

Combustion

- A chemical process in which a substance reacts with oxygen to give off heat is called combustion.
- The substance that undergoes combustion is said to be combustible. It is also called a fuel. The fuel may be solid, liquid or gas.
- Sometimes, light is also given off during combustion, either as a flame or as a glow.
- Fuels such as Liquid petroleum gas, compressed natural gas, petrol, diesel, coal etc undergo combustion to give off heat and light.

Conditions necessary for combustion

- There are three necessary conditions for combustion to take place:
 - a. Presence of a combustible substance.
 - b. Presence of a supporter for combustion.
 - c. Heating the substance to its Ignition temperature
- The most important condition for combustion is presence of a material that can undergo combustion.
- The second important condition for combustion is supporter of combustion such as air.
- In the limited supply or absence of air, the combustion reaction will stop after sometime.
- This is the reason, a person who has caught fire is wrapped in a blanket so as to cut off the air supply and the fire extinguishes.
- One more very important condition is heating of a material to its ignition temperature.
- The lowest temperature at which a substance catches fire and starts burning is called **Ignition temperature**.
- It is necessary to heat a substance to its ignition temperature so that it undergoes combustion.
- The ignition temperature of different substances is different.
- The substances which have very low ignition temperature and easily catches fire with a flame are called inflammable substances. Examples are petrol, alcohol, Liquified Petroleum Gas (LPG)etc.
- The substances which have very high ignition temperature and cannot catch fire easily with flame are called flammable substances.

Fuel efficiency

- The amount of energy produced in the form of heat as a result of complete combustion of a unit mass of a fuel is known as calorific value. Its unit can be expressed in joule/gm or KJ/ Kg.
- The calorific value of coal is 25000 – 33000 KJ/Kg.

Types of Combustion

- Combustion can be classified into three types:
 1. Rapid combustion
 2. Spontaneous combustion
 3. Explosion

Rapid combustion

- The combustion reaction that takes place rapidly to produce heat and light is called rapid combustion. For e.g. combustion of LPG.
- When a matchstick or a lighter is brought near a gas stove it catches fire rapidly.

Spontaneous combustion

- The combustion reaction in which a material catches fire on its own at room temperature is called Spontaneous combustion.
- For e.g. phosphorus burns in air at room temperature.

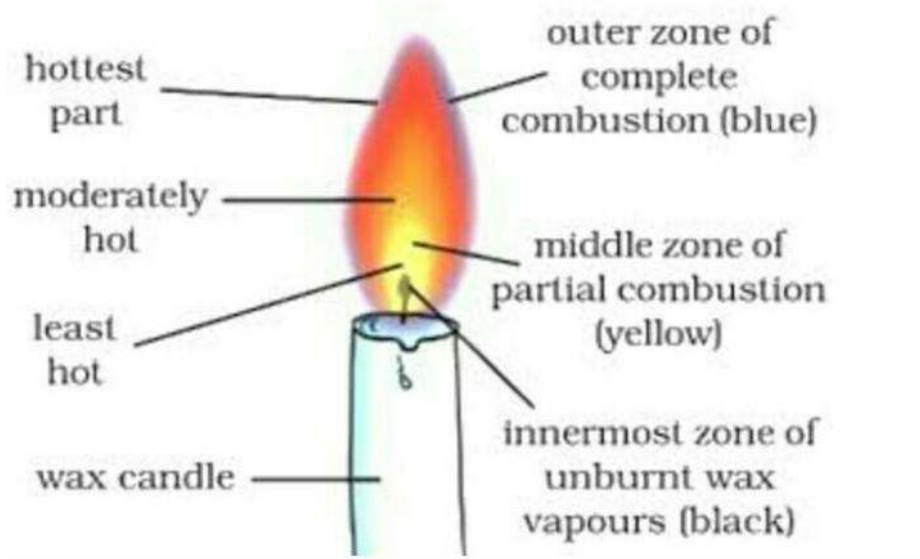
Explosion

- The combustion reaction in which a sudden reaction takes place with evolution of heat, light and sound is called Explosion.
- A large amount of gas is liberated during explosion.
- For e.g. crackers burnt on festivals.

Flame and its structure

- The region where combustion or burning of gaseous substance take place is called a Flame.
- All the gases that undergo combustion produce flame. But only those substances which vaporise during burning, burn with a flame.
- For e.g. LPG, wax, biogas, kerosene oil etc burn with a flame.
- Charcoal does not vaporise during burning and so does not produce a flame.
- A flame consists of three zones:
 - a. The outermost zone is the hottest of all zones. It is blue in colour because of complete combustion. It is the non-luminous part of the flame.
 - b. The middle zone of the candle flame is moderately hot and is yellow in colour because of partial combustion of fuel. It is the bright part of the flame.

- c. The innermost zone of the flame is the least hot among all zones and is black in colour. This is due to the presence of unburnt wax vapours.



Ways to control fire

- There are three conditions for combustion: fuel, air and heat.
- The fire can be controlled by removing anyone or two of these. However, It is not possible to remove the fuel.
- Water is the best fire extinguisher because it cools the combustible material to bring its temperature below the ignition temperature.
- Also the water vapours surround the fuel to cut off the air supply and the fire is extinguished.
- But water cannot be used in case of an electric fire or fire due to petrol or oil.
- In such cases use of fire extinguishers is the best option as it contains solid carbon dioxide.
- Carbon dioxide being heavier than oxygen covers the fire and breaks the contact between fire and air, it also does not harm the electrical equipment too.

Harmful effects of burning fuel

- Carbon fuels such as wood, coal etc produce unburnt carbon particles which is a dangerous pollutant and causes respiratory diseases.
- Incomplete combustion of fuels give off carbon monoxide which is a poisonous gas.
- Combustion of most of the fuels produce carbon dioxide which is the main cause of **Global Warming**.
- Burning of coal and diesel releases sulphur dioxide which is a suffocating and corrosive gas.

- Oxides of sulphur and nitrogen dissolves in rain water making it acidic. Such rain is called acid rain.
- Acid rain is very harmful for crops buildings and soil.

