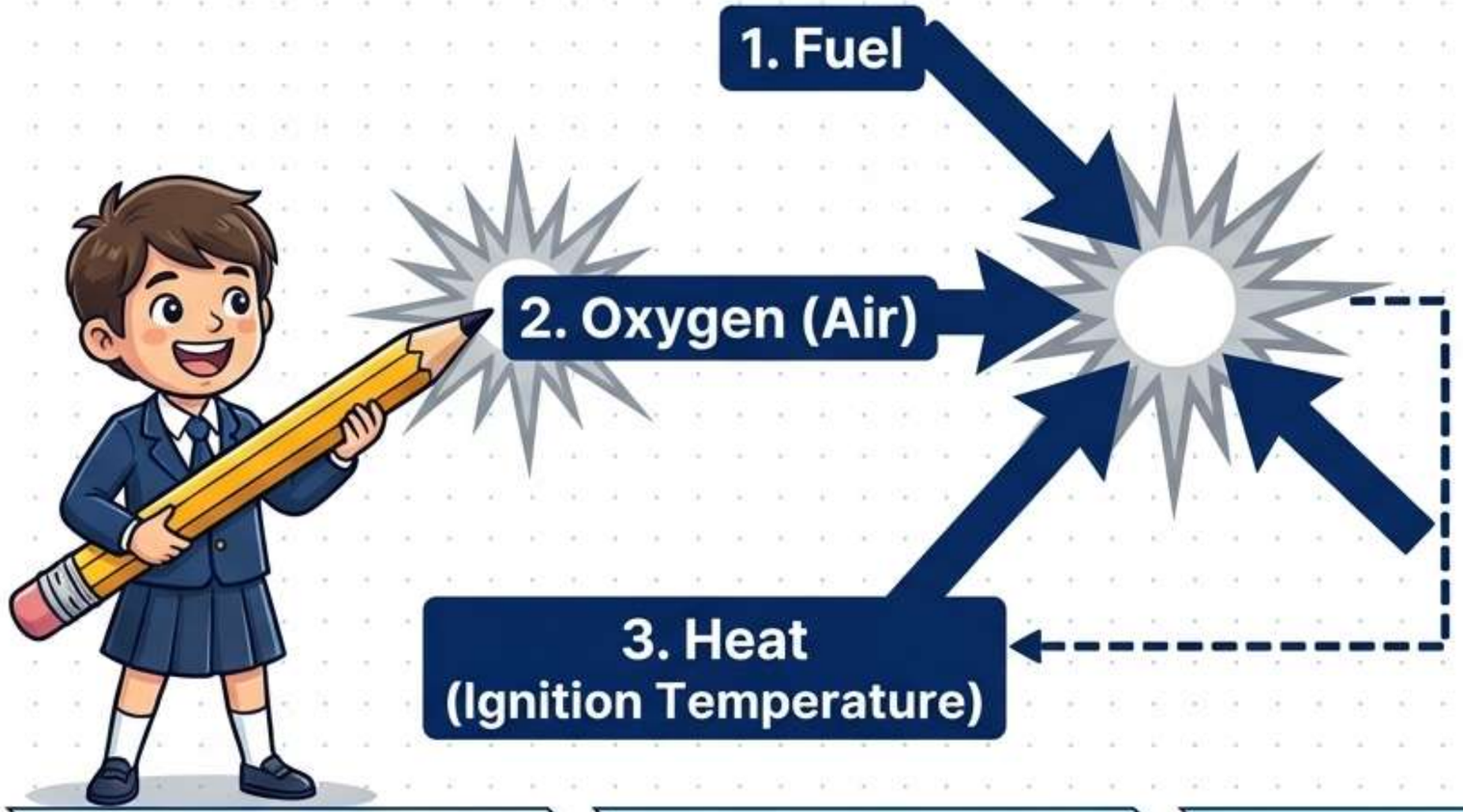
# MC24 Revision Notes | Class 8 | Science | Chapter: Combustion and Flame




## Definition

Combustion is a chemical process in which a substance reacts with oxygen to give off heat (and sometimes light).

## Why it Matters

From digesting food in our bodies (slow combustion) to launching rockets (rapid combustion), controlling fire allows us to harness energy—and prevent disasters.

