## **APPENDIX B: THE MECHANISM OF HYDROBORATION**

Hydroboration is an important synthetic process. Borane, which exists as  $B_2H_6$  but reacts as BH<sub>3</sub>, is electron-poor and readily reacts with  $\pi$ -bonds. The addition is *regioselective*, with the boron atom adding to the *least substituted end* of the double bond, and *stereospecific*, with the B and H atoms always adding to the *same face* of the double bond (*syn*-addition).



The first step is the concerted regioselective addition of the alkene  $\pi$ -bond (which is electron rich) to a B–H bond (which is electron poor):



Using BH<sub>3</sub> the hydroboration occurs three times in total (each B–H bond can react):



When the hydroboration is complete, alkaline peroxide is added to effect the oxidative cleavage of the C–B bonds, with *retention* of the configuration at the reacting carbon.



The overall sequence is an excellent way of adding water to an alkene, the OH group being added to the least substituted end of the double bond. The retention in the oxidation step ensures that only *syn*-hydration occurs. The selectivity is illustrated in the example below.



overall **syn-addition** of water via the **regioselective** addition of B to the least substituted end of double bond

The hydroboration reaction is subject both to electronic and steric effects, as illustrated in the following example. The reagent is **chemoselective** — it hydroborates a double bond more rapidly if it is more polarised and/or less hindered.

