CHAPTER: COMBUSTION & FLAME

Grade: **8**
Board: **CBSE**
Book: **NCERT**

1.

CHAPTER SUMMARY AND PLACEMENT

<Read through the following to understand how this chapter is connected with the previous and next grades and also the important concepts covered in it.>

1. Combustion and flame is being introduced for the first time in this grade. This chapter in grade 8 lays foundation for the stem of chemistry chapters in the senior years. In further grades it evolves into Carbon and it’s Compound in grade 10.
2. This chapter introduces the terms like combustion, flame and fuel. The chapter deals with different type of combustion and condition needed for combustion to take place. It also discuss in detail about flame and different zones of candle flame. At the end it discuss about fuels its types and property of an ideal fuel.
3. Since the central idea of the chapter is discussing various type of combustion and fuel. It also focusses on different types of flame.

2.

LEARNING OUTCOMES

<On completion of the chapter, students will be able to:>

1. Describe combustion
2. Distinguish between combustible and non-combustible substances
3. Identify the product formed during combustion
4. Identify different kinds of combustion
5. State the condition needed for combustion
6. Classify combustion into its types
7. Define flame and how a flame is produced
8. Identify different parts of a flame
9. Define fuel
10. Classify fuel into different types
11. Elaborate the characteristics of a good fuel
12. List the effect of burning of fuel on the environment
13. Recognize that some types of fire is caused due to uncontrolled combustion
14. State the measure that one should follow as a first aid when a person clothes catches fire
15. State different type of fire extinguishers
16. Apply the knowledge on the usage of fire extinguishers

3. KEYWORDS

Definitions of some terms used in the chapter:

Temperature: hotness or coldness of a substance

Global warming: climate change due to increase in carbon dioxide concentration

Acid rain: when oxides of nitrogen and sulphur get mix with water they form acid which fall down as acid rain

Fuel efficiency: measure of how far a vehicle can travel with per unit of fuel

Calorific value: the energy contained in a fuel

1 kilocalorie = 1000 calories

3. TEACHING PLAN

Follow this section for getting ideas on teaching the content covered in the chapter. The subtopic given in the first column with the matching learning outcome can be explained using instructions and resources listed subsequently

Subtopic and Learning Objective #1

Combustible and Non- combustible substances

Describe combustion
Distinguish between combustible and non-combustible substances

Teacher Activity

1. Carry out Activity 1 as a demonstration to introduce combustion
2. Now write the name Combustible substances on the board above the substances which burn easily in the presence of air. Tell them that these are known as flammable substance also. Example petrol wood, coal paper, nylon cloth, LPG, alcohol.
3. Write name Non- combustible substances above the substances which do not burn easily even in the presence of air. These are known as non – flammable substances. Examples sand, stone, glass etc.

Check for understanding:

a. Give three example for combustible and non- combustible substances each.
b. Define combustion.

Resources Suggested

Matchstick, candle, coal, paper, nylon cloth, sand, stone, glass, tong

ACTIVITY 1:

Name of the activity: Light me up
Use it as: Demonstration
LO: Describe combustion
Materials required: Matchstick, candle, coal, paper, nylon cloth, sand, stone, glass, and tongs
Steps:
Note: Be cautious while performing the demonstration.

1. Light a candle.
2. With a tong burn the given materials one by one.
3. Instruct students to observe the demonstration carefully.
4. Ask students which of the following substance burn and which do not.
5. Separately write them on the board.
6. Introduce the term combustion and tell that the process of burning of substances in the presence of oxygen (air) resulting in production of heat and light it is known as combustion.

Subtopic and Learning Objective #2

Combustion
Identify the product formed during combustion
Identify different kinds of combustion
State the condition needed for combustion

Teacher Activity

1. Burn a paper. Ask students to observe the product release during the process of combustion.
2. Conclude by saying that carbon dioxide and water is released during the process of combustion.
3. Inform students that when substance burns completely then carbon dioxide and water is produced along with release of large amount of heat and light. This is complete combustion. But if the oxygen supply is insufficient then the substance burns incompletely and a different product is produced which are carbon monoxide, water and energy. This is known as incomplete combustion.
4. Also discuss the equation for combustion.

