SCH4U

Organic Chemistry

hydrocarbon derivatives

MITCHELL KEMBER

(Family Name) (General Formula)

NAMING **Note:** *penta* can be replaced by *meth/eth/prop/but/…*
stands for a number from the chain

EXAMPLE (IUPAC name) (IUPAC name)

(structural diagram) (structural diagram)

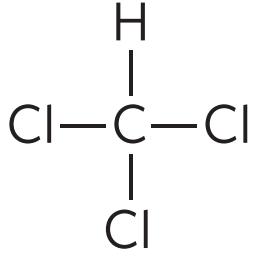
PHYSICAL (Something about polarity)
Note: Polar → higher boiling point & more soluble in water

CHEMICAL *Reaction Type*: (preparation reaction)
Reaction Type: (reaction)

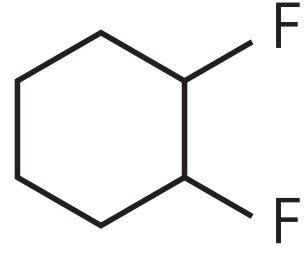
Organic Halides R—X

NAMING Just like alkyl groups (**F** fluoro, **Cl** chloro, **Br** bromo, **I** idodo).

EXAMPLE trichloromethane



1,2-difluorocyclohexane



PHYSICAL More polar than HCs due to halogen electronegativity.

CHEMICAL *Halogenation*: alkene/alkyne + halogen → alkyl halide
Elimination: alkyl halide + OH^- → alkene + H_2O + halide ion
Amine synthesis: alkyl halide + NH_3 → amine + halide

Alcohols R—OH

NAMING #-penta**nol** or #,#-pentane**diol**, …
(polyalcohol)
is location of OH
(hydroxyl group)

EXAMPLE ethanol CH_3CH_2OH 1-propanol $CH_3CH_2CH_2OH$

DEGREE **1°** $-CH_2-OH$ **2°** $-\underset{|}{CH}-OH$ **3°** $-\underset{|}{\overset{|}{C}}-OH$

PHYSICAL Much more polar than HCs and forms hydrogen bonds due to hydroxyl group. Dissolves polar & nonpolar compounds.

CHEMICAL Elimination: alcohol → alkene + H_2O
Oxidation: alcohol + (O)* → aldehyde/ketone + H_2O
Condensation: alcohol + alcohol → ether + H_2O

Ethers

R—O—R′

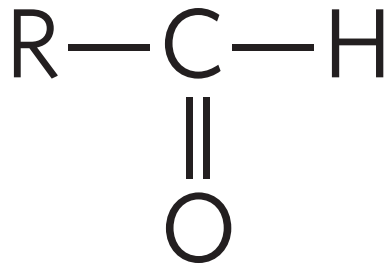
NAMING eth**oxy**pentane (smallest first) or methyl ethyl **ether** (non-systematic) or **di**pentyl **ether** (R and R′ are same)

EXAMPLE methoxymethane (dimethyl ether) $CH_3—O—CH_3$
methoxyethane (methyl ethyl ether) $CH_3—O—CH_2CH_3$

PHYSICAL More polar than HCs but less than alcohols. No hydrogen bonding. Mixes readily with polar & nonpolar substances.

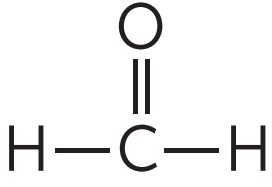
CHEMICAL *Condensation*: see alcohols

Aldehydes

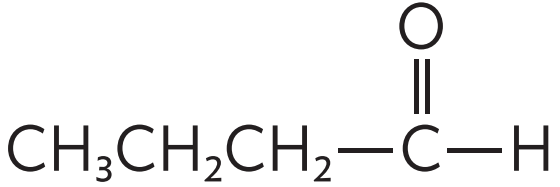


NAMING penta**nal** (prefix includes R and C)

EXAMPLE methanal



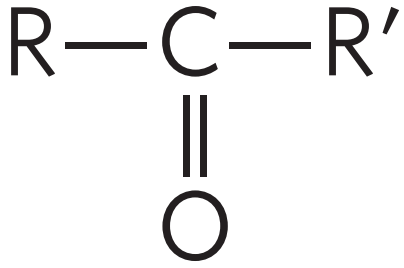
butanal



PHYSICAL More polar than HCs due to carbonyl =C=O, but less polar than alcohols. No hydrogen bonding.

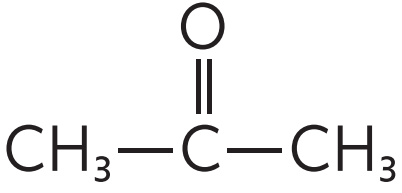
CHEMICAL *Oxidation*: see primary (1º) alcohols
Oxidation: aldehyde + (O)* → carboxylic acid
Hydrogenation: aldehyde + hydrogen → 1º alcohol

Ketones

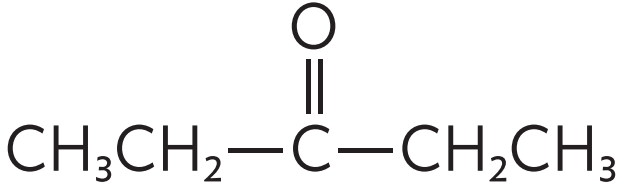


NAMING #-penta**none** (prefix includes R, C, and R′)

EXAMPLE propanone



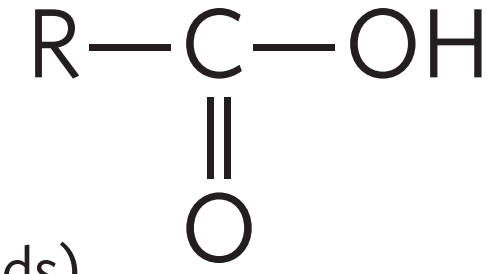
3-pentanone



PHYSICAL Same as aldehydes.

