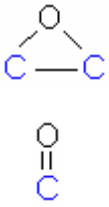
overview of reactions for R^- and H^-

		as nucleophiles		as bases (faster)	
	attack carbonyls or epoxides	←	RMgBr	→	deprotonate
	attack carbonyls or epoxides	←	RLi	→	O–H, N–H,
	attack carbonyls or epoxides	←	$LiAlH_4$	→	or S–H
	attack carbonyls	←	$NaBH_4$		
			NaH	→	

Another name for "expoxides" is "oxacyclopropanes".

acid-base reactions for R^- and H^-

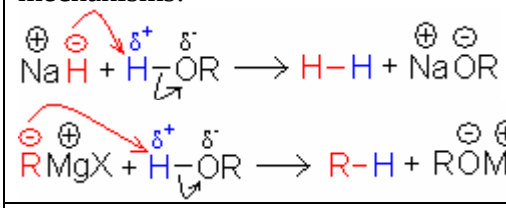
reactions:

NaH + ROH → H—H + NaOR

RMgX + ROH → R—H + ROMgX

Similar deprotonation reactions with other O-H, N-H, or S-H groups.

mechanisms:



synthetic utility:

NaH deprotonates alcohols, turning a poor nucleophile/base (neutral O, only good enough for S_N1/E1) into a good nucleophile/base (O^-, good enough for S_N2/E2).

To replace a functional group with a H: $RMgX + H_3O^+ \rightarrow R–H + H_2O + {}^+MgX$

Or, to replace a functional group with a D: $RMgX + D_3O^+ \rightarrow R–D + D_2O + {}^+MgX$

some other useful reactions

to convert a 1° or 2° alcohol to an alkyl bromide:

$R–OH + PBr_3 \rightarrow R–Br$

to convert a 1° or 2° alcohol to an alkyl chloride:

$R–OH + SOCl_2 \rightarrow R–Cl$

to convert a 3° alcohol to an alkyl halide:

$R–OH + HX \rightarrow R–X + H_2O$ (S_N1) (X=Cl, Br, or I)

to synthesize a Grignard reagent: RX + Mg → RMgX, X = Cl, Br, or I

to synthesize an alkyl lithium: RX + 2 Li → RLi + LiX

to synthesize an organocuprate: 2 RLi + CuI → R_2CuLi + LiI

Organocuprates can act as nucleophiles in an S_N2 reaction: $R_2CuLi + R'X \rightarrow R\text{-}R'$

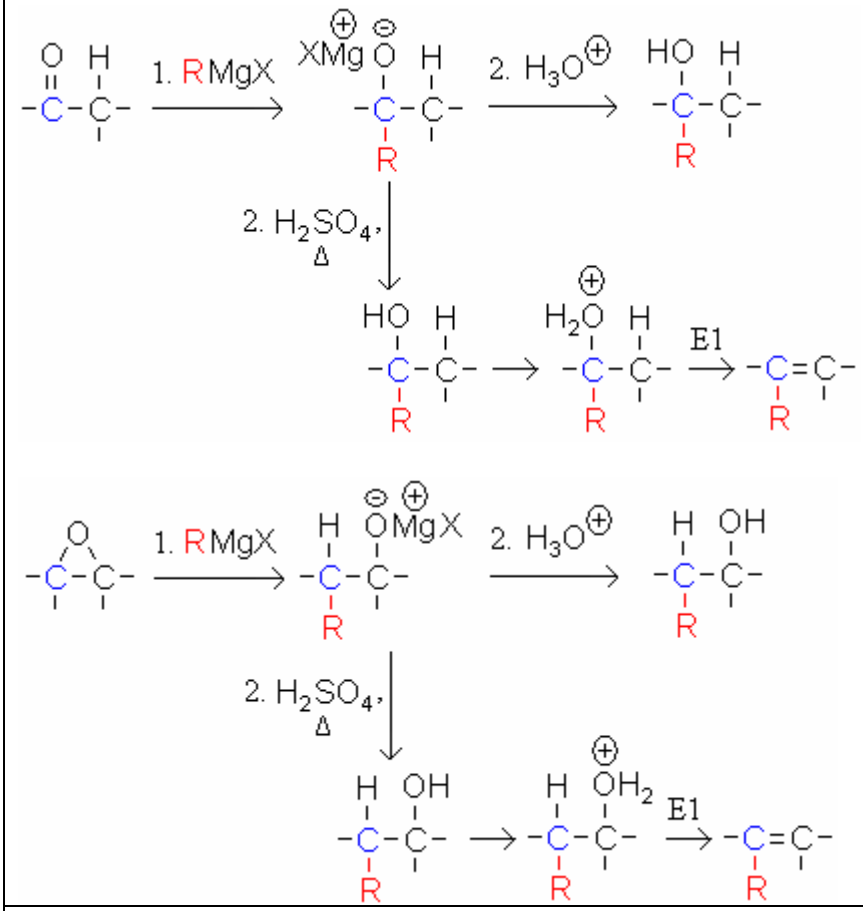
Grignards and alkyl lithiums, in contrast, cannot act as S_N2 nucleophiles.

Synthetic utility: Defunctionalizes, adds carbon-carbon sigma bonds.

Some courses may not cover organocuprates.

using R^- to attack carbonyls and epoxides

reactions:



synthetic utility:

Form carbon-carbon bonds.

RMgX + carbonyl forms a new C-C bond, with an O^- on the C that was attacked.

RMgX + epoxide forms a new C-C bond, with an O^- on the C next to the C that was attacked.