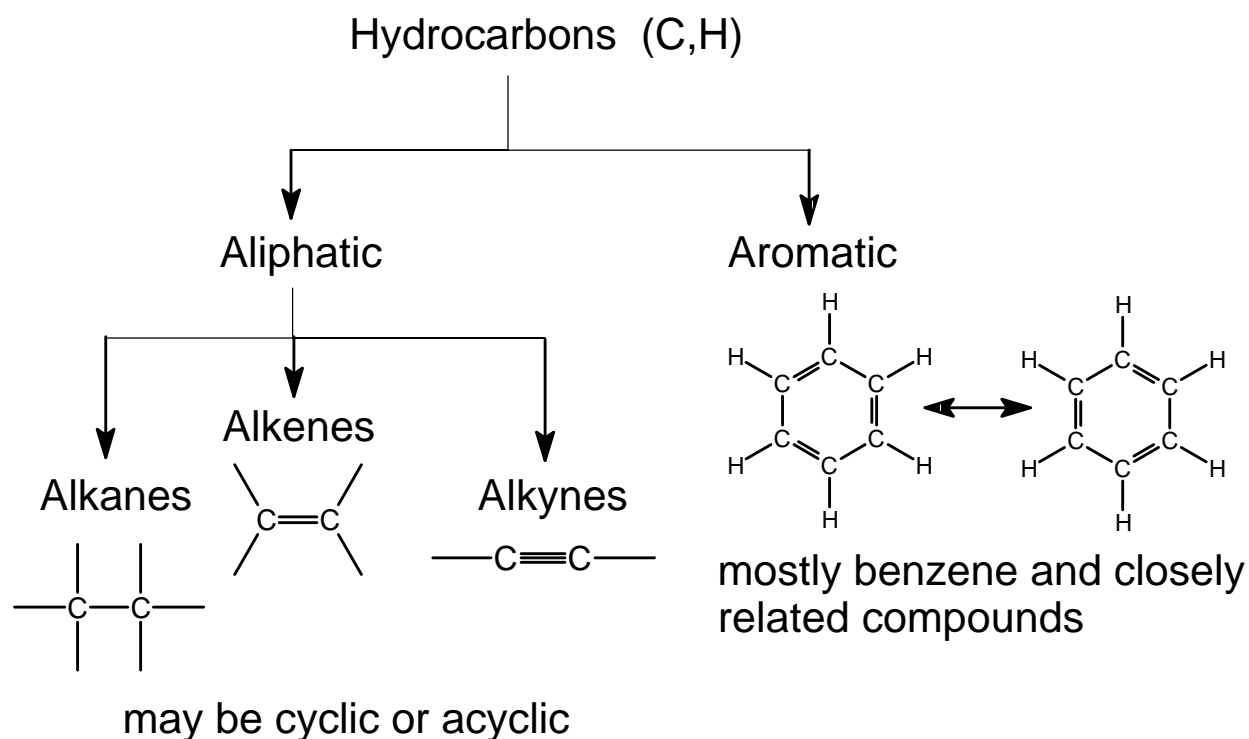


Alkanes



Acyclic alkanes have the general molecular formula C_nH_{2n+2} and are said to be *saturated*, *i.e.*, for a given # of carbon atoms alkanes have the maximum # of hydrogens possible – no double or triple bonds.

Let's meet some acyclic members of the clan.

CH_4 : methane.

C_2H_6 : ethane.

C_3H_8 : propane.

C_4H_{10} : the butanes; 2 constitutional isomers.

C_5H_{12} : the pentanes; 3 constitutional isomers.

C_6H_{14} : the hexanes; 5 constitutional isomers.

C_7H_{16} : the heptanes; 9 constitutional isomers.

C_8H_{18} : the octanes.

C_9H_{20} : the nonanes.

$\text{C}_{10}\text{H}_{22}$: the decanes; 75 constitutional isomers
theoretically possible.

$\text{C}_{20}\text{H}_{42}$: the eicosanes; 366,319 constitutional isomers
theoretically possible (not all could be made; in some the
atoms would be too close to each other for the molecule to
be stable [*steric hindrance*]).

Sources of Alkanes

Not usually synthesized; isolated from natural materials.

