carboxylic acid

PHYSICAL PROPERTIES
- ↑ bp ∵ H-bonds (higher than alcohols)
- soluble in H_2O ∵ C=O, O–H
- C↑, solubility↓

FORMATION OF C. ACIDS
- oxidation of 1° alcohols ($K_2Cr_2O_7$, heat)
- oxidation of aldehydes ($K_2Cr_2O_7$, heat)
- oxidation of alkenes ($KMnO_4 + H_2SO_4(aq)$, heat)
- Hydrolysis of nitriles → ($HCl(aq)/H_2SO_4(aq)$, heat)
  → ($NaOH(aq)$, followed by $HCl(aq)$, heat)

REACTIONS OF C. ACIDS.
- carboxyl group = $-\overset{O}{\overset{\|}{C}}-$ (carbonyl) + $-OH$ (hydroxyl)
- weak acids, partially dissociate in H_2O
- $CH_3COOH + H_2O \rightleftharpoons CH_3COO^- + H_3O^+$
- $-\overset{O}{\overset{\|}{C}}-O^-$ carboxylate ion (H^+ removed)
- undergoes all "normal" acid reactions.

CARBOXYLIC ACIDS W/ ALCOHOLS
- form esters through condensation reactions
  ↳ addition the elimination
- acid catalyzed & reversible.
- $R-\overset{O}{\overset{\|}{C}}-OH + R'-\ddot{O}H \underset{heat}{\overset{conc.\ H_2SO_4}{\rightleftharpoons}} R-\overset{O}{\overset{\|}{C}}-OR' + H_2O$
- reagent: alcohol
- conditions: heat, H_2SO_4 conc. catalyst.

C. ACIDS W/ LITHIUM ALUMINIUM HYDRIDE
- reduces c. acids to 1° alcohols
- water added at the end to destroy remaining $LiAlH_4$
- $R-\overset{O}{\overset{\|}{C}}-OH \xrightarrow[2.\ H_3O^+]{1.\ LiAlH_4 \text{ in dry ether}} RCH_2OH$

C. ACIDS W/ Na_2CO_3 & $NaHCO_3$
- $2CH_3COOH + Na_2CO_3 \rightarrow 2CH_3COONa + H_2O + CO_2$
- $CH_3COOH + NaHCO_3 \rightarrow CH_3COONa + H_2O + CO_2$
- reagent: sodium carbonate/ sodium hydrogencarbonate
- conditions: room temp
- effervescence.

C. ACIDS W/ PHOSPHORUS PENTACHLORIDE
- produces steamy fumes of HCl
- reacts w/ –OH group.
- $R-\overset{O}{\overset{\|}{C}}-OH + PCl_5 \rightarrow R-\overset{O}{\overset{\|}{C}}-Cl + POCl_3 + HCl$ (steamy fumes)
  (lose OH; lose 2 Cl; gain Cl; gain O; H + Cl)
- reagent: phosphorus (V) chloride
- conditions: room temperature.

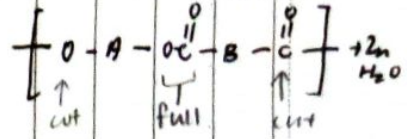
OR

- $3\,CH_3C(=O)OH + PCl_3 \rightarrow 3\,CH_3C(=O)Cl + H_3PO_3$
- less vigorous, no fumes

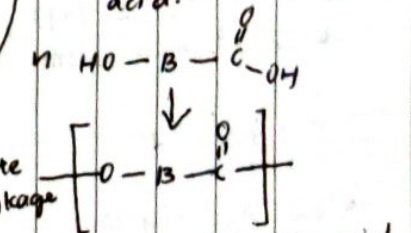
OR

- $CH_3C(=O)OH + SOCl_2 \rightarrow CH_3C(=O)Cl + SO_2\,(g) + HCl\,(g)$
  * like alcohol, lose –OH, gain Cl
  * C. acid 加 Cl 氯

POLYESTERS
- diol + dicarboxylic acid
- eg. Terylene → wash & wear garments.
- 2 monomer ⇒ diol + dicarboxylic acid.



- 1 monomer ⇒ hydroxycarboxylic acid.



↳ eg polylactic acid.

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DATE