FUEL

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FUEL

- A fuel is a substance, which on proper burning gives large amount of heat energy on combustion. It is used for domestic and industrial purposes. They contain carbon as a main constituent.

Calorific value of a fuel

- Calorific value of a fuel is the total quantity of heat liberated when a unit mass or volume of the fuel is completely burnt.

Unit of heat

- Heat energy is measured in terms of calorie or kilocalorie.

CLASSIFICATION OF FUELS

Sl. No.	State of fuel	Natural	Artificial
1	Solid	Wood, peat, lignite, coal	Wood charcoal, coke
2	Liquid	Crude petroleum	Kerosene, petrol, diesel, alcohol
3	Gaseous	Natural gas	Water gas, producer gas, biogas, coal gas, LPG

SOLID FUELS

COAL

- Coal is a natural fuel formed by the slow carbonization of vegetable matter buried under the earth some thousands of years ago. It is classified into four kinds based on the carbon content and the calorific value.

1. Peat 2. Lignite 3. Bituminous coal 4. Anthracite coal

1. Peat

- It is the first stage of formation of coal from wood. It is brown, fibrous jelly-like mass. It contains 80-90% moisture. The composition of peat is C = 57%; H_2 = 6%; O_2 = 35% and ash = 2.5%. The calorific value of peat is 5400 kcal/kg. It is a low-grade fuel due to high water content.
- It is used as fertilizer.
- It is used as packing material.

2. Lignite

- Lignite is immature form of coal. It contains 20-60% moisture. Air- dried lignite contains C = 60-70% and O_2 = 20%. It burns with a long smoky flame. The calorific value of lignite is 6500-7100 kcal/kg.
- It is used as a domestic fuel.
- It is used as a boiler fuel for steam production.
- It is used in the manufacture of producer gas.

3. Bituminous coal

- It is a high quality fuel. Its moisture content is 4%. Its composition is C = 83%; O_2 = 10%; H_2 = 5% and N_2 = 2%. Its calorific value is 8500 kcal/kg.
- It is used in metallurgy.
- It is used in steam production.
- It is used for making coal gas.
- It is also used for domestic heating.

4. Anthracite coal

- It is the superior form of coal. It contains C = 92-98%; O_2 = 3%; H_2 = 3% and N_2 = 0.7%. It burns without smoke. Its calorific value is 8700 kcal/kg**.**
- It is used for steam production and house hold purposes.
- It is used for direct burning in boilers and in metallurgy.
- It is used in thermal power plant.
- It is used in coal tar distillation.
- It is used in glass furnaces.

LIQUID FUELS

Liquid hydrogen

- Hydrogen is a colourless and odourless gas composed of diatomic molecules. It holds greater role as fuel in future.
- Liquid hydrogen is a favourable rocket fuel.
- On combustion, it produces more heat per gram than any other fuel.
- Further, it produces only water on combustion whereas the fossil fuels produce gases like SO_2, NO_2 and CO_2 causing environmental pollution. Hence, hydrogen as a fuel has more advantages than any other fossil fuels.

Petroleum

- Petroleum (Crude oil) is a naturally available liquid fuel. It is a dark greenish-brown viscous oil found deep in earth's crust. It is composed of various hydrocarbons with small amount of other organic compounds as impurities.

Refining of petroleum

- The process of purification and separation of various fractions present in petroleum by fractional distillation is called refining of petroleum. Refining is carried out in oil refineries.

Fractional distillation

- It is the process of separation of various components of a liquid mixture based on the difference in their boiling points by repeated evaporation and condensation.

Products of fractional distillation of petroleum and their uses:

SL. No.	Fractions	Temperature	Uses
1	Gases	Below 30°C	Used as industrial and domestic fuel
2	Petroleum ether	30°C to 80°C	Used as a solvent
3	Gasoline or petrol	40°C to 180°C	Used as a solvent, fuel and in dry cleaning
4	Kerosene oil	180°Cto 250°C	Used as illuminant and fuel
5	Diesel oil or gas oil	250°C to 320°C	Used as fuel for diesel engine
6	Heavy oil or lubricating oil	320°Cto 400°C	Used for lubrication, cosmetics and in medicines
7	Residue or asphalt or pitch	Above 400°C	Used for road making and water proofing of roofs

GASEOUS FUELS

PRODUCER GAS

- Producer gas is a mixture of carbon monoxide and nitrogen. It also contains traces of hydrogen and carbon dioxide.
- The average composition of producer gas is CO = 22-30%; H_2 = 8-12%; N_2 = 52-55% and CO_2 = 3%.Its calorific value is about 1300 kcal/m^3.
- It is used as a fuel in the extraction of metal.
- It is used in the manufacture of glass.
- It is used as a reducing agent in metallurgy.

WATER GAS

- Water gas is a mixture of carbon monoxide and hydrogen.
- It also contains traces of carbon dioxide and nitrogen.
- The average composition of water gas is CO = 41%; H_2 = 51%; N_2 = 4% and CO_2 = 4%. Its calorific value is 2800 kcal/m^3.
- It is used as a source of hydrogen gas.
- It is used as an illuminating gas.
- It is used as a fuel in ceramic industries

CNG (COMPRESSED NATURAL GAS)

- CNG is a good alternative fossil fuel. It mainly contains methane.
- CNG is made by compressing natural gas which is found in oil deposits landfills and waste water treatment plants to less than 1% of its volume, it occupies at standard atmospheric pressure.
- It is stored and distributed in hard containers at a pressure of 2900-3600 psi.
- It is cheaper than petrol or diesel.
- It emits fewer pollutants like CO_2, CO, etc. In New Delhi, it is used as a fuel for entire city bus fleet, taxis and three wheelers.
- It is safer than other fuels. In the event of a spill, it disperses quickly in air because, it lighter than air.

LPG (LIQUEFIED PETROLEUM GAS)

- It is a mixture of propane and butane.
- It is stored in steel cylinder under high pressure. When the cylinder is opened, it comes out in the form of gas.
- Commercially, it is supplied under various trade names.
- Its calorific value is 27,800 kcal/m^3.
- It is mainly used as a domestic fuel.
- It is used as a fuel in diesel engines.
- It is used as a motor fuel.

QUESTIONS

- Define calorific value of a fuel.
- How are fuels classified?
- Give two examples for solid fuels.
- Give two examples for liquid fuels.
- Give two examples for gaseous fuels.
- What are the varieties of coal? Explain .
- What is petroleum? What is refining of petroleum?
- Write a note on liquid hydrogen as fuel.
- Give the composition and uses of producer gas.
- Give the composition and uses of water gas.
- Give the composition and uses of CNG.
- Give the composition and uses of LPG.