# relative IMF / VP / BP

review : organic chem

- alcohol — ROH ; R = hydrocarbon
  ether — ROR' (R has only H & C)

| # C |
|---|
| 1 |
| 2 |
| 3 |
| 4 |
| 5 |
| 6 |

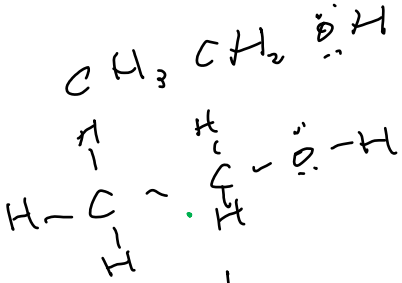
- meth ane
  eth ane
  prop ane
  but ane
  pent ane
  hex
  etc

identify relative VP / BP

Rule 1 : cpd with similar polarizability

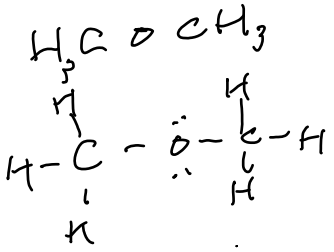
H-bond IMF > dipole-dipole IMF > London IMF

ex $C_2H_5OH$

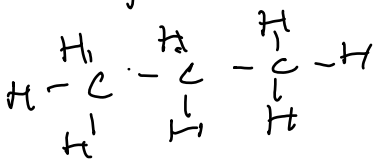


strong IMF → hard to separate liquid molecule → hard to boil; hard to evaporate → low VP

$H_3C-O-CH_3$



$C_3H_8$ $CH_3CH_2CH_3$



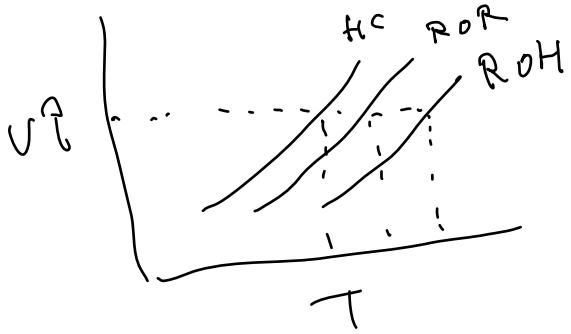
weak IMF → easy to separate liquid molecule → easy to boil; easy to evaporate → high VP

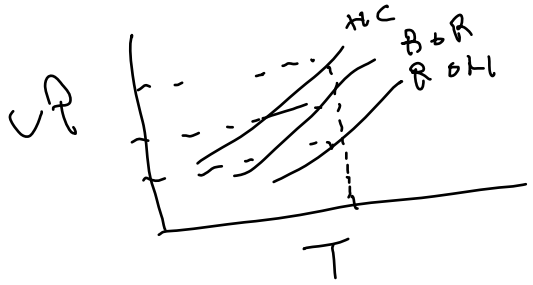
high BP (ROH)

↓ VP

low BP (HCl)

high VP



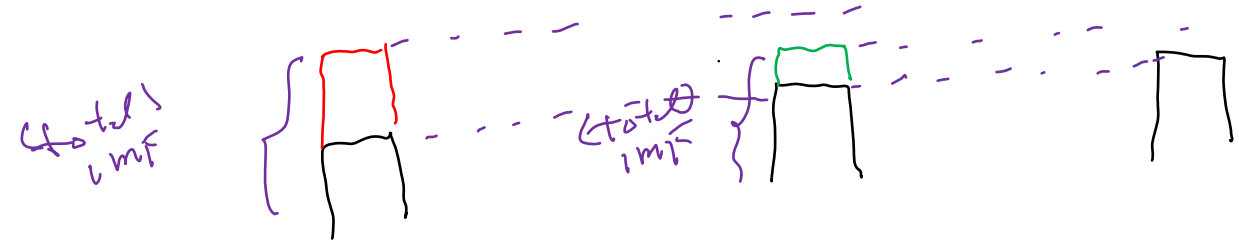




note:

ROH

ROR

HC




— London IMF

~ dipole-dipole IMF

— H-bond IMF

case 2: for nonpolar (or polar) cpd

↑ # $e^-$ : ↑ polarizability → ↑ London IMF strength

ex 1

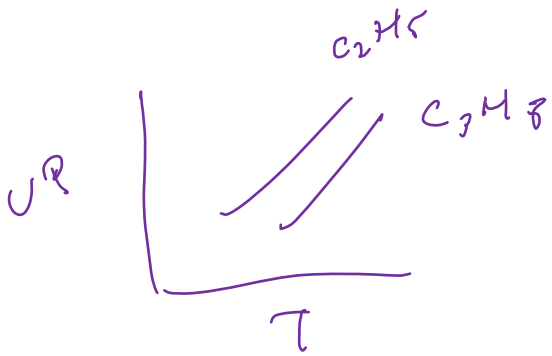
$C_2H_6$ vs $C_3H_8$

polarizability or strength of London IMF: low

high

→ high BP

low VP



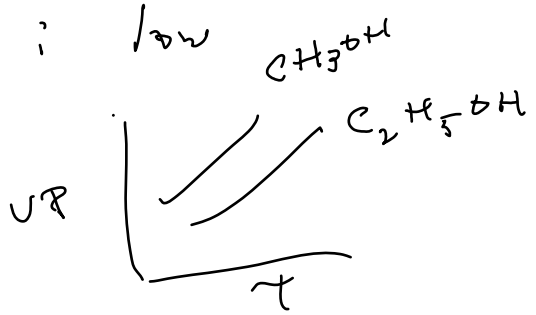
ex 2

H bond Imf : $CH_3OH$ yes $C_2H_5OH$ yes

polarizability

strength of London Imf : low

high → ↓ VP ↑ BP




MeOH EtOH

— London Imf

— H bond Imf

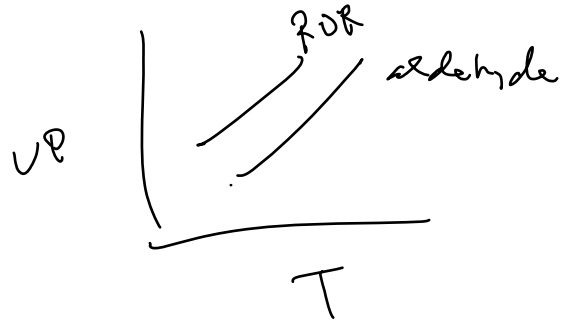
Case 3 for polar cpd with similar polarizability

