



COAL AND PETROLEUM

Key Points

1. INTRODUCTION

We see various materials for our basic needs. Some of them are found in nature and some have been made by human efforts.

Natural resources

The resources which are obtained from nature are called natural resources.
e.g. sunlight, air, forests, etc.

Man-made resources

The resources made by human beings are called man-made resources.
e.g. Plastics, cement, etc.

2. CLASSIFICATION OF NATURAL RESOURCES

Natural resources can be broadly classified into two kinds:

Inexhaustible natural resources

These sources are present in unlimited quantity in nature and are not likely to be exhausted by human activities.
E.g., Sunlight, air, etc.

Exhaustible natural resources

The amount of these resources in nature is limited, they can be exhausted by human activities.
E.g., Forests, coal, petroleum, minerals, wildlife, natural gas, etc.

Exhaustible Natural resources can be broadly classified into two kinds:

Renewable

These can replenish themselves by quick recycling. These are not likely to be exhausted. Both living and non-living resources.
E.g., Biological species, Water, Natural vegetation, Soil fertility, Wildlife, Aquatic animals, Humans

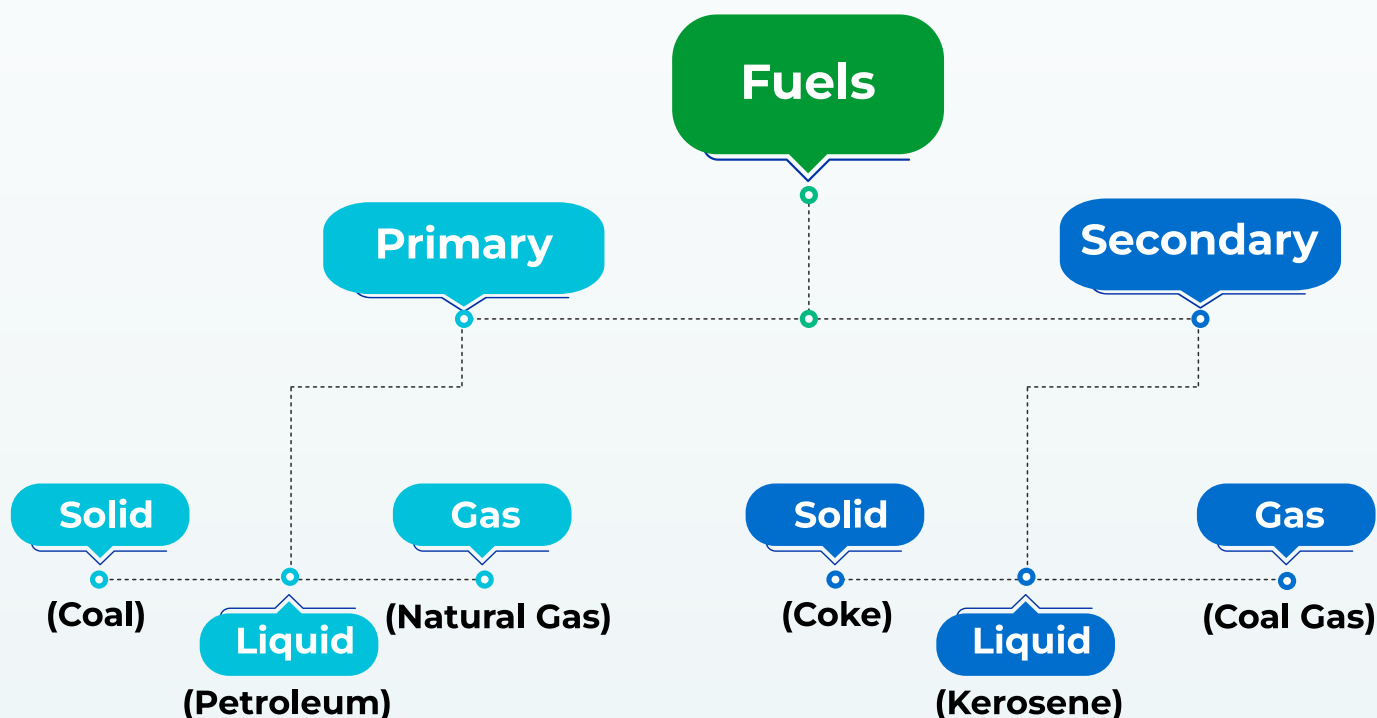
Non-renewable

These cannot replenish themselves by quick recycling. These may be exhausted. Only non-living resources.
E.g., Fossil fuels, Minerals



3. FUEL AND ITS CLASSIFICATION

A fuel is a substance, which burns in air to produce energy without releasing harmful gases in large quantities.



