8th – Combustion and Flame I

Combustion: the chemical process of burning of a substance in the presence of air or oxygen with the liberation of heat and light is called combustion. Substances can be classified as:

1. **Combustible substances:** substances that burn in air or oxygen to produce heat and light are called combustible substances. E.g. paper, wood, kerosene, LPG.
2. **Non combustible substances:** substances that do not burn in air or oxygen to produce heat and light are called non- combustible substances e.g.: water, sand, glass etc.

Types of combustion:

1. Rapid combustion: larger amount of heat and light are released in a very short span of time. E.g. combustion of LPG, which produces heat light intently. They also require external heat
2. Explosion: characterized by sudden release of heat, light and sound e.g.: bursting of firecrackers.
3. Spontaneous combustion: substances catch fire on their own, without the application of external heat e.g. white phosphorous.

Combustion of hydrocarbons can be divided in to two types:

1. Complete combustion: combustion takes place in adequate amount of air or oxygen. It results in the formation of carbon dioxide, water, heat and light.
2. Incomplete combustion: combustion take place in inadequate amount of air or oxygen .It result in the formation of carbon monoxide, soot, water, heat and light.

Soot: black powdered substance produced on incomplete combustion.

Condition necessary of combustion:

1. Presence of combustion substances: combustion is only possible in the presence of combustion substance i.e. called fuel. e.g. wood, charcoal, petrol etc.
2. Presence of a supporter of combustion: adequate amount of supporter of combustion e.g.: oxygen.
3. Attainment of ignition temperature: A substances start to burn after attainment of certain minimum temperature. The temperature at which a particular substances burn in the presence of air is called ignition temperature. A substance cannot catch fire below its ignition temperature.

Note: A substance will not burn without one or more of these conditions.

Inflammable substances: substances like petrol, LPG, alcohol catch fire easily because they have low ignition temperature and are inflammable substances.

Extinguishing a fire: Fire can be controlled by removing any one or more of these conditions. A fire extinguisher cuts off the supply of air or brings down the temperature of the fuel or both and controls the fire.

Fire can be controlled and extinguished by

1. Removing any combustible materials near the region of fire.
2. Cutting off the supply of air by using sand or blanket.
3. Bringing down the ignition temperature by using water

Fuel in most cases cannot be eliminated. If for instance, a building catches fire, then the whole building is the fuel.

Fire can be extinguished using water: Water evaporates, taking away heat from the fire, which in turn cools down the burning materials below its ignition temperature. However, water is dangerous in most of the cases:

1. When used over electrical fires, as it conducts electricity and can cause danger to the people trying to extinguish the fire.
2. Pouring over burning petrol, kerosene, or diesel: these substances are lighter than water and do not mix with water. As a result, water forms a layer beneath them and the substance continues burning.

Carbon dioxide fire extinguisher: consist of carbon dioxide filled under high pressure in cylinders. It is not a supporter of combustion .Being heavier than air; carbon dioxide settles down and cut off the supply of oxygen which extinguishes the fire.

When released from cylinders, CO_2 expands enormously in volume and cools down. So, it not only forms a blanket around the fire, it also brings down the temperature of the fuel.

Soda Acid Fire Extinguisher: It contain concentrated solution of sodium hydrogen carbonate and sulphuric and in separate compartments. When the fire extinguisher is used, the two substances come into contact with each other producing carbon dioxide. It is also called foam type fire extinguisher.

Flame: A flame is a region where combustion of fuel takes place.

Substances which vapourise during burning produce flames. E.g. kerosene, wax etc. Substances which do not vapourise during burning do not produce flames. E.g. coal, charcoal etc. The colour of flame depends on:

Temperature, amount of air available, nature of the substance burning

Luminous Flame	Non Luminous Flame
1. Give yellow flame	1. Give blue color flame
2. Emits lot of light	2. Emit very little light
3. Observed when there is insufficient oxygen or incomplete combustion	3. Observed when there is sufficient amount oxygen available
4. Temperature is less and leaves behind black soot and other residue.	4. Leave no residences behind