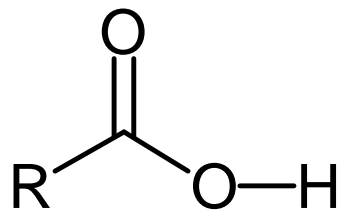


# 第十八章 羧酸及其衍生物 (carboxylic acids and their derivatives)



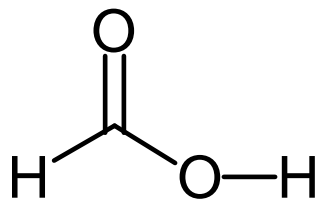
Structure	Name	Structure	Name
$\text{R}-\overset{\text{O}}{\parallel}{\text{C}}-\text{Cl}$	Acyl (or acid) chloride	$\text{R}-\overset{\text{O}}{\parallel}{\text{C}}-\text{NH}_2$	Amide
$\text{R}-\overset{\text{O}}{\parallel}{\text{C}}-\text{O}-\overset{\text{O}}{\parallel}{\text{C}}-\text{R}'$	Acid anhydride	$\text{R}-\overset{\text{O}}{\parallel}{\text{C}}-\text{NHR}'$	
$\text{R}-\overset{\text{O}}{\parallel}{\text{C}}-\text{OR}'$	Ester	$\text{R}-\overset{\text{O}}{\parallel}{\text{C}}-\text{NR}'\text{R}''$	
$\text{R}-\text{C}\equiv\text{N}$	Nitrile		

# 1)命名

a) Acid:

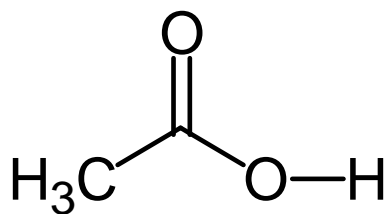
Systematic name

Common name



Formic acid

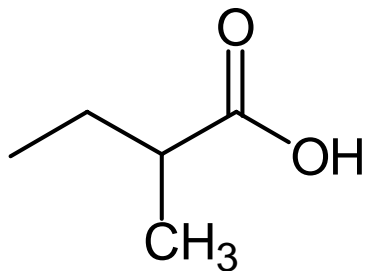
methanoic acid



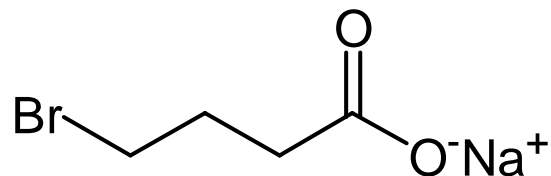
Acetic acid

ethanoic acid

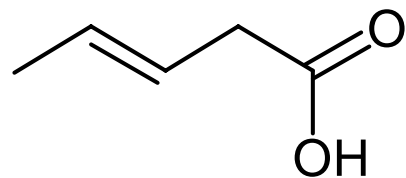
Exercise 816:



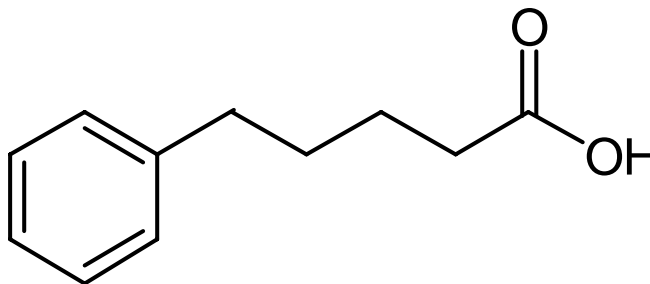
2-methylbutanoic acid



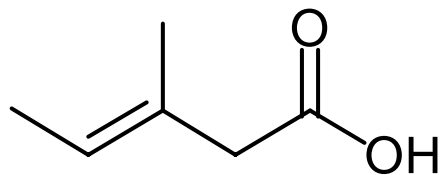
sodium 4-bromobutanoate



(*E*)-3-pentenoic acid



5-phenylpentanoic acid

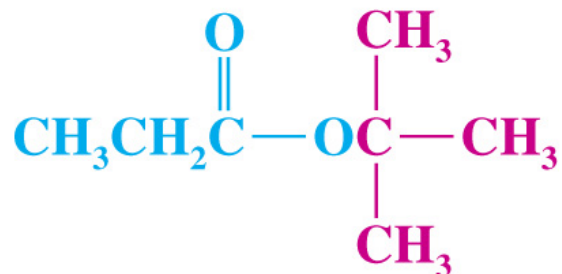


(*E*)-3-methyl-3-pentanoic acid

b) Esters:



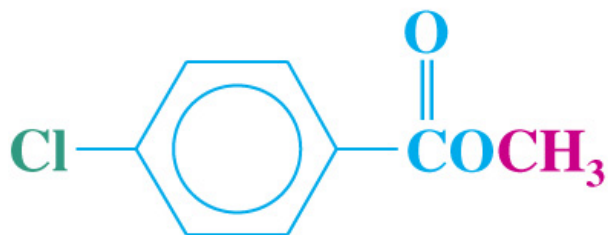
Ethyl acetate or  
ethyl ethanoate



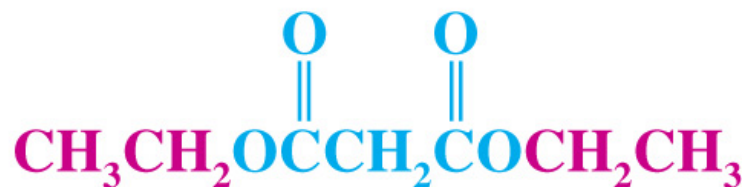
*tert*-Butyl propanoate



Vinyl acetate or  
ethenyl ethanoate

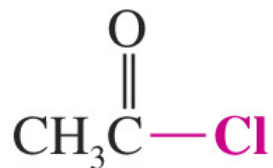


Methyl *p*-chlorobenzoate

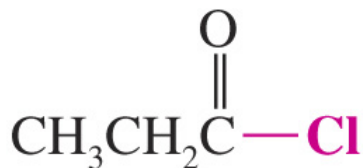


Diethyl malonate

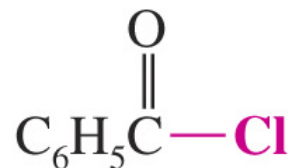
### c) Acyl chlorides



**Acetyl chloride**  
(ethanoyl chloride)  
mp  $-112^\circ\text{C}$ ; bp  $51^\circ\text{C}$

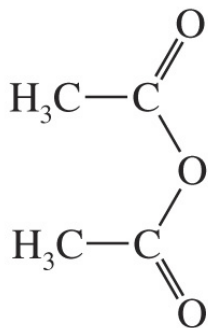


**Propanoyl chloride**  
mp  $-94^\circ\text{C}$ ; bp  $80^\circ\text{C}$



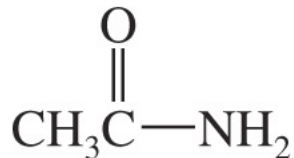
**Benzoyl chloride**  
mp  $-1^\circ\text{C}$ ; bp  $197^\circ\text{C}$

