St. Andrews Scots Sr. Sec. School

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Session: 2022-2023 – Notes

Class: VIII **Subject: Science** **Topic: Combustion and Flame** **Chapter: 5**

We use different kinds of fuel for various purposes at home, in industry and for running automobiles. These fuels are cow dung, wood, coal, charcoal, petrol, diesel, compressed natural gas (CNG), etc.

Combustion: It is a chemical reaction in which heat is released by a material when it reacts with oxygen.

Process of combustion

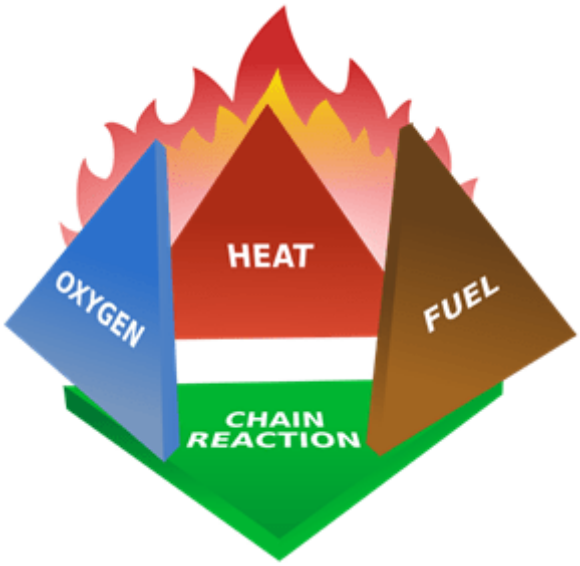
Fuel or Combustible Substance: Any material that undergoes combustion is called a combustible substance. It is also called as fuel. Some examples of fuels are petrol, diesel, etc. The fuel may be in solid, liquid or gas state. Sometimes, light is also given off during combustion, either as a flame or as a glow.

Inflammable Substances:
Those materials which have low ignition temperature and catch fire easily are termed as inflammable substances. Example includes petrol, LPG, etc.

Ignition Temperature:
(i) It is the minimum temperature at which any material catches fire.
(ii) If the temperature of combustible substance is lower than the ignition temperature then the substance will not burn.

Example: (i) Cooking oil catching fire when a frying pan is kept for long on a burning stove. (ii) Kerosene oil and wood do not catch fire on their own at room temperature. But, if kerosene oil is heated a little, it will catch fire. But if wood is heated a little, it would still not catch fire.

Things necessary for combustion to take place:
(i) Fuel or Combustible substance.
(ii) Air (With presence of Oxygen in it).
(iii) Temperature above the Ignition temperature.



Fire triangle

Measures to control fire:

1. Fire Brigade Stations:
In case of fire, fire brigades will extinguish the fire by sprinkling the water on the affected areas. The water will bring down the temperature below its ignition temperature. As a result, fire will stop spreading. Water vapours also surround the combustible material, helping in cutting off the supply of air. So, the fire is extinguished.

Fire brigade

2. Fire Extinguisher:
Water is the most common fire extinguisher. But, it works only on things like wood, paper, etc. However, in case fire is caught on electrical things then, water being good conductor of electricity will destroy those equipment. Even water is not good in case of fires due to oil, petrol, etc.
For such cases, Carbon dioxide (CO_2) is best extinguisher. This extinguisher cut off the air supply and thus brings down the temperature below the ignition temperature as a result fire gets extinguished. Moreover, it usually does not damage electrical equipment.

Fire Extinguisher

3. Use of Blankets:
If a person catches the fire, then blankets can be used to extinguish the fire.

Different Types of Combustion:
1. Rapid Combustion
In this type of combustion, the substances burns rapidly and yield light and heat.

Rapid Combustion

Example: Bring a burning matchstick or a gas lighter near a gas stove in the kitchen. Turn on the knob of the gas stove. We find that the gas burns rapidly and produces heat and light.

2. Spontaneous Combustion:
In this type of combustion, substances burst out into flames suddenly without any known reason.

Spontaneous Combustion

Examples: Many disastrous fires in coal mines result due to this kind of combustion. The heat rays coming from the sun or a lightning strike might be responsible for this kind of combustion.

Flame:
When something is burnt, a hot luminous gas emerges out of the substance. This gas is called as flame. Flames are result of the substances which vaporizes on burning. Example includes kerosene oil, wax, etc. which form flames on burning.

Flame structure:

When flames are observed carefully, one can notice different layers of flame as shown in figure below:

Outermost zone: It is blue in color and is hottest amongst all the zones. In this portion, complete combustion takes place.

Middle zone: It is yellow in color and is somewhat hot. In this portion, partial combustion takes place.

