

6

Combustion and Flame

TOPICS COVERED

6.1 Combustion and Its Types

6.2 Inflammable substances, Fire and Methods to control It, Flame and Its Structure.

6.3 Fuel: Efficiency, Types and Harmful Products formed by Burning It.

IMPORTANT POINTS TO REMEMBER

- A chemical process in which a substance reacts with oxygen to give off heat is called **combustion**.
- A substance which can undergo combustion is called a combustible substance. It is also called **fuel**.
- A substance which cannot undergo combustion is called a non-combustible substance.
- A **combustible substance**, **oxygen** and **ignition temperature** are required for combustion.
- The minimum temperature at which combustion starts in a substance is called **ignition temperature** of that substance.
- A substance which has very low ignition temperature and which can easily catch fire is called an inflammable substance, e.g. petrol, alcohol, etc.
- **Fire** can be controlled by removing any or all of the factors of combustion, i.e. fuel, oxygen (air) and ignition temperature (by lowering the temperature).
- **Water** is frequently used by the Fire Brigade. Water helps in bringing down the temperature. The blanket of steam cuts off air supply. Thus, water helps in putting off the fire.
- Water cannot be used for fires involving oil, petrol or electricity.
- Blanket is very useful in controlling fire at small scale. An object on fire is covered with a blanket which cuts off air supply and helps in putting off the fire.
- **Carbon dioxide** is the best fire extinguisher. Carbon dioxide is heavier than air. Thus, carbon dioxide creates a blanket over fire and cuts off air supply.
- Some substances burn rapidly, e.g. gas and petrol. This is called rapid combustion.
- In some cases, a substance begins to burn on its own without any apparent cause. This is called spontaneous combustion.
- When combustion reaction is sudden; it releases a large amount of heat, light and sound. This is called **explosion**.
- **Flame** is produced because of combustion of vapour of a substance. Substances which vapourise on heating produce flame. But substances which do not vapourise do not produce flame.

- The outermost zone of flame is blue in colour. Complete combustion takes place in this zone. It is the hottest part of the flame.
- Middle zone of flame is yellow and orange in colour. Partial combustion takes place in this zone. It is moderately hot.
- Inner zone of flame is dark in colour. No combustion takes place in this zone. This is the coolest part of the flame.
- A **good fuel** is the substance which is readily available, is cheap, burns easily in air and at a moderate rate, produces a large amount of heat, and does not leave behind any undesirable substance.
- **Fuel efficiency** is measured in terms of calorific value. The amount of heat energy produced on combustion of 1 kg of a fuel is called calorific value of that fuel. It is expressed as kilo Joule per kg (kJ/kg).
- Burning of carbon fuels (wood, coal, petroleum) releases unburnt carbon particles in air. These particles cause respiratory disease like asthma.
- Burning of most fuels releases carbon dioxide, carbon monoxide and oxides of sulphur and nitrogen. These substances pollute the air.

6.1 COMBUSTION AND ITS TYPES

Combustion: A chemical process in which a substance burns in oxygen to give out heat and light (which may or may not be produced) is called combustion.

Examples: Burning of Magnesium

Burning of Charcoal

Combustible Substances: Substances that burn easily in air to produce heat and sometimes light are called combustible substances.

Examples: Cloth, wood, dry leaves, paper, straw, petrol, LPG, wax etc.

Non-combustible Substances: Substances that do not burn in air nor do they give out heat and light are called non-combustible substances.

Examples: Glass, stone, steel, metals like gold, silver

Conditions Necessary for Combustion

- Combustible substance.
- Presence of oxygen (supporter of combustion)

Ignition Temperature: Minimum temperature at which a substance catches fire is called its ignition temperature.

Types of Combustion

Rapid Combustion: When a combustible substance burns at a rapid rate, producing a very large amount of heat and light in a very short period of time, it is called rapid combustion.

Example: Cooking gas (LPG), Burning of wax candle.

Spontaneous Combustion: When a combustible substance burns on its own without the help of any external source of heat, it is called spontaneous combustion.

Example: Burning of white phosphorus, sodium exposed to air, fire in coal mines and forest fires.

Explosive Combustion: A reaction that explodes suddenly with the evolution of a large amount of gases, heat, light and sound is known as explosion.

Example: Fire crackers, explosion of a bomb.