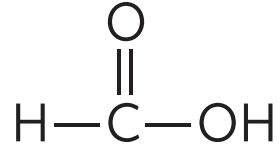
CHEMICAL *Oxidation*: see secondary (2º) alcohols
Hydrogenation: ketone + hydrogen → 2º alcohol

Carboxylic Acids

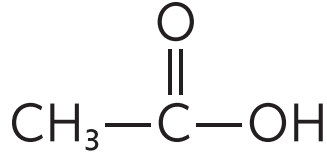


NAMING penta**noic acid** (prefix includes R and C)
or penta<u>ne</u>**dioic acid** (carboxyl at both ends)

EXAMPLE methanoic acid



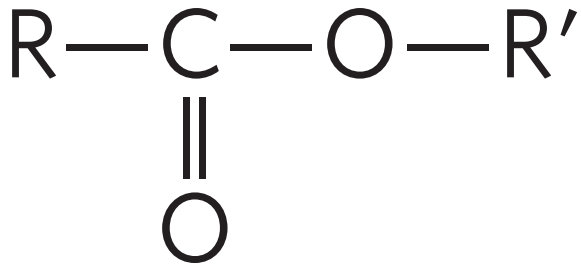
ethanoic acid (acetic acid)



PHYSICAL Polarity and hydrogen bonding similar to alcohols due to the carboxyl group —COOH (carbonyl + hydroxyl).

CHEMICAL *Oxidation*: see aldehydes
Condensation: carboxylic acid + alcohol → ester + H_2O
Condensation: carboxylic acid + amine → amide + H_2O

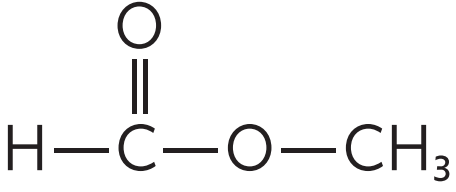
Esters



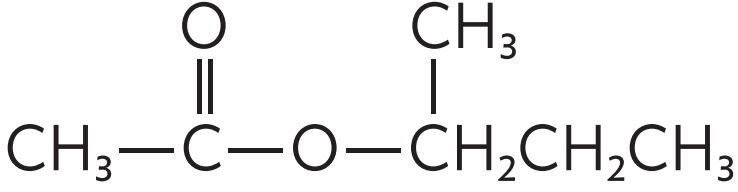
NAMING pentyl penta**noate**

R′ R and C

EXAMPLE methyl methanoate



1-methylpropyl ethanoate

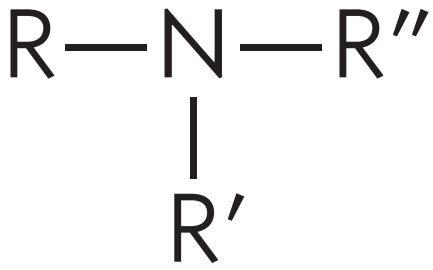


PHYSICAL Less polar than carboxylic acids. No hydrogen bonding.

CHEMICAL *Condensation*: see carboxylic acids

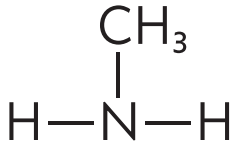
Hydrolosis: ester + H_2O → carboxylic acid + alcohol

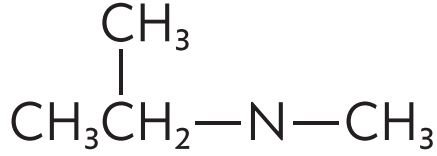
Amines



NAMING Just like alkyl groups (**NH_2** amino), *N* as # or pentyl**amine** (non-systematic)

EXAMPLE aminomethane (methylamine) *N,N*-dimethylaminoethane





DEGREE **1º** $-NH_2$ **2º** $-NH-$ **3º** $-N-$

PHYSICAL More polar than HCs due to N—C and N—H bonds, but less polar than alcohols. Often has an unpleasant odour.

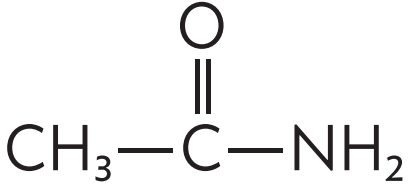
CHEMICAL Condensation: 1º amine + alkyl halide → 2º amine + halide

Amides

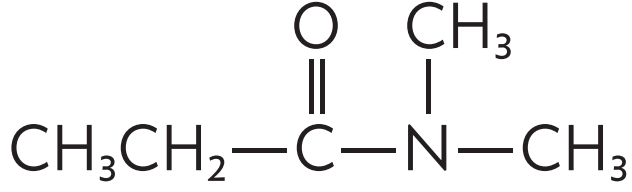
NAMING *N*-butyl-*N*-pentyl penta**namide**

R′ R″ R and C

EXAMPLE ethanamide



N,N-dimethyl propanamide



PHYSICAL Weak bases, generally insoluble in water. Amides with two N—H bonds are more polar.

CHEMICAL *Condensation*: see carboxylic acids

Hydrolosis: amide + H_2O → carboxylic acid + amine

Reaction Classification

- Addition
  - Hydrogenation
  - Halogenation
  - Hydrohalogenation
  - Hydration
    - Hydrolosis
      - Saponification
- Elimination
  - Dehydration
    - Condensation
      - Esterification
- Substitution
- Oxidation
  - Combustion

See the flowchart on page 83 of the textbook.

GOOD LUCK on the test on **Tuesday**, 10 December 2013.