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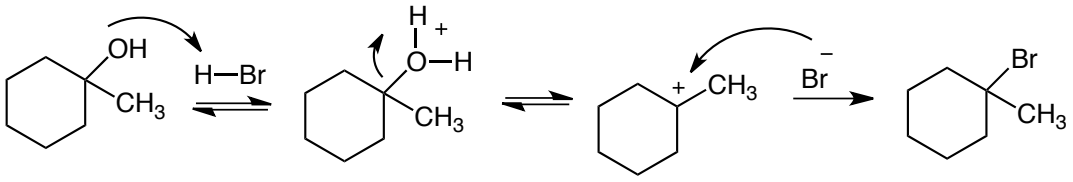
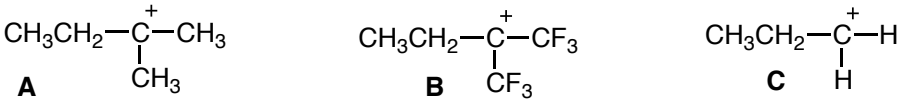
L. I. U.

Chem. 121, Sect 005, Quiz 2 Fall, 2011, 50 points

1. Give the product of the following reaction, giving the full reaction mechanism, showing all of the steps and intermediates and showing the movement of the electrons using the arrow formalism. (10 pts)

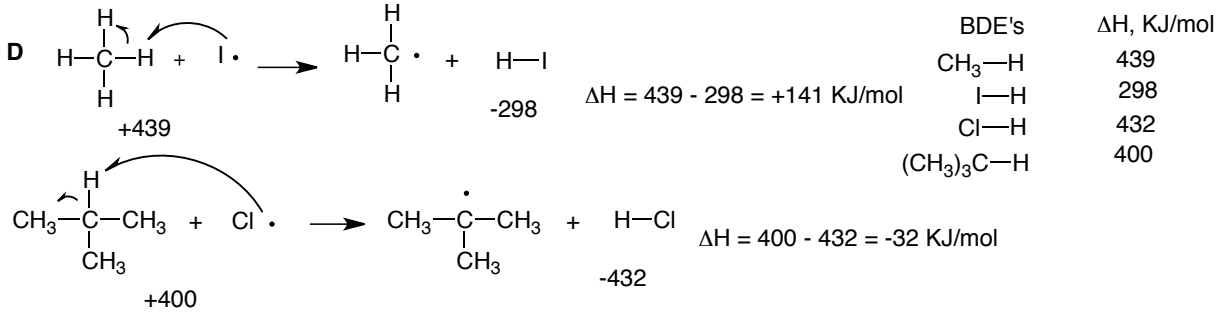


2. Which carbocation would be MOST stable? LEAST stable. Explain briefly in each case. (10 pts)



A is most stable since it is a tertiary carbocation with three electron donating alkyl substituents attached. **B** would be the least stable since it has two electron withdrawing substituents attached.

3. (a) Complete each reaction shown below. (b) Which reaction is more favorable? Explain your choice by calculating the ΔH for each reaction. (10 pts)



4. In experiment 2, the separation of acids and bases, one student separated her organic layer from her aqueous layer and poured both of them into beakers. She forgot to label her beakers. How could she quickly determine which layer is which? (5 pts)

She could add as few drops of water to the beaker that she thinks is the water layer. If the water disappears, then this layer is water.

5. In the preparation of *t*-butyl chloride (2-chloro-2-methylpropane, MW 92.57 g/mol, density 0.85 g/mL) from 12.0 mL of *t*-butanol (2-methyl-2-propanol, MW 74.12 g/mol, density = 0.775 g/mL), using an excess of concentrated hydrochloric acid, one student isolated 7.3 g of *t*-butyl chloride. Calculate the percent yield. (5 pts)

$$\%\ \text{Yield} = \frac{\text{actual yield}}{\text{theoretical yield}} = \frac{7.3\ \text{g}}{\left(\frac{(12.0\ \text{mL})\ (0.775\ \text{g/mL})}{74.12\ \text{g/mol}}\right)(92.57\ \text{g/mol})} \times 100 = 63\%$$

Name.....……..

6. If you have a solution containing 1.0 gram of benzoic acid ($PhCO_2H$) and 1.0 gram of 4-chloroaniline in methyl-*t*-butyl ether, explain how you could separate them from each other and the organic solvent, showing all reactions that you would perform. You have available 10% sodium hydroxide, 3M hydrochloric acid and concentrated hydrochloric acid. (10 pts)

First add an equal volume of 10% sodium hydroxide. This will deprotonate the benzoic acid, making it soluble in the aqueous layer, leaving the 4-chloroaniline in the organic layer. Then to isolate the solid benzoic acid, add concentrated hydrochloric acid and filter the solid. To isolate the 4-chlroanilien, add 3M hydrochloric acid to the organic layer and shake. This will protonate the 4-chlroaniline, making it soluble in the water layer. Separate this using the separatory funnel and then add 10% sodium hydroxide to neutralize the acid. Filter the solid.