Exercise 6.1

I. Very Short Answer Type Questions (1 Mark)

1. Give one word for the following:

(a) The process of burning a substance in the presence of oxygen. _____

(b) Substances that produce heat and light on burning. _____

(c) Substances that do not give heat and light on burning. _____

(d) The minimum temperature at which a substance catches fire. _____

(e) Substance that is required for combustion to take place. _____

2. Fill in the blanks:

(a) A chemical process in which a substance burns in oxygen to give out heat and light is called _____.

(b) Substances that burn easily in air are called _____ substances.

(c) _____ is an example of non-combustible substances.

(d) When a combustible substance burns at a rapid rate, it is called _____.

(e) An example of spontaneous combustion is _____.

II. Short Answer Type Questions-1 (2 Marks)

3. Define ignition temperature.

4. Identify combustible and non-combustible substance from the following: wood, paper, iron nails, kerosene oil, stone, straw, charcoal, matchstick, glass.

5. Give reasons for the following:

(i) A person whose clothes catch fire is covered with a blanket.

(ii) A matchstick does not burn by itself.

(iii) Kerosene oil catches fire quickly while wood takes a longer time to catch fire.

6. Burning of LPG gas is an example of rapid combustion. Why?

(NCERT Exemplar)

7. Crackers on ignition produces sound. Why?

8. What is combustion?

9. What are the conditions necessary for combustion?

(NCERT)

III. Short Answer Type Questions-2 (3 Marks)

10. What type of combustion takes place in burning of white phosphorus? Explain.

11. State the different types of combustion. Give one example of each.

12. State the type of combustion taking place in
 (i) Forest fires (ii) Fire-crackers (iii) LPG used in household
13. Why is it easy to burn a heap of dry grass as compared to green grass?
14. Distinguish between combustible and non-combustible substances.
15. What is combustion? What are the conditions necessary for combustion?

IV. Long Answer Type Questions (5 Marks)

16. With the help of an activity, show that oxygen is essential for burning.
17. With the help of an activity, show that it is essential for a substance to reach its ignition temperature before burning.
18. Two glass jars A and B are filled with CO_2 and O_2 gas respectively. In each jar, a lighted candle is placed simultaneously. In which jar will the candle remain lighted for a longer time and why? *(NCERT Exemplar)*

ANSWERS

1. (a) Combustion (b) Combustible
 (c) Non-combustible
 (d) Ignition temperature (e) Oxygen
2. (a) Combustion (b) Combustible
 (c) Stone
 (d) Rapid combustion
 (e) Burning of white phosphorus
3. Ignition temperature is the minimum temperature at which a substance catches fire.
- 4.
- | Substance | Types |
|--------------|-----------------|
| Material | Combustible |
| Wood | Combustible |
| Paper | Combustible |
| Iron nails | Non-combustible |
| Kerosene oil | Combustible |
| Stone | Non-combustible |
| Straw | Combustible |
| Charcoal | Combustible |
| Matchstick | Combustible |
| Glass | Non-combustible |
5. (i) Blanket cuts off the supply of air (oxygen) and does not let the fire to sustain.
 (ii) It has not reached its ignition temperature (it does not undergo spontaneous combustion).
 (iii) Ignition temperature of kerosene oil is lower than that of wood.
6. It burns at a rapid rate and gives out heat and light in large amount on burning.
7. It undergoes explosive combustion and form large amount of gases, heat, light and sound are formed due to chemical reactions.
8. A chemical process in which a substance burns in oxygen to give out heat and light (which may or may not be produced) is called combustion.
Examples: Burning of Magnesium
 Burning of Charcoal
9. Conditions necessary for combustion are:
 (i) Presence of combustible substance.
 (ii) Presence of oxygen (supporter of combustion).
10. Spontaneous combustion produces heat and light on its own.
11. (i) *Rapid combustion:* Burning of LPG.
 (ii) *Spontaneous combustion:* Burning of white phosphorus.
 (iii) *Explosion:* Bursting of crackers.
12. (i) *Forestfires:* Spontaneous combustion
 (ii) *Firecrackers:* Explosive combustion
 (iii) *LPG used in household:* Rapid combustion.
13. Ignition temperature of dry grass is lower than green grass, since green grass has water content.