1. Basics & Ignition
2. Types of Fire
3. Flame Structure
4. Fuels & Environment

# Prerequisites for Fire: Materials and Temperature

**Substance**

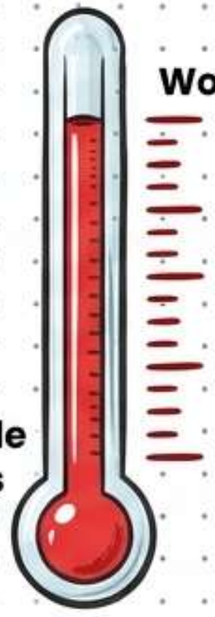
**Combustible**

**Easily undergoes combustion.**
(e.g., Wood, Paper, Kerosene, Charcoal, Magnesium).

**Non-Combustible**

**Does not catch fire.**
(e.g., Iron nails, Glass, Stone piece).

**Ignition Temperature** = The lowest temperature at which a substance catches fire.



**Wood, Coal**

**Inflammable Substances (< 100°C)**
- Petrol,
- Alcohol,
- LPG

**Fascinating Fact!** Phosphorus has an ignition temp of just 35°C! It can catch fire in a warm room without any matchstick.

## Matchstick Mechanism

Rubbing surface (Red Phosphorus + Glass) → Friction creates heat → Red converts to White Phosphorus → Ignites Potassium Chlorate & Antimony Trisulphide

# The 4 Modes of Combustion

## Slow Combustion

**Mechanism:**
Insufficient air, incomplete burn, leaves residue.

**Examples:**
Cow-dung cakes burning, human digestion/respiration.

## Rapid Combustion

**Mechanism:**
Fast, produces distinct heat and light. External ignition required.

**Examples:**
Burning LPG, lighting a matchstick, magnesium ribbon.

## Spontaneous Combustion

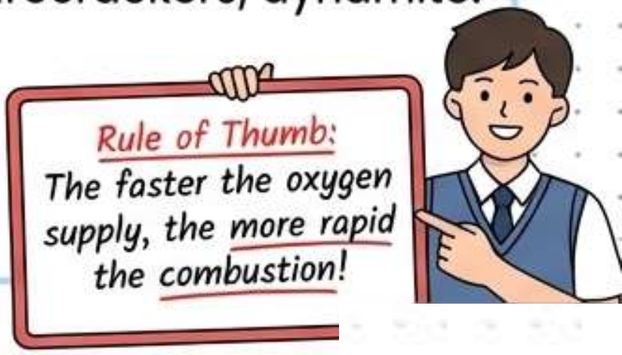
**Mechanism:**
Bursts into flames without any external heat trigger!

**Examples:**
White phosphorus exposed to air, spontaneous forest fires.

## Explosive Combustion

**Mechanism:** Sudden reaction releasing heat, light, sound, and a massive amount of gas.

**Examples:**
Firecrackers, dynamite.



# Fuels, Efficiency, and the Environmental Cost

## The Ideal Fuel Checklist

- ✅ Cheap & readily available
- ✅ Easy to store and transport
- ✅ High calorific value
- ✅ Moderate burn rate
- ✅ Leaves no ash or toxic gases

*(Note: No fuel is 100% ideal in reality)*

## Measuring Power: Calorific Value

Amount of heat produced by completely burning 1 kg of fuel.

$$\frac{\text{Heat produced (kJ)}}{\text{Mass of fuel (kg)}}$$

**Unit: kJ/kg**

Petrol (45,000 kJ/kg) vs. CNG (50,000 kJ/kg)
-> CNG is cleaner and more efficient!

## The Pollution Pathways

| | | | |
|---|---|---|---|
| Incomplete Burning | → | Releases Unburnt Carbon (Soot) & Carbon Monoxide | → Causes Asthma & Respiratory disease |
| Burning Coal/Wood | → | Releases huge amounts of $CO_2$ | → Traps heat -> Global Warming |
| Burning Coal/Diesel | → | Releases $SO_2$ + $NO_2$ | → Mixes with rain clouds -> Acid Rain |

*(Destroys crops, soil, and marble buildings)*

# High-Yield Definitions & Formulas

## Combustion

A chemical oxidation process in which a substance reacts with oxygen to release heat energy.

## Supporter of Combustion

The gas required for burning to take place. (Usually Oxygen / Air).

## Ignition Temperature

The absolute lowest temperature at which a combustible substance catches fire.

## Inflammable Substances

Materials with dangerously low ignition temperatures that easily catch fire with a small flame (e.g., Petrol, LPG).

## Calorific Value

The total heat energy produced on complete combustion of 1 kg of a fuel.

