



Organic chemistry

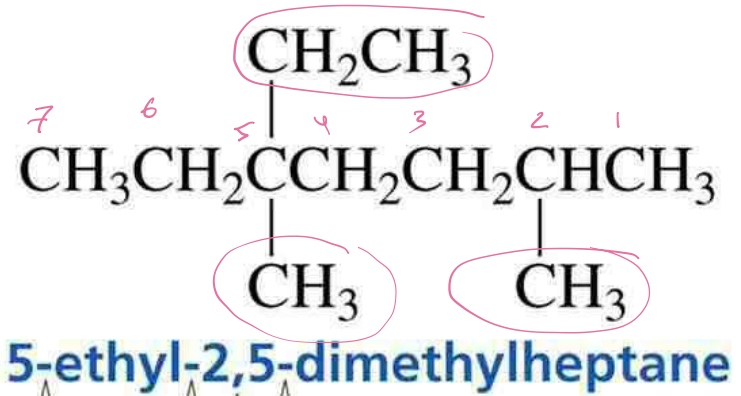
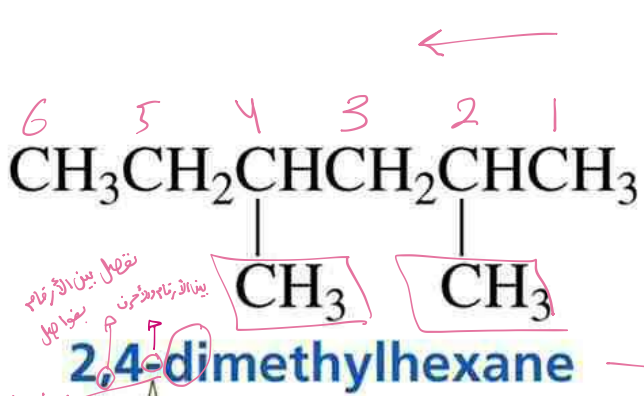
Lec: 4

Done by: Dema Alhussine

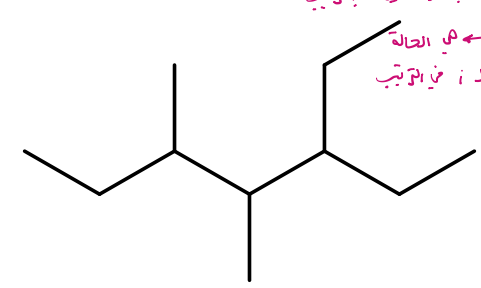
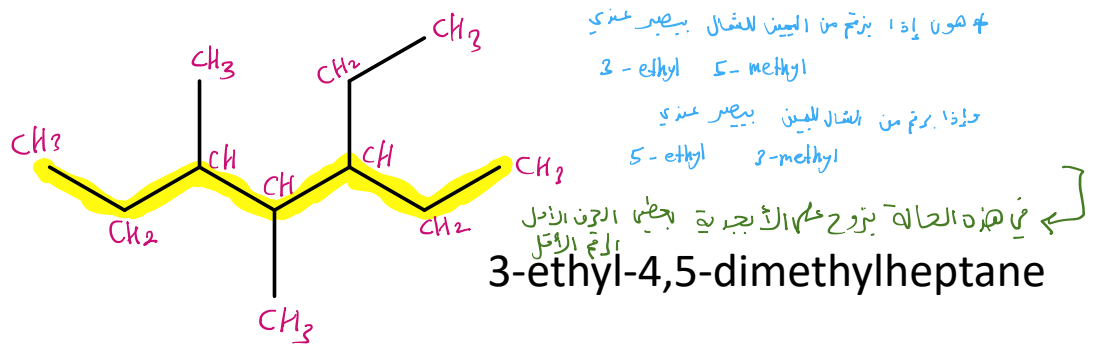
Examples:

