

JSR IAS ACADEMY

GENERAL SCIENCE

CHEMISTRY

Petroleum Products

Petroleum

Petroleum

- ❖ The term 'petroleum' is derived from the **latin** words 'petra' meaning rock and 'oleum' meaning oil.
- ❖ It is a fossil fuel formed from the remains of ancient marine organisms through death and decay.
- ❖ Petroleum is a complex mixture of hydrocarbons that occur in Earth in liquid, gaseous, or solid form.
- ❖ The term petroleum commonly denotes the liquid form, crude oil.
- ❖ But technically **petroleum also includes natural gas and bitumen, a solid form.**
- ❖ The natural gas and the crude oil constitute the primary fossil fuels.



Ancient cultures used crude oil for binding materials. It was also used as a sealant for waterproofing various surfaces.

Occurrence of Petroleum

- ❖ The chief petroleum producing countries are **U.S.A., Kuwait, Iraq, Iran, Russia and Mexico.**
- ❖ In India, petroleum is found in **Assam, Gujarat, Maharashtra (Mumbai), Andhra Pradesh (Godavari and Krishna basin) and Tamil Nadu (Cauveri Basins).**



The first oil well in the world was drilled in Pennsylvania, USA in 1859. The second oil well was drilled in Makum, Assam, India in 1867.

Refining of crude petroleum

- ❖ The crude petroleum obtained from the well is a dark colored viscous liquid which **contains many impurities such as water, solid particles and gases like methane and ethane.**

The steps involved in this process are given below.

Separation of water

The crude oil obtained from the oil wells will have salt water mixed with it.

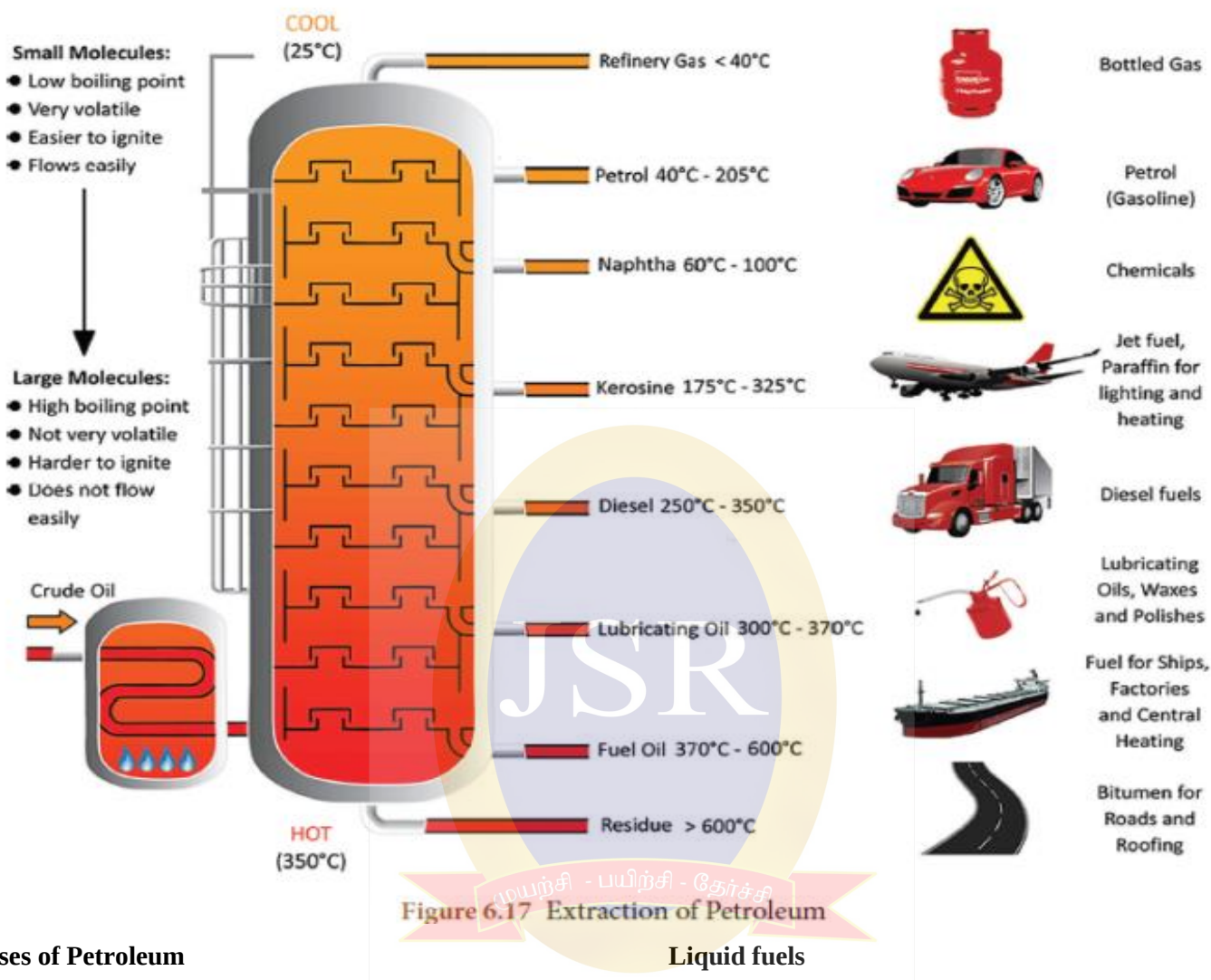
As the first step the water is removed from the crude oil.