4. CALORIFIC VALUE OF A FUEL

Calorific value of a fuel is the amount of heat energy liberated by complete burning of a unit mass or volume of a fuel. For liquid or gaseous fuels, volume of fuel is considered while for solid fuels mass of fuel is considered to find out the calorific value.

$$\text{Calorific value (kJ/Kg)} = \frac{\text{Amount of liberated heat energy}}{\text{Total mass of fuel}}$$

5. CHARACTERISTICS OF AN IDEAL FUEL

- It should have a high calorific value.
- It should not cause any pollution or should not produce harmful gases on combustion.
- It should be of low cost and easily available.
- It should be easy to handle, store and transport.
- It should have moderate ignition temperature.
- It should have moderate rate of combustion.

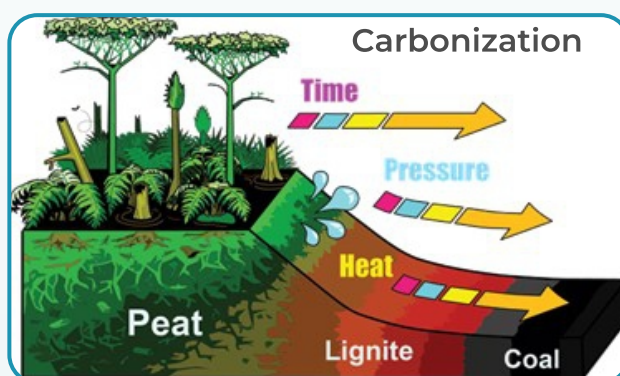
6. FOSSIL FUELS

Exhaustible natural resources like coal, petroleum and natural gas were formed from the dead remains of living organism (fossils). So, these are called fossil fuels.



7. COAL

- Coal is a natural fuel; it is hard as stone and is black in colour. It is one of the fuels used to cook food. Earlier, it was used in railway engines to produce steam to run and also used in thermal power plants to produce electricity. Coal is also used as a fuel in various industries.
- The process of conversion of dead vegetation into coal is called coalification / carbonization.
- When coal is heated in air, it burns and produces mainly carbon dioxide gas.



8. TYPES OF COAL

01

Anthracite

Anthracite is coal with the highest carbon content, between 86 and 98 percent, and a heat value of nearly 15,000 BTUs-per-pound.

02

Bituminous

It is the most popular form of coal and is used as domestic coal. Bituminous coal has a carbon content ranging from 45 to 86 percent and a heat value of 10,500 to 15,500 BTUs-per-pound.

03

Lignite

Lignite is a geologically young brown coal which has the lowest carbon content, 25-35 Percent, and a heat value ranging between 4,000 and 8,300 BTUs-per-pound.

04

Peat

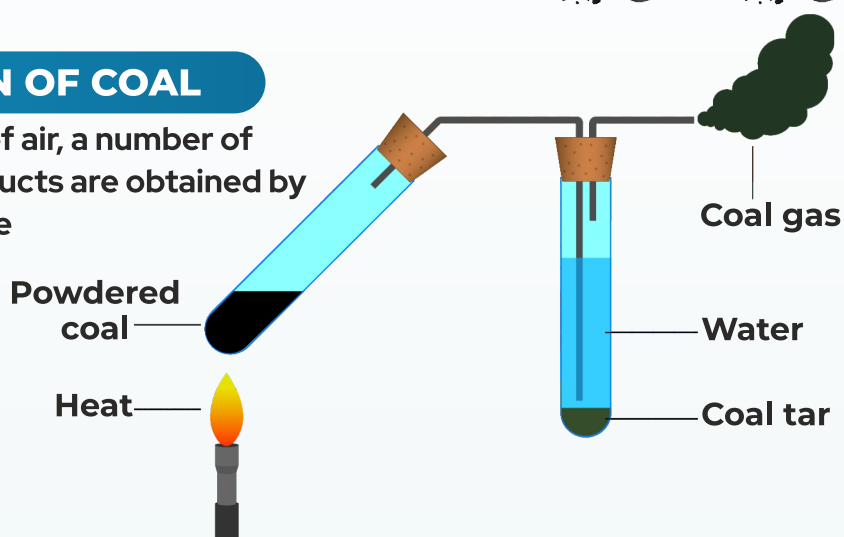
It is the youngest coal among all. It is a yellow jelly like mass containing large amount of water.