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

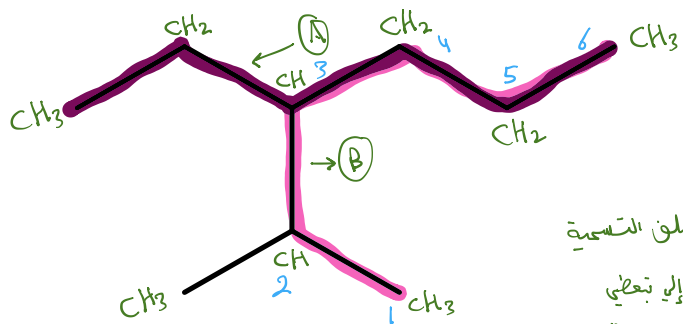
Note 2: Substituents are listed in **alphabetical order**.
(*di*, *tri*, *tetra*, *sec*, *tert* are not alphabetized)



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



Examples

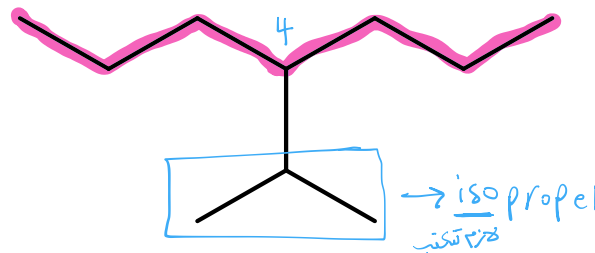


في عندي 2 longest chain

بس في كل chain 2 تخلق التسمية
فيها الحالة نضار ال chain الي تعطي
more branches

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

هون يبين الي اليسار / او اليمين ما حترق هون
←



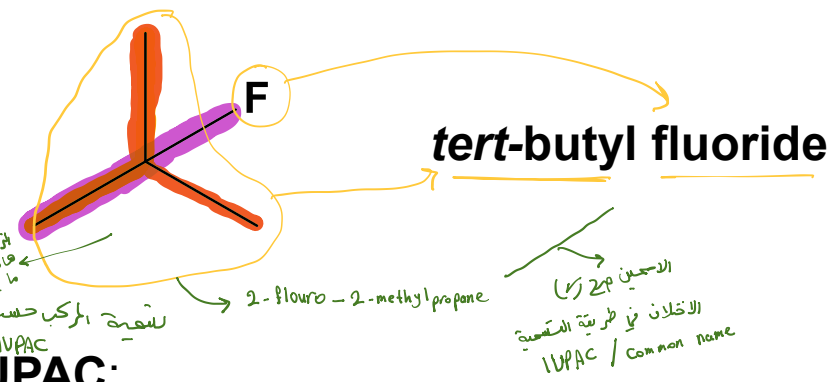
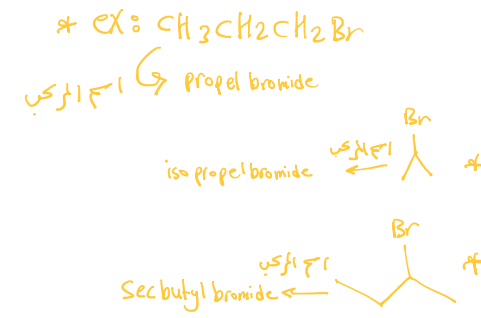
4-isopropylheptane

2.4: Alkyl and Halogen Substituents (R-X)

الكين حبة منها H ← تصبح الكيل ← طينيا محل H ← X ← يهر اسمها

Common name : Alkyl halide

eg. $\text{CH}_3\text{CH}_2\text{Br}$ Ethyl bromide



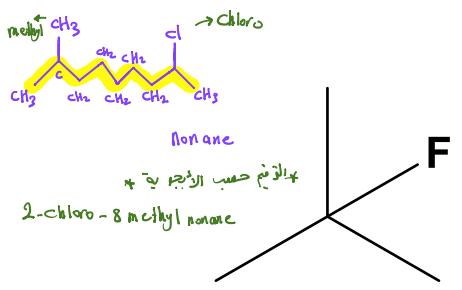
* طريقة تسمية المركبات
 بطريقتين
 Common name

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

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

* طريقة تسمية المركبات بطريقة IUPAC

تبادل الهالوجينات زيارتها في substituents



2-fluoro-2-methylpropane

معلومة عالية مثل :
 طريقة الـ common name تتركب للمركبات البسيطة / البسيطة
 أما إذا كان المركب more complex غير الـ IUPAC للتسمية

Sources of Hydrocarbons

تكون من hydrocarbons mixtures من النفط
وتتكون من الألكين
ميثان
إيثان

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.