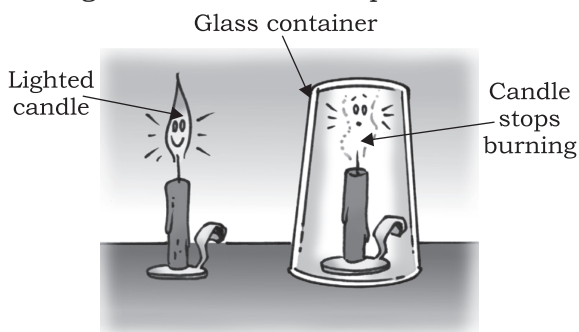
14.	Combustible Substances	Non-combustible Substance
	On burning, it given out heat and light e.g. kerosene.	On burning, it does not give out heat and light, e.g. stone.

15. **Conditions Necessary for Combustion:**

- Presence of combustible substance
- Presence of oxygen (supporter of combustion)

16. **To show that oxygen (air) is necessary for combustion of a substance**

Things needed: A candle, matchsticks, a glass container and a plate.



When a lighted candle is covered with a glass, the flame extinguishes

Method: Light a candle on a plate and cover the burning candle with a glass.

Observation: You observe that the candle stop burning after sometime. The candle burns as long as oxygen is present in the inverted glass. The supply of fresh air to the burning candle is cut-off by the inverted glass. When all the oxygen of the air (present inside the

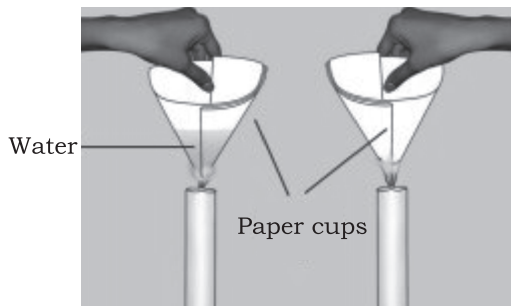
glass) is used up in burning, the candle stops burning (gets extinguished).

Conclusion: Oxygen (air) is necessary for combustion to take place.

Caution: Be careful while handling a burning candle.

17. **To show that it is essential for a substance to reach its ignition temperature before burning.**

Make two paper cups by folding a sheet of paper. Pour about 50 mL of water in one of the cups. Heat both the cups separately with a candle and observe?



Observation: You observe that the paper cup with water will burn slightly later than the empty paper cup. This is because water having high heat content will use up the heat for boiling before the paper starts burning.

Conclusion: A substance starts burning only when it reaches its ignition temperature.

Caution: Be careful while handling paper cups used for burning.

18. The jar containing O_2 since O_2 is a supporter of combustion, while CO_2 is a non-supporter of combustion.

6.2 INFLAMMABLE SUBSTANCES, FIRE AND METHODS TO CONTROL IT, FLAME AND ITS STRUCTURE

Inflammable Substances: Substances which have very low ignition temperature and can easily catch fire with a flame are called inflammable substances.

Examples: LPG, Kerosene, Alcohol, Paper, Straw, Petrol etc.

How Can We Control Fire: Fire can be controlled by working on two principle.

- Bringing down or lowering down the temperature of the burning substance below its ignition temperature.
- Cutting off the supply of air to the burning substance.

Water as a Fire-extinguisher: When water is thrown on fire, it cools the combustible substance below its ignition temperature and prevents the fire from spreading. Water heated by fire forms water vapour which surrounds the combustible substance and helps in cutting off the supply of air.

However water cannot be used to extinguish fire caused by electric wiring, because water is a good conductor of electricity and can give electric shock to people involved in fire-fighting operations.

Water also cannot be used to put off fire caused by burning of oil or petrol because water being heavier than oil, settles down at the bottom. The oil floats over this water and continues to burn.

Carbon dioxide as a fire extinguisher: It is best to extinguish fires involved in case of electrical equipments and inflammable materials like petrol, kerosene.

Flame: A flame is a region where combustion of a fuel (in its gaseous state) takes place to produce heat and light. In other words, substances which vapourise during burning produce a flame.

Examples: kerosene, wax, LPG produce a flame, while charcoal on heating does not vapourise and so does not produce flames, infact it becomes red-hot.

Structure of a Flames/Zones of a candle flame: A candle flame consist of three zones depending upon the amount of air it receives. These zones have different colours and temperature.

(a) *Innermost zone:*

- (i) It is zone of no combustion. (ii) It appears black.
- (iii) It is least hot. (iv) It contains unburnt wax vapours.

(b) *Middle zone:*

- (i) It is the zone of partial combustion. (ii) It emits yellow light.
- (iii) It is luminous due to the glow of hot carbon particles.
- (iv) It is moderately hot. (v) It contains unburnt carbon particle.

