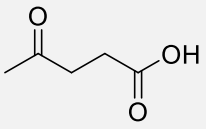
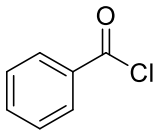
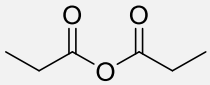
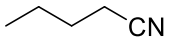
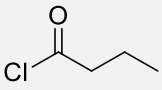
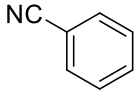
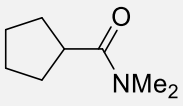
Chapter 20 Worksheet – Carboxylic Acids & Friends

20A. HYDROGEN & CARBON NUCLEOPHILES.

Draw the product of each reaction: **starting material + reagent → Product.**

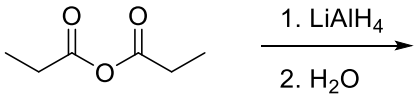
	Starting Material	Reagents *& translation* *know this mechanism	Draw the Product Pay attention to the amount of reagent added!
1		***(a) xs $NaBH_4$, MeOH** *sodium boro**hydride** in methanol*	
2		*** (b) 1. xs $LiAlH_4$** **2. H_2O** *lithium aluminum **hydride** followed by water*	
3		*** (c) 1. xs CH_3MgBr** **2. H_2O** ***Ethyl** magnesium bromide followed by water*	
4		*** (d) 1. PhMgBr (1 mol)** **2. H_3O^+** ***Phenyl** magnesium bromide followed by aqueous acid*	
5		*** (e) Ph_2CuLi (1 mol)** *Gilman reagent: **diphenyl organocuprate***	
6		**(b) 1. xs $LiAlH_4$** **2. H_2O** *lithium aluminum **hydride** followed by water*	
7		**(b) 1. xs $LiAlH_4$** **2. H_2O** *lithium aluminum **hydride** followed by water*	

No printer? No problem? Copy by hand & put your responses on the SAME PART of the SAME PAGE as this template. Thx!

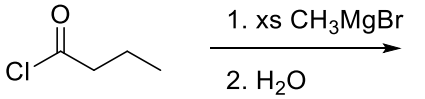
20A. Mechanisms – Acid Derivatives with hydrogen- and carbon-nucleophiles.

- Draw the arrow-pushing mechanism for each reaction, including all charged intermediates and product.

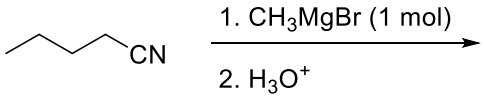
(3b) Acid anhydride reduction



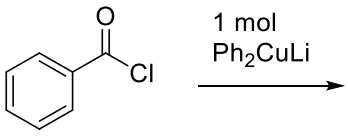
(5c) Grignard addition to acid chloride



(4d) Grignard addition to nitrile



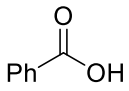
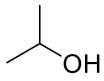
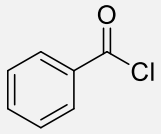
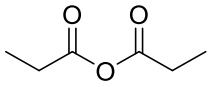
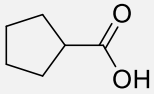
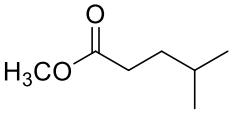
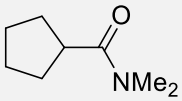
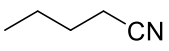
(2e) Gilman addition to acid chloride



No printer? No problem? Copy by hand & put your responses on the SAME PART of the SAME PAGE as this template. Thx!

20B. Nucleophilic Acyl Substitution – Mix & Match with Reaction Bootcamp! – required, NOT bonus

- Draw the product of each reaction: **starting material + reagent → Product.**

React each friend with each reagent and draw the product in the box		***(f)**  pyridine	***(g) H_3O^+**	*** (h)**  H^+ (acid catalyst)	***(i) xs NH_3**
2					
3		**No Reaction**			**No Reaction**
8		**No Reaction**	**No Reaction**		**No Reaction**
9		**No Reaction**			
7		**No Reaction**			**No Reaction**
4		**No Reaction**		**No Reaction**	**No Reaction**

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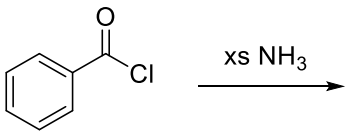
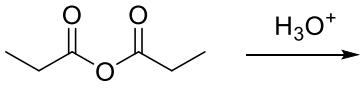
20B. Nucleophilic Acyl Substitution Mechanisms

- Draw the arrow-pushing mechanism for each reaction, including all charged intermediates and product.