*الخلاصة ← هذه المركبات جزء كبير منها موجود في الطبيعة وجزء منها يتم تحضيره

← تتعرف عليه بأجزاء Chapter

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

الخصائص الفيزيائية لا تؤثر على التركيب الكيميائي للمادة ← يعني لو حولت الماء إلى ثلج أننا نكون الخصائص الفيزيائية، أما الخصائص الكيميائية لم تتغير فالمادة بقيت H₂O

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)

ex: الجزيئات التي تكونت من الهيدروجين والأكسجين (Alkanes) لو حالتة قطب Nonpolar
معها شيء ما راح يتوحد معها Polar
في تظلمت يظهر على الترابيز بين الجزيئات



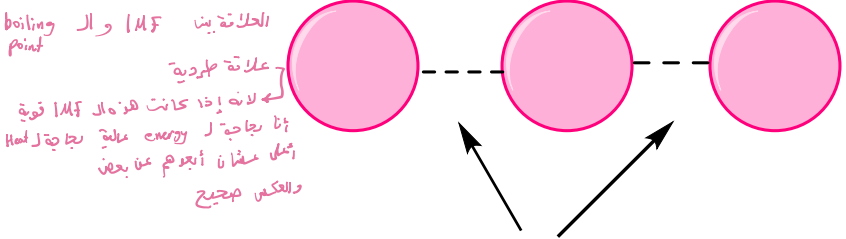
- 1- Structure of molecules
- 2- Polarity
- 3- Internal links / الروابط الداخلية

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

محاولة اتزان بين الـ Vapor and external Pressure
المادة في الحالة الغازية الـ molecules تكون متقاربة ولكنها مش organized
المادة في الحالة السائلة الـ molecules تكون متقاربة و organized



العلاقة بين IMF والـ boiling point
علاقة طردية
لأنه إذا كانت قوة الـ IMF قوية
أنا بحاجة لـ energy ملحة بدرجة لـ Heat
أشغل عشوائياً أبعدهم عن بعض
والعكس صحيح

مجموعة الـ functional group المتشابهة
الـ physical property لهم متقاربة

intermolecular forces (IMF) molecules
نوعاً ما متقاربة
رابطات بين الجزيئات - itself

Intermolecular Forces

2/ يلزمنا بي كل Chapter
لما نتكلم عن physical property

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:

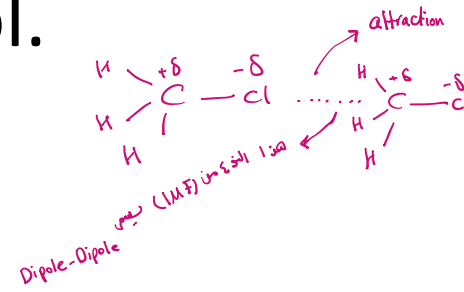
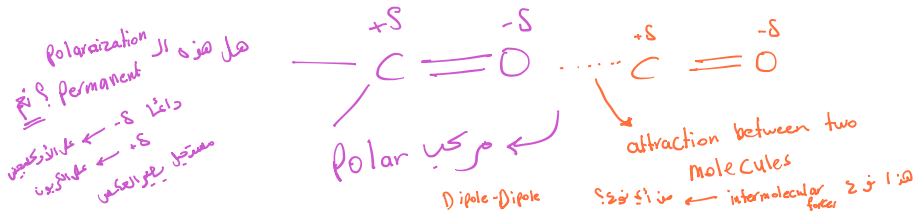
- 1) Hydrogen bonding (2)
- 2) Dipole-dipole (1)
- 3) Van der Waals or London Dispersion (3)

