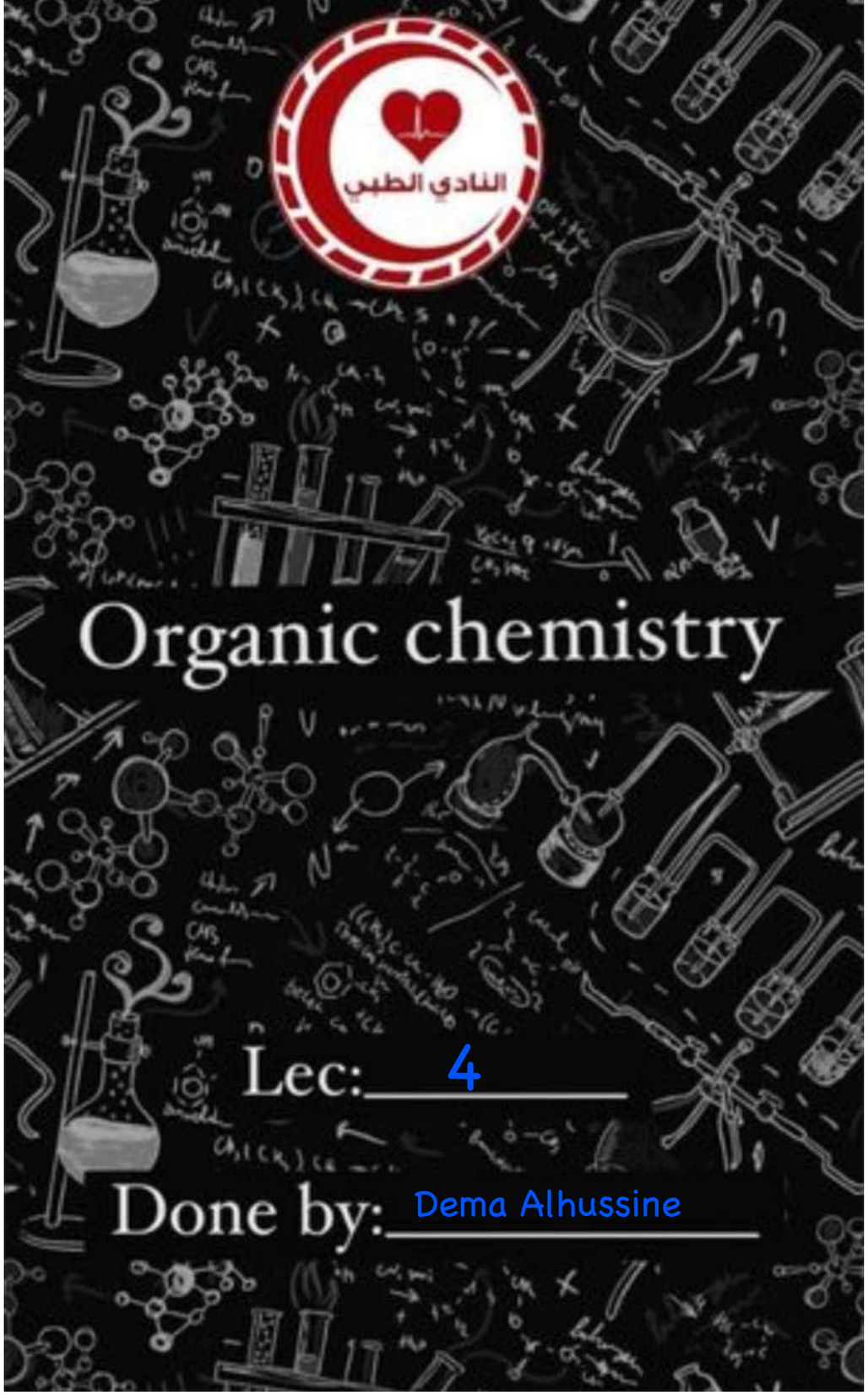
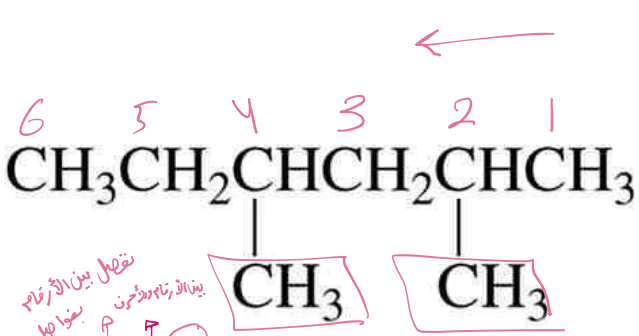

