

Reagents Used in Organic Chemistry

Ag₂O (silver oxide)

Silver oxide is used in the Tollens reaction to oxidize aldehydes to carboxylic acids. This is the basis of a test for the presence of aldehydes, since a mirror of metallic silver will be deposited on the flask. It is also commonly used as a base for the Hofmann elimination.

DIBAL (diisobutylaluminum hydride)

Di-isobutyl aluminum hydride (DIBAL) is a strong, bulky reducing agent. It is most useful for the partial reduction of esters to aldehydes at low temperature. It will also reduce other carbonyl compounds such as amides, aldehydes, ketones, and nitriles.

H₂CrO₄

Chromic acid is a strong acid and an oxidant. It will oxidize secondary alcohols to ketones and primary alcohols to carboxylic acids. It is sometimes generated by using K₂Cr₂O₇ in the presence of a strong acid.

H₂O₂

Hydrogen peroxide (H₂O₂) is the preferred oxidant in the hydroboration reaction, resulting in the formation of alcohols. Furthermore, it will oxidize aldehydes to carboxylic acids. This is also used for the oxidative workup in ozonolysis.

H₂SO₄

Sulfuric acid is a strong acid. It is particularly useful as an acid for elimination reactions, since the conjugate

base is a very poor nucleophile. (Alcohol on strong heating with H_2SO_4 gives alkene.) It is used in many other reactions simply as a strong acid.

HIO_4

Periodic acid is an oxidant that is useful for the cleavage of 1,2 diols (vicinal diols) into aldehydes or ketones.

KMnO_4

Potassium permanganate is a very strong oxidizing agent. It will oxidize primary alcohols and aldehydes to carboxylic acids, secondary alcohols to ketones and oxidatively cleave carbon-carbon multiple bonds.

$\text{KOC}(\text{CH}_3)_3$

Potassium tert-butoxide is a strong, sterically hindered base. It is the prototypical "bulky base", useful for forming less substituted (Hoffmann) alkenes in elimination reactions from alkyl halides.

LDA (lithium diisopropylamide)

Lithium di-isopropylamide (LDA) is a strong, bulky, non-nucleophilic base. It is the reagent of choice for selectively removing a proton from the least hindered carbon next to a ketone. It can also be used to form the Hofmann product in E_2 reactions.

LiAlH_4

Lithium aluminum hydride is a very strong reducing agent. It will reduce aldehydes, ketones, esters, and carboxylic acids to alcohols, and amides and nitriles to amines. It will also open epoxides to alcohols..

Lindlar Catalyst

Lindlar's catalyst is a poisoned palladium metal catalyst that performs partial hydrogenation of alkynes in the presence of hydrogen gas. It always gives the cis-alkene, in contrast to Na/NH₃, which gives the trans.

mCPBA (m-chloroperoxybenzoic acid)

meta-chloroperoxybenzoic acid (m-CPBA) is an oxidizing agent. One of its main uses is in the formation of epoxides from alkenes. It will also oxidize ketones to form esters, a reaction known as the Baeyer-Villiger reaction.

Me₂S

Dimethyl sulfide is used in the "reductive workup" for ozonolysis, especially when one wants to obtain aldehydes from alkenes. It reduces the ozonide that is formed, leading to formation of dimethylsulfoxide (DMSO)

NaBH₄

Sodium borohydride is a reagent for the reduction of ketones and aldehydes, it will also reduce acid halides. It is also used in the oxymercuration reaction to replace mercury with H.

NaCNBH₃

Sodium cyanoborohydride is a reducing agent. It is generally used for reductive amination - the reduction of imines to amines. Its common to perform this reaction under slightly acidic conditions.

NaIO₄

Sodium periodate is a strong oxidant. It will cleave 1,2 diols (vicinal diols) to give aldehydes and ketones.

O₃ (ozone)

Ozone will cleave alkenes and alkynes to give carbonyl compounds. This is called oxidative cleavage. The products formed can be dependent on the type of workup used. Reductive workup preserves aldehydes, whereas oxidative workup will oxidize any aldehydes to carboxylic acids.

OsO₄

Osmium tetroxide is a reagent for the formation of 1,2-diols (vicinal diols) from alkenes. The selectivity for this reaction is always syn.

PCC (pyridinium chlorochromate)

Pyridinium chlorochromate (PCC) is reagent for the oxidation of primary alcohols to aldehydes and secondary alcohols to ketones. It is much milder than reactants such as H₂CrO₄ and KmnO₄, which will oxidize primary alcohols to carboxylic acids.

Potassium phthalimide

Sodium (or potassium) phthalimide is a nitrogen-containing nucleophile used in the Gabriel synthesis. Potassium phthalimide reacts with alkyl halides to form a C-N bond, which is then hydrolyzed by treatment with hydrazine (NH₂NH₂) to give a primary amine.

PPh₃

PPh₃ is used for the formation of ylides in the Wittig reaction. It can also be used for reductive workup in the ozonolysis of alkenes.

Pyridine

Pyridine is a mild base. Since it bears no charges it is especially soluble in organic solvents. It is often used in reactions that generate HCl and other strong acids - think of it like a sponge for strong acid.

Ra-Ni (Rayney nickle)

Rayney nickle is a reagent for the reduction (hydrogenation) of double bonds. It sees the most use as a reagent for the replacement of sulfur by hydrogen.

TsCl (p-toluenesulfonyl chloride)

Tosyl chloride TsCl will convert alcohols to sulfonates, which are excellent leaving groups in elimination and substitution reactions.