CLASS - VIII

CHAPTER 3- COMBUSTION, FLAME AND FUELS

Day 1 Notes

Combustion: The process of burning of a substance in the presence of air to give heat, light or sound.

Eg. $C + O_2 \longrightarrow CO_2 + Heat$

$CH_4 + 2O_2 \longrightarrow CO_2 + 2H_2O + Heat$

Combustible Substance: Substances which undergo combustion.Also called as fuels. Eg. Wood, Paper, Petrol, CNG etc.

Non Combustible Substances: Substances which do not undergo combustion.

Eg. Sand, Glass, Water, CO_2 etc.

Inflammable Substances: Substances which have low ignition temperature and catch fire easily.

Eg. Petrol, LPG, CNG etc.

Substances

(Based on combustion)

Combustible — Non-Combustible

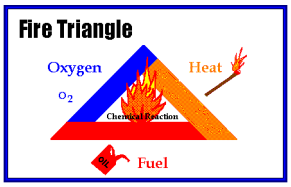
Eg. Petrol, Wood etc. — Eg. Sand, Water etc.

Produces flame — Does not produce flame

Eg. Wax, Oil, Camphor etc. — Eg. Charcoal Coal etc.

Conditions required for Combustion:

- Combustible Substance
- Supporter of Combustion (Air or Oxygen)
- Ignition Temperature



Ignition Temperature: The minimum temperature at which a substance catches fire. Also called kindling temperature.

Eg. Petrol has less ignition temperature than coal.

LPG > Diesel > Coke (Ascending order of ignition temperature).

Day 2 notes

Types of Combustion:

- **Slow Combustion:** Combustion in which fuel takes some time to burn. External heat is supplied.
  Eg. Burning of wood, coal etc.
- **Rapid or fast Combustion:** Combustion takes place quickly. External heat is supplied.
  Eg. Burning of LPG, Petrol etc.
- **Spontaneous Combustion:** Combustion in which a substance burns by itself without the supply of heat.
  Eg. Burning of white Phosphorus (P).
- **Explosive Combustion or Explosion:** Combustion which produces heat, light and sound in large quantity. External heat is supplied.

  Eg. Burning of fire crackers, bombs.

Complete and incomplete combustion.

S. No.	Complete combustion	Incomplete combustion
1	The combustion reaction that takes place in the presence of a sufficient or abundant amount of oxygen is called a combustion reaction.	The combustion reaction takes place in the presence of an insufficient amount of oxygen.
2	In this type of combustion, the flame is of blue colour.	In this type of combustion, flame is of yellow colour.

3	It will produce no smoke	It will produce soot
4	In this reaction, carbon dioxide is the primary product formed	In this reaction, carbon monoxide is the primary product formed
5	Example: Combustion of LPG	Example: Burning of wood that causes air pollution

Day 3 Notes

Fire Extinguishers: Device used to put off fire.

Principles:

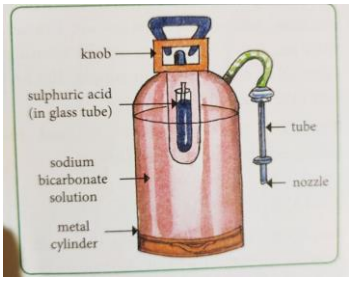
- Cooling the fire below ignition temperature.
- Cutting of the supply of air.

Types of fire extinguishers:

1. **Water:** Cools the combustible substance below ignition temperature.
   Water vapour formed is heavier than oxygen and surrounds the flame.
   Used for materials like wood, paper etc. on fire.

2. **Soda Acid fire extinguisher:** H_2SO_4 and $NaHCO_3$ present in the container react oncompression to form CO_2.

(HW: Draw a neat diagram of soda acid fire extinguisher.)



Day 4 notes

HOTS

1.Why is it difficult to burn a heap of green leaves while dry leaves catch fire easily?

Ans. Green leaves contain moisture which absorbs heat and does not allow leaves to reach ignition temperature.

2.Matchstick can light tiny splinter of wood but not big log of wood. Why?

