

## 8<sup>th</sup> – Coal and Petroleum



**Fuels:** substances that produce heat and light energy on burning are called fuels e.g. wood, coal kerosene LPG and petrol. Fuel is a source of energy and to obtain this heat energy, we have to burn the fuel. This burning is called oxidation. On the basis of physical state, fuels can be classified as solid liquid and gaseous:

1. **Solid fuels:** Fuels that exist in solid state at room temperature are called solid fuels example- wood, coal, charcoal.
2. **Liquid fuels:** Fuels that exist in liquid state at room temperature are called liquid fuels. Example-petrol, diesel
3. **Gaseous fuels** - fuels that exist in gaseous state at room temperature are called gaseous fuels. Example - natural gas and biogas

Liquid and gaseous fuels are preferred for domestic purposes like kerosene oil. Care should be taken so that complete combustion takes place. Incomplete combustion results in wastage of fuel and atmospheric pollution.

### Characteristics of fuels:

1. **Calorific value:** when one kilogram of fuel is completely burnt in the presence of pure oxygen is called calorific value of fuel. It is expressed in unit's kilojoule per gram (kJ/g). Higher the CV of a fuel the more heat it produces when burned.
2. **Efficiency:** When a fuel is burnt, some of the energy produced is given off as waste heat which cannot be used for cooking or other purposes. This is the effects of a fuel. It is expressed as percentage.
3. **Ignition Temperature:** the minimum temperature at which a fuel catches fire is termed as its ignition temperature. Those substances having low ignition temperature catches fire easily.

**Some important characteristics of an ideal/good fuel:** No fuel is considered as ideal. Yet CNG is the best fuel among all others.

1. It should have a high calorific value.
2. Ignition Temperature should be low but above the room temperature.
3. It should have slow rate with controlled combustion.
4. Should be fairly cheap and easily available
5. Should not cause pollution on burning
6. Should be safe to handle, store and transport.

### Some fuels based on these characteristics:

1. **Hydrogen as fuel:** it is the best fuel and has highest calorific value. It is only used as a fuel because it is highly inflammable.
2. **Methane and LPG as fuels:** Both have high calorific values they burn with a smokeless fire and do not cause pollution.
3. **Petrol and diesel as fuels:** Both are used in auto mobiles their main disadvantage is their limited availability and other is that their combustion releases harmful gases

**Fossil fuels:** fossil fuels are formed from the buried remains of plants and animals over a period of millions of years. They produce large amount of energy on burning. Natural resources are divided into two types:

1. **Inexhaustible natural resources:** Those resources which are unlimited in nature and cannot be exhausted by human activity. Like sunlight, air.
2. **Exhaustible natural resources:** those resources which are limited and can be exhausted by human use in millions of years. Like coal, petroleum, forest



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**Coal:** Coal is black or brownish black in color. It is one of the oldest fuels. It is mainly made up of carbon along with other elements mainly hydrogen, sulphur, oxygen. **Formation of coal:** Trees and other plants grown in swampy areas around 300 to 400 years ago died and remains got buried. In low oxygen conditions, high temperatures and absence of air, they formed a dark brown material called peat. Peat was compressed between layers of sediments and formed lignite. Even further compression resulted in formation of Anthracite. Depending on its carbon content it can be divided into three main types:

1. **Anthracite:** It has carbon content 92-98% and mainly used for heating. It is hard, black and glossy and is the source of any other fuel.

2. **Bituminous coal:** it has carbon content 60-80% and mainly used in heat and power generation and manufacturing of coke.

3. **Lignite:** It has carbon content around 25-35% and has lowest grade of coal. Commonly called brown coal. It is highly volatile and used in power generations.

Coal is processed further to obtain useful materials by destructive distillation (heating of coal at high temperature in absence of air in controlled environment):

