

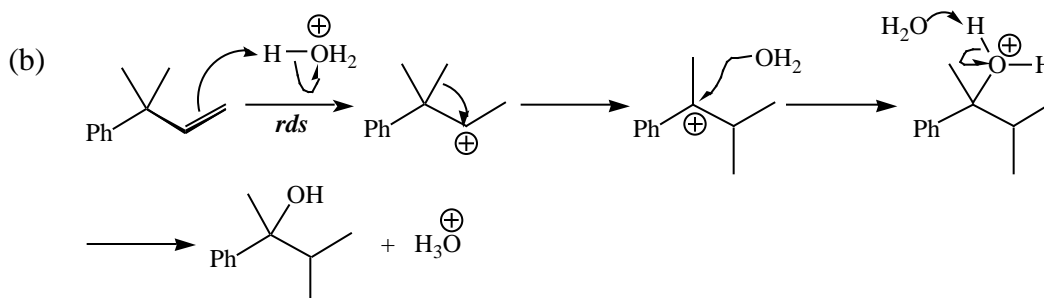
Statistics: High score = 99; Average score = 68.2; Low score = 15
 Standard deviation = Irrelevant as it does not control grade distribution in this class.

A note about exam keys: The answers presented here are usually significantly longer than expected from a student taking the exam. This exam key serves not only to reveal what was expected, but also as an instructional archive for current and future students.

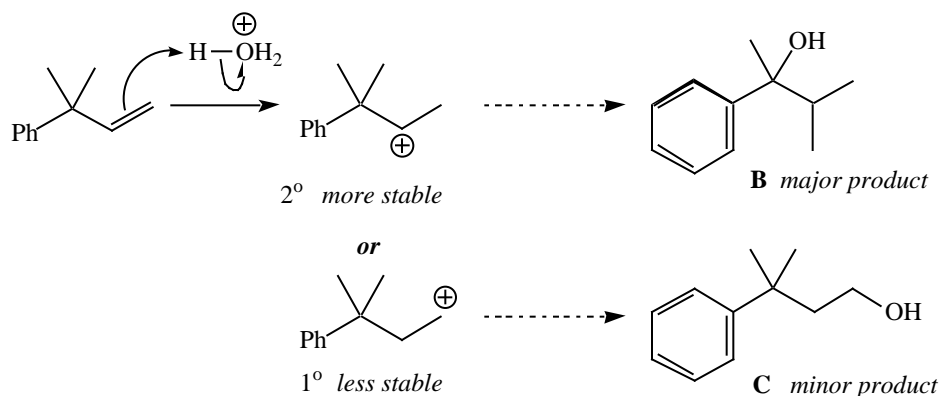
Exam key posted noon, Friday, August 1, 2003

To see the final course grade cutoffs consult "If Grades Were Assigned Today" at the Chem 30A web site.

1. (a) The major product is **B**.



- (c) Protonation of the alkene by hydronium ion can lead to two carbocations, one primary and one secondary. The primary carbocation leads to alcohol **C** whereas the secondary carbocation leads to alcohol **B** (after rearrangement). The secondary carbocation is more stable, so it is formed more readily, causing alcohol **B** to be the major product.

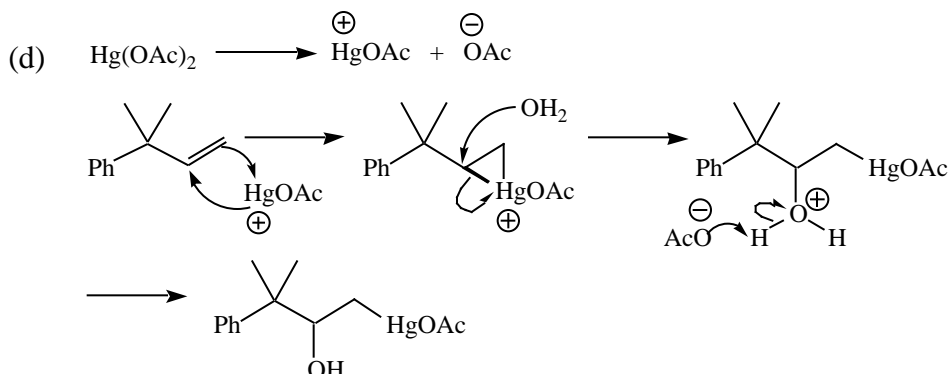


- (d) This is an addition reaction because the product contains most of the atoms of the reactants. The electrophile that adds to the alkene is H_3O^+ .