Ans. Splinter has less ignition temperature, heat produced by the matchstick is not enough for the log of wood to catch fire.

3.Why is Phosphorus stored under water?

Ans. Phosphorus has low ignition temperature (35^0C) and catches fire easily. So it is stored under water which cools it below its ignition temperature.

4. Why coal does not give flame while candle gives flame on burning?

Ans. Coal does not vapourise on burning. So, it does not give flame. On burning, a candle wax vapourises and gives flame.

5. Why is water not used to extinguish electrical fires?

Ans. Water is a good conductor of electricity as it contains few salts and minerals. So not used to extinguish electrical fires.

6. Why is water not used to extinguish oil fires?

Ans. Water being heavier settles down below oil, so water is not used. Instead sand or CO_2 fire extinguishers are used to extinguish oil fires.

Day 5

FLAME:

Flame is a zone of combustion of gaseous substances with the evolution of heat and light.

Eg. Coal does not give flame as it doesn't vapourise and burns directly.

When you light a candle, wax near the wick melts into a liquid.

The heat of the flame vaporizes the wax molecules and they react with the oxygen in the air. As wax is consumed, capillary action draws more liquid wax along the wick. As long as the wax doesn't melt away from the flame, the flame will consume it completely and leave no ash or wax residue.

Structure of Flame:

A candle flame consists of four zones. These are:

1. **Non luminous zone:**
    - Outermost and hottest zone.
    - Zone of complete combustion.

- Produced when fuels burn in sufficient supply of air.
- Blue in colour and faintly visible so called blue zone.

2. Luminous zone:

- Middle zone.
- Moderately hot.
- Zone of incomplete combustion.
- Fuels burn in insufficient supply of oxygen.
- Appears yellow as the flame is bright so called yellow zone

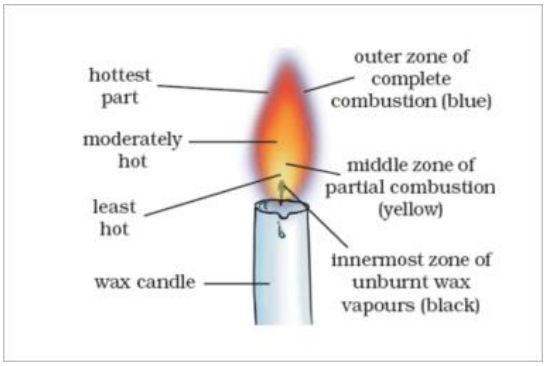
3. Dark zone:

- Innermost zone.
- Least hot part.
- Zone of no combustion.
- Appears black as no particles burn so called black zone.

4. Blue zone:

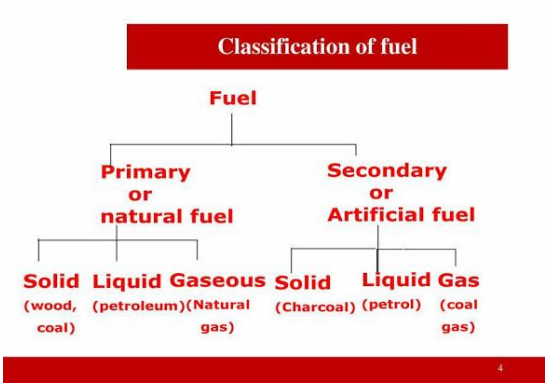
- Lowest part of flame
- Complete combustion
- Blue in colour

(NOTE: Draw the structure of flame on left hand side of your notebook.)



Day 6

Classification of fuels



Characteristics of Ideal fuel:

- ❖ High calorific value.
- ❖ Ecofriendly and pollution free.
- ❖ No residue or waste.
- ❖ Low cost.
- ❖ Easy to transport.
- ❖ Moderate ignition temperature.
- ❖ More abundant.

  NOTE: No fuel is 100% ideal fuel. Biogas, LPG,CNG are considered to be closest to an ideal fuel.