Complete combustion: $CH_4 + 2\ O_2 \rightarrow CO_2 + 2H_2O$ + Energy

Incomplete combustion: $2CH_4 + 3O_2 \rightarrow 2CO + 4H_2O$ + Energy

5. Ask students to guess the conditions that is needed for combustion to take place.
6. Perform Activity 2 to demonstrate that certain factors affect the process of combustion.

7. Draw the given table on the board.
8. Ask students to observe the demonstration carefully as they have to complete the observation table drawn on the board in their notebook.
9. Conclude by saying that aluminium foil did not burn while paper cup burn easily, because foil is non – combustible, oxygen is needed for combustion, as the burning cup extinguish after sometime upon covering it with a tumbler. Attainment of optimum temperature. In the activity the paper cup did not burn easily as the heat from the candle was taken up by water.
10. Add up by saying that there is a minimum temperature that a combustible substance must attain in order to burn and this is called ignition temperature

Check for understanding:

a. In the experiment which substance burn and which don't?
b. Which gas is needed for combustion?

Resources Suggested

Paper, match stick, aluminum foil, 2 small paper cups, tong, candle, matchstick, glass tumbler

ACTIVITY 2:

Name of the activity: Combustion
Use it as: Class activity
LO: factors affecting combustion
Materials required: aluminium foil, 2 small paper cups, tong, candle, matchstick, glass tumbler
Steps:

1. Hold the foil with a pair of tong.
2. Burn it over a candle.
3. Repeat step 2 with the paper cup.
4. Cover the burning cup with a glass tumbler.
5. Fill the second paper cup with water and try to burn it over a candle.

Subtopic and Learning Objective #3

Types of combustion
Classify combustion into its types

Teacher Activity

1. Ask students to share how is burning of paper different from burning of fire cracker.
2. Appreciate all responses.
3. Conclude by saying that both of them differ in the rate of combustion. Thus depending on the speed, combustion is of four types.
4. Discuss in detail with example slow, spontaneous, rapid combustion and also explosion.
5. Slow combustion occur at very slow speed and low temperature, example – energy obtain from food.
6. Spontaneous combustion – substances that catches fire without supply of external heat, example – phosphorus kept in air. (If possible show this activity)
7. Rapid combustion – is a combustion in which large amount of energy is released in a short period of time. If uncontrolled result in fire. Example – combustion of petrol or diesel. Explosion – produces large amount of heat, light and sound. Also large amount of gas is released.

Check for understanding:

a. Give two example of explosion.
b. How is spontaneous combustion different from rapid combustion?

Resources Suggested

Textbook

Subtopic and Learning Objective #4

Flame
Define flame and how a flame is produced
Identify different parts of a flame

Teacher Activity

1. Tell students to share names of some combustible substances. Ask them, which out of these produce flame. Appreciate all responses.
2. Light a candle. Ask students to identify and define a flame.
3. Conclude by saying that combustible substance vapourise on burning and vapour get ignited to form flame.
4. Ask students can they guess how a flame is produced?
5. Tell them that when we light the wick of a candle the wick starts burning and the heat melts the wax around the wick. The molten wax vaporises and burns producing flame.
6. Tell students to share other objects which produce flames.
7. If possible show that not all combustible substance produce flame on burning like coal or charcoal.
8. With the help of a light candle describe different zones of a flame.

