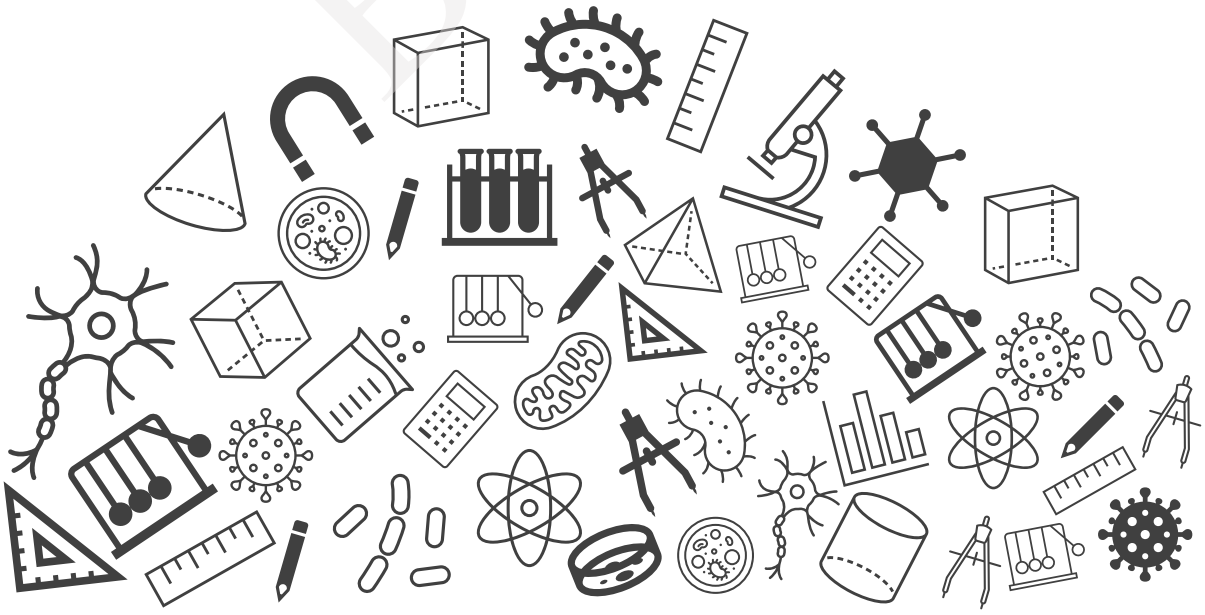
Grade 08
Chapter Notes

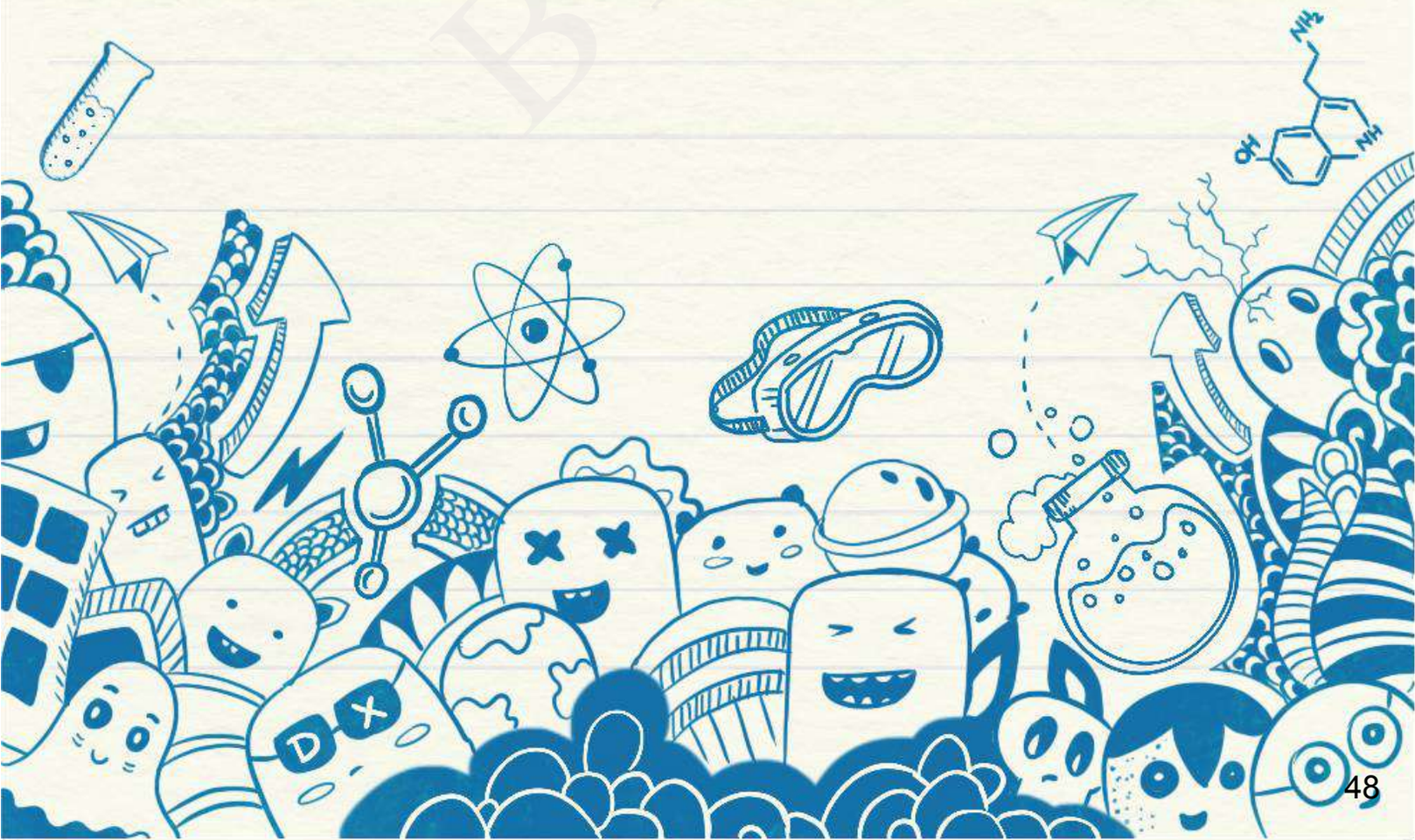


CHEMISTRY

BYJU'S

CHAPTER NOTES

Combustion and Flame



Topics to be Covered

1. Introduction to combustion
2. Types of substances
3. Ignition temperature
4. Types of combustion
5. Structure of flame
6. Fuels
7. Calorific value
8. Harmful effects of burning fuel
9. Fire triangle
10. Fire extinguisher

1. Introduction to Combustion

Burning of a substance in the presence of air (oxygen) to release energy is called as combustion. It can be represented as:

Substance + Oxygen ⟶ Energy

2. Classification of Substances

(Based on combustibility)

2.1. Combustible substances

- The substances that undergo combustion easily
- Examples: Matchstick, petrol, coal and paper

2.2. Non-combustible substances

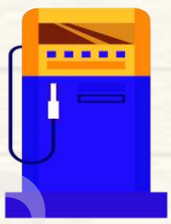
- The substances that do not undergo combustion
- Examples: Bricks, sand, iron nails and glass

3. Ignition Temperature

- Ignition temperature is the lowest temperature at which a substance catches fire.

Ignition temperature of certain substances

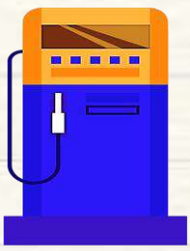
Wood: 260°C



Petrol: 220°C

Inflammable substances

Inflammable substances are the substances that catch fire quickly due to their low ignition temperature.



Petrol

LPG

Hydrogen

The terms flammable and inflammable mean exactly the same thing. They are used for substances that can burn very easily. The term non-flammable is used for substances that cannot burn at all or are very difficult to burn.

4. Types of Combustion

4.1 Based on the Supply of Oxygen

Combustion

Complete

- Sufficient supply of oxygen results in complete combustion.
- Production of clean blue flame.
- Production of carbon dioxide and water vapour.

Incomplete

- Limited supply of oxygen results in incomplete combustion.
- Production of yellow flame.
- Production of carbon monoxide and soot (residue).