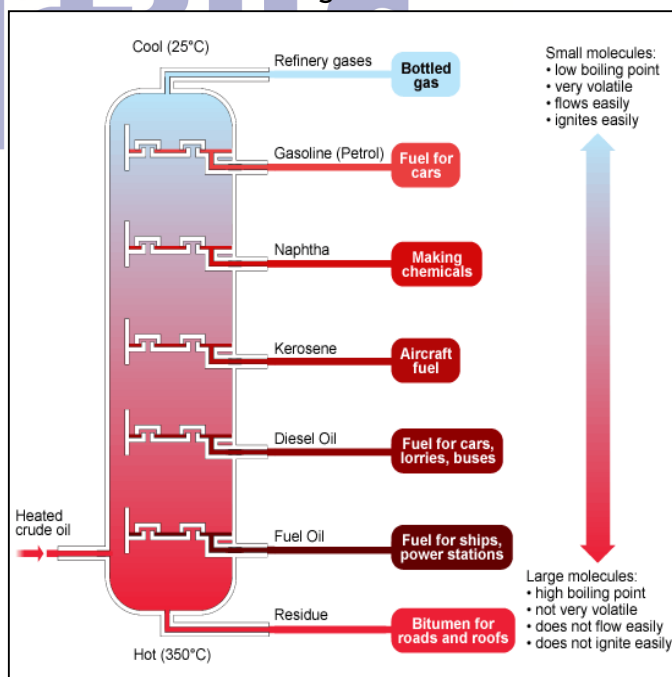
**Coke:** It is a hard, solid residue left behind destructive distillation of coal. It is pure form of carbon and used in steel manufacture, in power generations. Coal fields found near Bokaro and Jharia in Jharkhand.

**Coal tar:** thick, black, opaque liquid obtained as by product of the process of destructive distillation of coal. manufacturing coke. Used in antidandruff shampoos, ointments, soaps, perfumes, and making naphthalene balls.

**Coal gas:** gaseous fuel obtained as a by product of the process of manufacture coke. It is mainly composed of methane.

**Petroleum and natural gas:** Petroleum and natural gas were formed from the remains of tiny marine organism that died millions of years ago. Process of formation of petroleum and natural gas:

Tiny marine organisms died and settled on the ocean floor. With passage of time, this layer of dead organisms were covered beneath sediments. Enormous heat and pressure transformed the remains to petroleum and natural gas. Rising through porous rocks like sandstone, petroleum and natural gas reached a layer of impermeable rock and trapped below it. Petroleum and natural are extracted by drilling through the impermeable rocks. Petroleum is a complex nature of solid, liquid and gaseous hydrocarbon. The process of separating various constituents of petroleum is known as refining and carried out in refinery. It is heated to 400°c and introduced in fractionating column. Vapors of petroleum rise inside the fractionating column cool and condense at different heights, depending on their boiling paints and collected in different trays. Products obtained are:



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1. Below 30°C: petroleum gas (used as a domestic fuel in its liquefied form)
2. 30-120°C: petrol used as a fuel in automobiles, dry cleaning
3. 120-180°C: Naphtha used as a petrochemical
4. 180-250°C: kerosene (used as a fuel in lamps and stoves)
5. 250-350°C: diesels (used as a fuel in heavy motor vehicles and generators)
6. 350-500: lubricating oil used as oil in machinery and grease.
7. Above 500°C: fuel for ships and power stations and asphalt (used for making roads)

**Natural Gas:** is a naturally occurring hydrocarbon gas mixture consisting mainly of methane and some other hydrocarbons as well. Uses of natural gas:

1. Used for generation of electricity
2. CNG used as fuel in automobiles as well as domestic fuel
3. Production of ammonia
4. Used to produce hydrogen
5. Manufacture of steel, glass, plastic etc.

**Advantages of fossil Fuel:**

1. This technology is globally developed.
2. Fossil fuels are cheap and reliable.

**Limitation of Fossil Fuels:**

1. They are a finite resource.
2. They are often cheap because of subsidies.
3. They undergo combustion to make the environment acidic.
4. They can damage the environment through human error
5. They can contribute to public health issues.
6. **Air pollution:** use of fossil fuels adds many undesirable substances called pollutants. These adversely affect the life of organisms some main air pollutants.
  - a) Carbon monoxide
  - b) Carbon dioxide
  - c) Sulphur dioxide
  - d) Soot particles
- e) **Acidic Rain:** oxides of sulphur and nitrogen dissolve in rain water and form acid. Such rain is called acidic rain. It causes skin and breathing problems.

**Global Warming:** the phenomenon due to which excessive heat is trapped in the atmosphere because of excessive carbon dioxide, which lead to melting of ice caps, glaciers and resulting in weather changes.

**Conservation of fossil fuels can be done by:**

1. Energy saved is energy produced.
2. Judicious use of the existing resources.
3. Use of alternate sources of energy. Example: tidal power, wind energy, solar energy, nuclear energy etc.
4. In India, Petroleum Conservation Research Association (PCRA) give advise to save petrol and diesel:
  - a. We should drive at constant and moderate speed.
  - b. We should switch off the engine at traffic lights.
  - c. We should ensure correct tyre pressure.
  - d. We should ensure regular maintenance of vehicle.

