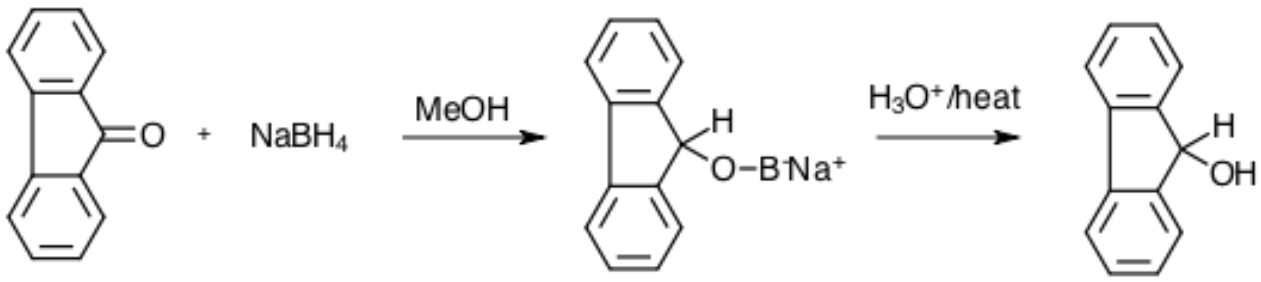
Reduction

Summary:

Carbonyl compounds are oftentimes reduced using metal hydrides, such as sodium borohydride or lithium aluminum hydride. These compounds are highly reactive (flammable) and caustic. In this representative example, sodium borohydride is used to reduce a ketone, 9-fluorenone.



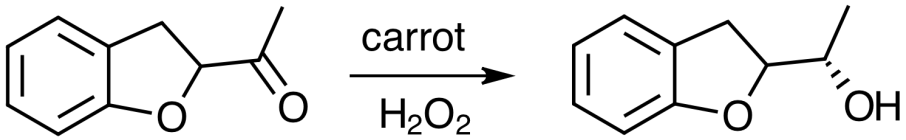
Reference: Reduction of 9-Fluorenone, Experimental Organic Chemistry, Gilbert and Martin, 5th edition, 2011, 582

Chemical Name Aldrich Catalog #	Amount per 100 students (g or mL)	EH&S	Purchasing cost per 100 students ($)
9-fluorenone F1506	30 g		$14.85
Methanol 322415	750 mL		$37.75
Sodium borohydride 71320	2.5 g		$2.30
Sulfuric acid, 3M 258105	100 mL		$0.53
Water n/a	500 mL		n/a

Reduction – A Greener Approach

Summary:

This procedure uses carrot bits (Daucus carota) to catalyze the oxidation of a ketone. The resulting product produces a chiral center, allowing for the discussion of chirality.



Reference: J.Chem.Ed, 2006, 83 (7), 1049 - Enantioselective Reduction by Crude Plant Parts: Reduction of Benzofuran-2-yl Methyl Ketone with Carrot (Daucus carota) Bits

Chemical Name Aldrich Catalog #	Amount per 100 students (g or mL)	EH&S	Purchasing cost per 100 students ($)
Carrot n/a	1250 g		n/a
Water n/a	5000 mL		n/a
2-benzofuranyl methyl ketone 154377	1 g		$8.62
Heptane 246654	1000 mL	*	$49.50
Ethyl acetate 270989	5750 mL		$235.43
Magnesium sulfate 793612	250 g		$9.10

Comparison: Reduction

Comparison of greener and traditional lab:

- Greener method avoids the use of sodium borohydride
- Greener method introduces the concepts of enzymatic catalysis and chirality
- Greener method can be performed at room temperature
- Greener method generates more solvent waste due to extraction procedure

	Purchasing costs	Waste (per 100 students)	"Greener" benefits
Greener method	$302.65	6.7L liquid waste 5L aqueous waste 250 g solid waste	
Traditional method	$55.43	1.3L liquid waste	

Other greener lab options to explore:

- Green Chemical Experiment: Indigo Dyeing, Chem. Educ. 2008, 13(6), 344–347 (ketone reduction)
- Synthesis of Methyl Diantilis, a Commercially Important Fragrance, J. Chem. Educ. 2006, 83, 285–286 (aldehyde reduction)