A process similar to combustion occurs inside our body as well. It is respiration.

4. Types of Combustion

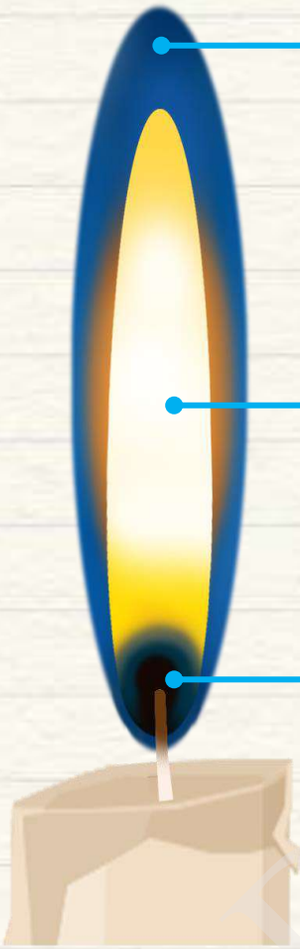
4.2 Based on the requirement of External heat

Combustion

- **No external heat source is required**
  - **Spontaneous**
    - The substance suddenly bursts into flames, without any external ignition source
    - 
    - Combustion of Phosphorous
- **External heat source is required**
  - **Rapid**
    - The substance burns rapidly to produce heat and light.
    - 
    - Combustion of a matchstick
  - **Explosion**
    - The substance undergoes sudden reaction on ignition to produce heat, light and sound.
    - 
    - Combustion of firecrackers

Spontaneous combustion of coal dust has resulted in many disastrous fires in coal mines.

5. Structure of Flame



Outermost zone (Non- luminous zone)
- Hottest zone
- Temperature = 1400°C.
- Blue in colour.
- Complete combustion occurs.

Middle zone (Luminous zone)
- Moderately hot
- Temperature = 1200°C.
- Yellow in colour.
- Incomplete combustion occurs.

Innermost zone (Dark zone)
- Least hot zone
- Temperature = 600°C.
- Black in colour.
- Contains unburnt wax vapours.

The substances that do not vaporize while burning do not produce flames.

Charcoal burning without flames

The substances which vaporize while burning produce flames.

Kerosene oil burning with flames in lamp

6. Fuel

- Fuels are the combustible substances that produce significant amount of heat upon combustion.

- Solid fuels: Wood and coal
- Liquid fuels: Petrol and kerosene
- Gaseous fuels: LPG and CNG

All combustible substances are not fuels as some combustible substances like paper and do not produce significant amount of heat upon combustion.

6.1 Ideal Fuel

- An ideal fuel should have the following characteristics:


Easy availability


Releases large amount of heat


Economical

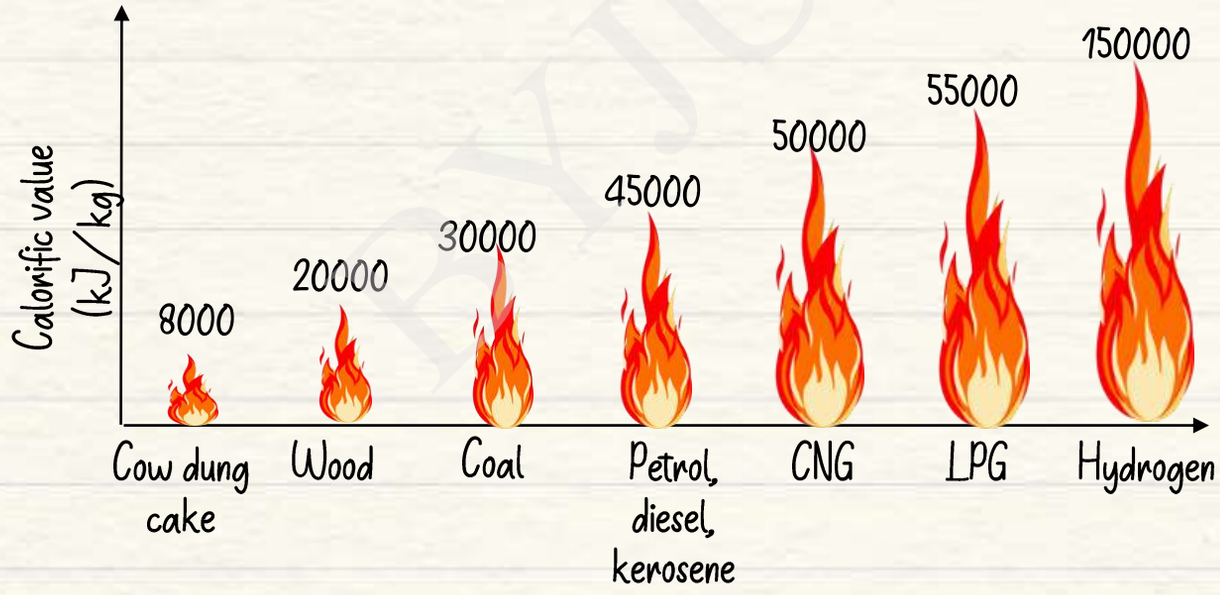

No undesirable residue

1. Calorific value

- Calorific value is the heat energy (in kJ) produced on complete combustion of 1 kg of fuel.

$$\text{Calorific value} = \frac{\text{Amount of heat produced (kJ)}}{\text{Mass of fuel (kg)}}$$

Calorific value of various fuels



Calorific value is used the express the efficiency of a fuel.

5. Conservation of fossil fuels

Air pollution

Due to unburnt carbon particles and harmful gases

Respiratory problems (Asthma)

Due to unburnt carbon particles

Carbon monoxide poisoning

Due to incomplete combustion of fuels

Acid rain

Due to oxides of nitrogen, sulphur and carbon

Global warming

Due to carbon dioxide and other gases

Melting of Glaciers

Rise in sea level

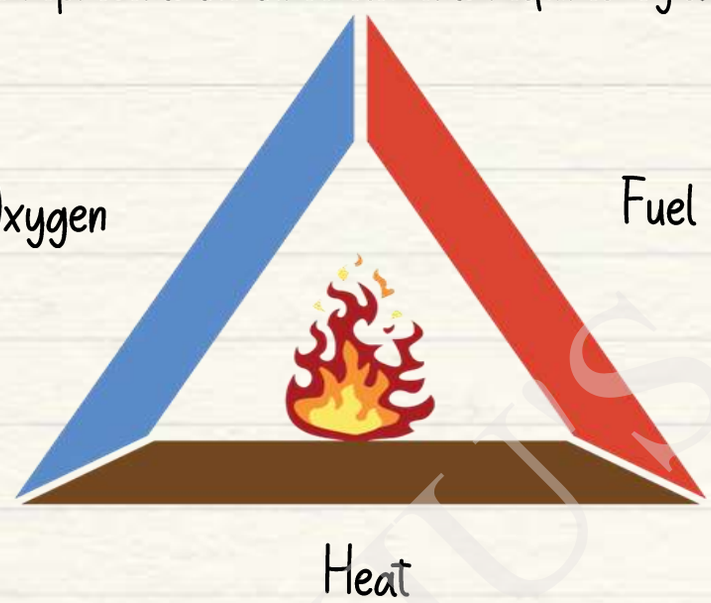
Floods

Submerging of low-lying coastal areas

Fuels like CNG (Compressed Natural Gas) and LPG (Liquefied Petroleum Gas) are called cleaner fuels as they produce the harmful products in very small amounts.

9. Fire triangle

A fire triangle represents the three elements required by a fire needs to ignite.



- A fire can be extinguished by removing one or more of the elements in the fire triangle:
- Cut off the supply of air (oxygen)
- Cut off fuel
- Reduce heat to bring down the temperature of the fuel below the ignition temperature

In most of the cases, the fuel cannot be eliminated for extinguishing fire.