Non-Luminous Zone	Luminous Zone	Dark Zone
It is the zone of complete combustion due to direct contact with oxygen in air.	It is the zone of incomplete combustion due to insufficient supply of oxygen.	It is the zone of no combustion of wax due to lack of oxygen from air.
It is the outermost zone of the flame of the candle.	It is the middle zone of the flame of the candle.	It is the innermost zone of the flame of the candle.
The wax vapours present in this zone burn completely in air.	The wax vapours present in this zone burn partially in air. The unburnt wax particles glow in this zone.	The wax vapours do not burn in this zone; the vapours just get accumulated here.
The colour of the flame is blue in this zone.	The colour of the flame is orange yellow in this zone.	The colour of the flame is greyish-black in this zone.
It is the hottest zone.	It is a moderately hot zone.	It is the least hot zone.

9. Perform Activity 3, to identify which zone is hottest.
10. Show students the effect of flame on wire after inserting it to each zones. Tell them to write the observation in their notebook.
11. Thus wire turns red hot in non –luminous zone.
12. Discuss with students the example of goldsmith using the zone to melt the objects.

Check for understanding:

a. Define flame.

Resources Suggested

Matchstick, candle, charcoal, coal, thin metal, wire, tong

ACTIVITY 3:

Name of the activity: Which is hottest?
Use it as: Class activity
LO: Which zone of flame is hottest
Materials required: candle, match stick, thin metal wire, tong
Steps:

1. Burn a candle.
2. With a tong introduce a thin metal wire in the non-luminous zone for a minute.
3. Repeat step 2 and insert the wire in remaining two zones.

Subtopic and Learning Objective #5

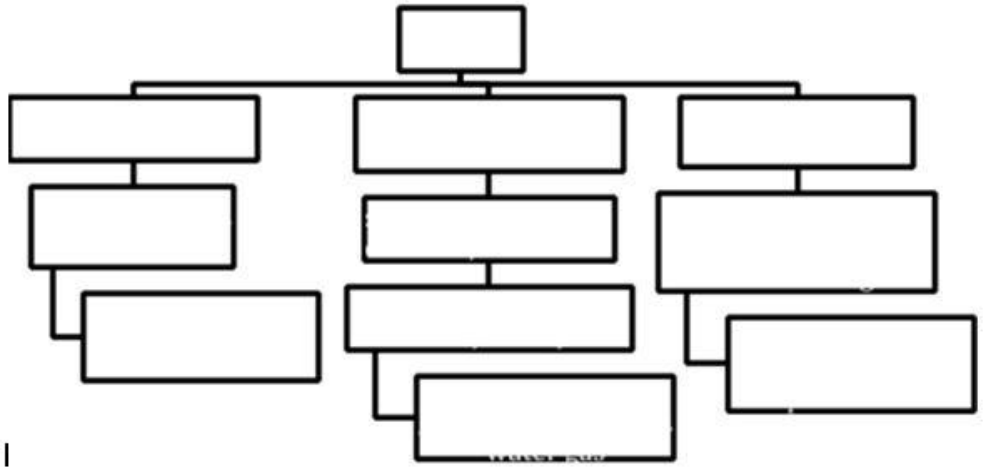
Fuel
Define fuel
Classify fuel into different types
Elaborate the characteristics of a good fuel

Teacher Activity

1. Ask student to share the meaning of fuel. Inform them that those substance which produce large amount of heat on combustion are known as fuel.
2. Draw the given table on board. Tell students to copy it in their notebook and complete the table.

Situation	Fuel needed
Cooking food	
Generation of electricity	
Running of bus	

3. Ask students to share their answers.
4. Based on it inform students that we choose fuel based on our uses and we depend on fuel to carry out various essential activities.
5. Draw a flow chart on board as given below. Ask students to guess the examples of the fuel which they know. Write the second row first and ask students to guess. If they are not able to answer then complete it.