(c) *Outermost zone:*

- (i) It is the zone of complete combustion.
- (ii) It appears blue in colour.
- (iii) It is non-luminous as complete combustion takes place.
- (iv) It is the hottest part of the flame.

Exercise 6.2

I. Very Short Answer Type Questions (1 Mark)

1. Give one word for the following:

- (a) An example of inflammable substance. _____
- (b) Requirement to produce fire. _____
- (c) The hottest part of the flame. _____
- (d) The zone of no combustion appears in. _____
- (e) Substances which vapourise during burning produce. _____

2. Fill in the blanks:

- (a) Substances which have very low ignition temperature and can catch fire easily are called _____ .
-

- (b) Fire can be controlled by cutting off the supply of _____ .
(c) A _____ is a region where combustion of a fuel takes place.
(d) _____ is a zone of complete combustion in a flame.
(e) The _____ zone contains unburnt carbon particles.

II. Short Answer Type Questions-1 (2 Marks)

3. Why is water not used in controlling electrical fires? (NCERT)
4. Which zone of flame is used by goldsmiths to make gold ornaments and why?
5. Which zones of a flame contain (i) unburnt vapour of wax, (ii) very hot carbon particles?
6. What are inflammable substances. Give two examples.
7. State the two principles on which fire can be controlled. (NCERT)

III. Short Answer Type Questions-2 (3 Marks)

8. How does water acts as a fire-extinguisher?
9. Why is carbon dioxide considered as the best fire-extinguisher?
10. Two students A and B heated the same mass of water on a candle flame. Student A kept the beaker slightly above the flame of the candle and student B kept the beaker close to the wick of the candle. In which case, the water will get heated in the shortest time. Why?

IV. Long Answer Type Questions (5 Marks)

11. With the help of an activity, show that the non-luminous zone is the hottest part of the flame.
12. You are provided with three watch glasses containing milk, petrol and mustard oil. Suppose you bring a burning candle near these materials one by one, which material will catch fire instantly and why? (NCERT Exemplar)
13. Manu was heating oil to fry potato chips. The cooking oil all of a sudden caught fire, he poured water to extinguish the fire. Do you think this action was suitable. If yes, why? If not, why not? What should Manu have done? (NCERT Exemplar)
14. Explain the zones of a flame with the help of a labelled diagram.
15. Observe the activity shown by the given diagram and answer the questions:
(i) What do you observe?
(ii) What do you infer from this activity?
16. Anu wants to boil water quickly in a test tube. On observing the different zones of the flames, she is not able to decide which zone of the flame will be best for boiling water quickly. Help her in this activity. (NCERT Exemplar)
17. If you hold a piece of iron wire with a pair of tongs inside a candle flame. Will it produce a flame. (NCERT Exemplar)

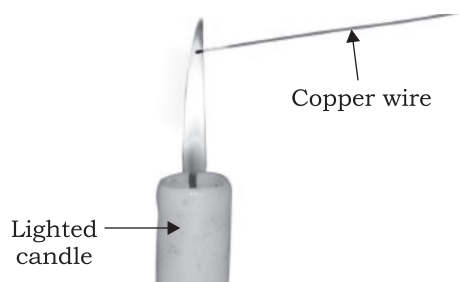


ANSWERS

- (a) Kerosene
(b) Oxygen
(c) Outermost Non-luminous zone
(d) Innermost zone (e) Flame
- (a) Inflammable (b) Oxygen
(c) Flame
(d) Outermost zone (e) Middle
- Water is a good conductor of electricity.
- Outermost zone, since it is the hottest part of the flame.
- (i) Innermost zone
(ii) Middle zone
- Inflammable Substances:* Substances which have very low ignition temperature and can easily catch fire with a flame are called inflammable substances.
Examples: LPG, Kerosene, Alcohol, Paper, Straw, Petrol etc. (Any two)
- How can we control fire:* Fire can be controlled by working on two principles.
(i) Bringing down or lowering down the temperature of the burning substance below its ignition temperature.
(ii) Cutting off the supply of air to the burning substance.
- Water as a Fire-extinguisher:* When water is thrown on fire, it cools the combustible substance below its ignition temperature and prevents the fire from spreading. Water heated by fire forms water vapour which surrounds the combustible substance and helps in cutting off the supply of air.
However water cannot be used to extinguish fire caused by electric wiring, because water is a good conductor of electricity and can give electric shock to people involved in fire-fighting operations.
Water also cannot be used to put off fires caused by burning of oil or petrol because water being heavier than oil, settles down at the bottom. The oil floats over this water and continues to burn.
- Carbon dioxide as a fire extinguisher:* It is best extinguisher to fires involved

in case of electrical equipments and inflammable materials like petrol, kerosene.