Dipole-dipole

نوعية ←

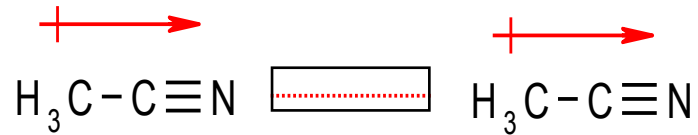
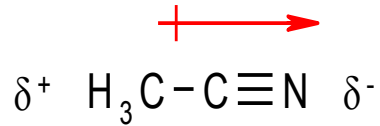
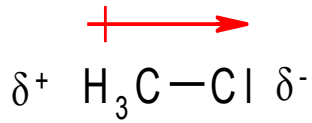
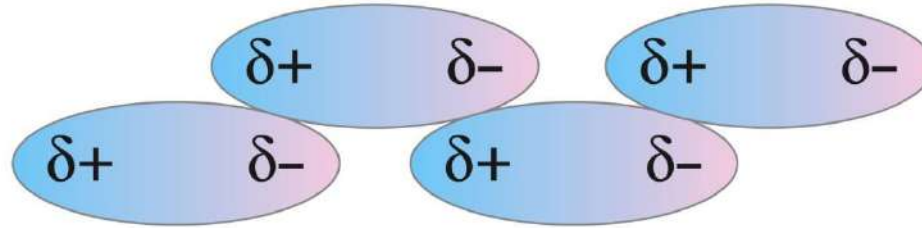
Dipole-dipole forces arise from the attraction of oppositely charged atoms (other than H) in molecules. These molecules may have a **permanent dipole moment**. Generally in organic molecules they result from the presence of C-X bonds where X is more electronegative than C.

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



Dipole-dipole

→ ممکنہ تھون
بین 2 molecule
مقطبیتوں ر بس مش (م)
ما بھجی



Hydrogen Bonding

نوع خاص من الرابطة
Dipole-Dipole

example
على ال
Dipole-Dipole
Dipole

هذا النوع
أقوى من
Dipole-Dipole
رابطات طوره في نوعه العالي

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

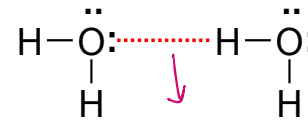
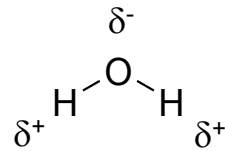
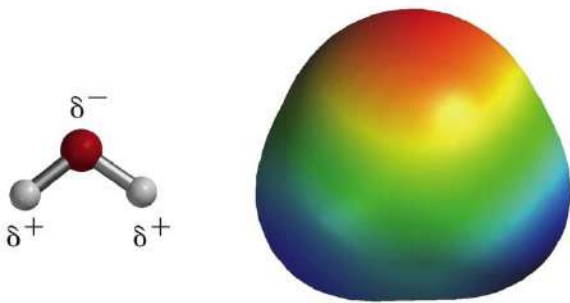
هو ارتباط
H مع N, O, F

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⁻)

