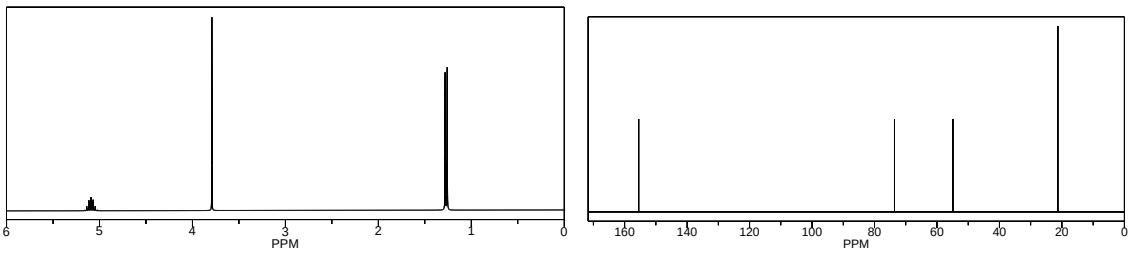
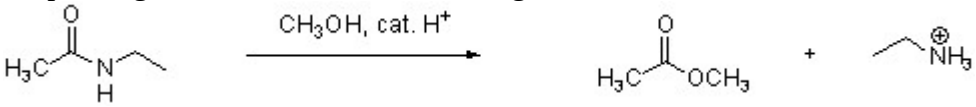
**$C_5H_{10}O_3$**




Provide an arrow pushing mechanism for the following reaction.

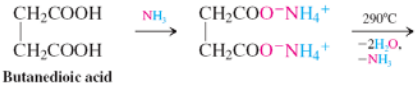



**Intramolecular esterification = _____**

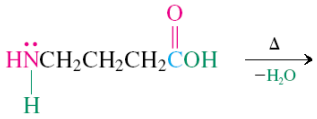
Hydroxy carboxylic acids may form

_____


**Dicarboxylic acids + amines → _____**

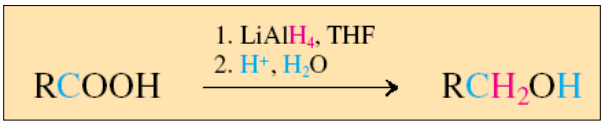


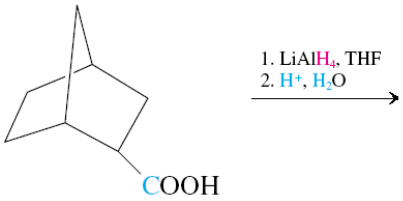

**amino acids intramolecular cyclization → _____**




**Carboxylic Acids Reactions**

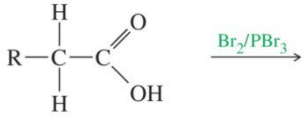
**Carboxylic acids + $LiAlH_4$ → 1° alcohols**

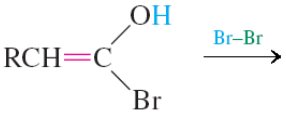


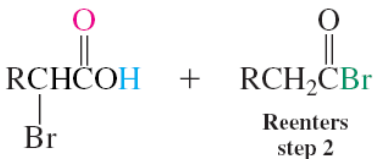




**Carboxylic acid + $Br_2/PBr_3$ → _____**


**Mechanism**

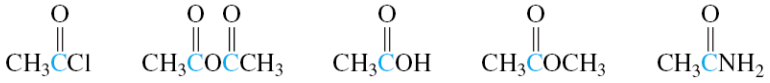


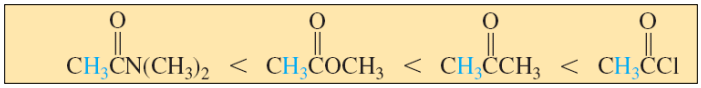



## Carboxylic Acid Derivatives

$^{13}C$ NMR are in narrow range near _____

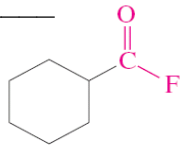


acidity of α-hydrogens also _____



### Alkanoyl Halides

**-ic acids →** _____

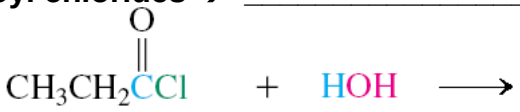


Pentanoyl fluoride

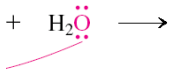
**carboxylic acid →** _____

3-Methylbutanoyl bromide

**Water + alkanoyl chlorides →** _____

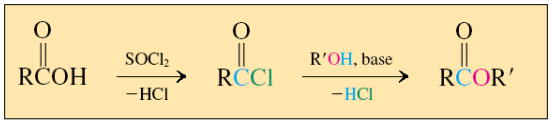


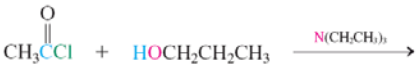
**Mechanism**



**Alcohols + alkanoyl chlorides →** _____

Hydroxide, pyridine or a 3° amine _____

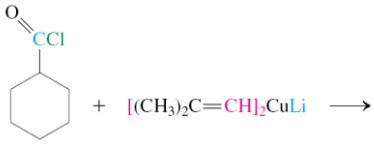




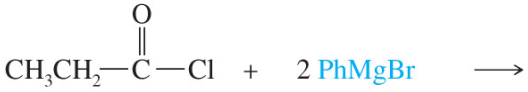
**Mechanism**

### Reductions

**Organocuprates + alkanoyl chlorides →** _____

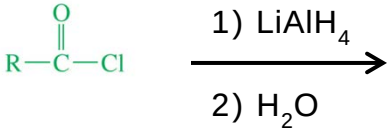


**Lithium/Grignard + alkanoyl chlorides →** _____

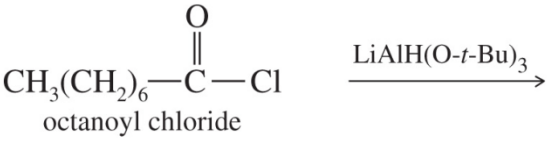


an acid chloride

**$LiAlH_4$+ alkanoyl chlorides →** _____



**$LiAl[OC(CH_3)_3]_3$ + alkanoyl chlorides →** _____



octanoyl chloride