Alkanes –
3 - Properties and Applications

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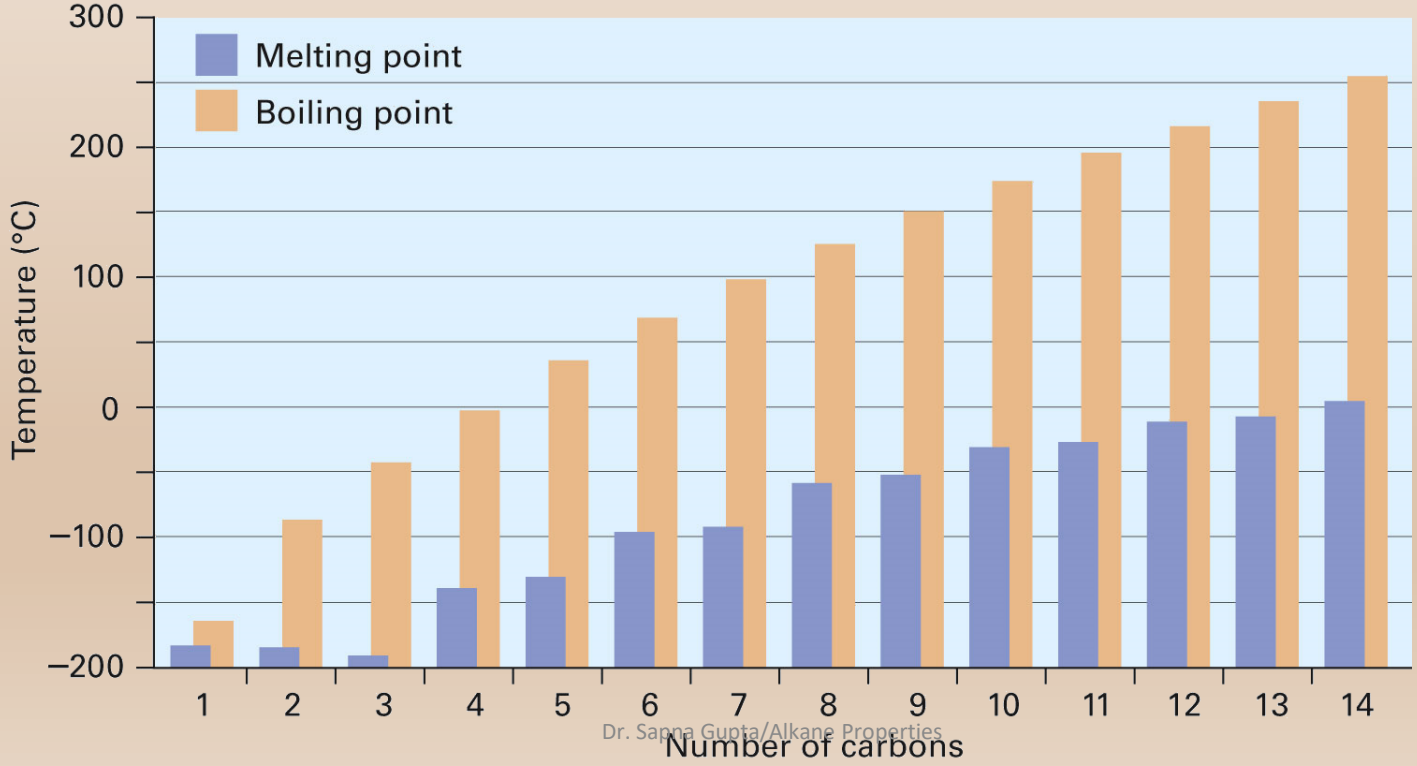
Physical Properties of Alkanes

1) Boiling points and melting points increase as size of alkane increases since dispersion forces increase as electron density increases

- Straight chain compounds will have a higher boiling point than branched alkanes
- Cycloalkanes have similar properties to straight chain alkanes



Physical Properties of Alkanes, contd…

- Constitutional isomers have different physical properties (melting point, boiling point, densities etc.)
  - Constitutional isomers have the same molecular formula but different connectivity of atoms

Molecular Formula	Structural Formula	mp (°C)	bp (°C)[a] (1 atm)	Density[b] (g mL^{-1})	Index of Refraction[c] (n_D 20°C)
C_6H_{14}	$CH_3CH_2CH_2CH_2CH_2CH_3$	−95	68.7	0.6594^{20}	1.3748
C_6H_{14}	$CH_3CH(CH_3)CH_2CH_2CH_3$	−153.7	60.3	0.6532^{20}	1.3714
C_6H_{14}	$CH_3CH_2CH(CH_3)CH_2CH_3$	−118	63.3	0.6643^{20}	1.3765
C_6H_{14}	$CH_3CH(CH_3)CH(CH_3)CH_3$	−128.8	58	0.6616^{20}	1.3750
C_6H_{14}	$CH_3C(CH_3)_2CH_2CH_3$	−98	49.7	0.6492^{20}	1.3688

[a] Unless otherwise indicated, all boiling points given in this book are at 1 atm or 760 torr.
[b] The superscript indicates the temperature at which the density was measured.
[c] The index of refraction is a measure of the ability of the alkane to bend (refract) light rays. The values reported are for light of the D line of the sodium spectrum (n_D).

Physical Properties of Alkanes, contd…

- **Solubility in Water –** not soluble in water as alkanes have dispersion IMF and water has H-bonding.
- **Density** (compared to water) **–** less than water.
- **Odor –** pleasant smelling.

Alkane Sources

- Most alkanes are obtained from under the earth through drilling.
- Natural gas, methane, is obtained through fracking.
- Petrol can be obtained from under the earth on land or water (off shore drilling)

❖All extractions are polluting and dangerous.

❖But alkane extraction produces not only alkanes but other ancillary aromatic products.

❖Cracking is a way to make unusable alkanes into usable products.

Applications

- Fuel source – most alkanes are good for energy production – natural gas (methane), compressed gas (propane), lighter fluid (butane) petrol (isooctane), kerosene (C_{10}-C_{16} alkanes) etc.
- Solvents – used in labs and industry as non polar solvents.
- Miscellaneous – wax, Vaseline are all alkanes.

Key Words/Concepts

- Be able to compare physical properties of alkanes to each other and other functional groups as we learn them.