9. DESTRUCTIVE DISTILLATION OF COAL

When coal is heated in the absence of air, a number of products are formed. The main products are obtained by the destructive distillation of coal are

- (I) Coke
- (II) Coal tar
- (III) Coal gas



I. Coke

Coke is a tough, porous and black substance. It is an almost pure form of carbon. Coke is used as a fuel and as a reducing agent in the smelting of iron ore in a blast furnace and in the manufacture of steel and in the extraction of many metals.

II. Coal-tar

Coal-tar is a black, thick liquid with an unpleasant smell. It is used in manufacturing of various products for e.g. dyes, drugs, explosives, perfumes, plastics, paints etc., Bitumen, a petroleum product, is used in place of coal-tar for metalling the roads.

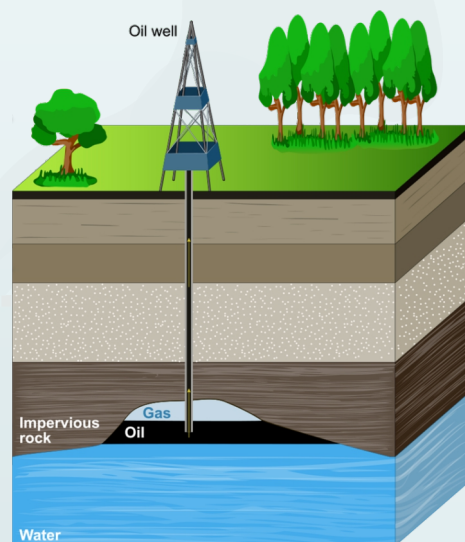
III. Coal gas

Coal gas is obtained during the processing of coal to get coke. It is used as fuel in many industries situated near the coal processing plants. Coal gas was used for street lighting for the first time in London.

10. PETROLEUM

It is dark brownish to green coloured viscous liquid fossil fuel. It has strong foul smell due to the presence of sulphur containing compounds in it. It is commonly called as crude oil. Petroleum is also called black gold. Thus, petroleum means "rock oil".

Origin of petroleum : Petroleum is a complex mixture of solid, liquid and gaseous hydrocarbons, mixed with salty, water and earthy particles. It is always found trapped between two impervious rocks. Petroleum is formed by the anaerobic decomposition of extremely small sea animals and plants which got buried in the sea bed millions of years ago. Petroleum occurs at a moderate depth (500 m to 200 m). The Petroleum is lighter than salt water and hence, floats over it. Natural gas is found above petroleum.