- In student A's beaker, water will get heated first, since outermost zone is the hottest part of the flame.
- To show that the non-luminous zone is the hottest part of a candle flame
Things needed: A candle, a candle stand, matchsticks, a thin copper wire and a pair of tongs.
Method:
(a) Take a candle and fix it on a candle stand. Light the candle.
(b) When you have a steady candle flame, hold a thin long copper wire with a pair of tongs and hold it just inside the flame for about 30 seconds.



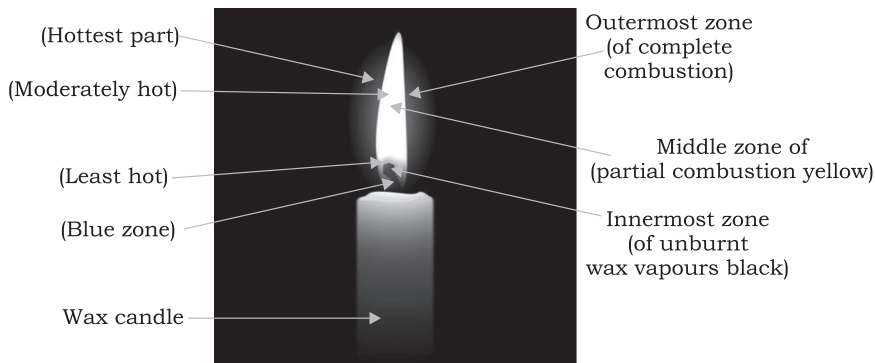
Non-luminous zone of the flame has a high temperature.

Observation: You notice that the portion of the copper wire just outside the flame become red hot.

Conclusion: The portion of the copper wire getting red hot indicates that the non-luminous zone of the flame has a high temperature. Infact, this part of the flame is the hottest part.

- Petrol will catch fire instantly as it is highly inflammable with least ignition temperature among the given three materials.
- Water is not suitable for fire involving oil. Manu should have first switched off the gas stove and covered the frying pan with a lid to cut off the supply of oxygen.

14.



Different zones of candle flame

15. (i) (a) The glass tube is filled with slightly greyish-white vapours which start coming out from the other end of the glass tube.
 (b) The vapours catch fire and burn with a long flame at the end of the glass tube.
 (ii) Burning of wax vapours at the end of

the glass tube shows the presence of wax vapour in the innermost-dark zone of the candle flame.

16. She must choose the outermost zone, as it is the hottest part of zone.
 17. It will become red-hot and glow. It does not produce a flame as it does not vaporise on burning.

6.3 FUEL: EFFICIENCY, TYPES AND HARMFUL PRODUCTS FORMED BY BURNING IT

Fuels: The materials which are burnt to produce a large amount of heat energy are known as fuels.

Examples: LPG, kerosene, diesel and petrol.

Fuel Efficiency/ Calorific Value: The efficiency of a fuel is determined by its calorific value. Calorific value of a fuel is the amount of heat energy liberated on complete combustion of 1 kg of a fuel. It is expressed in kilojoule per kilogram (kJ/kg).

Example: Hydrogen gas has the highest calorific value of 150,000 kJ/kg.

Characteristics of an Ideal Fuel

- (i) It should be fairly cheap and easily available.
- (ii) It should not leave any residue.
- (iii) It should have a high calorific value.
- (iv) It should be easy to handle, safe to transport and convenient to store.
- (v) It should have a proper ignition temperature.

Types of Fuels: Fuels have been classified as:

Incomplete Combustion: When a fuel is burnt in insufficient supply of air, it is called incomplete combustion. The gas evolved is carbon monoxide, which is a poisonous gas.

Solid fuel	Liquid fuel	Gas fuel
Coal	Kerosene	LPG
Coke	Petrol	CNG
Charcoal	Diesel	Biogas
Wood		
Paraffin wax		

Complete combustion: When a fuel is burnt in sufficient supply of oxygen, it is called complete combustion. The gas evolved is carbon dioxide.