النادي الطبي
Organic chemistry
Lec: 4
Done by: Dema Alhussine

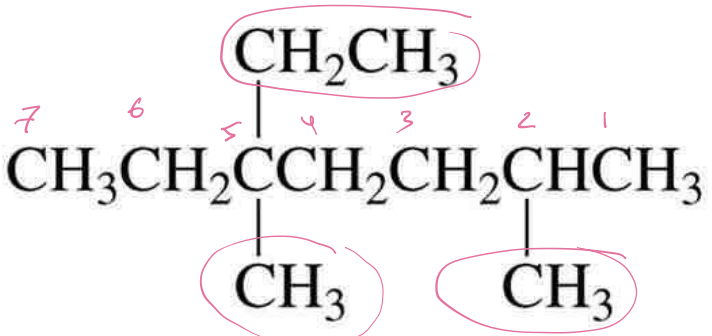
Examples:

Note 1: *di-*, *tri-*, and *tetra-* are used for the same **Multiple** Substituents

Note 2: Substituents are listed in alphabetical order.
(di, tri, tetra, *sec*, *tert* are not alphabetized)

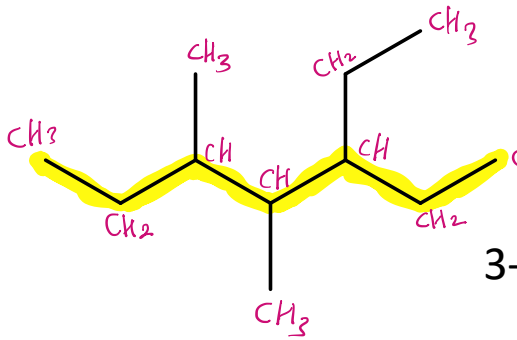


2,4-dimethylhexane

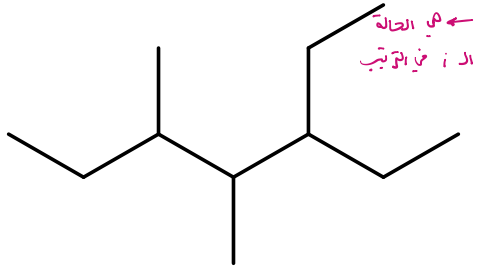


5-ethyl-2,5-dimethylheptane

numbers are separated by a comma;
a number and a word are separated by a hyphen

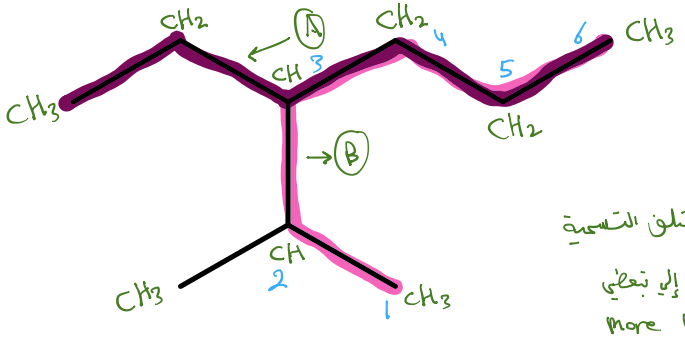


3-ethyl-4,5-dimethylheptane



Examples

هون بعين إلى اليسار / أو اليسار إلى اليمين ما حتفرق هون

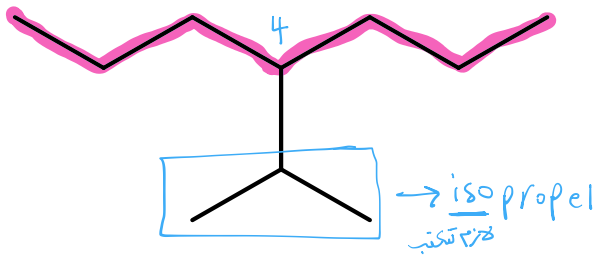


2 longer chain فيه عندي

بس في كل 2 chain تختلف التسمية

في هاي الحالة نختار ال chain إلي بتعطي more branches

3-ethyl-2-methylhexane وفي هذا المثال Chain (B) ←

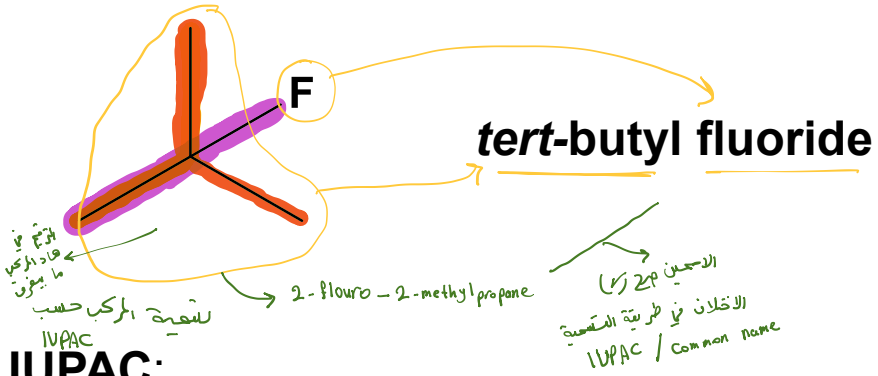


4-isopropylheptane

2.4: Alkyl and Halogen Substituents (R-X)

Common name : Alkyl halide

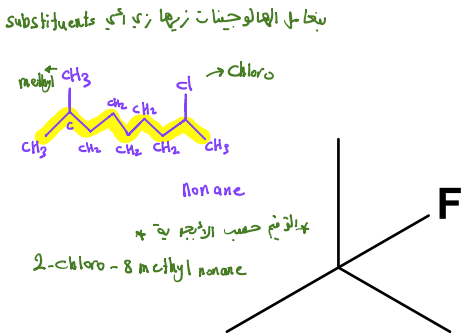
eg. CH_3CH_2Br Ethyl bromide



IUPAC:

Halogen substituents are named by changing the *-ine* ending of the element to *-o*.

F: fluoro Cl: chloro Br: bromo I: iodo-



2-fluoro-2-methylpropane

Sources of Hydrocarbons

Hydrocarbons are found in crude oil and natural gas. Both are mixtures of different hydrocarbons and they are separated by “fractional distillation” a process where the different compounds are separated in a long distilling column based on their boiling points. Heavy fractions can be “cracked” into small lighter, hydrocarbons using heat and/or catalysts.