Occurrence of Petroleum

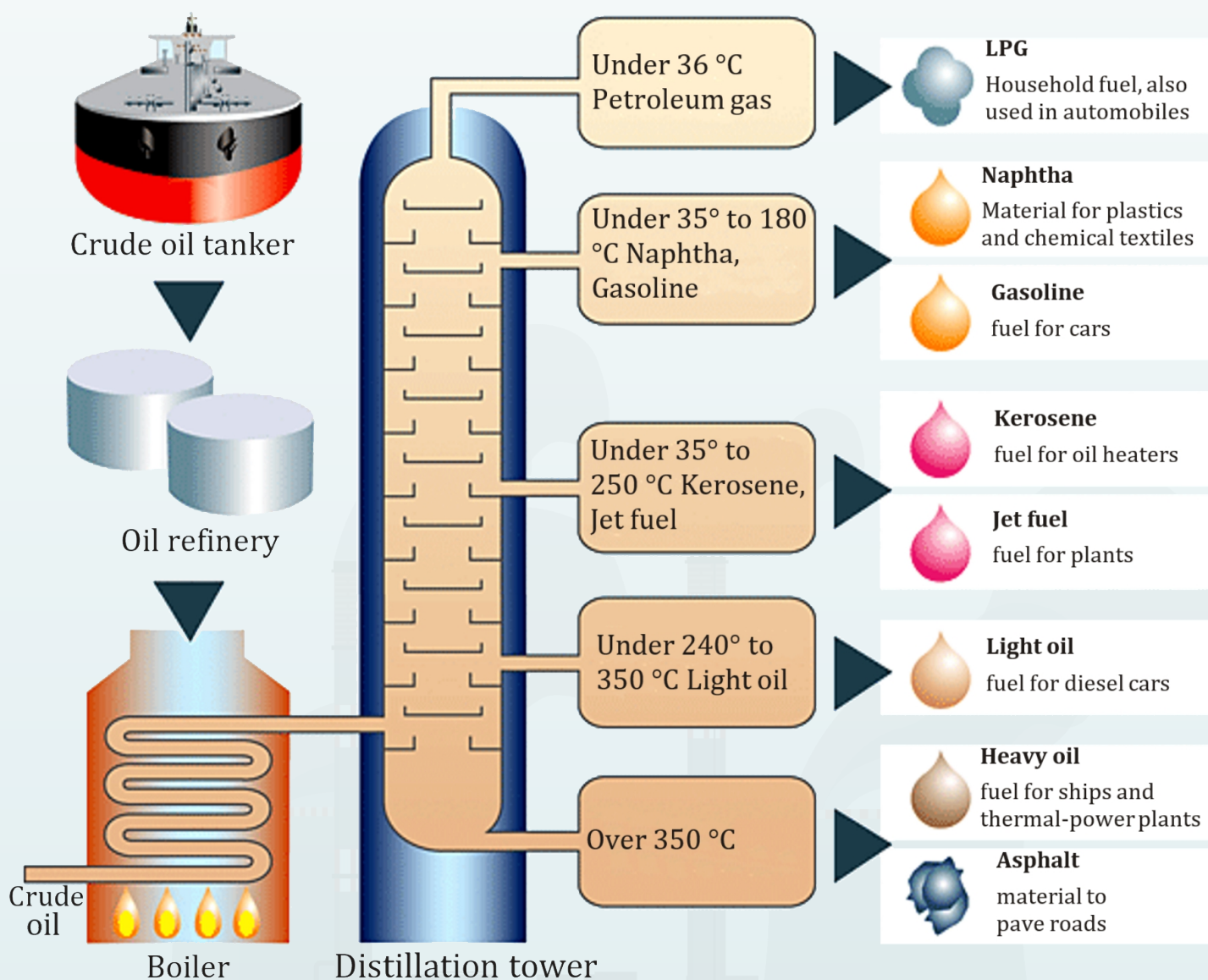


(i) Drilling of Oil Wells

The hole is drilled in the Earth's crust & when it reached the rock cap, the natural gas comes out first with a great pressure. When the pressure of gas subsides, petroleum starts flowing out due to pressure of natural gas.