Harmful Products formed by Burning of Fuel: The increased use of fuels has harmful effects on the environment.

Air Pollution: Burning of fossil fuels like coal and petroleum produce gases like carbon monoxide, carbon dioxide, oxides of sulphur, oxides of nitrogen, unburnt carbon particles which causes air pollution.

Carbon monoxide: When inhaled, it combines with the haemoglobin of our blood to form carboxyhaemoglobin. Due to the formation of carboxyhaemoglobin, blood cannot carry oxygen to various body parts which leads to suffocation and may even cause death. It is dangerous to sleep in a closed room with coal burning inside, during a cold winter night. This is because no fresh supply of air can enter the room and the gas released is carbon monoxide which can lead to suffocation and even fatal-death.

Carbon dioxide: Increased concentration of CO_2 in the atmosphere will tend to trap more Sun rays in the earth's atmosphere which is also called greenhouse effect and then ultimately led to global warning.

Effects of Global warning:

- (i) It adversely affects the monsoon rains.
- (ii) It causes changes in the seasonal pattern.
- (iii) It causes melting of glaciers.

Sulphur dioxide: Burning of coal and diesel releases sulphur dioxide gas. It is an extremely suffocating and corrosive gas. It dissolves in rain water and form sulphuric acid (acid rain).

Oxides of Nitrogen: Exhaust of vehicles contains oxides of nitrogen which are poisonous.

SPM: Burning of fuels containing carbon and its compounds releases ash and fine unburnt carbon particles in air. These particles are known as suspended particulate matter.

Lead compounds: Some lead compounds are released in the atmosphere by the exhausts of vehicles. These lead compounds are poisonous in nature.

CNG–A Cleaner Fuel: CNG (Compressed Natural Gas) replaces diesel and petrol as fuel in vehicles which produces harmful products in very small amount.

Exercise 6.3

I. Very Short Answer Type Questions (1 Mark)

1. Give one word for the following:

- (a) A substance on burning produces heat and light. _____
 - (b) Efficiency of a fuel is determined by its _____
 - (c) An example of solid fuel is _____
 - (d) Fuel with highest calorific value _____
 - (e) Gas produced during incomplete combustion. _____
 - (f) An increase in the temperature of the earth. _____
-

2. Fill in the blanks:

- (a) An ideal fuel should have _____ ignition temperature.
- (b) The amount of heat energy liberated to burn 1 kg of fuel is called its _____.
- (c) _____ is a liquid fuel used in homes.
- (d) Increase in concentration of _____ lead to the increase in temperature of the earth's atmosphere.
- (e) On inhaling _____, it combines with haemoglobin of the blood reducing the oxygen capacity, lead to suffocation and even death.
- (f) _____ combines with rain and forms _____.
- (g) _____ leads to melting of glaciers.

II. Short Answer Type Questions-1 (2 Marks)

- 3. Distinguish between complete and incomplete combustion.
- 4. Why is it advised not to sleep in a closed room with coals burning during a cold winter night.
- 5. How does burning of fossil fuels cause air pollution?
- 6. LPG is a better domestic fuel than wood. Why?
- 7. What is a fuel? Give one example.
- 8. Define calorific value. Give its unit.

III. Short Answer Type Questions-2 (3 Marks)

- 9. State the characteristics of an ideal fuel.
- 10. How can we classify fuels? Give examples.
- 11. How does the amount of carbon dioxide affect our environment?
- 12. People usually keep *angithi* in closed rooms during winter season. Why is it advised to keep the door open?
- 13. 5 kg of a fuel produces 3,20,000 J of heat energy on complete combustion. Calculate the calorific value of the fuel. (NCERT)

IV. Long Answer Type Questions (5 Marks)

- 14. What is a fuel? List the characteristics of an ideal fuel.
- 15. How do exhausts of automobiles affect the environment?
- 16. What is global warming? What are its effects?

ANSWERS

- | | |
|--|--|
| <ul style="list-style-type: none">1. (a) Fuel (b) Calorific value(c) Coal (d) Hydrogen gas(e) Carbon monoxide(f) Global warming <ul style="list-style-type: none">2. (a) Proper (b) calorific value(c) Kerosene (d) Carbon dioxide(e) Carbon monoxide(f) Sulphur dioxide, acid rain/
sulphuric acid(g) Global warming | <ul style="list-style-type: none">3. It is dangerous to sleep in a closed room with coal burning inside, during a cold winter night. This is because no fresh supply of air can enter the room and the gas released is carbon monoxide due to incomplete combustion of fuel. When inhaled, it combines with the haemoglobin of our blood to form carboxyhaemoglobin. Due to the formation of carboxyhaemoglobin, |
|--|--|
-

blood cannot carry oxygen to various body parts, which leads to suffocation and may even cause death.

