



UNIT V  
FUELS AND COMBUSTION

5.1 Introduction,

5.2 Classification

## 5.1 Introduction

Fuel is a substance that is burned to provide nuclear energy, heat or power. Materials like coal, wood, oil, or gas can provide heat when burned. Methanol, Gasoline, Diesel, Propane, Natural gas, Hydrogen are types of fuel. Nuclear energy is produced by burning plutonium.

From fuel efficiency or fuel economy, we can measure how long any vehicle could travel, which is the opposite of fuel consumption. Fuel consumption is the amount of fuel vehicle uses to travel a particular distance. Fuel efficiency is measured in kilometers per liter. The efficiency with which the fuel does a conversion of energy is known as fuel efficiency.

### What is Fuel?

Definition of fuel is any substance that can provide heat and produce energy when it is burned. This energy that releases is generally in the form of chemical energy or heat energy.

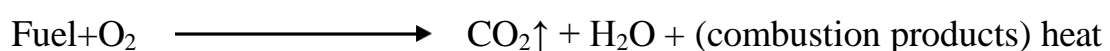
The recent invention of nuclear technology means now even nuclear energy may be released due to nuclear fission or fusion.

This heat energy that fuels release is used for various purposes such as cooking, in heaters, for many industrial and manufacturing purposes. At other times we use an engine to convert this heat energy into mechanical energy.

Like when we use petrol to run our cars. The oil which is used to as fuel in the engine is known as Fuel oil. And then there is the fuel our bodies use.

Every cell requires energy to perform its functions. They get this energy from organic molecules such as carbohydrates, fats etc.

This process of using fuels is known as cellular respiration. And these organic molecules are obtained via nutrition, which is why we call food as the fuel of our bodies.



### Examples of Fuel

Methanol, Gasoline, Diesel.

Natural gas, Hydrogen, Biodiesel.

## Fuel Efficiency

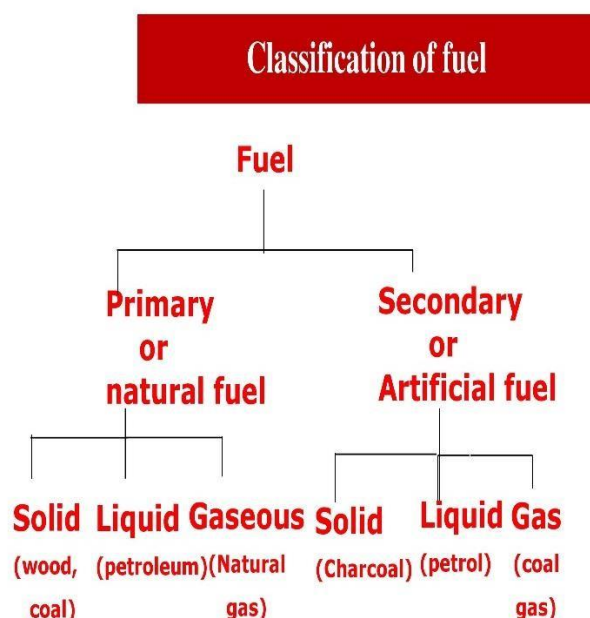
Now you know that energy cannot be created or destroyed, all energy can only be transferred. Fuel also do not create energy. They only convert the chemical energy of the fuel to the kinetic energy with the help of the thermal energy supplied to them. The efficiency with which the fuel does this conversion of energy is known as fuel efficiency.

Now let us take a look at how we measure this fuel efficiency. Fuel efficiency is measured as the amount of heat that 1 kg of fuel (any fuel) produces on combustion. This is known as the calorific value of the fuel. The unit of measurement of fuel efficiency is kilojoules per kg, i.e. kJ/kg.

## Characteristics of a good fuel

- A good fuel should have, High calorific value.
- Moderate ignition temperature and velocity of combustion. Low moisture content, non-combustible matter.
- Easy to transport.
- The products of combustion must be harmless. Combustion must be easily controllable.
- Must not burn with much smoke.

## 5.2 Classification of fuels



## **Solid fuel**

Solid fuel refers to various types of solid material that are used as fuel to produce energy and provide heating, usually released through combustion.

Solid fuels include wood, charcoal, peat, coal, hexamine fuel tablets, and pellets made from wood (see wood pellets), corn, wheat, rye and other grains.

Solid-fuel rocket technology also uses solid fuel (see solid propellants). Solid fuels have been used by humanity for many years to create fire. Coal was the fuel source which enabled the revolution, from firing furnaces, to running steam engines.

Wood was also extensively used to run steam locomotives. Both peat and coal are still used in electricity generation today.

The use of some solid fuels (e.g. coal) is restricted or prohibited in some urban areas, due to unsafe levels of toxic emissions.

The use of other solid fuels as wood is decreasing as heating technology and the availability of good quality fuel improves.

In some areas, smokeless coal is often the only solid fuel used. In Ireland, peat briquettes are used as smokeless fuel. They are also used to start a coal fire.

Coal is a fossil fuel which mainly contains carbon and is formed as a result of alteration of vegetable matter under favorable conditions (high temperature and pressure) under the earth.

It consists of C, H, N, O & non-combustible inorganic matter.

## Coalification or Metamorphism

The process of conversion of vegetable matter (wood) into coal is called Coalification. The flowchart showing the sequential conversion of wood into coal is given as,

Wood → Peat → Lignite → Bituminous coal → Anthracite



Lignite



Peat



Anthracite



Bituminous  
coal

### Classification of coal (Varieties of coal)

Fuel	Property	% of carbon	C.V(k.cal/kg)	Applications
Wood		50	4000-4500	Domestic fuel
Peat	Brown fibrous jelly like mass	50-60	4125- 5400	Soil amendment
Lignite	Soft, brown coloured coal	60-70	6500-7100	Steam generation
Bituminous	Dark grey coloured coal	80-90	8000-8500	Making coal gas & metallurgical coal
Anthracite	Black of dark brown coloured  high rank coal	90-98	8650-8700	Smithing coal, Coking  coal, Power generation