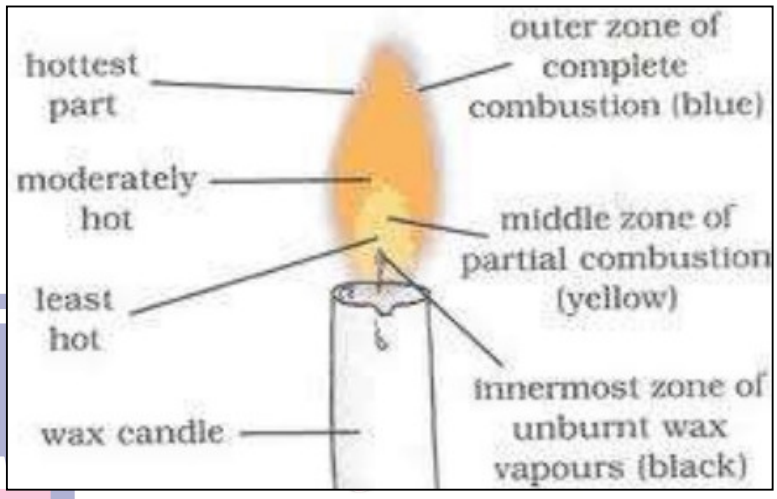
Candle flame: A candle flame can be divided into three zones depending on the amount of oxygen available:

1. The outer zone(blue): is the hottest part of the flame. In this zone, the wax vapours have enough oxygen to burn completely producing carbon dioxide and water. This zone emits very little light.
2. The middle zone (yellow): is less hot than the outer zone. Here, incomplete combustion of wax vapours (due to low oxygen) produces carbon particles(which glow, giving this zone its yellow colour) and carbon monoxide. This zone emits most light.
3. The inner zone(black): is the coolest part of the flame. In this zone, the wax vapours remain unburned as no oxygen is available. This zone is completely dark and emits no light.



Combustion of A Candle-If we observe a candle flame closely, we will notice the following:

1. The wick burns and it stands in a pool of liquid wax.
2. There is a small portion of unburnt wick between the flame and the liquid wax.
3. The liquid wax is trapped in a cup of solid wax.
4. The liquid or solid wax never catches fire.

Conclusion:

1. It is only the wax vapours that burn. Neither liquid wax nor solid wax burns.
2. When a candle wick is lit, the heat produced from the flame melts the wax.
3. The wick soaks or absorbs the molten wax.
4. The heat of the flame vaporizes the molten wax in the wick.
5. The wax vapours burn in the flame. The process continues till the entire wax is consumed or the candle is extinguished.

Fuels:

Criteria for ideal fuel

1. Easily and readily available
2. It is cheap
3. Burns easily in air at moderate rate
4. Produces large amount of heat
5. Burns completely and does not leave any undesirable substance after burning.

Substances which meet above criteria are known as ideal fuel. But ideal fuel is not

available in practical life. Fuels which meet most of the criteria are considered as good fuel.

Fuel efficiency: Efficiency of a fuel is measured by its calorific value. Calorific value is the amount of heat produced by the complete burning of 1 kg of fuel. Hence calorific value of fuel is expressed in **kilo joule per kg (k J/kg).** A fuel with higher calorific value is considered as an efficient fuel.

Burning of Fuel Produces Harmful Products

- Since, no fuel is considered as an ideal fuel, thus they do not undergo complete combustion and produce unwanted substances.
- These substances have harmful effect on the humans and the environment.

(a) Fuels; like, wood, petrol, diesel, coal, etc. release unburnt carbon particles. These unburnt carbon particles create pollution by mixing in air. They lead to diseases of respiratory system and many other related diseases.

(b) Incomplete combustion of carbon fuels produces carbon monoxide. Carbon monoxide is a poisonous gas which may kill a person.

(c) Most of the fuels release carbon dioxide gas. Excess carbon dioxide gas in the atmosphere leads to global warming (the rise in temperature of the atmosphere of the Earth)

(d) Burning of coal and diesel produce sulphur dioxide. It is suffocating and corrosive gas. Oxides of sulphur and nitrogen dissolve in rain water and form acids. Such rain is called Acid Rain.

Acid rain is harmful for animals and plants. Acid rain is also harmful for buildings and monuments. The famous Taj Mahal has lost much of its shine because of acid rain.

CNG(Compressed Natural Gas) is considered as a cleaner fuel. It releases harmful products in very small amount. Now-a-days CNG is being used to run vehicles in many towns, such as Delhi, Ahmadabad and Mumbai.

This has helped in reducing the level of pollution

Exercise

1. Why do we wrap a blanket around a person who catches fire?
2. With the help of an experiment show that oxygen is necessary for burning of a candle?
3. Why does a goldsmith blows the outermost zone of a flame with the help of metallic blow pipe?

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