Harmful effects of burning fuels(REFER TEXT BOOK)

CALORIFIC VALUE:

- The amount of heat produced by the complete combustion of 1 kg of fuels.

Coal formation

Carbonisation: The slow process of conversion of fossils into coal under high temperature and pressure in the absence of air.

Day 7

Flow chart

Plants get buried under the surface of earth

↓

Dead plants gets compressed as more sand, clay and water gets deposited

↓

High temperature and pressure turn buried plants into coal

Varieties of coal:

S.No	type of coal	% of carbon
1	Peat	60%
2	Lignite	70%
3	Bituminous	70-80%
4	Anthracite	90-95%

Note: more the percentage of carbon in coal better is the quality of coal

Destructive distillation: The process of heating a substance at high temperature in the absence of air

Example:

1) Wood → turns to charcoal (destructive distillation)

2) Coal→ a) Coke b) Coal tar c) Coal gas

Destructive distillation of coal

Products of coal:

Destructive distillation of coal gives various products like

1. Coke
2. Coal Tar
3. Ammonical liquor
4. Coal gas

Uses of coal:

- as domestic and industrial fuel
- to generate electricity
- for manufacturing synthetic petrol and natural gas
- extraction of metals
- sources of organic compounds
- used to make coke Coal Tar and coal gas
- in the earlier days to run steam engines

Day 8

Coke

properties:

- Tough, Porous, black residue left behind after destructive distillation of coal
- one of the purest form of carbon(98% carbon)

uses :

- as a fuel
- in extraction of metals
- in the manufacture of Steel
- for preparation of compounds like calcium carbide(Ca_2C) water gas ($CO+H_2$)and producer gas ($CO+N_2$)

Coal Tar

Properties:

- thick black liquid with unpleasant smell
- mixture of 200 different carbon compounds
- Residue obtained during destructive distillation of coal

Uses:

Used in making naphthalene balls synthetic dyes drugs explosives and paints etc.

Coal gas:

- mixture of combustible gases like hydrogen methane carbon monoxide(H_2+CH_4+CO)
- has high calorific value

Uses:

- Industrial fuel for lighting purpose.

Day 9

Petroleum and its products

Crude oil or Petroleum:

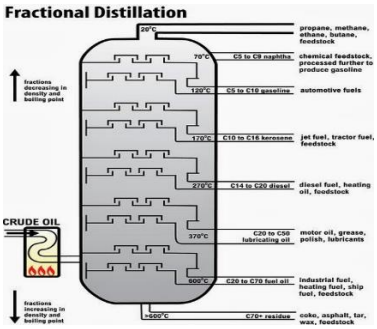
Properties:

- Dark, viscous, oily liquid with strong unpleasant odours.
- Complex mixture of several hydrocarbons inflammable, lighter than water and insoluble

Formation:

- crude oil is formed by the bacterial decomposition of Dead plants and animals which sank to the bottom of the sea
- over a period of millions of years this got converted into hydrocarbons and were trapped by impervious rocks

Refining of Petroleum or fractional distillation: The process of separating Petroleum into to useful constituents is called refining it is based on the differences in there boiling points



Example

1 purification of crude oil gives a number of petrochemicals

2. To obtain liquid oxygen and nitrogen from air

Petrochemicals: useful chemicals obtained from Petroleum and natural gases after refining are called petrochemicals

LPG (liquefied Petroleum gas):

- Petroleum gas is liquefied under high pressure mainly contains butane (C_4H_{10}) gas
- Colourless and odourless gas with high calorific value
- ethyl mercaptan is added to it to give a characteristic order to detect leakage
- used as cooking fuel

CNG (compressed natural gas)

Formation:

- CNG is a fossil fuel that occurs along with Petroleum deposit under the earth crust properties
- mainly consists of Methane
- clean fuel
- colourless and odourless gas
- lighter than air
- combustible and non toxic gas

Uses:

- as a domestic and industrial fuel
- fuel for Transport and power generation
- as a good source of hydrogen to prepare ammonia

POLLUTION AND JUDICIOUS USE

Will mark important points in textbook.