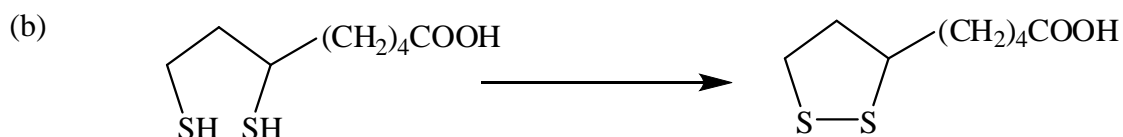
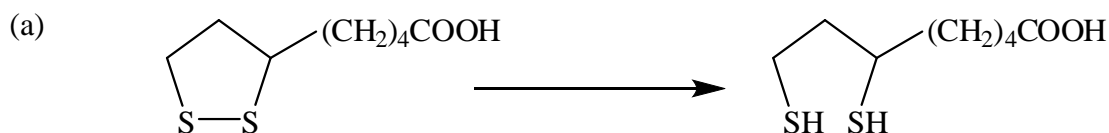
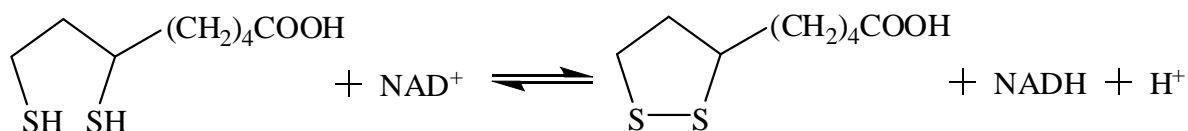


Work through the ChemCAL modules "Nucleophilic Substitution Reactions" and "Organic Reduction and Oxidation".

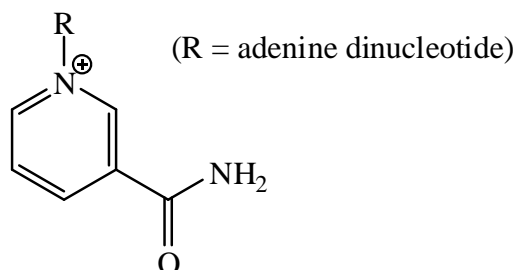
1. Lipoic acid (thioctic acid) plays an essential role in biochemical redox processes. Indicate the laboratory reagents and conditions required for the following conversions.



2. The biological process corresponding to the conversion of dihydrolipoic acid into lipoic acid may be written as

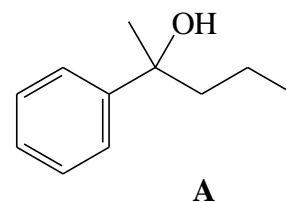


The structure of NAD^+ is drawn below. Draw the structure of NADH .

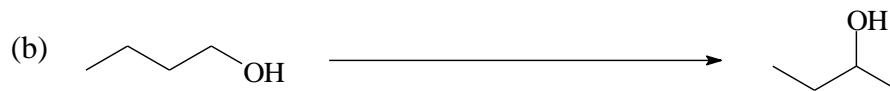
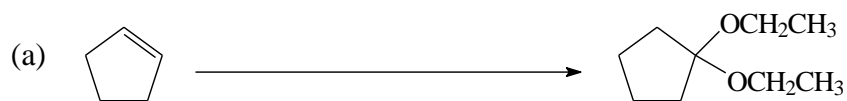


3. When 2-phenyl-2-pentanol, **A**, is treated with concentrated sulfuric acid, a mixture of alkenes (**B**, **C**, and **D**) is formed.

Compounds **B** and **C** are diastereoisomers. Compounds **B** and **D** (and **C** and **D**) are constitutional isomers. Give the structures and names for **B**, **C**, and **D**.



4. Give the reagents and reaction conditions required to carry out the following conversions. Note that more than one step may be necessary.



5. Draw the major products of the following reactions. Write "NR" if there is no reaction.

