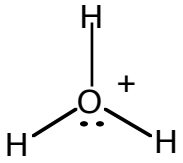
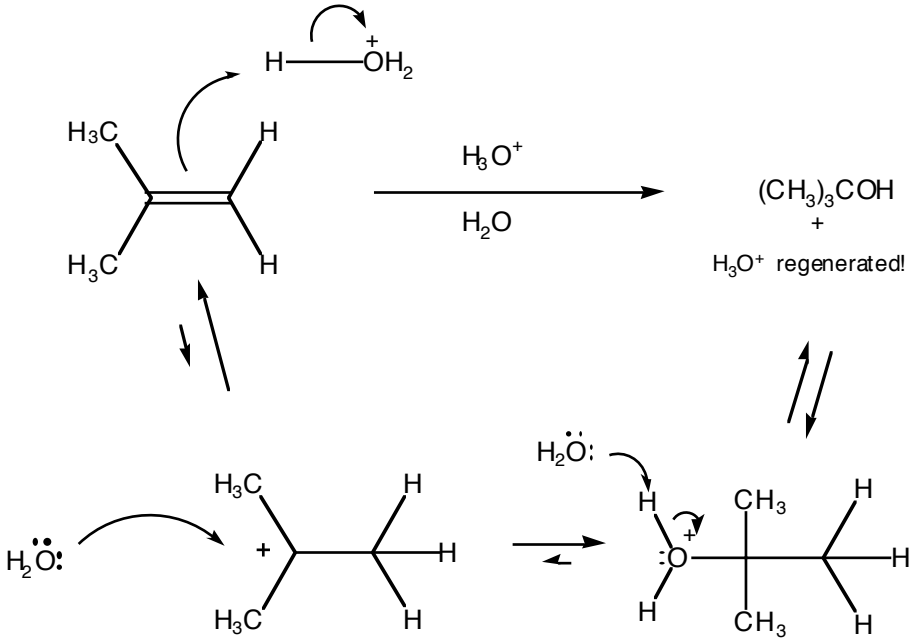
Answers to Problem 31, Chemistry 301X - 2006

In Problem 28, we looked at the reaction of the hydronium ion, H_3O^+, with 2,3-dimethyl-2-butene. Some of you wondered why the hydronium ion was necessary - why not just use water.

(a) What is the hydronium ion anyway? Draw a perfect Lewis "dot" structure for H_3O^+.



(b) Write a mechanism for the reaction of isobutene with the hydronium ion to give only *tert*-butyl alcohol. Make sure you have every step perfect. Bonus: you can now explain why only a catalytic amount of hydronium ion is necessary for this reaction.



(c) Why does the reaction fail utterly when water is used, when there is no hydronium ion present? Remember: water does ***not*** ionize to H^+ and ^-OH.

Water is far too weak an acid to protonate an alkene. The p*K*a of water is 15.7. The p*K*a of the hydronium ion is – 1.7. The hydronium ion is a 10^{17} stronger acid than water.