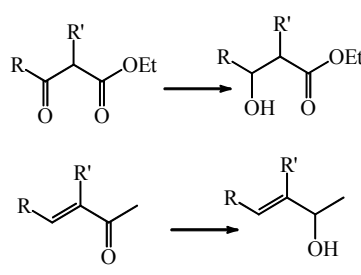
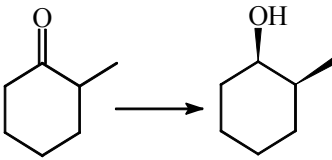
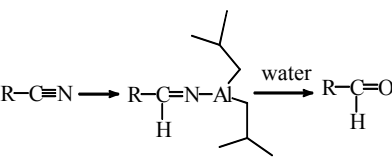
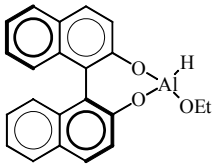

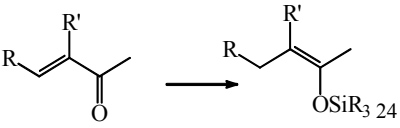


Name/composition	Typical Use and Comments	Scope & Limitations
NaBH ₄ /ROH	ketone and aldehydes alcohols	reactivity decreases with decreasing proton availability, $k_{\text{water}} > k_{\text{MeOH}}$
NaBH ₄ /CH ₃ CN + Cd ⁺² ref ¹	RCOCl aldehydes	aprotic solvent moderate reactivity
Ph ₃ PCuBH ₄ ²	same as above	very mild can be done in the presence of ketones and esters, reagent in active form as an indefinite shelf life
NaBH ₄ /DMF-THF ³	same as above	aprotic solvent moderate reactivity
Zn(BH ₄) ₂ ⁴	ketone and aldehydes alcohols 	nonbasic avoids cleavage of esters, good for enone 1,2 reduction avoids 1,4 reduction
NR ₄ BH ₄ ⁵	Selective reduction of aldehydes over ketones	
NaBH ₃ CN ^{6,7}	RCHO + R'NH ₂ + NaBH ₃ CN RCH ₂ -NHR'	mild, will not attack ketones without H ⁺ (cat)
BH ₃ (for refs see Scope & Limitations column)	Alkene hydroboration	will reduce an amide in the presence of an ester ⁸ and RCO ₂ H in the presence of ester or ketone! ⁹

<p><i>Lisec</i>-Bu₃BH¹⁰ <i>Nasec</i>-Bu₃BH</p>	 <p>α, β-enones enolates 1,4-reduction¹¹</p>	<p>Nicknamed Selectride, “an SN₂ H⁺ donor, bulky reagent selects the least hindered approach.</p>
<p>LiEt₃BH</p>	<p>reduces epoxides to alcohols¹² tosylates to alkanes (alcohol defunctionalization)¹³</p>	<p>similar chemical reactivity and selectivity as above</p>
<p>LiAlH₄</p>	<p>RCN or RCONR₂ amines halocarbons to alkanes ketones, esters, carboxylic acids, aldehydes, acetals (sometimes) alcohols</p>	<p>“LAH” Highly reactive, hard to control; explodes on heating, grinding, or on exposure to water</p>
<p>NaAlH₂(O(CH₂)₂OCH₃)₂</p>	<p>as above¹⁴</p>	<p>Nicknamed Red-Al[®] less reactive than above</p>
<p>above reagent + CuBr</p>	<p>1,4-reduction of enones¹⁵</p>	
<p><i>i</i>Bu₂AlH¹⁶</p>	<p>ketones to alcohols nitriles to aldehydes</p>  <p>lactones to lactols¹⁷ ester to aldehyde (tricky)¹⁸ enones allylic alcohols 1,2-reduction¹⁹</p>	<p>DIBAL</p>

	<p>enantioselective reductions of ketones to optically active alcohols. Both enantiomers are available.²⁰</p>	
<p>$\text{Bu}_3\text{SnH}^{21}$</p>	<p>$\text{R-X} \mid \text{R-H}$ heat + AIBN radical $\text{X}=\text{Br, I, SePh, NO}_2, \text{SH}$</p>	
<p>$\text{Bu}_3\text{SnH}^{22}$</p>	<p>$\text{R-O-COX} \mid \text{RH}$ $\text{X}=\text{OR, SR, NR}_2$</p>	<p>Barton deoxygenation</p>
<p>Diimide²³</p> 	<p>(H-N=N-H) generated by $\text{NaO}_2\text{C-N=N-CO}_2\text{Na}$, RCO_2H, or NH_2NH_2, Cu(II), O_2, or TosNH-NH_2, organic(aq) solvent</p>	<p>selectively reduces electronically symmetrical double bonds, in the presence of amines thioethers, unsaturated ketones, etc.</p>
<p>$\text{Et}_3\text{SiH}^{24}$ With $\text{RhCl}\cdot\text{P(Ph)}_3$</p>		<p>1,4-reduction of enones to silyl enol ethers</p>

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