2.7: Physical Properties of Alkanes and Nonbonding Intermolecular Interactions

A physical property is any property of matter or energy that can be measured. When it changes, the chemical composition of the object does not change

density
Solubility
boiling point
melting point

***Alkanes** are insoluble in water.* This is because water molecules are *polar,* whereas alkanes are *nonpolar* (Like dissolves like: Polar/ionic solvents **dissolve** polar/ionic solutes and non-polar solvents **dissolve** non-polar solutes)

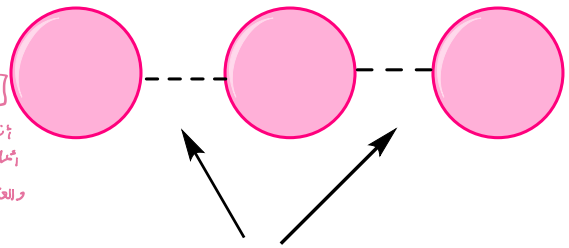
Solute → polar
Solvent ← polar

Solute → non polar
Solvent → non polar

***Alkanes** have lower boiling points for a given molecular weight than most other organic compounds.* This is because they are nonpolar molecules.

The physical properties of molecules are in part dependent on the type's of intermolecular forces (IMF) present.

Boiling point: The temperature at which the vapor pressure becomes equilibrium with the external pressure



attraction

Intermolecular Forces

chapter كل في بلزما 2/
physical property عن نحكي لما

The physical properties of molecules are in part dependent on the type's of intermolecular forces (IMF) present.

Boiling points (BP) are also dependent on the **mass of the molecule.**

Solubility, the ability to dissolve into a solvent is dependent on IMFs.

The strength of the interaction between molecules is also dependent on the **overall shape** of the molecule.

