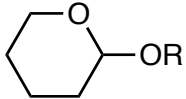
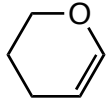


# CHM 422 Organic Synthesis, Dr. Laurie S. Starkey

## Protective Groups

Protective groups (PG) are used widely in the synthesis of complex, multifunctional organic compounds. The purpose of a PG is to "hide" a functional group so a different part of the molecule can be worked on without interference. All good PG's are not only easy to introduce but must be easy to remove so the functional group can eventually be "unmasked". A wide variety of PG's have been developed to protect alcohols, amines, thiols, carbonyls and carboxylic acids. [see "Protective Groups in Organic Synthesis" by Greene, 1991 Wiley] PG's are used on -OH, -NHR, -SH and -CO<sub>2</sub>H groups to replace the acidic hydrogen on each. (At the same time, the nucleophilicity of the amine is reduced.) Carbonyls, which can react with nucleophiles and bases, are protected as acetals which are inert to these conditions.

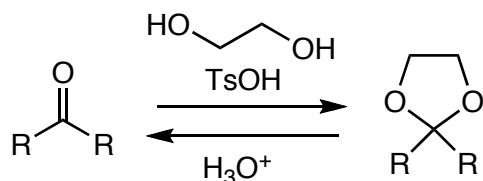
### Protection for alcohols, ROH → RO-PG

abbreviation + name	structure	ROH + ? to form	to remove PG
<b>silyl ethers</b>			
TMS trimethylsilyl ether	(CH <sub>3</sub> ) <sub>3</sub> Si-OR	TMSCl, base	Bu <sub>4</sub> NF (TBAF)
TBS or TBDMS t-butyldimethylsilyl ether	t-Bu(CH <sub>3</sub> ) <sub>2</sub> Si-OR	TBSCl, base	TBAF
TES triethylsilyl ether	(Et) <sub>3</sub> Si-OR	TESCl, base	TBAF
TIPS triisopropylsilyl ether	(i-Pr) <sub>3</sub> Si-OR	TIPSCl, base	TBAF
<b>misc. ethers</b>			
Bn benzyl ether	PhCH <sub>2</sub> -OR	BnBr, base	H <sub>2</sub> , Pd
PMB or MPM <i>p</i> -methoxybenzyl ether	4-(CH <sub>3</sub> O)-PhCH <sub>2</sub> -OR	MPMCl, base	DDQ [ox]
Tr triphenylmethyl (trityl) ether	(Ph) <sub>3</sub> C-OR	TrCl, base	formic acid or H <sub>2</sub> /Pd
<b>esters</b>			
Bz benzoate ester	PhCO <sub>2</sub> R	BzCl, base	base, H <sub>2</sub> O
Ac acetate ester	CH <sub>3</sub> CO <sub>2</sub> R	Ac <sub>2</sub> O, base	base, MeOH or H <sub>2</sub> O
Pv pivaloate ester	(CH <sub>3</sub> ) <sub>3</sub> CCO <sub>2</sub> R	PvCl, base	base, H <sub>2</sub> O
<b>acetals</b>			
MOM methoxymethyl ether	CH <sub>3</sub> OCH <sub>2</sub> -OR	MOMCl, base	acid, H <sub>3</sub> O <sup>+</sup>
MEM methoxyethoxymethyl ether	CH <sub>3</sub> OCH <sub>2</sub> CH <sub>2</sub> OCH <sub>2</sub> -OR	MEMCl, base	acid, H <sub>3</sub> O <sup>+</sup>
THP tetrahydropyranyl ether		 TsOH	acid, H <sub>3</sub> O <sup>+</sup>
			dihydropyran (DHP)

### Protection for amines, RNH<sub>2</sub> → RNH-PG

<b>carbamates</b>			
BOC t-butylcarbamate (t-butoxycarbonyl)	t-BuOC(O)NHR	(BOC) <sub>2</sub> O, base	formic acid
CBz or Z benzylcarbamate	PhCH <sub>2</sub> OC(O)NHR	CBzCl, base	H <sub>2</sub> /Pd

### Protection for Carbonyls (acetal/ketal)



### Protection for 1,2- or 1,3-Diols (acetonide)