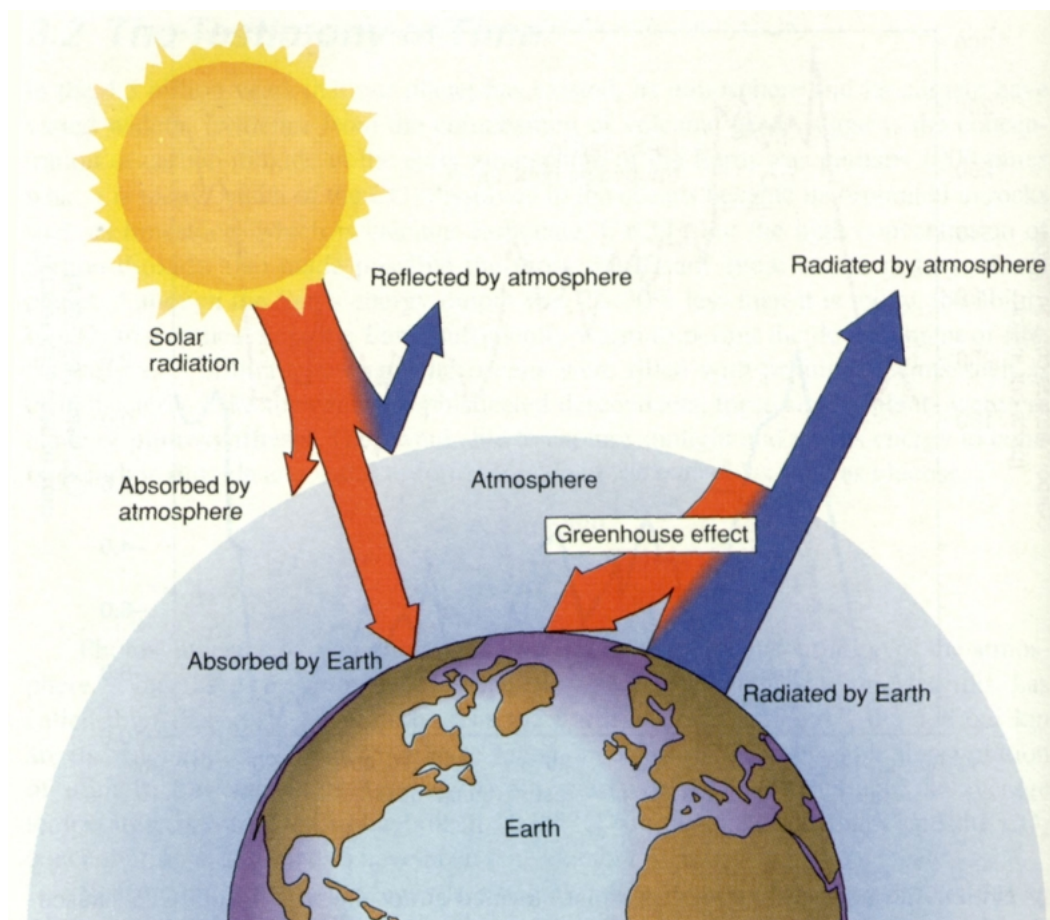
Methane — CH_4 — simplest alkane — combustible gas.