6. In groups distribute 4 fuel cards.
7. Ask groups to sequence the fuels based on their preference of good fuel.
8. Conclude by saying that fuel T is the best fuel, as it shows the following property.
9. Less expensive, easily available, easy to store, transport and handle, produce no harmful substances, leaves no residue after burning, low ignition temperature, moderate rate of combustion. These are the properties of a good fuel.
10. Conclude by discussing about fuel efficiency and calorific value. Tell students that the fuel which has maximum calorific value is the best fuel for burning, as it release large amount of energy when per kg of that fuel is burnt completely in the air.
11. Homework – In groups ask students to gather and write points on “Effect of burning fuel on the environment” and “ways to prevent this”.

Check for understanding:

a. What should be the property of a good fuel?
b. Give three examples of renewable and non – renewable fuel.

Resources Suggested

Fuel cards, blackboard and chalk

Resource 1:

Fuel Cards
Card 1 – Fuel W – less expensive, produce harmful substance, rapid rate of combustion, easy to transport.
Card 2 –Fuel S – easily available, leaves residue, high ignition temperature.
Card 3 – Fuel T – produce no harmful substances, moderate rate of combustion, , low ignition temperature, easy to store
Card 4 – Fuel Y – mild rate of combustion, high ignition temperature, leaves residue, easy to transport and easily available.

Subtopic and Learning Objective #6

Fire

List the effect of burning of fuel on the environment
Recognise that certain fire is caused due to uncontrolled combustion
State the measure that one should follow as a first aid when a person clothes catches fire

Teacher Activity

1. Begin the class by asking each group to share their homework with rest of the class.
2. Add any missing point. Appreciate student effort.
3. Discuss the effect of burning on human health, plants and animals. Tell students that reducing and recycling will help a lot and will reduce air pollution. It will also reduce global warming. Also discuss about acid rain.
4. Ask students to share instances when combustion has turn out to be a major cause of fire outbreak.
5. Inform students that uncontrolled combustion lead to serious accidents, this can be controlled either by removing the combustible substance, or by cutting the contact between the burning substance and air, or by bringing the temperature of the substances below ignition temperature.

6. Tell students based on their previous knowledge share with the class what should one do if someone clothes catches fire.
7. Discuss all the points of first aid given to a person who has minor or major burns.
8. Ask students to share the measures one should follow during fire outbreak.

Check for understanding:

a. List the first aid administered to a person who has develop burns.
b. List ways by which fire can be put off.

Resources Suggested

Resource 2

Subtopic and Learning Objective #7

Fire Extinguishers
State different type of fire extinguishers
Apply the knowledge on the usage of fire extinguisher

Teacher Activity

1. Show the picture of a fire extinguisher or a real fire extinguisher.
2. Ask students what it is, where we use it.
3. Share with students that it is a fire extinguisher which contain certain chemical in them which cut off the contact of the burning substance with air and lowers the temperature below ignition temperature, thus put off the fire.
4. Based on the type of fire the choice of fire extinguisher is done.
5. Discuss
6. about the carbon dioxide fire extinguisher and soda acid fire extinguisher.

Check for understanding:

a. Name the different type of fire extinguisher.

Resources Suggested

Resource 2

Resource 2:



Fire Extinguisher

4. WORKSHEETS

Print or copy the worksheet questions on the blackboard and ask the students to attempt them. They can be given as homework or a class test as well.

Worksheet 1

Use it like: test after the chapter is complete, homework

Answer the following questions in brief:

1. Distinguish between flammable and non- flammable substances.
2. Write the equation for complete and incomplete combustion.
3. What is a good fuel?
4. List the effect of burning of fuel on the environment.
5. What are the product of combustion?

Worksheet 2

Use it like: checking students understanding in class, oral test

Identify different zones of candle.



Worksheet 3

Use it like:

State true/false:

1. Solid fuels such as coal leave _____ after burning.
2. Majority of the fuels containing hydrocarbons are _____ type of fuels.
3. _____ has the highest calorific value.
4. Burning of coal releases _____ gas in the atmosphere.
5. Use of leaded petrol produces _____ compounds

5. SOLUTIONS

This section gives you sample answers for activities and questions listed above.