↑ polarity = ↑ dipole moment → ↑ dipole dipole Imf strength

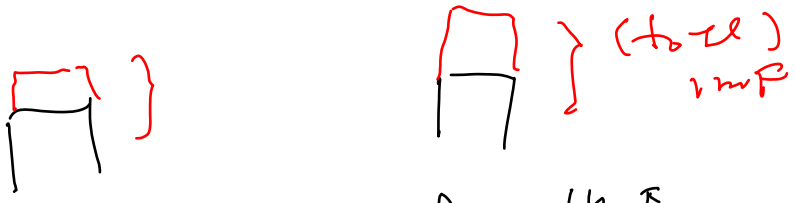
ex $CH_3OCH$ (ether) $\mu = 1.3$ D (less polar) ↓ weaker Imf ↓ easy to evaporate ↓ ↑ VP

$CH_3CHO$ (aldehyde) $\mu = 2.7$ D (more polar)

$H-\overset{O}{\overset{\|}{C}}-R$



ether aldehyde



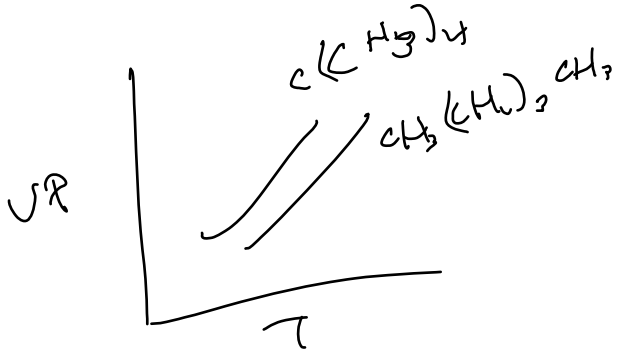

~ London IMF

~ dipole dipole IMF

Case 4 shape : ↑ surface area → ↑ IMF

and similar polarizability

ex $CH_3(CH_2)_3CH_3$ ↔ isomers → $H_3C-C(CH_3)_2-CH_3$




smaller SA

∴ ↑ VP ← ← weaker IMF

In the case, it was not ambiguous.

Given relative VP or/and BP, distance relative IMF

Case 1 $H_2O$ vs $NH_3$

H bond IMF: yes yes

polarizability: 18 17 ~ similar

($\#e^-$)

total IMF ?

BP: 100°C > −33°C

$H_2O$ $NH_3$

given:

find relative IMF

$H_2O$ $NH_3$

total IMF

~ London IMF ~ H bond IMF

case b

HCl vs HBr

low high

high low

?

same e⁻ : polarity : total IMF

given BP : HCl < HBr

for relative IMF : total # components

HCl HBr

total IMF

total IMF

~ London IMF

same : London : HCl < HBr

dipole : HCl > HBr

dipole IMF : HCl ≈ HBr b/c BP : HCl < HBr

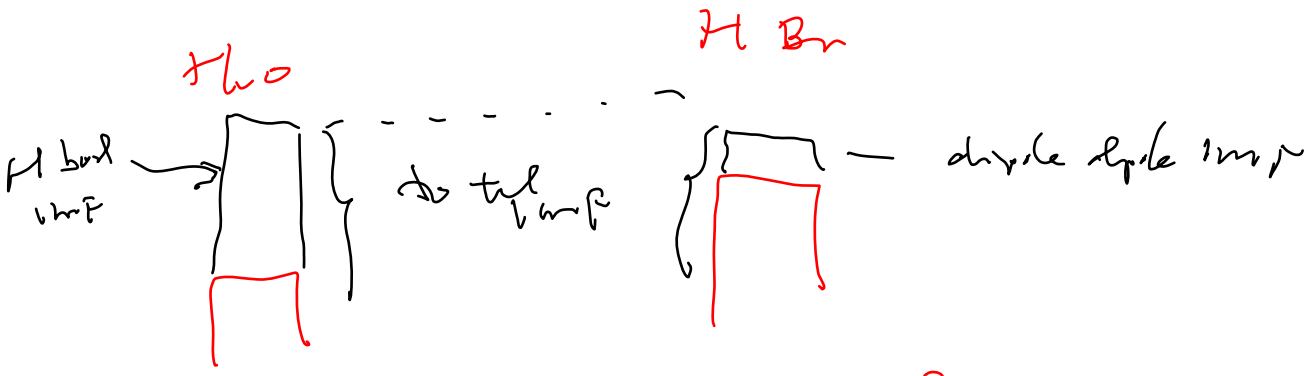
total IMF

i.e. I° due to London IMF

case 2

$H_2O$ vs HBr

given: BP: $H_2O$ > HBr, ss




— London imf
~ dipole-dipole

total IMF: $H_2O$ > HBr b/c
BP: $H_2O$ > HBr
where London imf
HBr > $H_2O$

H bond imf in $H_2O$ > dipole dipole imf in HBr,

where total IMF ($H_2O$) > total IMF (HBr)
based on BP: $H_2O$ > HBr