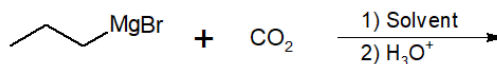


## 21.11: ADDITIONAL EXERCISES

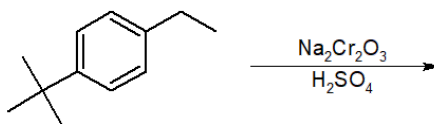
### General Review

21-1 Provide the products for the following reactions.

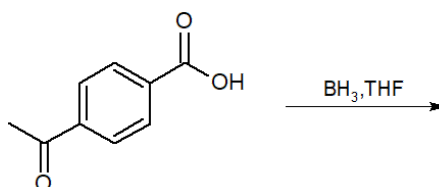
a)



b)



21-2 Provide the proper IUPAC name for the product of the following reaction.



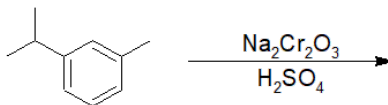
### Synthesis of Carboxylic Acids

21-3 For the following reactions, predict the final product and provide their proper IUPAC nomenclature.

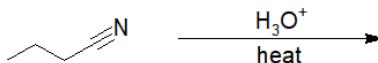
a)



b)



c)



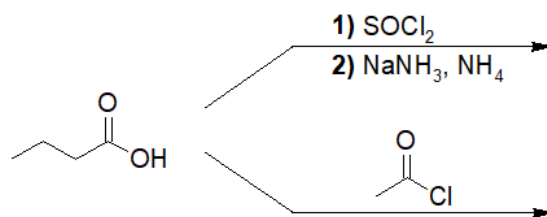
21-4 Propose another method of synthesis (starting with cyclopentane) to make the product in the previous question, 21-3.a.

21-5 Choose the correct alkene that was oxidatively cleaved by hot, concentrated potassium permanganate to form 3-methylbutanoic acid.

- a) (4E/Z)-oct-4-ene
- b) (4E/Z)-2-methyloct-4-ene
- c) (4E/Z)-2,7-dimethyloct-4-ene
- d) (3E/Z)-2,5-dimethylhex-3-ene

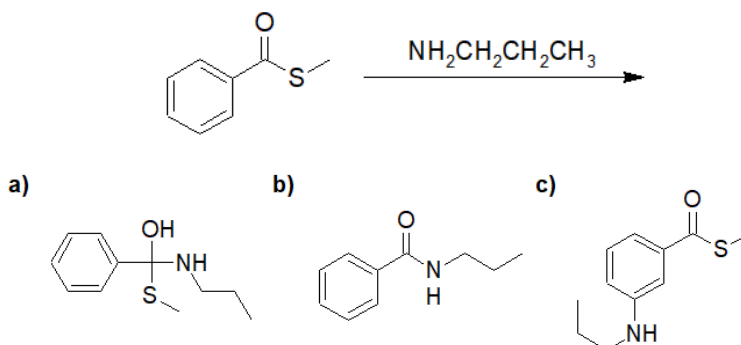
### Reactions of Carboxylic Acids and Derivatives: Nucleophilic Acyl Substitution

21-6 Provide the structures of the products of the following reactions.



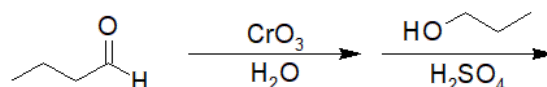
21-7 Provide the structure of the product that forms when propanoic acid reacts with thionyl chloride, then an excess of  $\text{CH}_3\text{CH}_2\text{MgBr}$  and finally followed by an acid workup.

21-8 Choose the correct product of the following reaction.

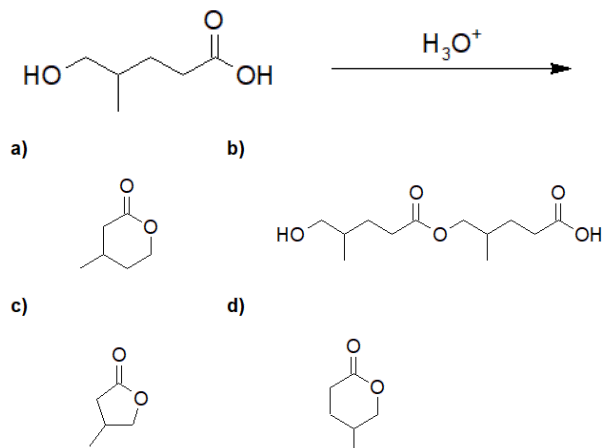


### Condensation of Acids with Alcohols: the Fischer Esterification

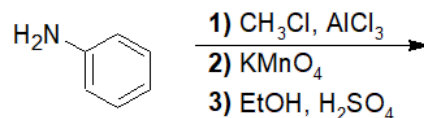
21-9 Predict the product of the following Fischer Esterification reaction.



21-10 Choose the correct product of the following Fischer Esterification reaction.

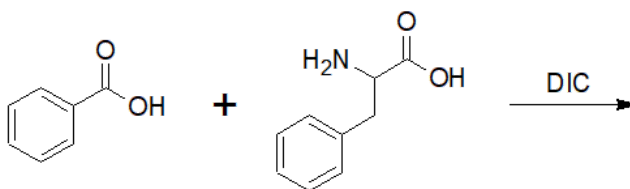


21-11 Predict the product of the following reaction (use a benzene ring with a total of two para-oriented substituents).

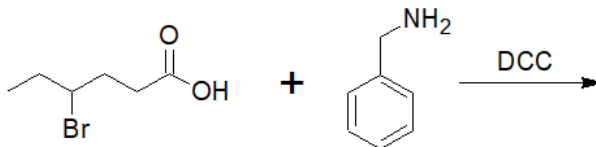


### Condensation of Acids with Amines: Direct Synthesis of Amides

21-12 Give the structure of the product of the following reaction.

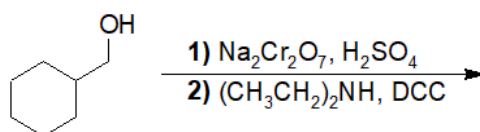


21-13 Choose the correct IUPAC nomenclature of the product and provide its structure.



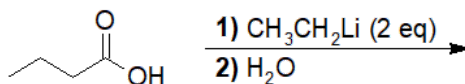
- a) benzyl 4-bromohexanoate
- b) (4E)-N-benzylhex-4-enamide
- c) N-benzyl-4-bromohexanamide
- d) 4-bromo-N-phenylhexanamide

21-14 Provide the structure of the final product.



#### Alkylation of Carboxylic Acids to Form Ketones

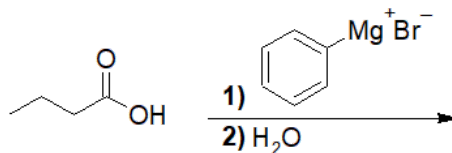
21-15 Predict the product of the following reaction.



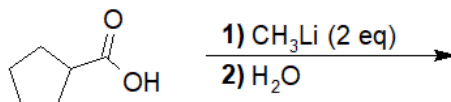
21-16 Explain why two equivalents of organolithium reagent is necessary to alkylate carboxylic acids (see problem 20-1).

21-17 Give the products of the following reactions.

a)



b)



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