An end-product of the anaerobic decay of plants,
found in —

☹ marsh gas

☹ farts

👉 cattle flatulence —————> greenhouse gas





natural gas

☞ produced by anaerobic decay of prehistoric microorganisms

☞ clean source of heat

☞ odorless



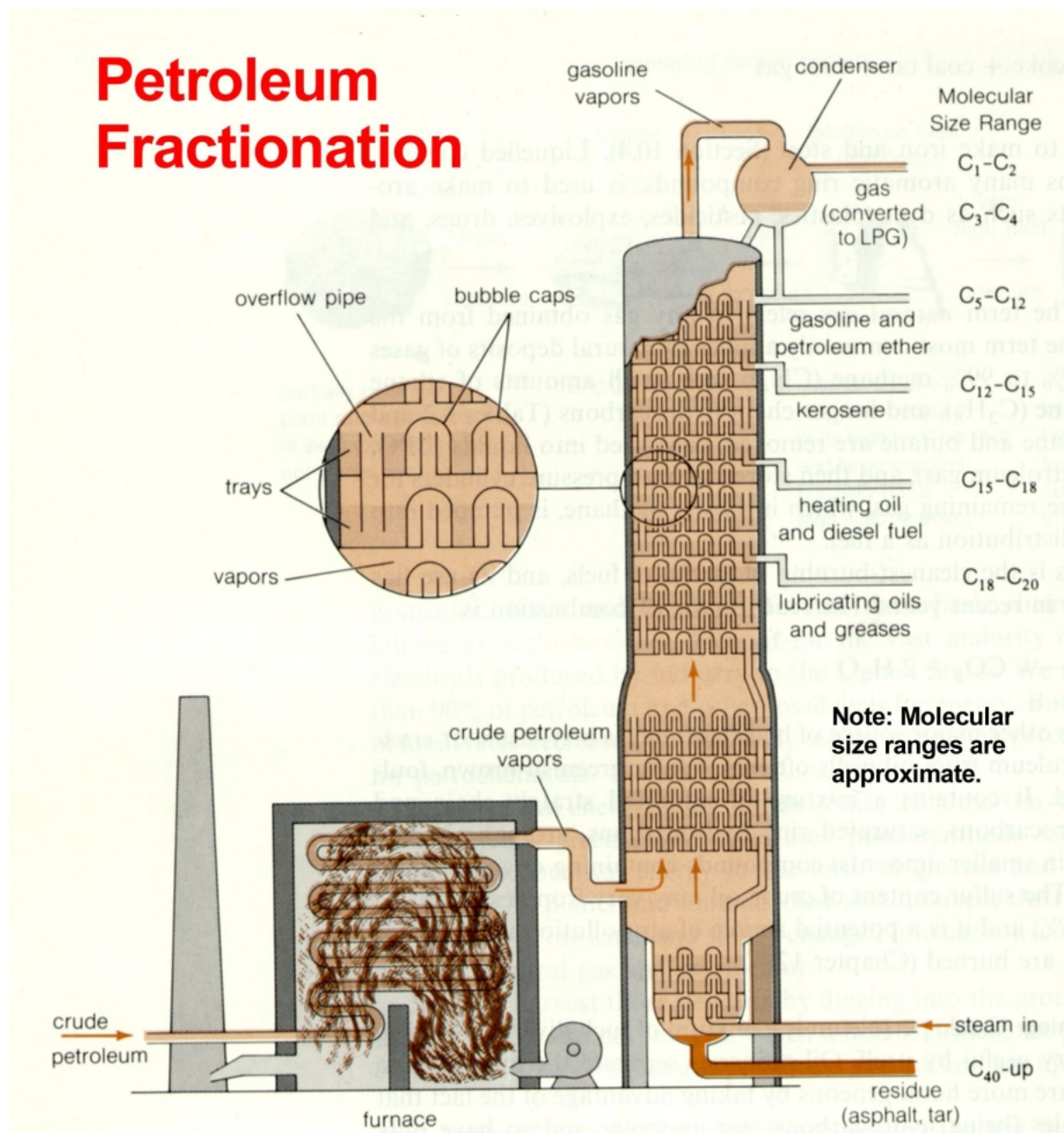
firedamp

☞ coal mines

☞ miners' (Davy) safety lamp

Sources of Other Alkanes —

principal source = natural gas & distillation of petroleum



<u>Fraction</u>	<u>Distillation Temperature</u>	<u>Number of Carbons</u>
-----------------	---------------------------------	--------------------------

Gas	<20°C	1 - 4
-----	-------	-------

Natural gas is mainly methane.

Bottled gas is usually mainly propane; sometimes butane.

Ligroin	20-100°C	5 - 7
---------	----------	-------

Gasoline	30-200°C	5 - 10*
----------	----------	---------

*Seasonal blend --- relatively more 5 & 6 carbon cpds. in winter, more 9 & 10 carbon cpds. in summer.

Kerosine	175-325°C	12-18
----------	-----------	-------

Fuel Oil	>275°C	12 & up
----------	--------	---------

Lubricating Oil	non-volatile, vacuum dist.	
-----------------	-------------------------------	--

Asphalt	non-volatile	
---------	--------------	--

For gasoline "OCTANE NUMBER" is important.

The higher the octane number, the less a gasoline motor will tend to "knock."

Octane numbers – heptane = 0, engines knock badly;
2,2,4-trimethylpentane ("isooctane") = 100, good fuel.

The octane number of a gasoline blend is the % of 2,2,4-trimethylpentane in a mixture of the above two compounds which has the same knocking properties as the gasoline;

eg gasoline with a rating of 87 has the same knocking properties as a mixture which is 87%

2,2,4-trimethylpentane and 13% heptane.

The octane rating of a gasoline is improved by—

1) Reforming –

Pt, heat

Aliphatic $\xrightarrow{\hspace{1cm}}$ More highly branched
aliphatic + Aromatic.

2) Cracking – breaks larger molecules into gasoline size, mostly branched.

3) Additives –

☺ tetraethyllead, $\text{Pb}(\text{CH}_2\text{CH}_3)_4$ ☹

☺ methyl *t*-butyl ether, $\text{CH}_3\text{-O-C}(\text{CH}_3)_3$ ☹