4. Burning of fossil fuels like coal and petroleum produce gases like carbon monoxide, carbon dioxide, oxides of sulphur, and nitrogen, unburnt carbon particles which causes air pollution.

Complete combustion	Incomplete combustion
(i) It occurs when there is sufficient supply of oxygen gas.	(i) It occurs when there is insufficient supply of O ₂ gas.
(ii) CO ₂ (carbon dioxide) gas is evolved.	(ii) CO (carbon monoxide) gas is evolved.
(iii) Blue flame is produced e.g. LPG.	(iii) Yellow flame is produced e.g. kerosene lamp.

6. (i) It has a higher calorific value.
 (ii) It does not leave any residue.
 (iii) It is easily available.
 (iv) It is easily transportable and stored in cylinders.
7. The materials which are burnt to produce a large amount of heat energy are known as fuels.
Examples: LPG, kerosene, diesel and petrol. (Any one)
8. The efficiency of a fuel is determined by its calorific value. Calorific value of a fuel is the amount of heat energy liberated on complete combustion of 1 kg of a fuel. It is expressed in kilojoule per kilogram (kJ/kg).
9. Characteristics of an Ideal Fuel
- (i) It should be fairly cheap and easily available.
 (ii) It should not leave any residue.
 (iii) It should have a high calorific value.
 (iv) It should be easy to handle, safe to transport and convenient to store.
 (v) It should have a proper ignition temperature.

10. *Types of Fuels:* Fuels have been classified as:

Solid fuel	Liquid fuel	Gas fuel
Coal	Kerosene	LPG
Coke	Petrol	CNG
Charcoal	Diesel	Biogas
Wood		
Paraffin wax		

11. Increased concentration of Carbon dioxide in the atmosphere will tend to trap more Sun rays in the earth's atmosphere which is also called greenhouse effect and then ultimately led to global warming.

Global warning:

- (i) It adversely affects the monsoon rains.
 (ii) It causes changes in the seasonal pattern.
 (iii) Causes melting of glaciers.

12. When fuel is burnt in insufficient supply of oxygen, it leads to incomplete combustion and produces carbon monoxide. When inhaled, it combines with the haemoglobin of our blood to form carboxyhaemoglobin. Due to the formation of carboxyhaemoglobin, blood cannot carry oxygen to various body parts which leads to suffocation and may even cause death. Thus it is dangerous to sleep in a closed room with coal burning inside, during cold winter night because no fresh supply of air can enter the room and the gas released i.e., is carbon monoxide can lead to suffocation and even fatal-death.

$$13. m = 5 \text{ kg} \\ Q = 320,000 \text{ J} = 320 \text{ kJ}$$

$$\therefore \text{Calorific value} = \frac{Q}{m} = \frac{320}{5} \\ = 84 \text{ kJ/kg}$$

14. Any material which is burnt to produce large amount of heat energy is known as a fuel. For example, LPG, Kerosene, Petrol.

Characteristics of an Ideal Fuel

- (i) It should be fairly cheap and easily available.
 - (ii) It should not leave any residue.
 - (iii) It should have a high calorific value.
 - (iv) It should be easy to handle, safe to transport and convenient to store.
 - (v) It should have a proper ignition temperature.
15. (i) Burning of coal and diesel releases sulphur dioxide gas. It is an extremely suffocating and corrosive gas. It dissolves in rain water and form sulphuric acid (acid rain).
- (ii) Exhaust of vehicles contains oxides of nitrogen which are poisonous.
- (iii) Vehicular exhaust releases unburnt

carbon particles in the air which causes respiratory problems like asthma.

- (iv) Carbon monoxide releases in air which is a poisonous gas.
- (v) Carbon dioxide releases in air exhaust is a greenhouse gas which causes global warming.
16. Global warming: Average rise in the temperature of the earth, due to increase in the concentration of greenhouse gases like CO_2 in the atmosphere, caused by combustion of fuels and exhausts from the vehicles, is called global warming.
- (i) It adversely affects the monsoon rains.
- (ii) It causes changes in the seasonal pattern.
- (iii) It causes melting of glaciers.