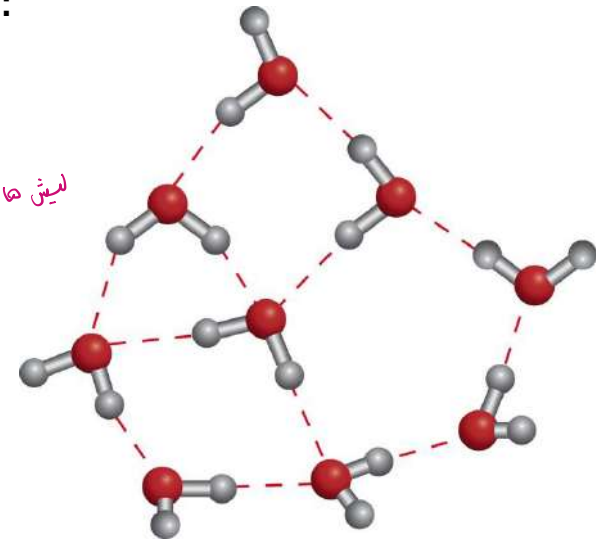
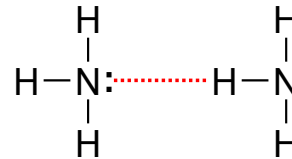
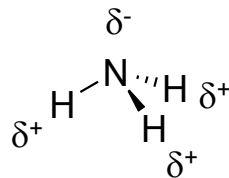
Geometry: $X-H \cdots :X-$



Hydrogen bonding

high electronegativity

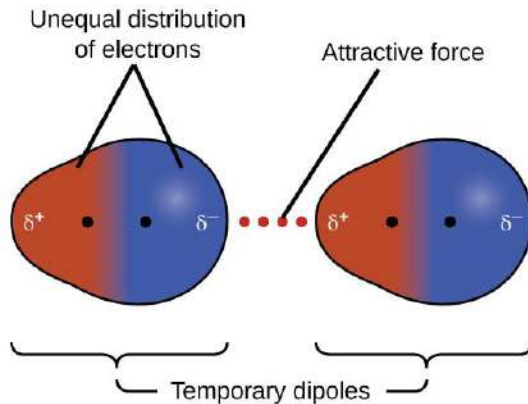
ليش هاي الايطة اتوى؟ لانه N, O, F بجزم انهم



Van der Waals (dispersion)

عزیمتی ذرات شی فی مرکبات ال alkane
weak لکنه موجود
المرکبات Nonpolar

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.

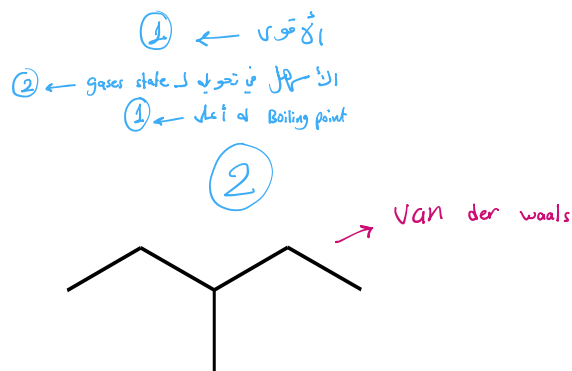
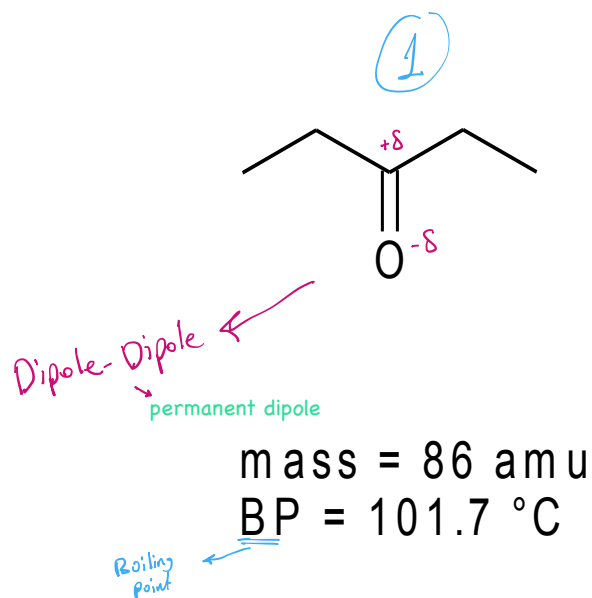


Very Weak attraction

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.