Intermolecular Forces

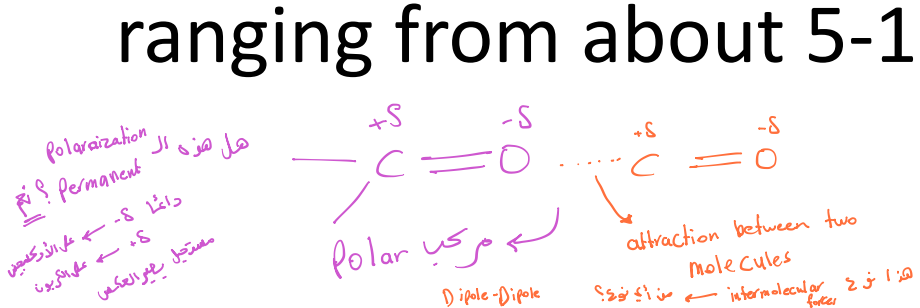
There are 3 types of IMFs, by decreasing strength they are:

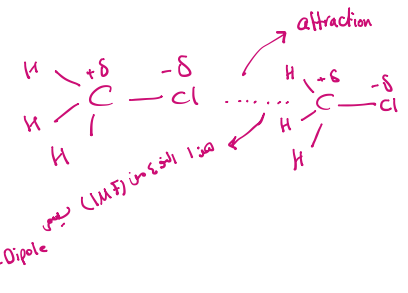
1) Hydrogen bonding (2)
2) Dipole-dipole (1)
3) Van der Waals or London Dispersion (3)

Dipole-dipole

Dipole-dipole forces arise from the attraction of oppositely charged atoms (other than H) in molecules. These molecules may have a **permanent** dipole moment. Generally in organic molecules they results from the presence of C-X bonds where X is more electronegative that C.

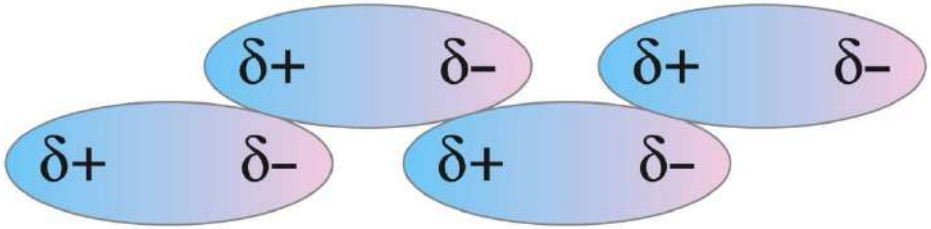
These are generally weaker than H-bonding, ranging from about 5-10 kJ/mol.

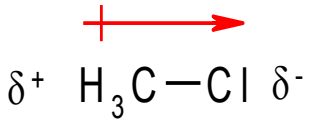


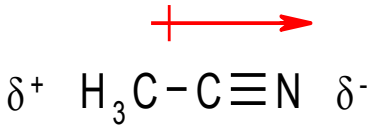


Dipole-dipole

ممكن تكون بين 2 molecule مختلفين (بس مش بهم) ما بهمين







Hydrogen Bonding

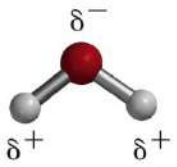
Hydrogen bonding is a complex interaction that includes dipole-dipole, as well as orbital interactions and the transfer of electron density between molecules.

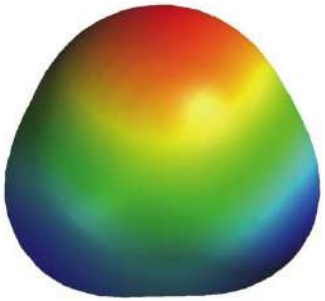
These are the strongest of the IMFs and range from 5 – 25 kJ/mol

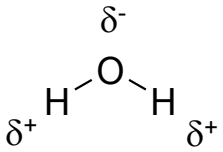
Hydrogen Bonding

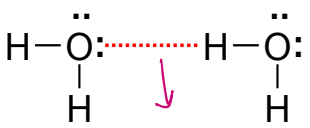
Occur primarily between OH, NH and FH. The more EN the atom the stronger the interaction. (The atom H is attached to usually has a lone pair of e^-)