Did You Know?

- Combustion can take place in the absence of air. For example, sodium burns in the atmosphere of chlorine. Sodium burns in water. In fact, combustion is an oxidation reaction in which chlorine, fluorine, bromine, sulphur etc. are oxidising agent.
- A fire cracker burns in the absence of air. However there is an internal supply of oxygen due to decomposition of oxidising agent like potassium chlorate, potassium nitrate etc.
- A matchstick can burn wood shaving but not a large piece of wood. The wooden piece due to its large size takes a long time to attain its ignition temperature whereas the wood shavings due to their smaller size reach their ignition temperature in lesser time.

HOTS & VALUE BASED QUESTIONS

1. Neha watched a magician moving his finger through the flame of the lighted candle and touching the wick of the candle. She was amazed to see that the hand of the magician did not burn. Why? **(HOTS)**
2. What is the difference do you observe between the burning of coal and burning of kerosene? **(HOTS)**
3. A fuel X has a calorific value of 17000 kJ/kg while another fuel Y has the calorific value of 55000 kJ/kg. Which is a better fuel and why? **(HOTS)**
4. Forest fires are the most commonly occurring phenomena in many parts of North America. Is it due to the camp fires or bonfires ignited during picnic? Justify your answer. **(HOTS)**
5. Observe the following activity and answer the following questions. **(HOTS)**
 - (i) What do you observe when a clean glass plate is introduced into the luminous zone of the flame?

(ii) Which is this zone of the flame?

(iii) What do you infer from this activity?

6. Observe the activity shown by the given diagram and answer the questions below: **(HOTS)**

(i) What do you observe?

(ii) What do you conclude from this activity?

7. Shruti and Radhika were playing together in the house. Shruti decided to make tea. She switched on the gas and placed the tumbler containing water on the gas stove. Accidentally, her full sleeve shirt caught fire. Radhika quickly covered her with a blanket and the fire was put off.

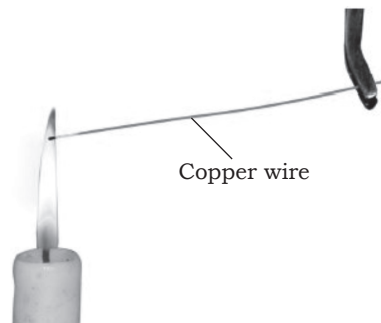
(i) Why did Radhika cover Shruti with a blanket?

(ii) What values are possessed by Radhika?

(VBQ)

8. Sushma observed that the burner of the stove is giving a yellow coloured flame unlike the usual blue flame. She immediately called upon the stove mechanic to fix the problem. What could be the probable reason for the above mentioned problem? What values are possessed by Sushma? **(VBQ)**

9. Mohan was sleeping during winters in a poorly ventilated room warmed up using burning wooden sticks. He was found unconscious in the morning and rushed to hospital. Medical examination confirmed the presence of carboxy haemoglobin in his blood sample. Give the scientific explanation of the situation. What values does Mohan have? **(VBQ)**



ANSWERS

- Since in a flame, the innermost part of the flame (wick) is least hot.
- Burning of coal: It leaves a residue. It produces smoke. Its calorific value is less.
Burning of kerosene: It does not leave any residues. It does not produce any smoke. Its calorific value is high.
- | | |
|---------------------------|---------------------------|
| X | Y |
| $Q = 17000 \text{ kJ/kg}$ | $Q = 55000 \text{ kJ/kg}$ |

Y is a better fuel since its calorific value is higher than that of X.
- Sparks from bonfires or camp fires alongwith heat can lead to forest fires.
- (i) A circular blackish ring is formed on the glass plate.
(ii) It is the middle luminous zone of flame.
(iii) It indicates the deposition of unburnt carbon particles present in luminous zone of the flame.
- (i) The portion of the copper wire just outside the flame gets red hot.
(ii) It indicates that the outermost zone is the hottest part of the flame.
- (i) Because blanket cuts off the supply of oxygen.
(ii) Scientific awareness, alertness and regulant attitude.
- (i) Insufficient supply of oxygen produces yellow flame.
(ii) Scientific bent of mind, awareness, intelligent.
- Incomplete combustion lead to evolution of carbon monoxide gas which when inhaled binds with haemoglobin, causes lack of oxygen supply to the body parts and hence results in unconsciousness. Mohan does not have scientific bent of mind.