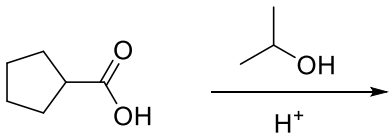
(2i) Aminolysis of acid chloride



(3g) Hydrolysis of acid anhydride



(8h) Fischer esterification – alcohololysis of carboxylic acid

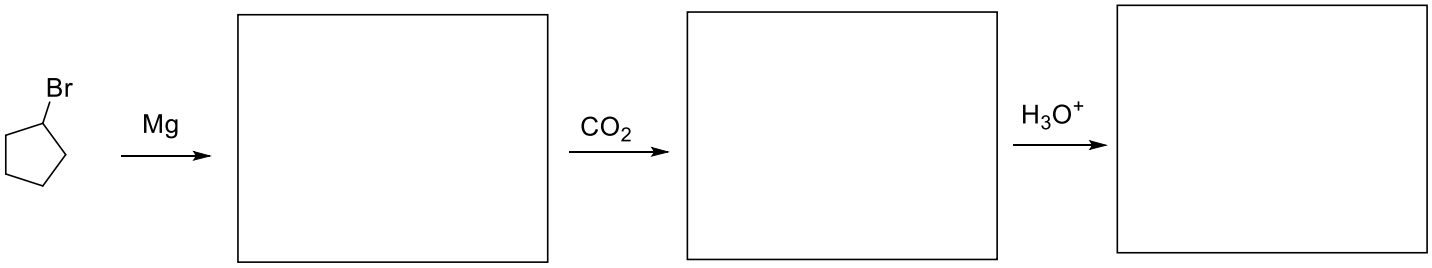


(4g) Hydrolysis of nitrile

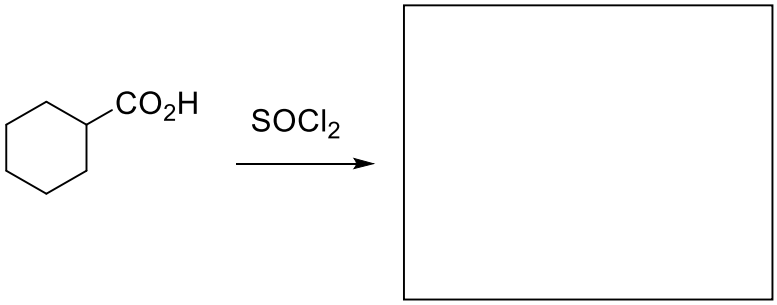
20C. Miscellaneous Reactions that didn't fit nicely into tables

- Fill in the box: Draw the product of each reaction: **starting material + reagent → Product.**
- Mechanisms are helpful, but are not required here (probably not enough space anyway).

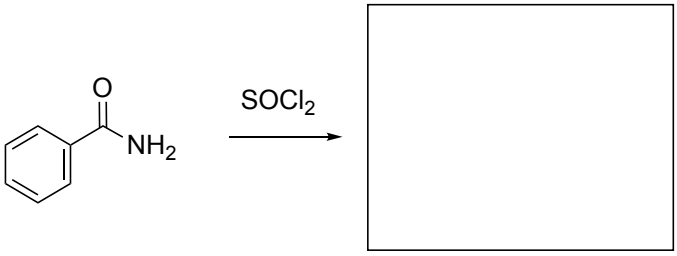
10. Grignard formation and addition to carbon dioxide



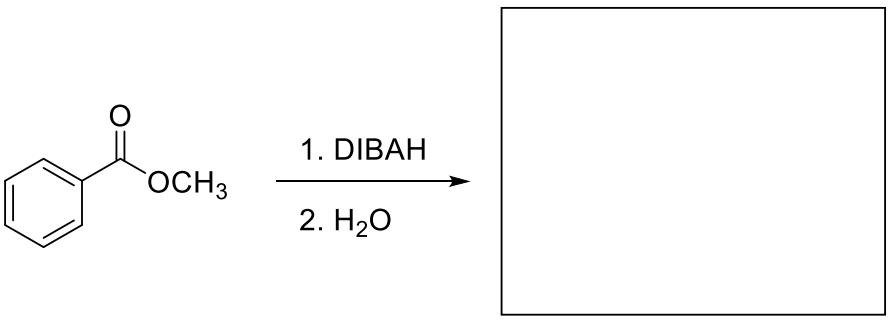
11. Addition of thionyl chloride to carboxylic acid



12. Addition of thionyl chloride to amide – corrected / updated on 2/18



13. Partial reduction of an ester with **DIBAH** (diisobutyl aluminum **hydride**)



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BONUS – optional, extra credit

1. Make up a molecule that includes a carboxylic acid and all of its friends!
    a. Acid chloride
    b. Acid anhydride
    c. Carboxylic acid
    d. Ester
    e. Amide
    f. Nitrile
2. Add decorations to make your molecule look like an animal, creature, or something else that's fun 😊