### d) Carboxylic anhydride

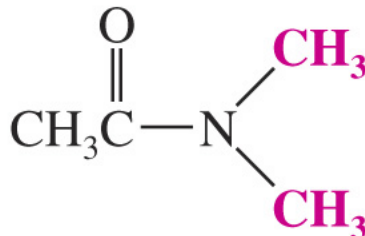


**Acetic anhydride**

## e) Amides



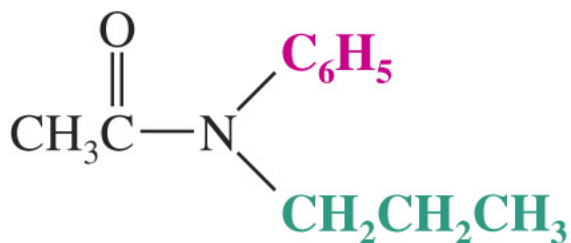
**Acetamide**  
(ethanamide)  
mp 82°C; bp 221°C



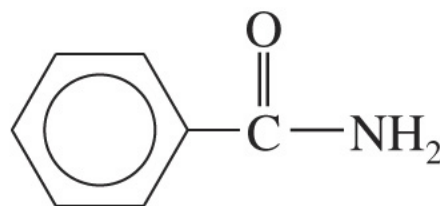
***N,N*-Dimethylacetamide**  
mp -20°C; bp 166°C



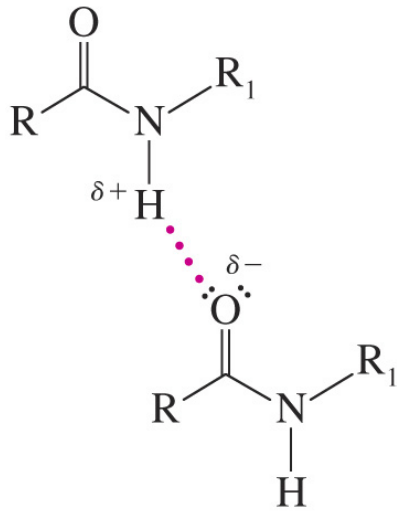
***N*-Ethylacetamide**  
bp 205°C



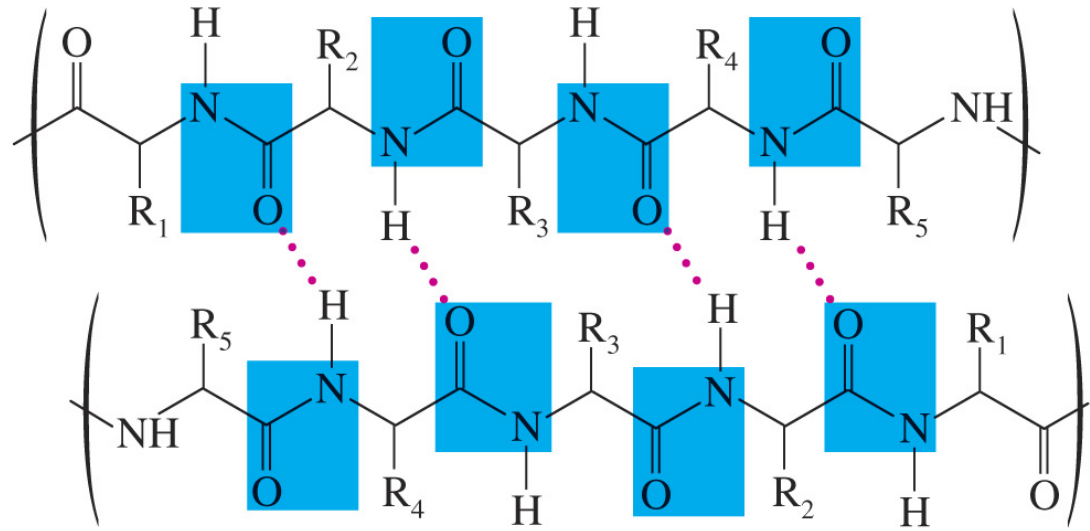
***N*-Phenyl-*N*-propylacetamide**  
mp 49°C; bp 266°C at 712 torr