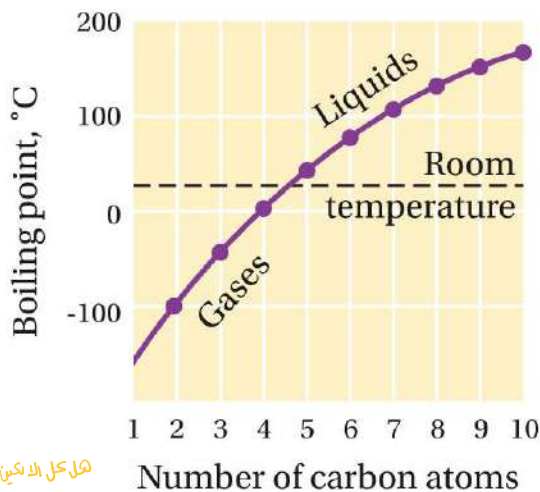


mass = 86 amu
BP = 63.3 °C

مثبت عامل 2/ يحكي عنه بعدين

→ the only (IMF) ^(قوى لندن) الموجودة بينهم هي Van der Waals

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



Name	Formula	Boiling point, °C
pentane	$\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_3$	<u>36</u>
2-methylbutane (isopentane)	$\begin{array}{c} \text{CH}_3\text{CHCH}_2\text{CH}_3 \\ \\ \text{CH}_3 \end{array}$	<u>28</u>
2,2-dimethylpropane (neopentane)	$\begin{array}{c} \text{CH}_3 \\ \\ \text{CH}_3 - \text{C} - \text{CH}_3 \\ \\ \text{CH}_3 \end{array}$	<u>10</u>

كلهم الكين Alkanes

العلاقة بين الوزن الجزيئي

structural isomers

the same molecular formula

structural formula

الذات؟ كلهم لهم نفس عدد الكربون والوزن الجزيئي

الاختلاف في الـ structure

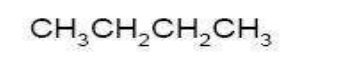
boiling point الـ *
يحدد على branching لكن إذا
تغيرت عدد الكربون أو إذا تغيّرت
الـ mass تغيّر المركبات



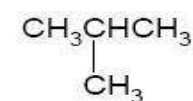
More branches الـ العيب هو إنه الـ
تقلل الـ surface area إلى بيبيـر فيها
interaction

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

Example:
مثلاً إذا تغيّرت (IMF)
والتي هي من قوة لندن
تزيد في الـ size
أزيد عدد الكربون
كلما زادت
عدد الكربون كلما
زادت الـ boiling point



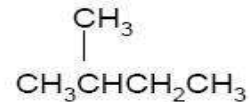
n-butane, 0°C



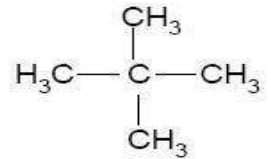
Isobutane, -12°C



n-pentane, 36°C



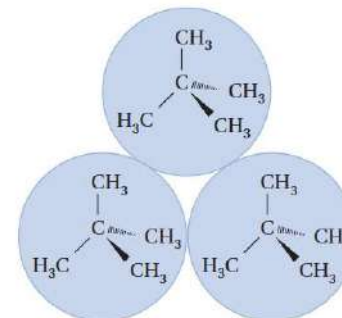
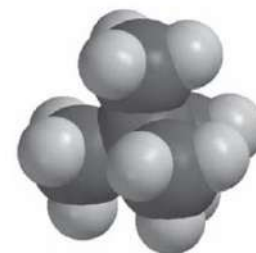
Isopentane, 28°C



Neopentane, 9.5°C

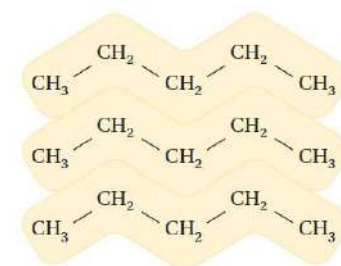
Structural Effects on IMFs

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.



2,2-dimethylpropane
bp 10°C

(a)



pentane
bp 36°C

(b)