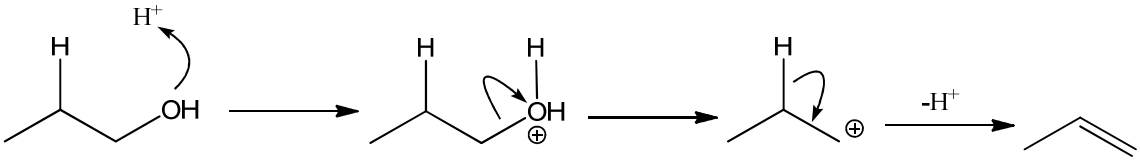
CHEM1902/4 Worksheet 5 – Answers to Critical Thinking Questions

The worksheets are available in the tutorials and form an integral part of the learning outcomes and experience for this unit.

Module 9: Elimination Reactions

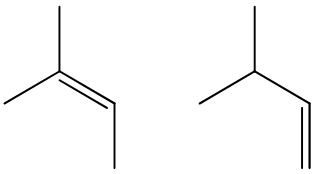
1. See below.



2. *E* – elimination. 1 – one species involved in rate determining step. The second step, involving breaking a C-O bond, is the rate determining step.

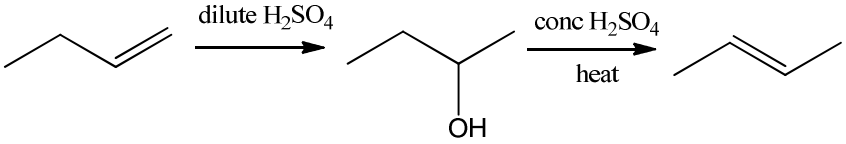
3. Without protonation, the leaving group would be the anion OH^- in the second step. With protonation, the leaving group is the much more stable H_2O molecule.

4. The major product will be the one in which the double bond is more substituted:



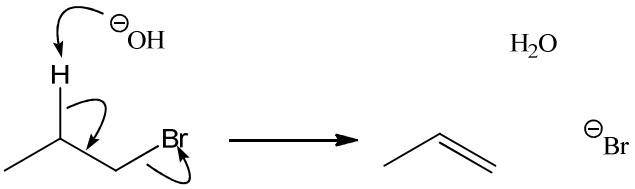
major product minor product

Extension



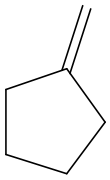
The first step relies on Markovnikov's rule (which is based on the relative stability of the different possible carbocation intermediates) and the second step relies on Zaitsev's rule (which is based on the relative stability of the different alkene products) - both of which are linked to hyperconjugation.

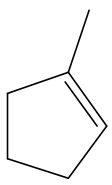
5. See below.



6. Elimination with 2 species involved in the rate determining step: *E*2

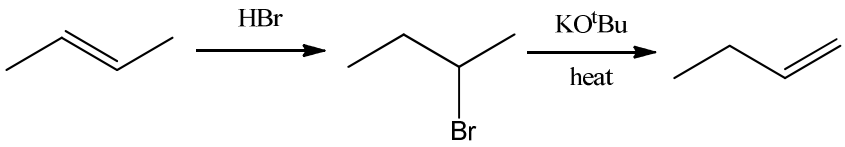
7. H_a is less hindered than H_b so a bulky base will preferentially remove H_a to form the alkene below. This is *not* the product predicted by Zaitsev's rule. Zaitsev's rule predicts the most stable (thermodynamic) rather the most easily formed (kinetic).





8. OH^- is not a bulky base so more of the alternative product (which is the more stable, more substituted alkene) would be formed:

Extension



Note that if an alcohol is formed in the first step, the elimination reaction will not occur. KO^{t}Bu will remove the most acidic H atom which is the O-H one rather C-H

Key to success: practice further by completing this week's tutorial homework

Remember: The spectroscopy problem solving assignment must be completed by the end of week 7.