**Benzamide**  
mp 130°C; bp 290°C

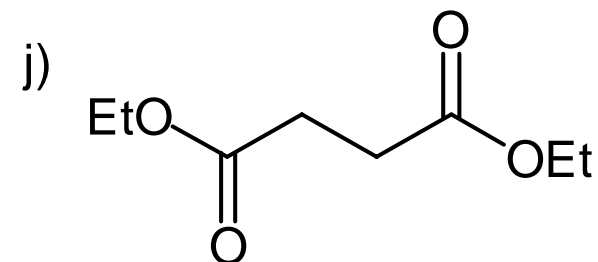
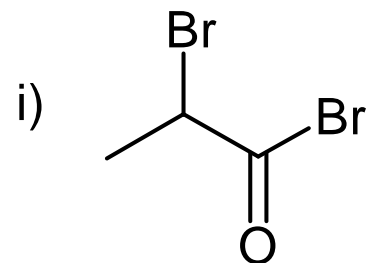
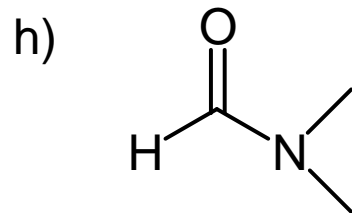
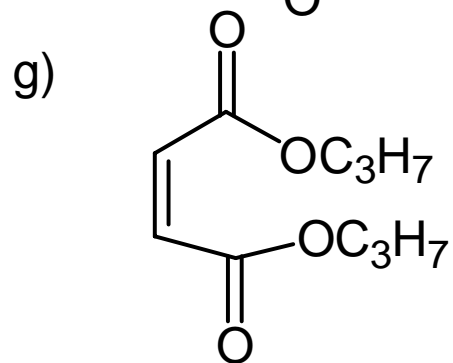
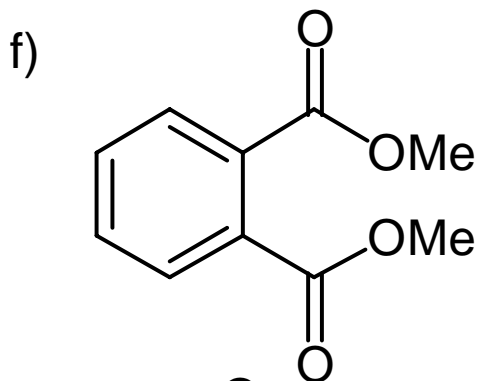
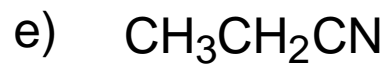
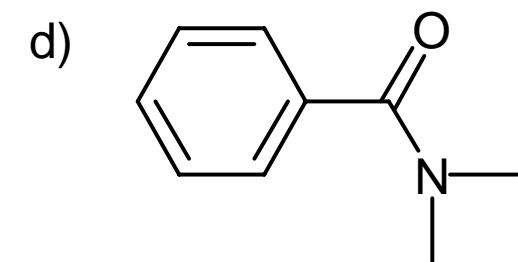
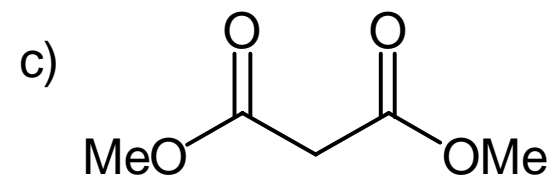
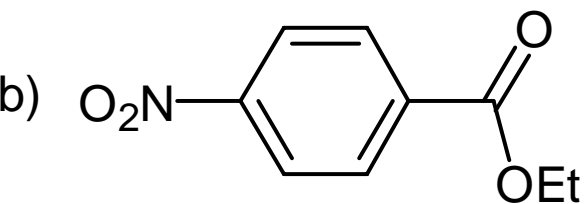
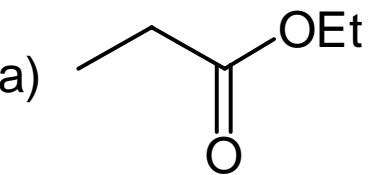


**Hydrogen bonding (red dots)  
between amide molecules**



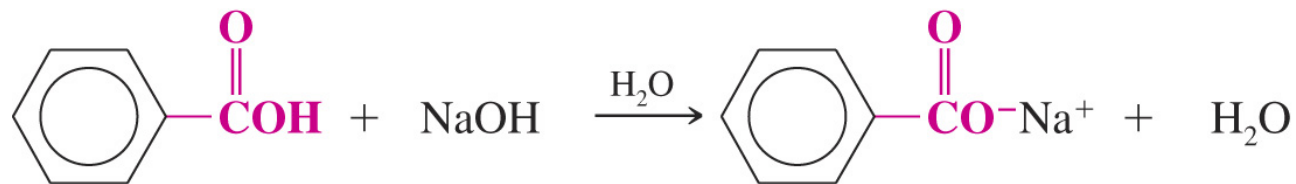
**Hydrogen bonding between amide groups of peptide  
chains. This interaction between chains (called a  
 $\beta$  sheet) is important to the structure of many proteins.**