Measured in kJ/kg.

## Acid Rain

Rain made highly acidic by mixing with Oxides of Sulphur and Nitrogen (pollutants from fossil fuels).

# Crucial Scientific Diagrams

## Zones of a Candle Flame

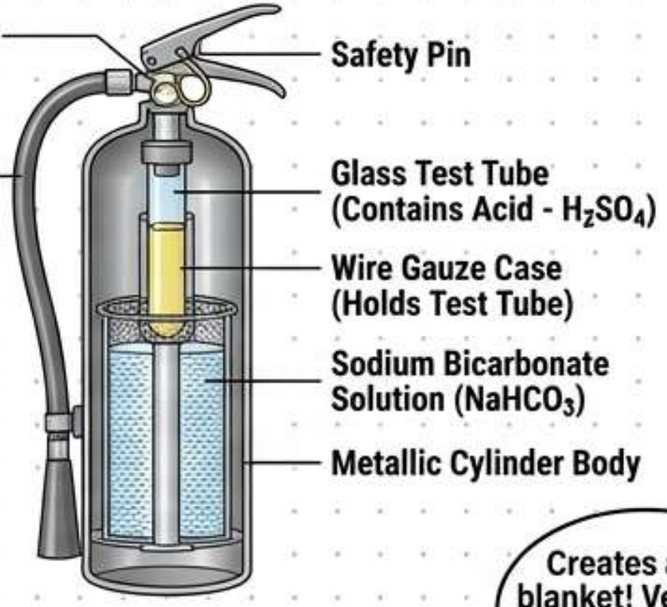
**Outer Zone (Blue):**
Non-Luminous Zone.
Complete combustion.
The HOTTEST part (~1800°C).

**Middle Zone (Yellow):**
Luminous Zone.
Partial combustion of wax vapours.
Moderately hot. Emits soot.

Black ring

**Inner Zone (Black):**
Dark Zone.
Unburnt wax vapours.
LEAST hot.


## Soda-Acid Fire Extinguisher




1. Plunger hits floor → 2. Glass tube breaks → 3. Acid + Sodium Bicarbonate mix → 4. Massive release of $CO_2$ blanket


$$2NaHCO_3 + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O + 2CO_2$$

**Mechanism: Heavy $CO_2$ sinks, forming a blanket that cuts off the oxygen supply.**

# Most Asked Board Questions & Expected Keywords

**Q1: Why is water NOT used for fires involving electrical equipment or oil?**
**Ans:** Water conducts electricity (shock risk). Water is heavier than oil, so it sinks, allowing the oil to continue burning on top.

**Q2: Why do goldsmiths blow the outermost zone of a flame for melting gold?**
**Ans:** The outermost (blue) zone has maximum oxygen supply, leading to complete combustion, making it the hottest zone.

**Q3: Differentiate between rapid and spontaneous combustion.**
**Ans:** Rapid requires external ignition (matchstick). Spontaneous occurs without any external heat (e.g., phosphorus in air).

**Q4: Why is CNG considered a better fuel than coal?**
**Ans:** Higher calorific value (50,000 kJ/kg), leaves no ash, releases almost no harmful pollutants (clean fuel).

**Q5: How does a blanket extinguish a fire when a person's clothes catch fire?**
**Ans:** It physically breaks contact with the air, acting to cut off the supporter of combustion (Oxygen).

# Common Mistakes & Exam Traps

**Trap 1: The Flame Zone Illusion**
*The inner zone is the hottest because it's closest to the wick.*

→ **NO! The OUTERMOST zone is the hottest because it gets the most oxygen for complete combustion.**

**Trap 2: The Sun's Combustion**
*The sun produces heat via rapid combustion.*

→ **NO! The sun operates on Nuclear Fusion. It does not use oxygen or combustion at all!**

**Trap 3: Calorific Value Units**
*Writing the unit as Joules/gram.*

→ **The standard SI unit must be written as kJ/kg (Kilojoules per Kilogram).**

**Trap 4: Extinguisher Gas Reversal**
*Fire extinguishers release Oxygen to blow out the fire.*

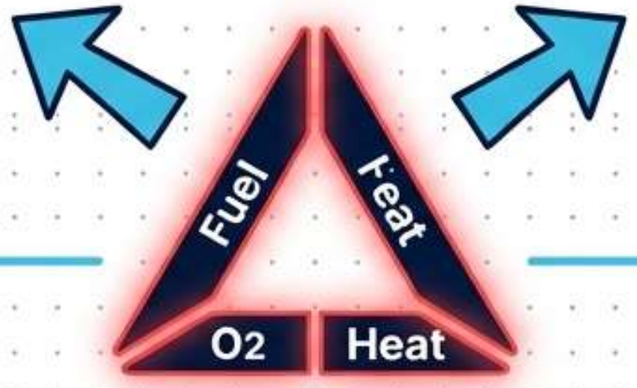
→ **NO! They release Carbon Dioxide ($CO_2$) because it is heavier than oxygen and blankets the fire.**

