INTERMOLECULAR FORCES

1) HYDROGEN BONDING

\[ X - H \cdots \cdot X \quad x = N, O, F \]

\[ \text{H}_2\text{O} - \text{H} \cdots \cdot \text{O} - \text{H} \]
2) DIPOLE - DIPOLE
3) van der Waals
Higher boiling?

\[ \text{CH}_3\text{CH}_2\text{OH} \]

\[ \text{CH}_3\text{OCCH}_3 \]

\[ \text{X-H} \cdots \text{X} \]

\[ \text{CH}_3\text{CH}_2\text{OH} \cdots \text{CH}_3\text{CH}_3 \]

H-bonding

higher boiling

\[ 78^\circ \text{C} \]

dipole-dipole

\[ -25^\circ \text{C} \]
SOLUBILITY

LIKE DISSOLVES LIKE

H-bonding

\[
\begin{align*}
\text{CH}_3 - \text{O} - \text{H} & \quad \text{H-bonding} \\
\text{H} - \text{O} - \text{H} & \quad \text{H-bonding} \\
\text{O} - \text{H} - \text{H} & \quad \text{H-bonding} \\
\text{CH}_3 - \text{O} - \text{H} & \quad \text{H-bonding}
\end{align*}
\]
H-bonding

van der Waals

not soluble
**FUNCTIONAL GROUPS**

**ALKANES**

$\text{CH}_4$

**ALKENES**

$\text{H-C=C-H}$

**ALKYNES**

$\text{H-C≡C-CH}_3$
ALCOHOLS

\[ \text{CH}_3\text{-O\text{-H}} \quad R\text{-OH} \]

ETHER

\[ \text{CH}_3\text{-O\text{-CH}_3} \quad R\text{-O\text{-R}'} \]

\[ R, R' = \text{alkyl or aryl} \]
**ALDEHYDES**

\[
\begin{align*}
&\text{CH}_3 - \text{C} = \text{H} \\
&\text{H} - \text{C} = \text{H}
\end{align*}
\]

**KETONES**

\[
\begin{align*}
&\text{CH}_3 - \text{C} - \text{CH}_3 \\
&\text{R} - \text{C} - \text{R}^1
\end{align*}
\]
Carboxylic Acids

\[ CH_3-C-OH \]

\[ R-C-OH \]

Acid Chlorides

\[ CH_3-C-Cl \]

\[ R-C-Cl \]
ESTERS

\[ \text{CH}_3\text{C} = \text{O} - \text{CH}_3 \]

\[ \text{O} \]

\[ \text{R} = \text{O} - \text{O} - \text{R}' \]

\( R' = \text{alkyl} \)

\( R = \text{H}, \text{alkyl, aryl} \)
**Amides**

$$\text{CH}_3-O-N\text{CH}_3$$

$$\text{R-C-N-R}''$$

**Amines**

$$\text{CH}_3-N\text{CH}_3$$

$$\text{R-N-R}''$$
HYDROCARBONS

ALIPHATIC, AROMATIC, ALKENES
(=alkane)

COUNT TO 10

1. CH₄  METHANE
2. CH₃CH₃  ETHANE
3. CH₃CH₂CH₃  PROPAINE
4. CH₃CH(CH₃)CH₃  n-BUTANE
5. CH₃(CH₂)₃CH₃  n-PENTANE
6. CH₃(CH₂)₄CH₃  n-HEXANE
7. CH₃(CH₂)₅CH₃  n-HEPTANE
8. CH₃(CH₂)₆CH₃  n-OCTANE
9. CH₃(CH₂)₇CH₃  n-NONANE
10. CH₃(CH₂)₈CH₃  n-DECANE
-CH₂CH₂CH₃
  n-propyl

-CH₂CH₂CH₂CH₂CH₃
  n-butane

CH₃–C–CH₃
  iso-butane

CH₃–C–CH₃
  iso-propyl

CH₃–C–CH₃
  iso-propyl chloride

CH₃–C–CH₃
  iso-propyl
-CH₂CH₂CH₂CH₃
n-butyl

CH₃
CH₃-C-H

iso-butyl

Seh-CH₂CH₃
sec-butyl

CH₃
CH₃-C-

CH₃

tert-butyl
t-butyl
REACTIONS OF ALKANES

1) COMBUSTION

\[ \text{CH}_4 + 2\text{O}_2 \rightarrow \text{CO}_2 + 2\text{H}_2\text{O} \]

2) CRACKING

\[ \text{H}_3\text{C}-\text{C}-(\text{H}-\text{C}-\text{H}) \xrightarrow{\text{Pd or Pt, high temp.}} \text{H}_3\text{C}-\text{H} \]
3) HALOGENATION

\[ \text{H}_{2} - \text{C} - \text{H} + \text{Br} - \text{Br} \xrightarrow{\text{hv}} \text{H}_{2} - \text{C} - \text{Br} - \text{H} - \text{Br} \]
one conformation
NEWMAN PROJECTION

H - C - C - H

STERIC HINDRANCE LESS

STAGGERED

ECLIPSED