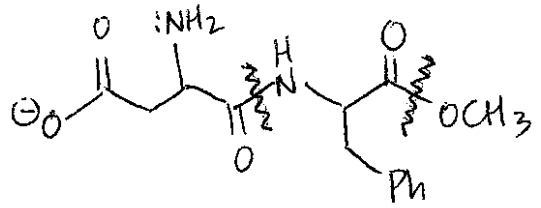
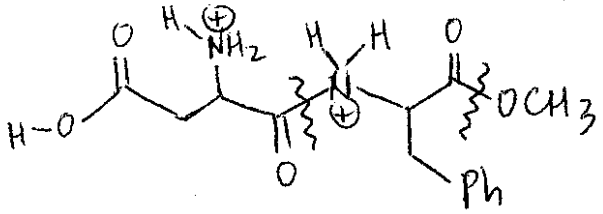
PROBLEM SET 12 SOLUTIONS CHEM 3231

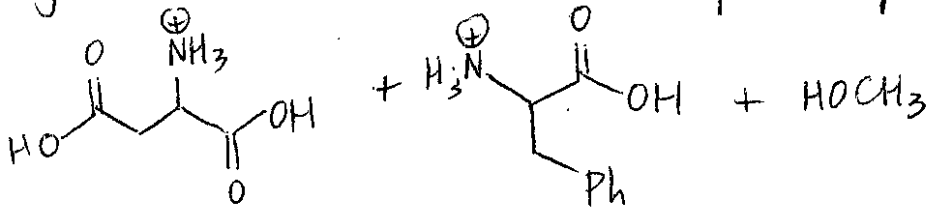
1. There are several bonds in aspartame that will be hydrolyzed in acid:



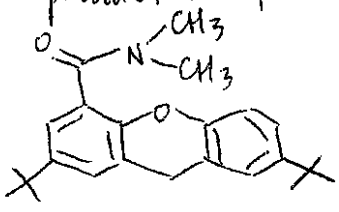
First of all, the carboxylate and free amines will be protonated in acid — so that the structure will look like



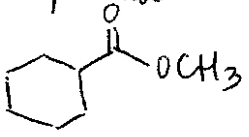
Cleavage at the two bonds above will yield 3 products:



2. (a) This product is formed via the acid chloride:

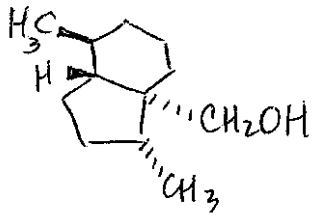


(b) This product is also formed via the acid chloride:

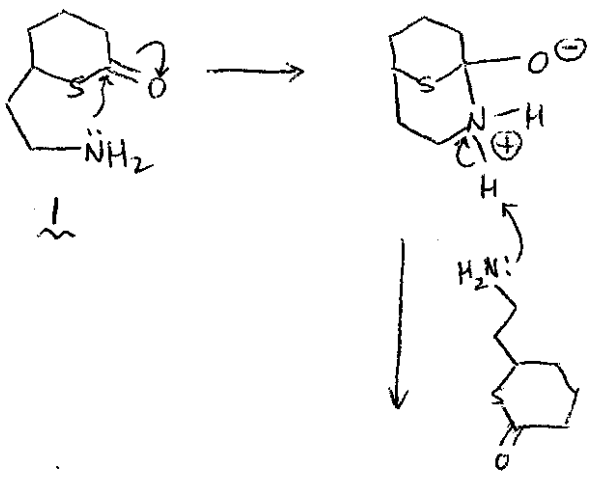


#2(cont)

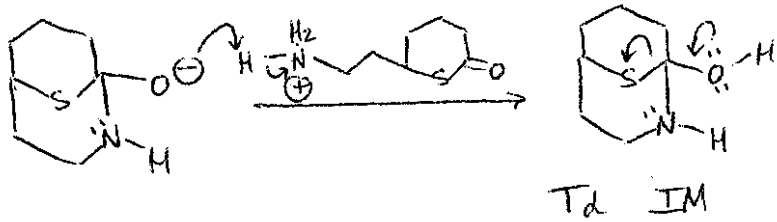
(c) This reaction is hydride reduction of the ester group:



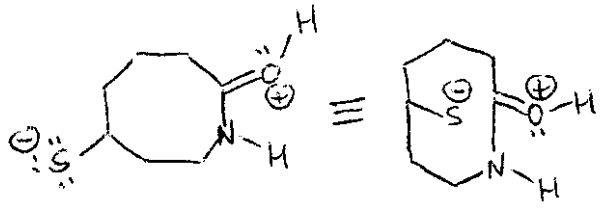
3.



We need to transfer a proton from N to O. We'll use a molecule of 1 as the H^+ transfer agent, since there is no solvent around to do it.