# Exercise 821:





## 2) 羧酸的酸性

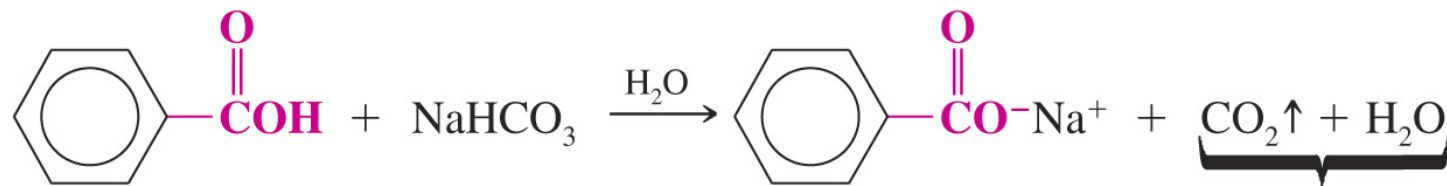


**Benzoic acid**  
(water insoluble)  
*Stronger acid*

*Stronger base*

**Sodium benzoate**  
(water soluble)  
*Weaker base*

*Weaker acid*

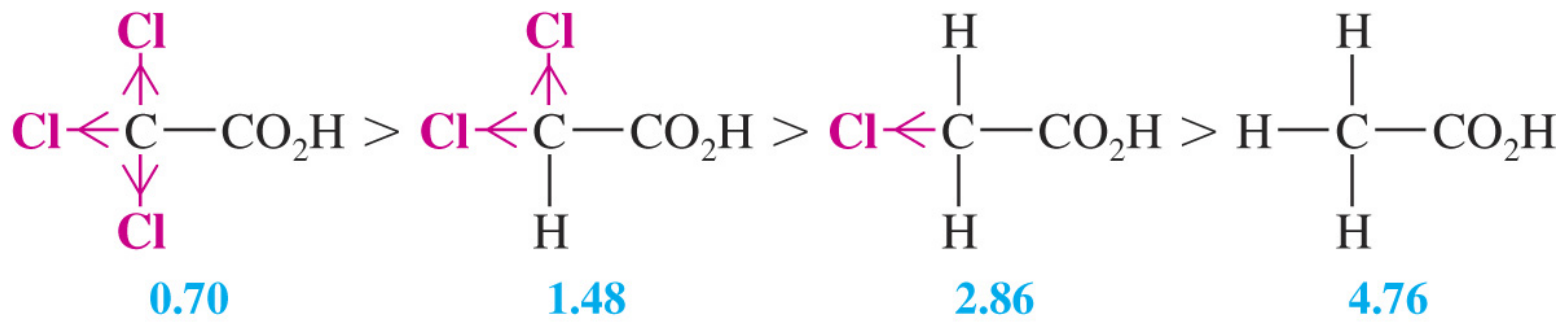


(water insoluble)  
*Stronger acid*

*Stronger base*

(water soluble)  
*Weaker base*

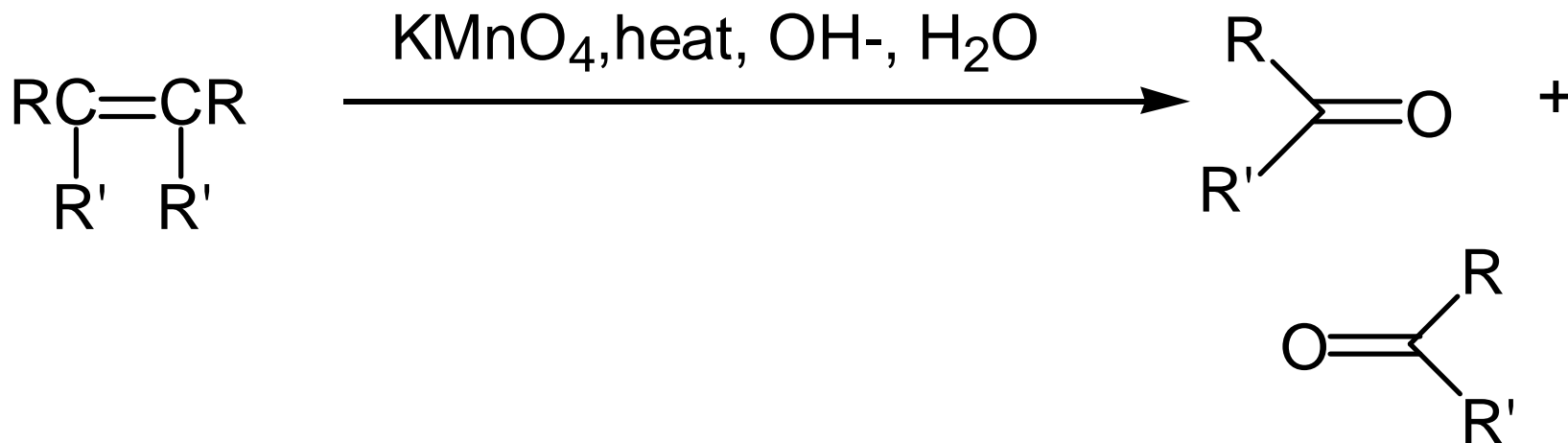
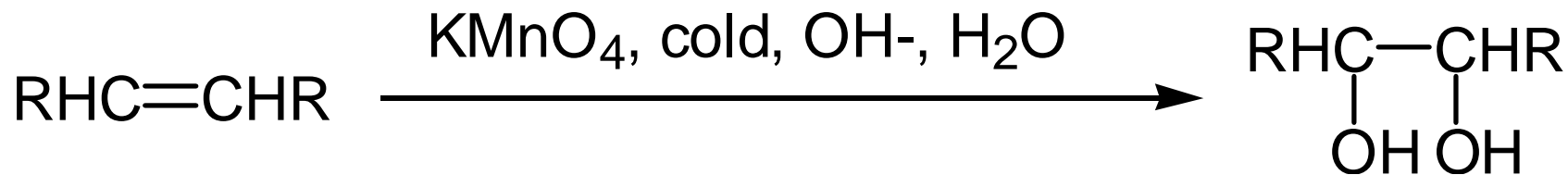
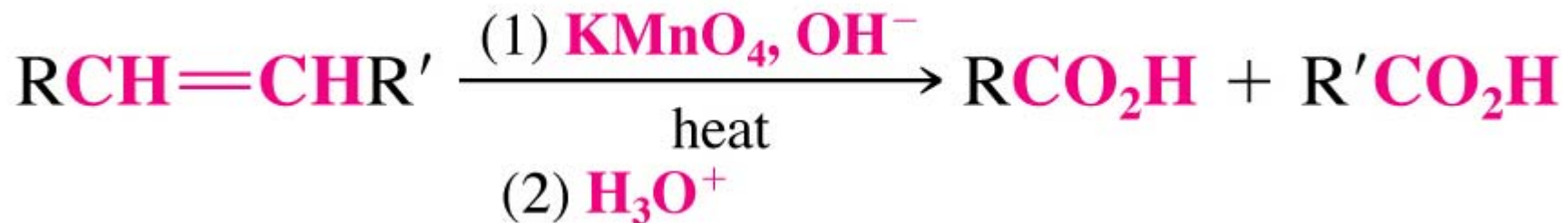
*Weaker acid*