Innermost zone: It is black in color and is coolest amongst all the zones.

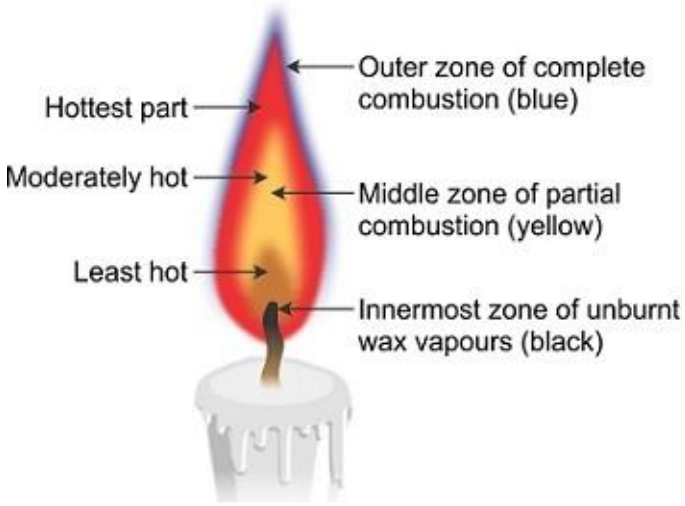


Diagram to show different zones of flame

Fuel:
The substance that undergoes combustion is called as fuel. Examples of fuels are wood, charcoal, petrol, kerosene, etc.

Characteristics of good fuel:
(i) It should easily be available.
(ii) It should be cheap.
(iii) It should generate large amount of heat.
(iv) It should not leave any unwanted matter after combustion.

Ideal Fuel
(i) The fuel which satisfies all the characteristics of good fuel is termed as an ideal fuel.
(ii) Probably, there is as such no ideal fuel present.

Fuel Efficiency
(i) The quantity of heat generated on combustion of 1 kg of a fuel is called its calorific value.
(ii) Its unit is kilojoule per kg (kj/kg).

Calorific Values of Different Fuels:

Fuel	Calorific Value (kJ/kg)
Cow dung cake	6000 - 8000
Wood	17000 - 22000
Coal	25000 - 33000
Petrol	45000
Kerosene	45000
Diesel	45000
Methane	50000
CNG	50000
LPG	55000
Biogas	35000 – 40000
Hydrogen	150000

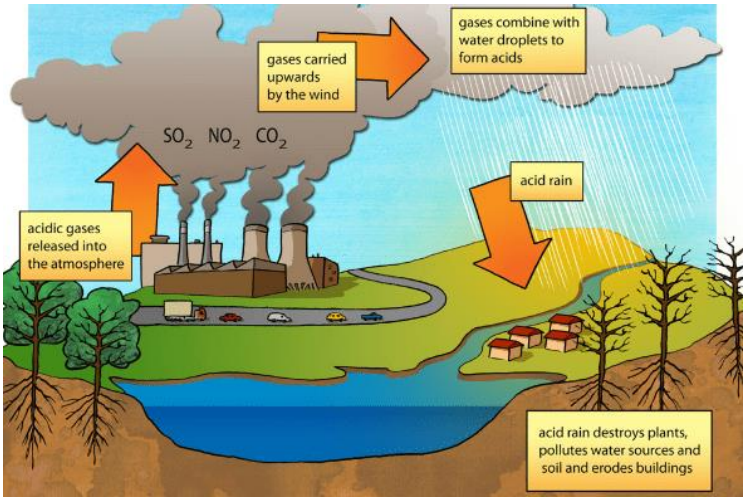
Harmful Effects of Burning Fuels: The increasing fuel consumption has harmful effects on the environment.

1. Various air pollutants like unburnt carbon particles released due to partial burning of carbon fuels causes many respiratory diseases.

2. The partial burning of some fuels releases carbon monoxide, which is a poisonous gas. And this gas can kill a person if left in a room filled with this gas.

3. ***Global Warming:*** Combustion of most fuels the increase the amount of carbon dioxide in the atmosphere that has lead to increase in the average temperature on the earth.

4. ***Acid Rain:*** Due to burning of coal and diesel, Chemicals like sulphur dioxide and nitrogen dioxide are released into the air. The pollutants reacts with the water vapour present in the air and forms sulphuric and nitric acid. When it rains, these acids are also present. Such kind of rain is called Acid Rain. It is very harmful for crops, buildings and soil.



Acid Rain

Prevention from Acid rain: The use of diesel and petrol as fuels in automobiles is being replaced by CNG (Compressed Natural Gas), because CNG produces the harmful products in very small amounts. CNG is a cleaner fuel.

CNG Auto Mobiles