Fractional Distillation and Cracking

Off the coast of Newfoundland, in the Gulf of Mexico, and in many countries in the Middle East (Iraq, UAE, Kuwait) crude oil or petroleum is drawn out of the crust of the earth.

Recall from Grade 10 Science, that fossil fuels are formed when plants or animals die in a swamp or bog and are buried under sediment. Over 1000s of years pressure from the sediment and glaciers combined with heat from the earth's core turn the dead tissues into fossil fuels.

This petroleum mixture contains gases, liquids, and dissolved solids composed of many different hydrocarbon molecules, some of which may be up to 40 carbon atoms long.

	Small hydrocarbons	Medium length hydrocarbons	Long length hydrocarbons
# of Carbons in chain	1-4	5-22	23 or more
Examples	Methane, ethane, propane, butane (fuels for heating and cooking)	Gasoline, furnace oil, heavy greases for lubricants	Wax, cosmetics, polish, asphalt
State at room temperature	Gas	Liquid	Solid

Fractional Distillation

Fractional distillation is used to separate the many components of petroleum. Essentially, molecules of various sizes are separated into portions called fractions. Each fraction contains similar-sized molecules. The lighter fractions boil at lower temperatures, and the heavier fractions boil at higher temperatures.

Cracking

With gasoline or other fuels, the more branches on the hydrocarbon, the higher the octane. Fractional Distillation produces long straight, un-branched chains of hydrocarbons. Cracking converts the straight-chain hydrocarbons into shorter-branched chains.

How it works:

In fractional distillation, the crude oil (hydrocarbon mix) is first heated to very high temperatures, high enough to evaporate nearly all of the hydrocarbons, small and large. Then the hot gases are allowed to rise in a tall fractionation tower. The upper parts of the tower are cooler than the lower parts. Each gas turns into a liquid at or below its own boiling point. As the hot gases travel up through the lower, warmer sections, the larger molecules condense. The smaller molecules with their low boiling points are still gases and climb higher, to the top of the tower where the temperatures are lowest