FUELS

A fuel is a chemical which burns giving out energy.

We obtain our fuels from crude oil and natural gas. The fuels we obtain are mainly hydrocarbons - they consist of Hydrogen and Carbon only.

When the fuel burns it reacts with the Oxygen present in the air.

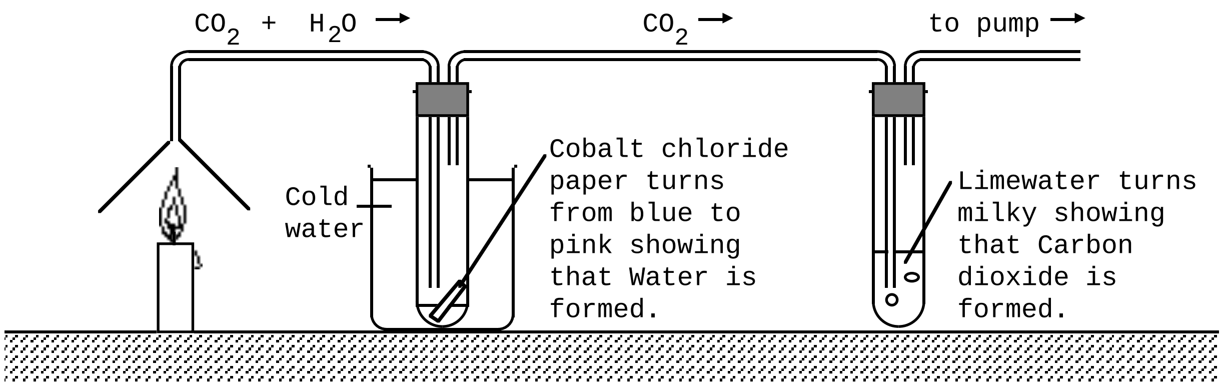
The burning, or **combustion**, gives out energy - it is an exothermic reaction.

All hydrocarbons burn to give Carbon dioxide and Water

e.g. the burning of natural gas (mainly Methane):

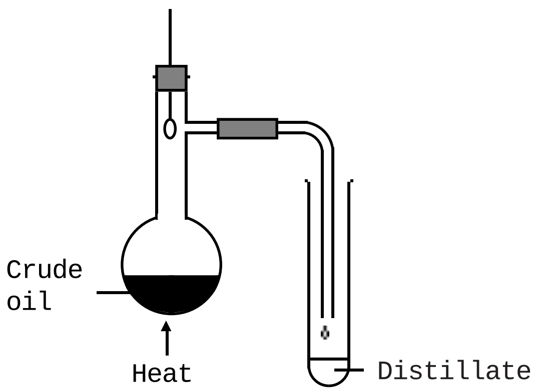
Methane	+	Oxygen	->	Carbon dioxide	+	Water
CH_4		O_2	->	CO_2		H_2O

We can show that Carbon dioxide and Water are formed by burning a candle. Candle wax is a mixture of C_{20} - C_{30} hydrocarbons.



CRUDE OIL

Crude oil is a mixture of hydrocarbons which can be separated by fractional distillation:



The oil is gradually heated. The small gas molecules boil off first, at low temperatures. We call this the 'gas fraction'. It consists of C_1 to C_4 hydrocarbons e.g. Butane C_4H_{10} (BP 0 ^{0}C). The gas fraction is used to make Calor Gas.

As the oil is heated further, slightly larger molecules with higher boiling points begin to distil over. This is petrol, a mixture of C_5 to C_{10} hydrocarbons e.g. Heptane C_7H_{16} (BP 98 ^{0}C).

Further heating produces larger molecules with even higher boiling points. This is paraffin, a mixture of C_{10} to C_{18} hydrocarbons e.g. Decane $C_{10}H_{22}$ (BP 174 ^{0}C).

Further heating produces diesel, a mixture of C_{15} to C_{25} hydrocarbons e.g. Hexadecane $C_{16}H_{34}$ (BP 280 ^{0}C).

Further heating produces lubricating oil, a mixture of C_{20} to C_{70} hydrocarbons, and bitumen, giant hydrocarbon molecules with more than 70 Carbon atoms!

We note that the smaller the molecules the easier the fraction ignites. Petrol and paraffin, with small molecules, catch fire easily and are therefore used as fuels: petrol in the car engine; paraffin in aeroplane engines. Diesel needs a higher temperature to ignite and requires a special engine. Lubricating oil and bitumen are not used as fuels; their ignition temperature would be too high.

We also note that the smaller the molecules the quicker the fraction evaporates. Petrol used in hot countries must contain a larger proportion of the higher boiling hydrocarbons e.g. C_9H_{20} and $C_{10}H_{22}$.

We also note that the smaller the molecules the more runny (or less viscous) the fractions. Petrol flows inside easily inside the car engine; diesel is much thicker and may even become solid (freeze) in cold weather.

Crude oil is the source of most of our fuels. Crude oil is also the source of the chemicals we use to make textiles, dyes, plastics, detergents and fertilisers. What will happen when the oil runs out? We should be conserving our stocks of crude oil and looking for alternative sources of energy.

POLLUTION CAUSED BY THE MOTOR CAR

If the supply of Oxygen is insufficient for complete combustion then Carbon, Carbon monoxide and unburned hydrocarbons can be produced. Carbon monoxide is a poisonous gas.

Soot particles produced by the incomplete combustion of diesel are harmful.

Most fuels contain trace amounts of Sulphur compounds. When the fuels burn, Sulphur dioxide is released into the atmosphere. Sulphur dioxide is a poisonous gas. It also causes acid rain.
The sulphur can, however, be removed from the fuels thus reducing the amount of pollution.

Nitrogen and Oxygen from the air react inside a petrol engine to form Nitrogen oxides which are poisonous gases. Nitrogen dioxide causes acid rain.

The catalytic converter speeds up the conversion of pollutant gases into harmless gases e.g.

$$2NO \quad + \quad 2CO \quad + \quad \rightarrow \quad N_2 \quad + \quad 2CO_2$$