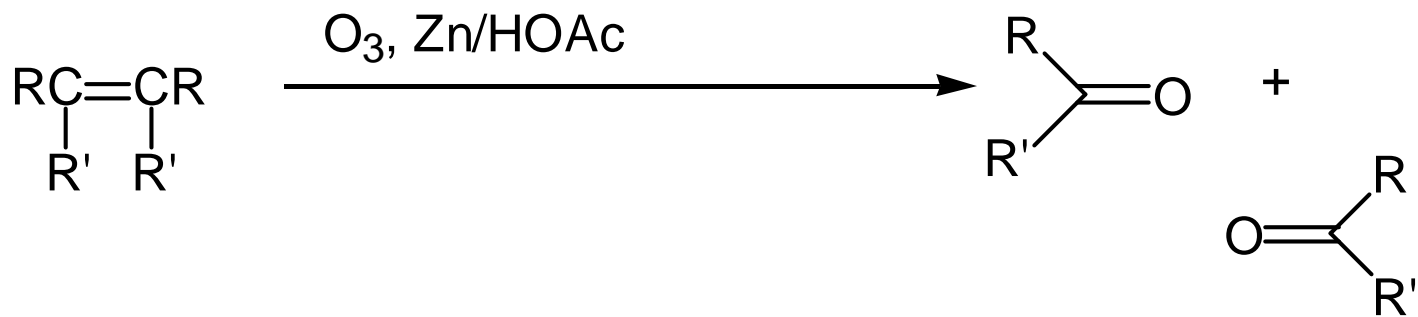
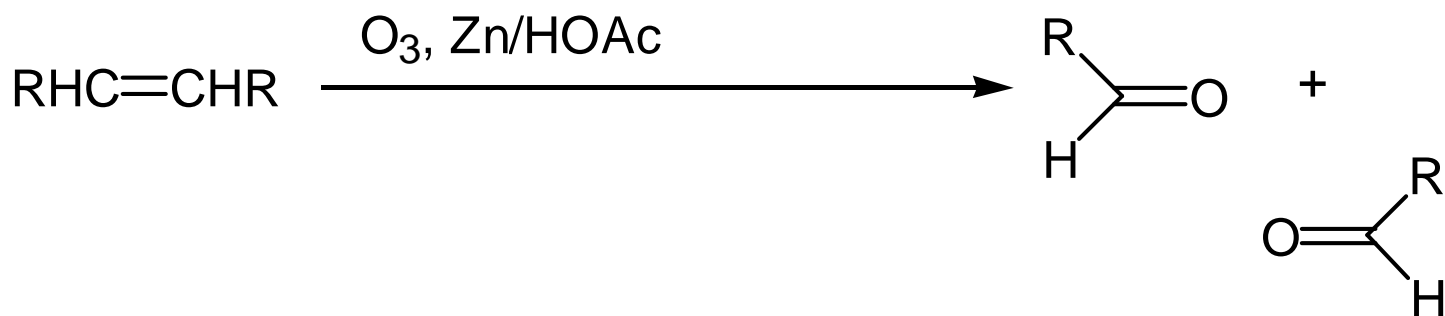
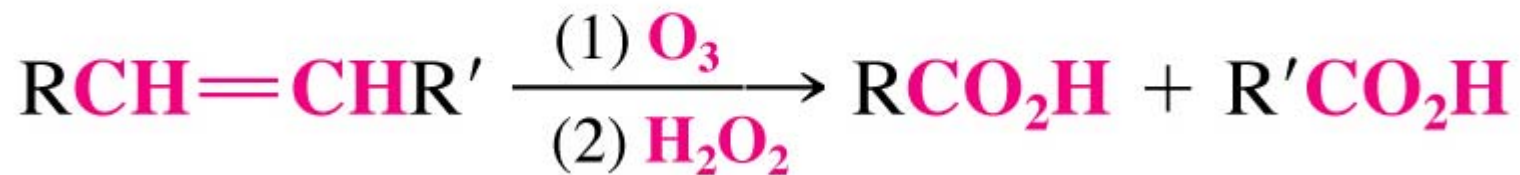


Exercise 818:

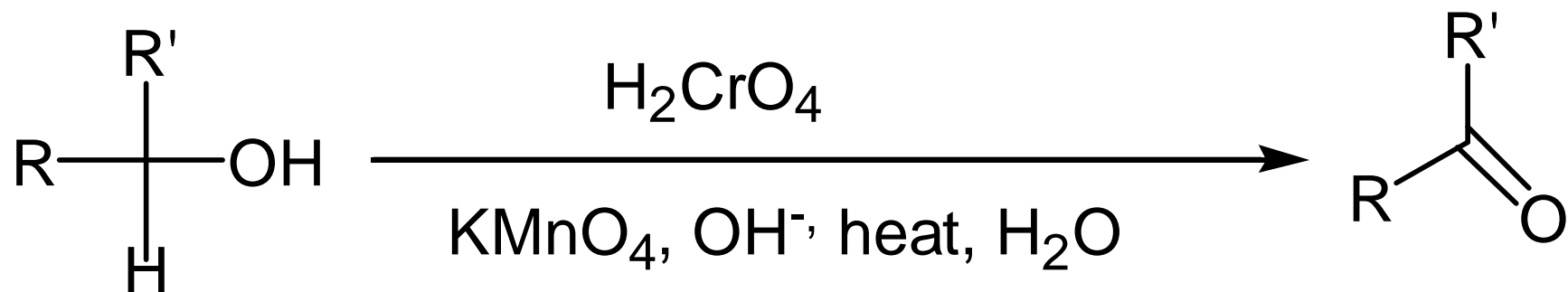
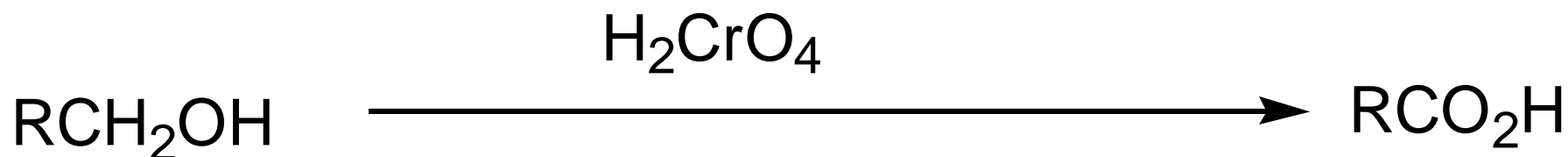
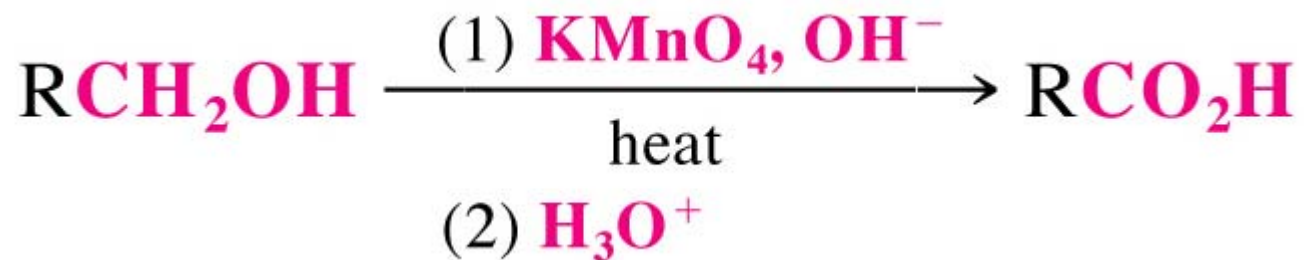
## 2) 羧酸的製備