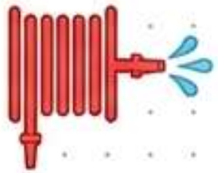
**Trap 5: Flammable vs. Inflammable**
*Thinking 'inflammable' means it cannot burn.*

→ **TRAP! Flammable and Inflammable mean the exact same thing (easily catches fire). The opposite is Non-combustible.**

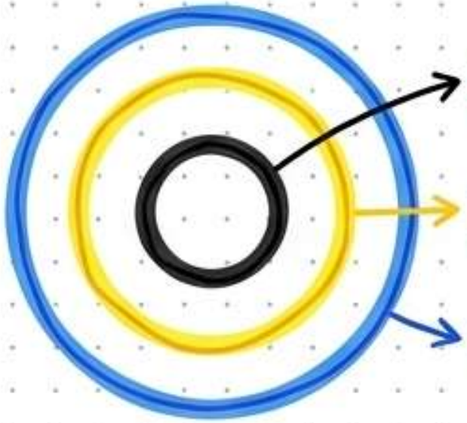
# 10-Minute Rapid Revision Sheet

| | |
|---|---|
| **Slow** (Respiration) | **Rapid** (LPG) |
| **Spont.** (Phosphorus) | **Explosive** (Crackers) |



- **To stop fire:**
- 1. **Cool it** (Water)
- 2. **Cut $O_2$** ($CO_2$ extinguisher)
- 3. **Remove fuel**



**Inner**, unburnt, cool

**Middle**, partial, soot

**Outer**, complete, 1800°C

**Fuel burning → CO = Poison.**

**→ $CO_2$ = Global Warming.**

**→ $SO_2$/$NO_2$ = Acid Rain.**

**Perfect Fuel = High Calorific Value (kJ/kg) + Low Ignition Temp + No Pollution**

# The Perfect Answer Blueprint

## 2-Mark Strategy (The Direct Hit)

**Q:** Define Calorific Value.

**Structure:**

1. **Definition** (Amount of heat from 1kg fuel)

+

2. **SI Unit** (kJ/kg)

- 
- 
- 

**Don't write paragraphs!**

## 3-Mark Strategy (The Bulleted List)

**Q:** What are the characteristics of a good fuel?

**Structure:**

1. **Intro sentence** ("An ideal fuel has the following traits:")

+

2. **4 concise bullet points** (Cheap, High calorific value, moderate burn rate, leaves no ash)