Worksheet 1

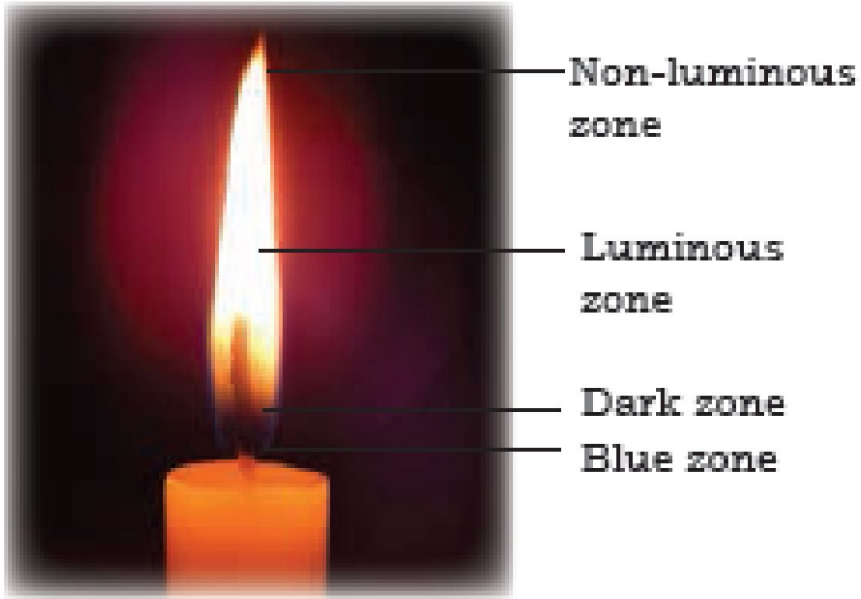
1. Flammable – which burn easily in the presence of air, inflammable – which do not burn easily in the presence of air.
2. Complete combustion: $CH_4 + 2\ O_2 \rightarrow CO_2 + 2\ H_2O + \text{Energy}$
   Incomplete combustion: $2\ CH_4 + 3\ O_2 \rightarrow 2\ CO + 4\ H_2O + \text{Energy}$
3. A good fuel is the one which shows the following property - less expensive, easily available, easy to store, transport and handle, produce no harmful substances, leaves no residue after burning, have low ignition temperature (but higher than room temperature), have moderate rate of combustion. It has high calorific value.
4. Burning fuels adversely impacts the environment. Some effects of burning fuels are as follows:

a. Incomplete combustion of fuels produce unburnt particles and leave ash behind. They stay in the atmosphere in the form of suspended particulate matter which causes many respiratory ailments and reduces visibility.
b. Release of carbon dioxide on burning fossil fuels causes global warming that results in change in season patterns, affects rainfall patterns, causing glaciers and ice caps to melt increasing the sea level.

c. Partial combustion of fossil fuels produces carbon monoxide which as poisonous gas and cause suffocation.
d. Release of Sulphur dioxide and other oxides of nitrogen causes acid rain. Acid rain impacts crops, plants and buildings.
e. Combustion of leaded petrol release poisonous lead compounds.

5. Product of combustion are carbon monoxide, water and energy during incomplete combustion & carbon dioxide, water and energy during complete combustion.

Worksheet 2



Worksheet 3

1. residue
2. Liquid
3. Hydrogen
4. carbon dioxide
5. poisonous

6. EXTRA RESOURCES

Carry out the following suggested activities/ tasks if you have the time and resources to do them

1. **Video Links:**

Show the following videos to the students on computer/ tablet/ screen:

a) Types of combustion:
https://www.youtube.com/watch?v=gw926jR8xkQ

b) Working of fire extinguisher:
https://www.youtube.com/watch?v=rVYYOQS1I1g

2. **Extension involving more concepts:**
Purpose: extended
What type of flame is produced by LPG gas burner?