a) 由烯烴氧化斷裂而製成

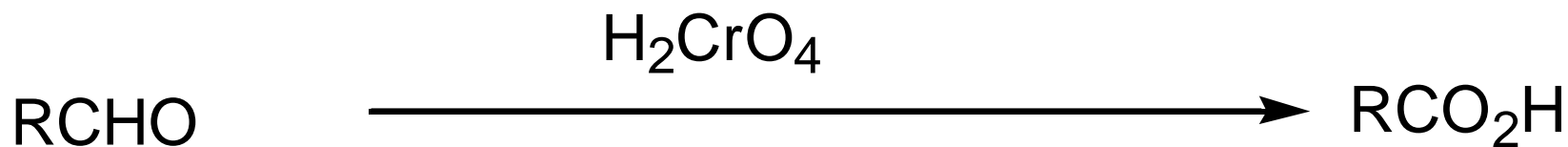




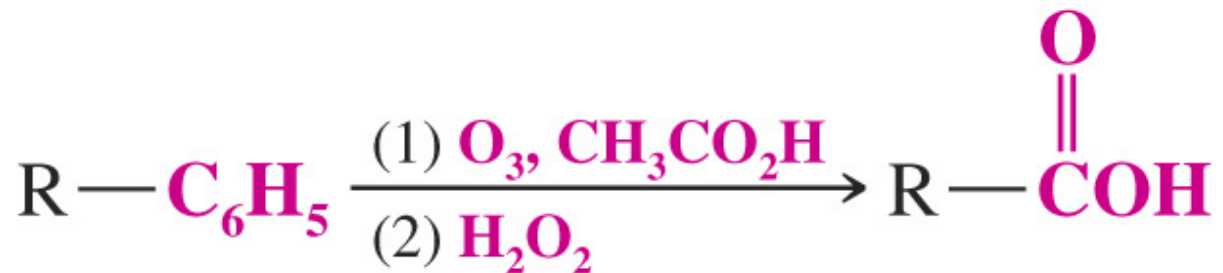
b) 由醇氧化而製成



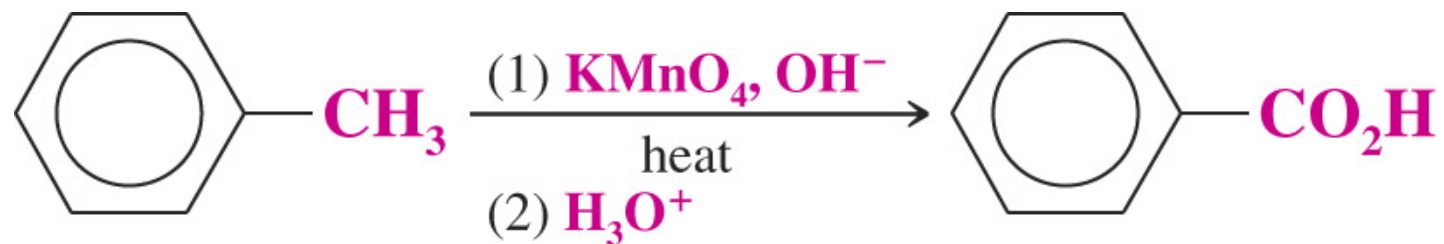
c) 由醛氧化而製成:



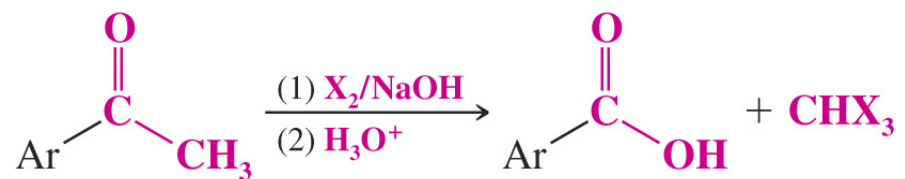
d) 苯环氧化



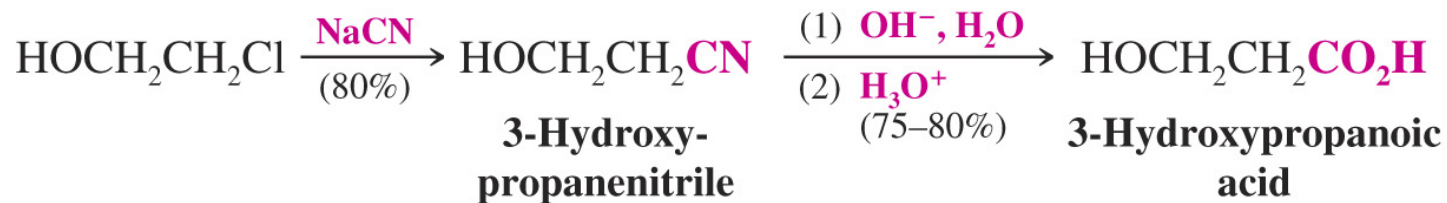
e) 烷基苯氧化



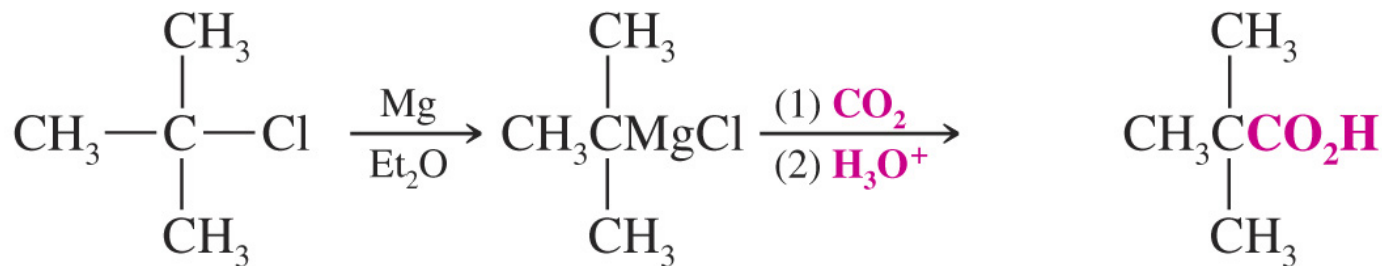
f) 甲基酮氧化(The Haloform Reaction): 解釋機制



### g) Nitrile 水解



### h) Grignard反應

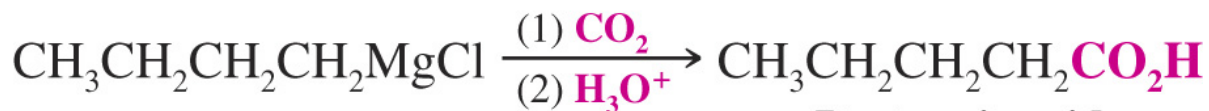


*tert*-Butyl chloride

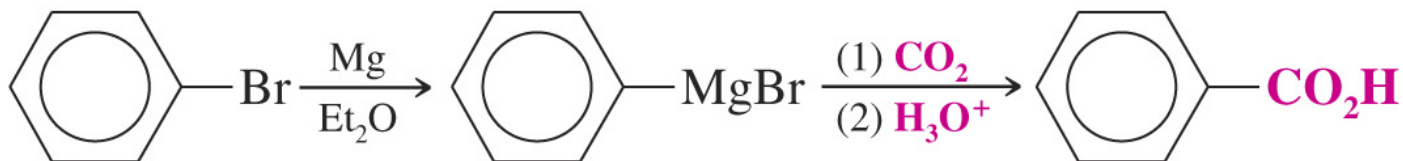
2,2-Dimethylpropanoic acid  
(79–80% overall)



Butyl chloride



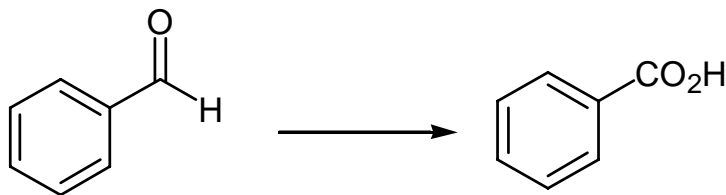
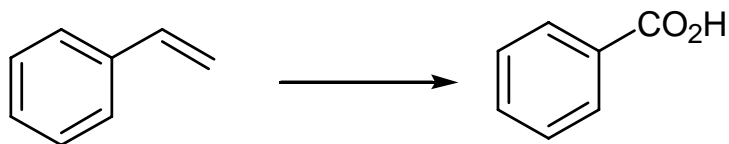
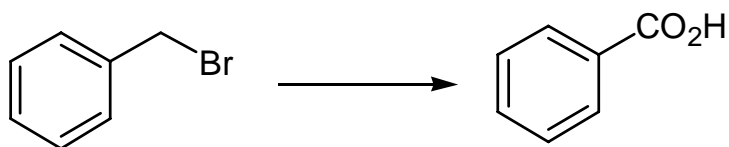
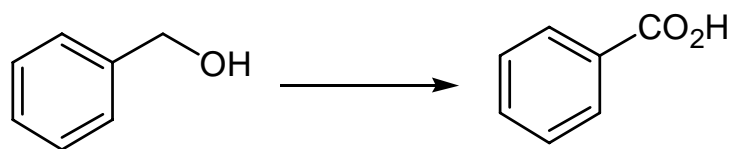
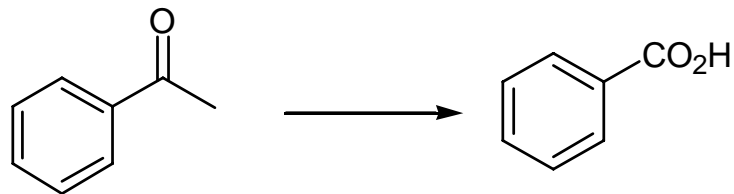
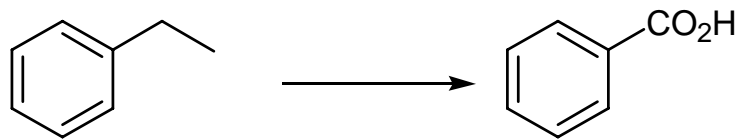
Pentanoic acid  
(80% overall)



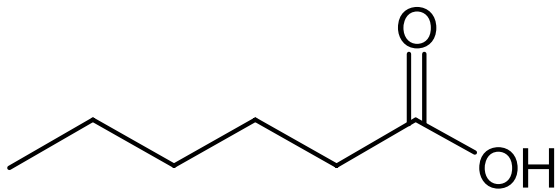
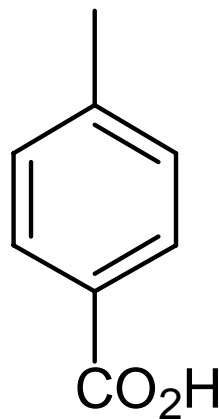
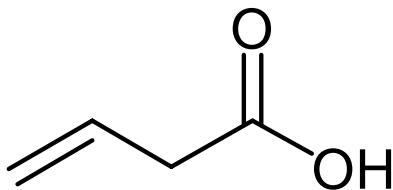
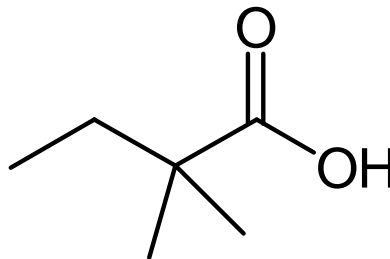
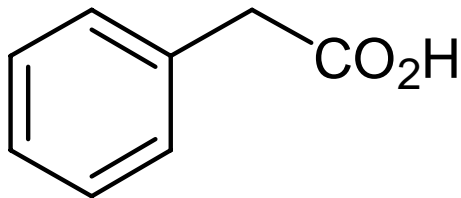
Benzoic acid  
(85%)

