyl (4-Bromobenzyl)-phosphonate
CAS RN: 38186-51-5

D3689 5g 25g



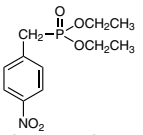
Diethyl (4-Iodobenzyl)-phosphonate
CAS RN: 173443-43-1

D4000 5g 25g



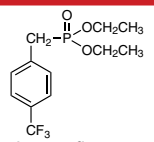
Diethyl (4-Methoxybenzyl)-phosphonate
CAS RN: 1145-93-3

D5208 5g



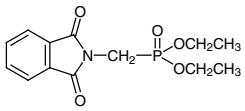
Diethyl (4-Nitrobenzyl)-phosphonate
CAS RN: 2609-49-6

D5900 1g 5g



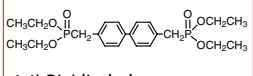
Diethyl [4-(Trifluoromethyl)-benzyl]phosphonate
CAS RN: 99578-68-4

P1193 5g 25g



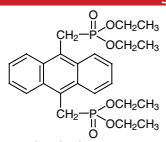
Diethyl (Phthalimidomethyl)-phosphonate
CAS RN: 33512-26-4

B1923 1g 5g



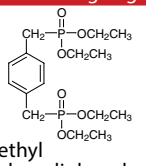
4,4'-Bis(diethyl-phosphonomethyl)biphenyl
CAS RN: 17919-34-5

B2801 1g 5g



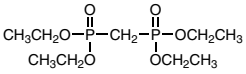
9,10-Bis(diethyl-phosphonomethyl)anthracene
CAS RN: 60974-92-7

T1582 5g 25g 100g



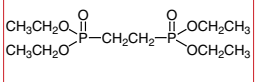
Tetraethyl *p*-Xylylenediphosphonate
CAS RN: 4546-04-7

T2329 5g 25g



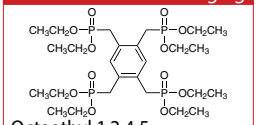
Tetraethyl Methylenebis(phosphonate)
CAS RN: 1660-94-2

T2294 1g 5g



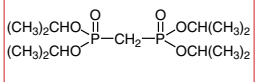
Tetraethyl Ethylenediphosphonate
CAS RN: 995-32-4

T3904 1g 5g



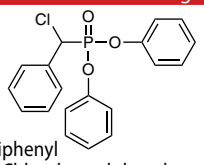
Octaethyl 1,2,4,5-Tetrakis(phosphonomethyl)-benzene
CAS RN: 136455-49-7

M1319 25g



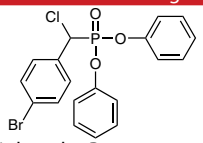
Tetraisopropyl Methylenediphosphonate
CAS RN: 1660-95-3

D3824 1g 5g



Diphenyl α-Chlorobenzylphosphonate
CAS RN: 58263-67-5

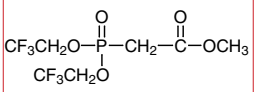
D3875 5g 25g



Diphenyl 4-Bromo-α-chlorobenzylphosphonate
CAS RN: 189099-56-7

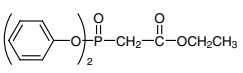
Z-Selective Horner-Wadsworth-Emmons Reagents

B1714 1g 5g 25g



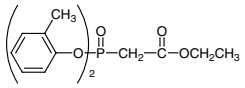
Methyl Bis(2,2,2-trifluoroethyl)-phosphonoacetate
CAS RN: 88738-78-7

D2547 1g 5g



Ethyl Diphenylphosphonoacetate
CAS RN: 16139-79-0

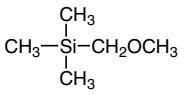
D2548 1g



Ethyl Di-*o*-tolyl-phosphonoacetate
CAS RN: 188945-41-7

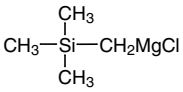
Peterson Reaction Reagents

M1264 5mL



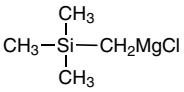
Methoxymethyl-trimethylsilane
CAS RN: 14704-14-4

T1451 100mL



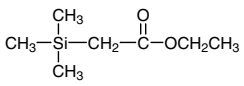
Trimethylsilylmethyl-magnesium Chloride
(20% in Ethyl Ether, *ca.* 1mol/L)
CAS RN: 13170-43-9

T2609 100mL



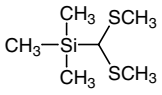
Trimethylsilylmethyl-magnesium Chloride (*ca.* 18% in Tetrahydrofuran, *ca.* 1mol/L)
CAS RN: 13170-43-9

T1584 5g 25g



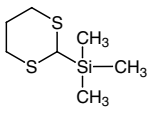
Ethyl (Trimethylsilyl)-acetate
CAS RN: 4071-88-9

B2004 1g



Bis(methylthio)-(trimethylsilyl)methane
CAS RN: 37891-79-5

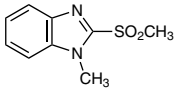
T1514 5g 25g



2-Trimethylsilyl-1,3-dithiane
CAS RN: 13411-42-2

Julia-Kocienski Olefination Reagents

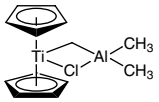
M2860 1g 5g



1-Methyl-2-(methylsulfonyl)-benzimidazole
CAS RN: 61078-14-6

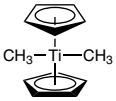
Titanium Reagents

C1411 25mL



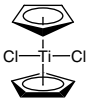
Tebbe Reagent
(*ca.* 0.5mol/L in Toluene)
CAS RN: 67719-69-1

D4100 25g 100g



Petasis Reagent
(5% in Tetrahydrofuran/Toluene)
CAS RN: 1271-66-5

T0616 5g 25g



Titanocene Dichloride
CAS RN: 1271-19-8

T2052 20mL 100mL 500mL

$TiCl_4$

Titanium(IV) Chloride (14% in Dichloromethane, *ca.* 1.0mol/L)
CAS RN: 7550-45-0

T3238 20mL 100mL 500mL

$TiCl_4$

Titanium(IV) Chloride
(*ca.* 19% in Toluene, *ca.* 1.0mol/L)
CAS RN: 7550-45-0

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