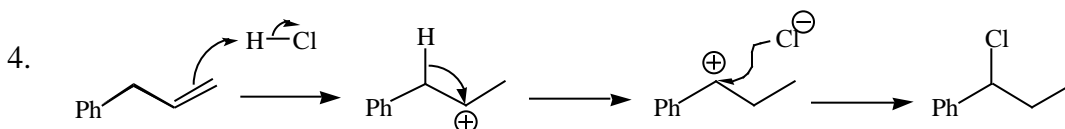
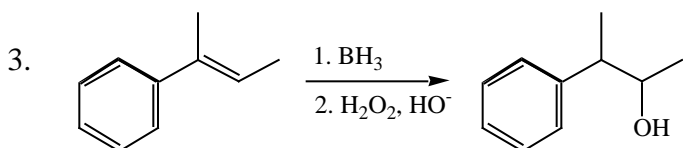
2. (a) Oxymercuration (or oxymercuration-demercuration).

(b) The major product is **D**.

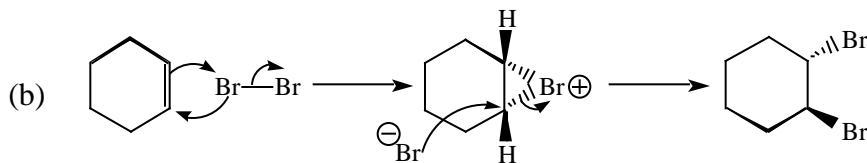
(c) This reaction does obey Markovnikov's Rule.



(e) As shown in answer 1 (b), this alcohol can only be formed from the given alkene if a [1,2]-methyl shift occurs, most probably by a carbocation rearrangement. Such a carbocation rearrangement occurs in order to make a more stable carbocation. In a mercurinium ion, the carbon atoms bear $+$ and do not have open octets. Since the mercurinium ion carbons carry less positive charge, a mercurinium ion does not have enough driving force to rearrange. This is a key advantage of oxymercuration over acid-catalyzed hydration: Because oxymercuration avoids carbocations, products of skeletal rearrangement are never observed.

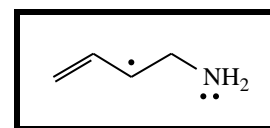


5. (a) Reaction of an alkene with Br_2 results in **anti** addition.

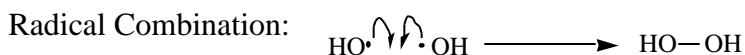
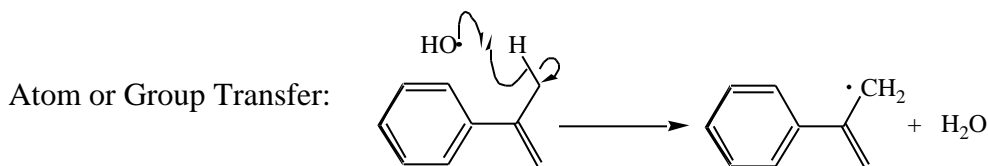
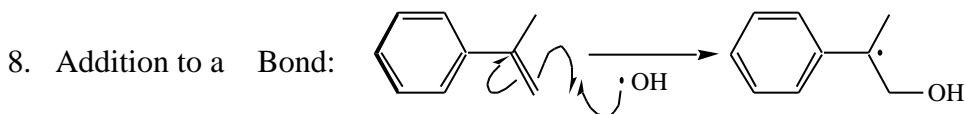


(c) Nucleophilic attack on a carbon bearing a leaving group occurs along the σ^* orbital (the backside of the carbon, much like an $\text{S}_{\text{N}}2$ reaction). As shown in the mechanism this leads to a trans arrangement of the two C-Br bonds, and net anti addition of Br_2 .

6. There are many possible solutions. The radical shown here is secondary with resonance and thus more stable than a primary radical.



7. Radicals are **electrophilic**. This is because the atom bearing the unpaired electron also has an **open octet**.



9. (a) The major reaction product is **E**.