Geometry: X-H ----:X-



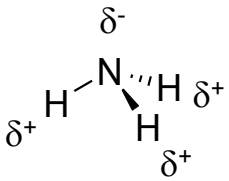


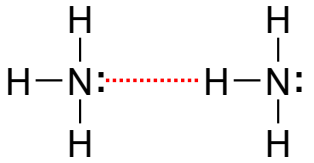


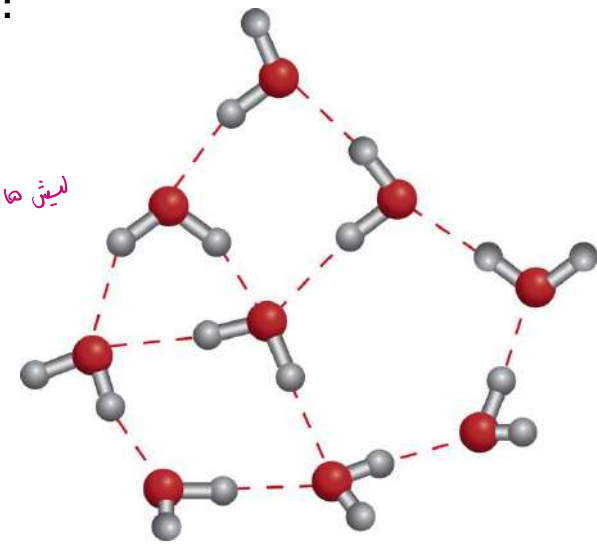


Hydrogen bonding

high electronegativity ← N,O,F بعرفهم إنهم ليش هاي الرابطة أقوى؟ لأنه

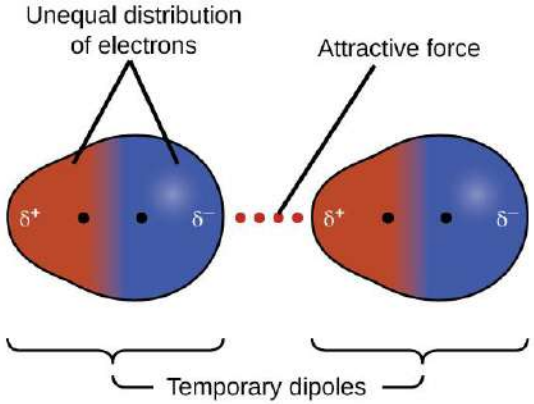






Van der Waals (dispersion)

Van der Waals or (London) ***dispersion*** forces arise from the movement of electrons within a molecule. This natural motion can produce an uneven distribution of the electrons (polarization of the distribution) resulting in a **temporary dipole moment** in the molecule. This will induce the movement of electrons in adjacent molecules producing a dipole moment in them. These "induced" dipole moments are very brief as they disappear when the electrons move to new locations within the molecule, so they forces are very brief and weak, only 2-5 kJ/mol.

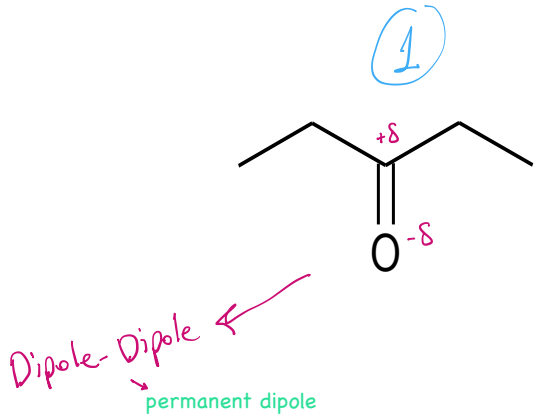


Very Weak attraction

London dispersion, < dipole-dipole, < Hydrogen bonding

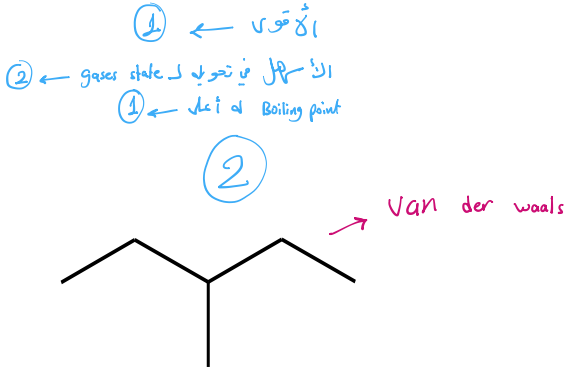
Effects on Physical Properties (cont'd)

Dipole forces: much strong IMFs so the BP is higher when dipole-dipole interactions are present, i.e.