(ii). Refining of Petroleum

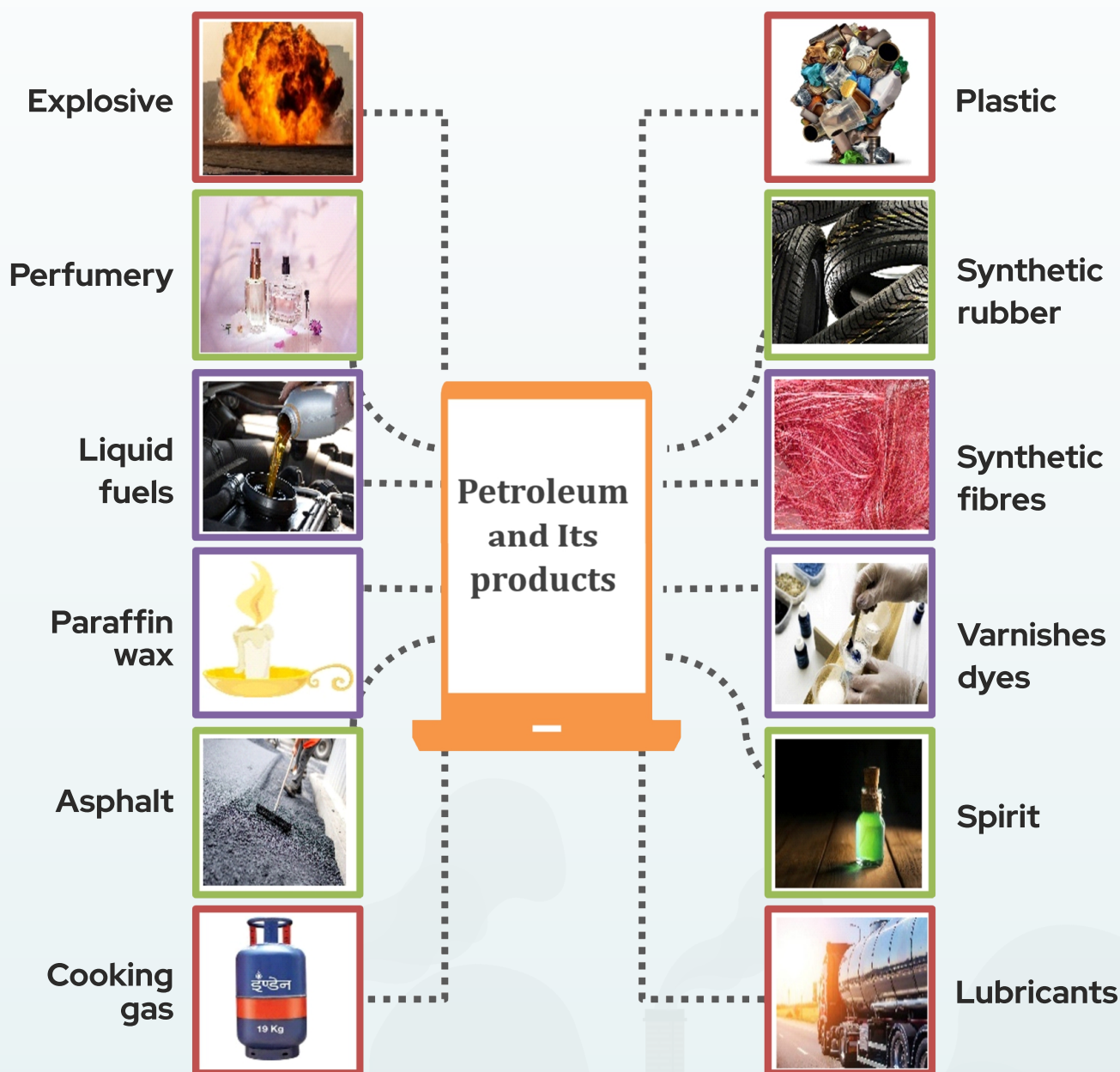
The process of separating the various components of petroleum from one another is known as the refining of petroleum. This is done by a process called fractional distillation which is based on the fact that the different components of petroleum have distinctly different boiling points. In fractional distillation, crude petroleum is heated to a temperature of 400°C or slightly above in a furnace.



Fractional distillation of crude oil



11. FRACTIONS OF PETROLEUM AND THEIR USES



12. NATURAL GAS

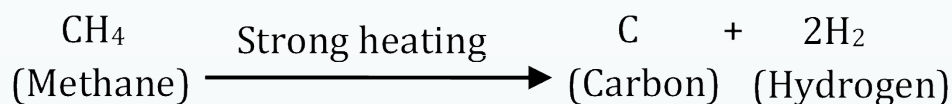
Natural gas was formed millions of years ago along with petroleum when microscopic sea plants and animals died and got buried under the sand or mud. These plants and animals under anaerobic conditions changed to gas. ONGC (Oil and Natural gas Corporation Limited) is India's largest oil and gas exploration and production company. It is generally found trapped between impervious rocks, sometimes along with petroleum and sometimes without petroleum.

Composition: It consists mainly of methane (about 85%), ethane (about 10%), propane (about 3%) and butane. When natural gas is compressed at high pressure then it is called CNG (compressed natural gas). CNG is used for power generation.



Uses of Natural Gas

- (1) As a fuel - It has a very high calorific value of 55 k J/g.
- (2) As a source of hydrogen and carbon



13. CONSERVATION OF FOSSIL FUELS

In India, the Petroleum Conservation Research Association (PCRA) offers the following tips to conserve petrol and diesel while driving.

- Drive at a constant and moderate speed as far as possible. Driving at a high speed or slow speed wastes a lot of fuel.
- Switch off engine if you have to wait at traffic lights or for any other reason.
- Check the tyre pressure regularly, low pressure or too high-pressure waste fuel.
- Make sure that you send your vehicle to garage for regular maintenance.