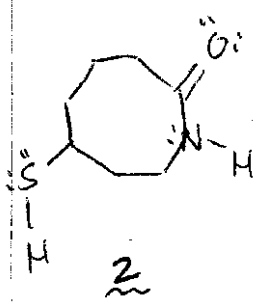


Td IM

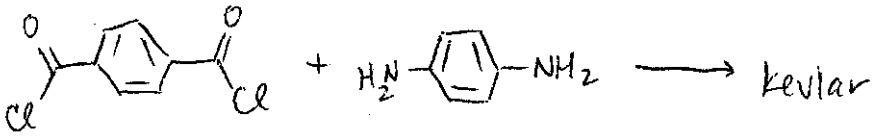


we need to transfer a H^+ again

So use molecule of 1 as before (I won't show the steps, though)

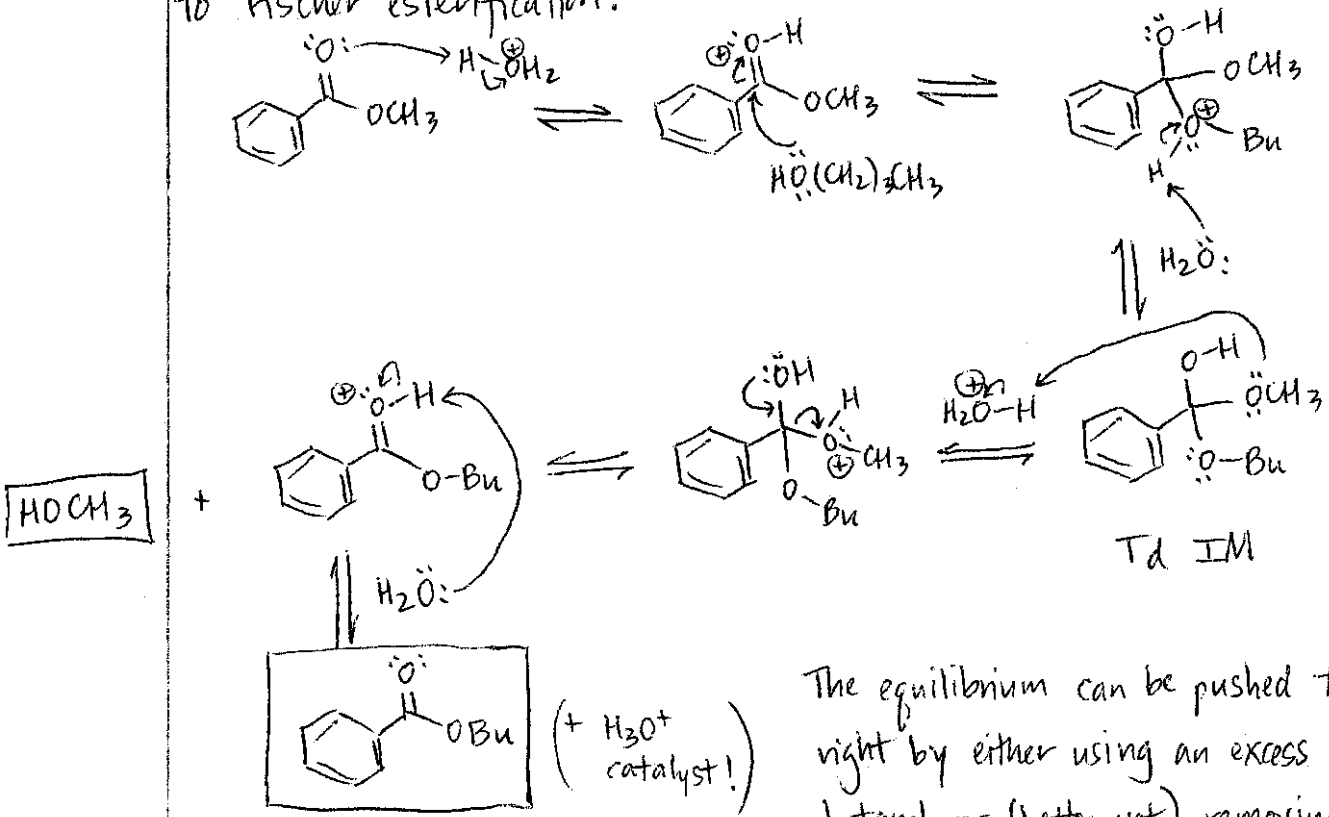


4. Notice that kevlar is made of repeating amide bonds. Therefore, it could be synthesized by reaction of the following diacid chloride with the appropriate diamine (see below).



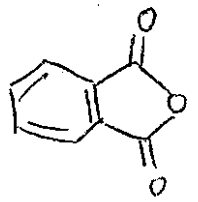
The diacid chloride is preferred to the diacid here because it is much more reactive ∴ better polymerization!

5. The mechanism of acid-catalyzed transesterification is analogous to Fischer esterification.



The equilibrium can be pushed to the right by either using an excess of butanol, or (better yet) removing MeOH by distillation as it forms in the reaction.

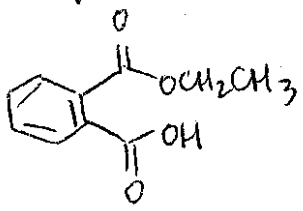
6. X:



$C_8H_4O_3$

4 different C's

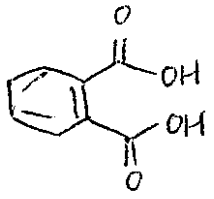
$\xrightarrow[\Delta]{CH_3CH_2OH}$



Z

10 different C's

$\xrightarrow[2.\ H_3O^+]{1.\ ^-OH/H_2O}$



Y

IR 3500–2500, 1720 cm^{-1} (characteristic of RCOOH!)

4 different C's