10. Fire Extinguisher

Water

A fire triangle represents the three elements required by a fire needs to ignite

Blanket

Cuts off the supply of oxygen

Sand

Cuts off the supply of oxygen

Carbon dioxide

Reduces the temperature of fuel and cuts off the supply of oxygen

Water is not suitable for extinguishing fires involving:

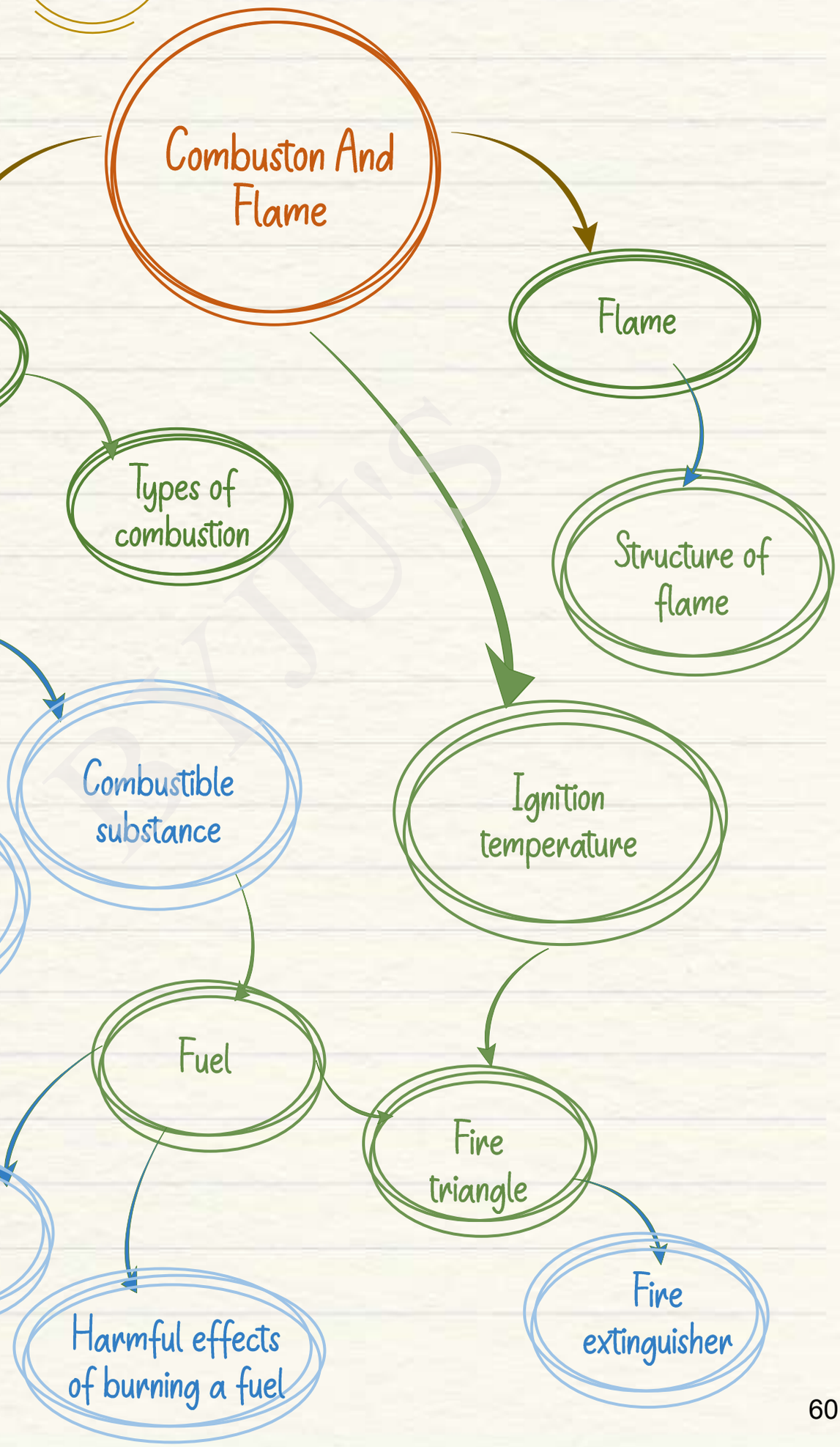
Oil

Water being heavier sinks below the oil, and oil keeps burning on the top.

Electrical equipment

Water may conduct electricity and electrocute the person trying to douse the fire.

Mind Map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Flame
Structure of flame
Ignition temperature
Fuel
Calorific value
Harmful effects of burning a fuel
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