

# Chapter 6: Combustion and Flames

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## I. Combustion:

- It is a chemical process in which a substance reacts with oxygen to produce heat, light and flames.
- Combustible substances: Any substance which can combust can easily catch fire.
- Fuel: a combustible substance which produces energy after burning is called a fuel
- Air is necessary for combustion.
- Ignition temperature:
  1. The lowest temperature at which a substance catches fire.
  2. A combustible substance cannot catch fire or burn as long as its temperature is lower than its ignition temperature
  3. The substances which have very low ignition temperature and can easily catch fire with a flame are called inflammable substances. Examples of inflammable substances are petrol, alcohol, Liquefied Petroleum Gas (LPG) etc.
- **Match stick:**
  - Safety matches have 3 components: antimony trisulphide and potassium chlorate on the wooden stick. The major part is red phosphorus which is present on the rubbing surface along with powdered glass.
  - When a match is struck red phosphorus gets converted into white phosphorus which in turn reacts with potassium chlorate in the matchstick head. This leads to production of heat to ignite antimony trisulphide and combustion begins.
- **Controlling fire:**
  - 1) One should always have the telephone number of the fire service in your area.
  - 2) Fire can be controlled by removing one or more of requirements: fuel, air (to supply oxygen) and heat (to raise the temperature of the fuel beyond the ignition temperature).
  - 3) Water is generally used to control fire as Water cools the combustible material because of which that its temperature is brought below its ignition temperature. This prevents the fire from spreading.
  - 4) Water vapors surrounding the combustible material, helping in cutting off the supply of air. Hence helping the fire to be extinguished.
  - 5) Use fire extinguishers.
- **Fire extinguishers:**
  - 1) Water is most common fire extinguisher. Limitation is that it can only be used when thing like wood and paper are on fire.
  - 2) In case of fire involving electrical equipment, inflammable materials like petrol, carbon dioxide (CO<sub>2</sub>) is the best extinguisher.

➤ **Types of combustion:**

- 1) **Rapid combustion:** In this type of combustion gas burns rapidly producing heat and light. E.g., combustion of L.P.G
- 2) **Spontaneous combustion:** in this type of combustion a material suddenly bursts into flames, without the application of any obvious cause is called spontaneous combustion. E.G., forest fires
- 3) **Explosion:** A sudden reaction in which combustion leads to release of heat, light and sound and a large amount of gas is called as explosion

**II. FLAME:**

It can be defined as a hot glowing body of ignited gas that is generated by something on fire

➤ **Structure of a flame:**

- A still candle flame can studied to understand the structure of flame.
- **The innermost zone:** It has black color due to presence of unburnt wax vapors. This is the least hot zone.
- **The middle zone:** It has yellow color, medium hot, bright part of the flame. Here partial combustion of fuel takes place.
- **The outermost zone:** it is the hottest zones, blue in color, non-luminous part of the flame and there is complete combustion of fuel in this zone.

**III. FUEL:**

➤ **Characteristic of good fuel:**

- i. It should be readily available.
- ii. It should be cheap.
- iii. It should burn easily in air at a moderate rate.
- iv. It should not leave any undesirable substance in air.

➤ **Fuel efficiency:**

- Efficiency is related to the calorific value.
- **Calorific value:** It is the amount of heat energy produced on complete combustion of 1 kg of a fuel
- The calorific value of a fuel is expressed in kilojoule per kg (kJ/kg).

➤ **Harmful effects of burning fuel:**

- i. Unburnt carbon particles released in the air by burning fuels can cause respiratory diseases, such as asthma.
- ii. Incomplete combustion of fuels releases carbon monoxide gas which is very poisonous. Its life threatening to burn coal in a closed room.
- iii. Combustion of fuels releases carbon dioxide in air. Increased amounts of carbon dioxide led to Global warming.
- iv. Sulphur dioxide which is released burning of coal can lead to acid rains. SO<sub>2</sub> is a corrosive gas.
- v. Burning fuel is harmful for crops, buildings and soil.