Removal of sulphur compounds

The crude oil will have harmful sulphur compounds as impurities. In this step these impurities are removed.

Fractional distillation

- ❖ Petroleum is a mixture of various constituents such as petroleum gas, petrol, diesel, kerosene, lubricating oil, paraffin wax, etc.
- ❖ The process of separation of various constituents or fractions of petroleum is done by fractional distillation in fractionating columns.
- ❖ The process of heating a mixture of liquids having different boiling points and then separating them by cooling is called fractional distillation.
- ❖ Crude petroleum is first heated to about 400°C in a furnace.
- ❖ As the vapours of crude oil move up the tower, the various fractions condense according to their boiling point ranges.
- ❖ The various fractions of petroleum obtained are tabulated below.
- ❖ Many useful substances are obtained from petroleum and natural gas. These are termed '**petrochemicals**'.
- ❖ These are used in the manufacture of detergents, fibres, and other man-made plastics like polythene.
- ❖ Hydrogen gas obtained from natural gas, is used in the production of fertilizers.
- ❖ Due to its great commercial importance, petroleum is also called '**black gold**'.



Uses of Petroleum

- ❖ Liquefied Petroleum Gas or LPG is used in houses as well as in the industry.
- ❖ Diesel and petrol are used as fuels for vehicles. It is also used to run electric generators.
- ❖ Petrol is used as a solvent for dry cleaning.
- ❖ Kerosene is used as a fuel for stoves and also in jet planes.
- ❖ Lubricating oil reduces wear and tear and corrosion of machines.
- ❖ Paraffin wax is used to make candles, ointments, ink, crayons, etc.
- ❖ Bitumen or asphalt is mainly used to surface roads.

Types of fuel

Solid fuels

- ❖ Fuels like wood and coal are in solid state and they are called solid fuels.
- ❖ This type of fuel was the first one to be used by man.

Liquid fuels

- ❖ Most of the liquid fuels are derived from the fossil remains of **dead plants and animals petroleum oil**, coal tar and alcohol are some of the liquid fuels.
- ❖ These fuels give more energy on burning and burn without ash.

Gaseous fuel

Coal gas, oil gas, producer gas and hydrogen are some of the gaseous fuels.

Characteristics of fuel

An ideal fuel should have the following characteristics.

- ❖ It should be readily available
- ❖ It should be easily transportable
- ❖ It should be less expensive
- ❖ It should have high calorific value
- ❖ It should produce large amount of heat
- ❖ It should not leave behind any undesirable substances

Efficiency of Fuel

During the combustion of fuel carbon combines with oxygen and liberates large amount of heat.

Specific Energy

Specific energy is the amount of energy produced by unit mass of a fuel. It is defined as the energy per unit mass.

It is used to measure the stored energy in certain substances. Its unit is Jkg^{-1} .

Calorific Value

It is the quantity of heat produced by the complete combustion of fuel at constant pressure and normal conditions. It is measured in terms of KJkg^{-1} .

Table 6.1 Calorific value of fuel

Fuel	Calorific Value (KJ/kg)
Cow dung cake	6000 – 8000
Wood	17000 – 22000
Coal	25000 – 33000
Petrol	45000
Kerosene	45000
Diesel	45000
Methane	50000
CNG	50000
LPG	55000
Biogas	35000 – 40000
Hydrogen	150000

Octane Number

Octane number denotes the amount of octane present in petrol.

The fuel having high octane number is called as an ideal fuel.

Cetane Number

Cetane Number measures the ignition delay of the fuel in diesel engine.

When cetane number is higher the ignition delay is shorter. The fuel with high cetane number is called as the ideal fuel

Table 6.3 Difference between Octane number and Cetane number

Octane Number	Cetane Number
Octane rating is used for petrol	Cetane rating is used for diesel
It measures the amount of octane present in petrol.	It measures the ignition delay of the fuel in diesel engine.
Octane number of petrol can be increased by adding benzene or toluene.	Cetane number of diesel can be increased by adding acetone.
The fuel with high octane number has low cetane number	The fuel with high cetane number has low octane number.

It is estimated that **coal will last for 148 years, petroleum for 40 years and natural gas for 61 years.**

Bio diesel

Bio diesel is a fuel obtained from vegetable oils such as **soya bean oil, jatropha oil, corn oil, sunflower oil, cotton seed oil, rice-bran oil and rubber seed oil.**

DO YOU KNOW?

Hydrogen - The future fuel

Hydrogen could be the best alternative fuel in the future. It is a clean fuel as it gives out only water while burning. Moreover, it has the highest energy content. It does not pollute air.

Wind energy

Wind mills are mostly located at Kayathar, Aralvaimozhi, Palladam and Kudimangalam in Tamil Nadu.

Gobar Gas

- ❖ Gobar gas is obtained by the fermentation of cow dung in the absence of air (anaerobic conditions).
- ❖ It mainly contains methane and a little ethane.

Solar Energy

Solar energy is the only viable fuel source of non depleting nature for, sun provides a free and renewable source of energy.