**Underline key terms.**

## 5-Mark Strategy (The Master Builder)

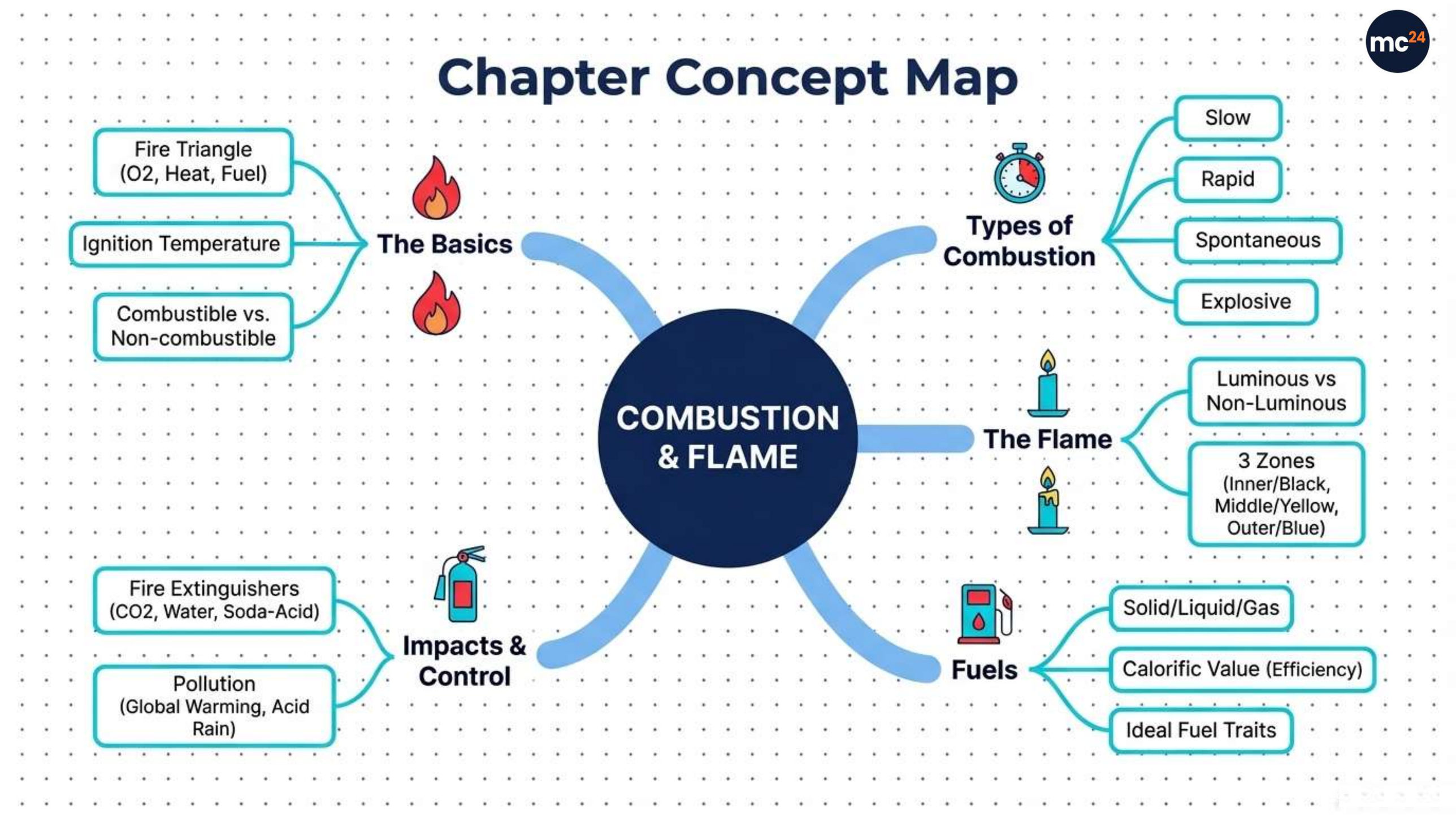
**Q:** Explain the zones of a candle flame.

**Maximize Points!**

**Structure:**

1. **Mandatory Diagram:** Large, neat, labeled with a pencil.
2. **Zone Breakdown:** Use subheadings for Inner, Middle, Outer zones.
3. **Detail:** For each zone state Color, Combustion type, and Heat level.
4. **Real-world Application:** Add the Goldsmith fact to guarantee the final mark.

# Chapter Concept Map



# MC24 Memory Tricks & Shortcuts

## Trick 1: The Flame Zone Colors

**Mnemonic:** "B.O.Y."

**Blue** (Outer/Hottest) → **Orange/Yellow** (Middle) → **Yuck/Black** (Inner/Coolest)

## Trick 2: Fire Fighting Basics

**Mnemonic:** "The Triple C"

Cool it down (water) | Cut the air ($CO_2$/blanket) | Clear the fuel

## Trick 3: Acid Rain Causes

**Mnemonic:** "S.O.N. creates Acid"

**S**ulphur **O**xides
&
**N**itrogen oxides.

## Trick 4: Combustion Speed

**Mnemonic:** "S.R.S.E. (Slowly Running Sparks Explode)"

(Slow, Rapid, Spontaneous, Explosive)

# Final Exam Checklist

*Don’t close this PDF until you can confidently check every box below!*

- [ ] I can draw and label the Fire Triangle.
- [ ] I know the difference between combustible and inflammable.
- [ ] I can list the 4 types of combustion with examples.
- [ ] I can draw, label, and explain the 3 zones of a candle flame.
- [ ] I can write the chemical equation for the Soda-Acid fire extinguisher.
- [ ] I know the standard unit for Calorific Value (kJ/kg).
- [ ] I can explain the specific causes of Acid Rain and Global Warming.

**You’ve mastered the science. Now go ace the exam!**