3) London Dispersion force

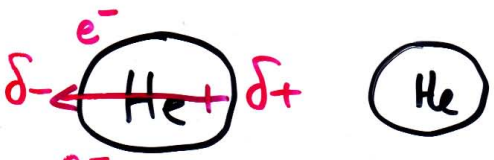
- Every molecule has this one.
- the more e⁻s = the greater the force!

How?

ex: $^{4}_{2}He$

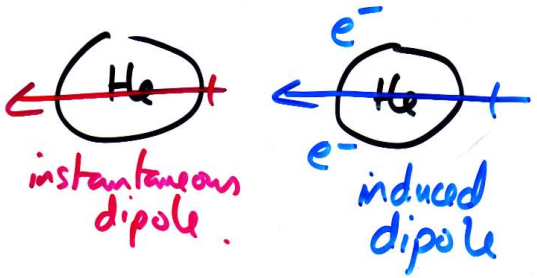
d-d ✗
ion-d ✗
London ✓

every now + again ... more e⁻s might be found on one side over the other.



instantaneous dipole

will induce a dipole on other atom.



instantaneous dipole.

induced dipole

which leads to an attraction!

London Dispersion force.

- e⁻s keep moving ... leading to disappearing (+ reappearing) dipoles ... which are always attractive.

@ Room temp: (gasoline) (wax)

methane octane

$CH_4(g)$ $C_8H_{18}(\ell)$ $C_{20}H_{42}(s)$

$10e^-$ $66e^-$ $162e^-$

as #e⁻ ↑ → London force ↑

$g \rightarrow \ell \rightarrow s$

London force, is very strong (dominating?) for large molecules.

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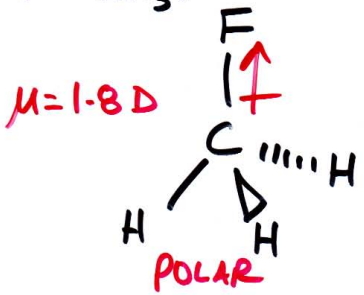
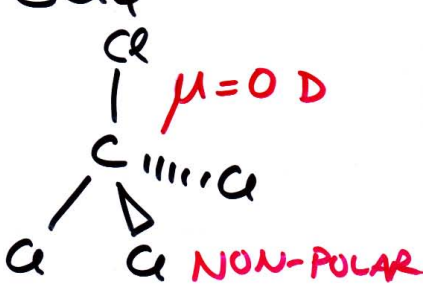
ex: CH_3F



CCl_4



CH_3F (18e⁻s) IMFs CCl_4 (74e⁻s)

d-d London

more IMFs stronger .. ?

≠

weaker IMFs ?

bp = −78.4°C

⇒ Weaker IMF

bp = +76.5°C

higher bp ⇒ needs more E to boil

⇒ Stronger IMF

But, London ∝ #e⁻s!

The Hydrogen Bond

(very important Biologically)

need 2 things for an H-Bond

DONOR ACCEPTOR

N—H ····· :N—

OR

O—H ····· :O—

OR

F—H ····· :F—

ex