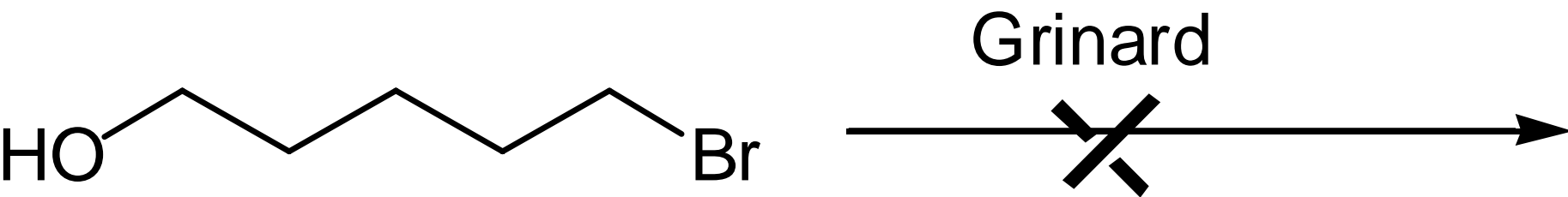
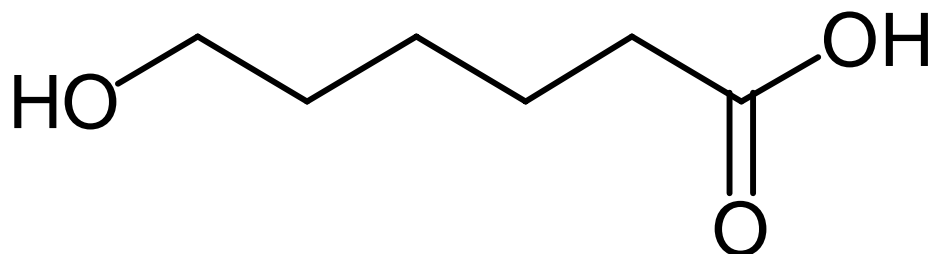
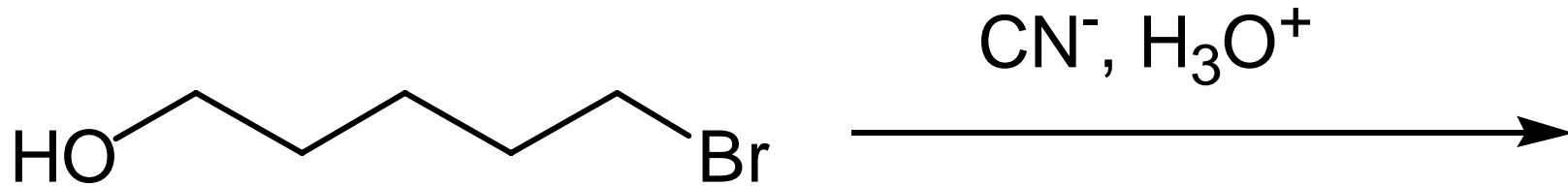


給出試劑即反應條件:



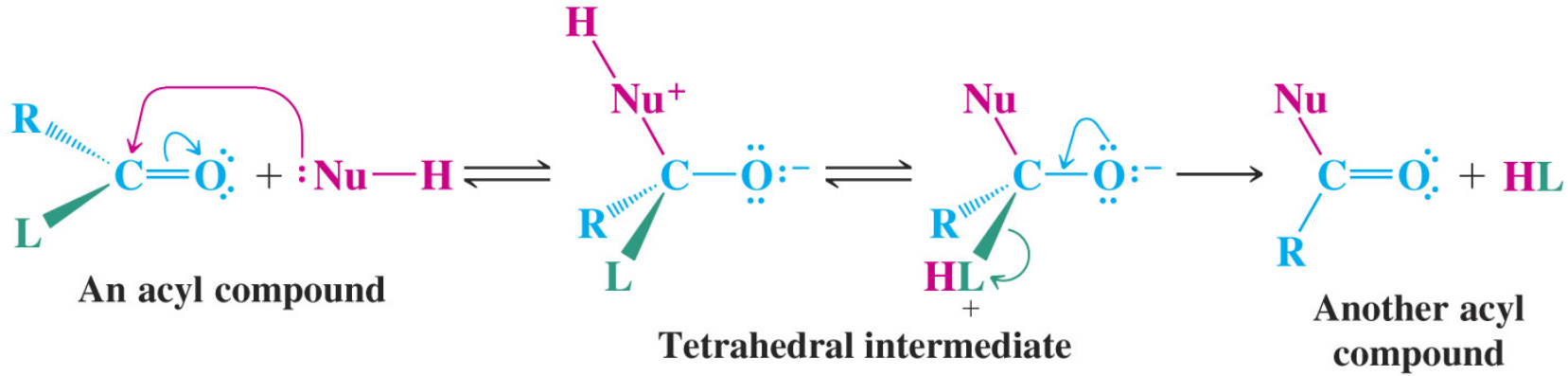
用Grignard反應合成下列化合物：





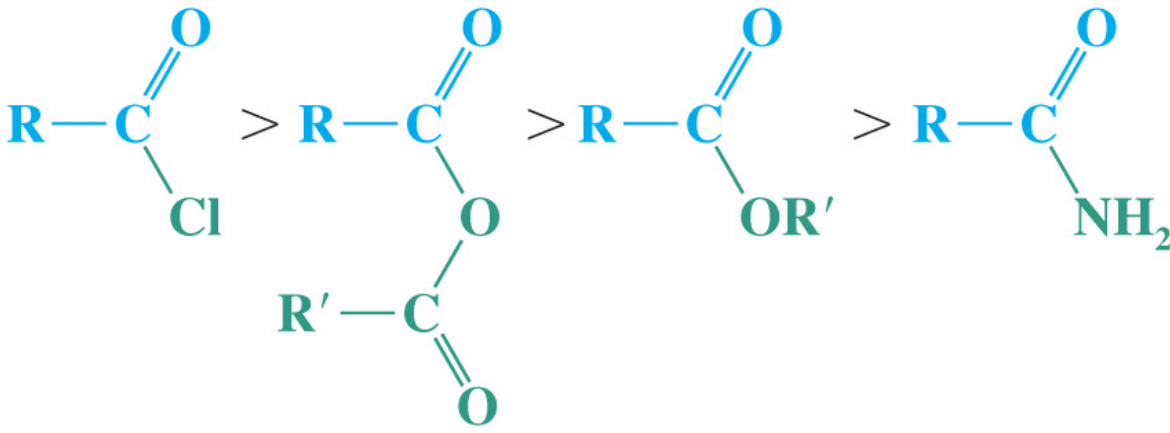
解釋

### 3) 羧酸衍生物的nucleophilic addition反應



Nucleophilic addition

Elimination



Acyl chloride

Acid anhydride

Ester

Amide