mass = 86 amu
BP = 101.7 °C

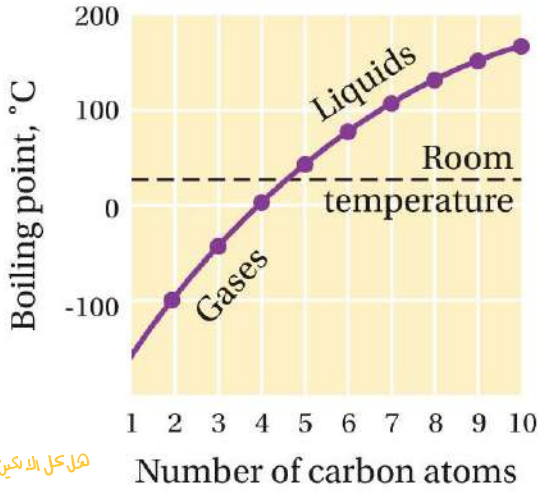
Boiling point



mass = 86 amu
BP = 63.3 °C

مثبت عامل ر/ يحكي عنه بعدين

Alkanes: no H-bonding or dipole moment (C & H have nearly the same EN ∴ not polar).



Name	Formula	Boiling point, °C
pentane	$CH_3CH_2CH_2CH_2CH_3$	36
2-methylbutane (isopentane)	$CH_3CHCH_2CH_3$ (with CH_3 branch)	28
2,2-dimethyl-propane (neopentane)	$C(CH_3)_4$	10

- Boiling point for alkanes increases with increasing size (mass)
- Boiling point for alkanes decreases with increasing branching

Example:

$CH_3CH_2CH_2CH_3$

n-butane, O° C

CH_3CHCH_3 (CH_3 branch)

Isobutane , -12° C

$CH_3CH_2CH_2CH_2CH_3$

n-pentane, 36°C

$CH_3CHCH_2CH_3$ (CH_3 branch)

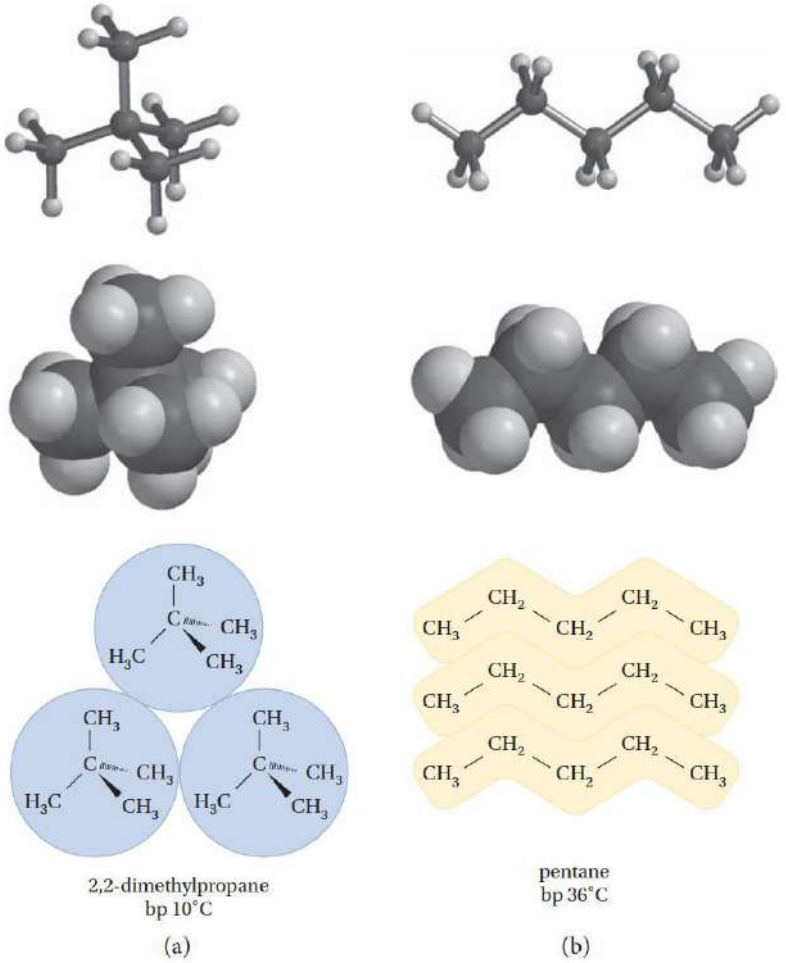
Isopentane, 28°C

$C(CH_3)_4$

Neopentane,9.5°C

Structural Effects on IMFs

The strength of the IMFs depend on the amount of contact between the molecules, especially for dispersion forces. Hence the shape of the molecule can affect the **surface area of contact,** long thin molecules have more surface in contact than spherical molecules.



11-3-2024 Monday