

Class:8	Subject: Science	Topic: Combustion and Flame
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SUMMARY SHEET		
Learner Previous Knowledge	Generic knowledge of different types of fuels used at home, in automobiles and in industries	
Target Knowledge for this Topic	Combustion Understand what combustion is; Experiment whether a substance is combustible or not; Find out the conditions necessary for combustion; Find out about the different types of combustion; Study the different zones of a flame and their characteristics; Investigate the functioning of a fire extinguisher; Fuel Investigate about the different types of fuel and so understand what a fuel is;(Connect this with the concept of fossil fuels) Understand what is the efficiency of fuel; Study the characteristics of an ideal fuel; Learn and find out what happens when a fuel burns;	
Learning Goals		
<i>More Complex Learning Goal-</i> Students will be able to identify and explain logical errors in given situations related to combustion and analyze appropriateness of fuels as per its usage		
<i>Target Learning Goal-</i> Students will be able to describe combustion, conditions necessary for it and explain different zones of flame and explain different kinds of fuels.		
<i>Simpler Learning Goal-</i> Students will be able to list types of combustion and conditions necessary for it, types of fuels and characteristics of fuel		
Period No.	Lesson Objectives	Teaching Learning Materials Required
1	Define combustion and identify items which are combustible/non-combustible	- Board and markers - Worksheet 1 - Activity 1: For every group: piece of wood, candle, strip of paper, nail, stone, wool, Bunsen burner, tongs - Activity 2: For every group: Candle, Glass cover, two wooden blocks [wooden rulers will also do]

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2	Hypothesize if substances can burn on their own or not and then explain the concept of ignition temperature.	- Board and markers - Worksheet 2 - For every group: piece of coal, small piece of wood, paper, dry leaf, cotton ball, tongs, stop watch
3	Explain the conditions needed for fire to start, deduce how we can stop it and explain what inflammable substances are.	- Board and markers - Worksheet 3 - Reference sheet1 - Materials for activity 2 paper cups, 2 candles or 2 Bunsen burner, water, cup holder [tongs or any other equipment to hold]
4	Categorize items according to their rate of combustion and then explain different types of combustion.	- Board and markers - Worksheet 4
5	Explain flame and its characteristics.	- Board and markers - Worksheet 5 - Activity 1: For every group: Candle, Camphor, Coal, matchstick and tongs
6	Analyze suitability of fuels based on the given information.	- Board and markers - Worksheet 6 - Dictionary for each student
7	List the characteristics of fuel and brainstorm on how burning of fuel impacts the environment.	- Board and markers - Reference sheet 2 - Chart paper, colours for each group

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Period 1

Lesson Objectives

At the end of this lesson students will be able to:

- Define combustion and identify items which are combustible/non-combustible

Teaching Learning Materials required

- Board and markers
- Worksheet 1
- Activity 1: For every group: piece of wood, candle, strip of paper, nail, stone, wool, Bunsen burner, tongs
- Activity 2: For every group: Candle, Glass cover, two wooden blocks [wooden rulers will also do]

Details of Teaching Learning Experience

Seating Arrangement: - In groups of 4 or 5

Lesson Beginning <u>Time:</u> 5min <u>Purpose:</u> • Activate the prior knowledge	<u>Introduction to the topic</u> • Introduce the topic by asking the students what is used at home as source of energy for a variety of purposes. Pose questions such as: ○ What are the means used to cook food at our home? ○ How does the automobile in your house run? What does it need? ○ What do you think people who cannot afford expensive gadgets and cooking gas to cook, use for their daily requirement of fuel? ○ Can energy be produced without burning anything? • Collate their responses on the board. • Inform the students that they will now find out information on burning.
Lesson Middle <u>Time:</u> 20 min. <u>Purpose:</u> • Develop conceptual understanding	<u>Instructions for Activities& Worksheet</u> • Distribute the material required for activity to the groups. • Distribute worksheet 1 to all the students. • Ask the groups to read the instructions. • Announce that the activity involves burning substance and they need to be careful while doing it. • Let the students do the activity. • Ask them to fill in the worksheet appropriately.

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	Let the groups now share their responses and brainstorm for the answers. Collect all the answers and ensure that they arrive at a common consensus.
Lesson End <u>Time:</u> 10min <u>Purpose:</u> - Finish up - Homework Distribution	<u>Finish Up</u> - Clear doubts of the students. <u>Homework Assignment</u> - Write the following question on board. Ask the students to write it in their notebook for homework. 'Sun produces heat and light, is that also combustion? Find out.'

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Worksheet 1

Skill: Spirit of Inquiry

Activity 1

Material: piece of wood, candle, strip of paper, nail, stone, wool, Bunsen burner, tongs

Instructions

1. Light the burner.
2. Hold each item with tongs and burn them one after the other.
3. Observe what happens.
4. Record your observation.

❖ Were you able to burn all given items?

Information:

- The process of burning is called combustion. This process produces heat and light.
- The substances which can burn are called combustible substances.
- ❖ Based on the above knowledge, fill in the given table.

Item	Combustible	Non-Combustible
Wood		
Paper		
Nail		
Stone		
Wool		

Activity 2

Material: Candle, Glass cover, two wooden blocks [wooden rulers will also do]

Instructions

1. Light the candle.
2. Put it between the two wooden blocks on a table.
3. Invert the glass cover over the candle such that it rests on the two wooden blocks. This will ensure that there is space between the cover and the table and air can enter the glass cover easily.
4. Observe what happens to the candle.
5. Now remove the wooden blocks and once again cover the candle. The cover will rest on the table and air will not be able to enter the glass cover.
6. Record your observations.

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Observation Questions:

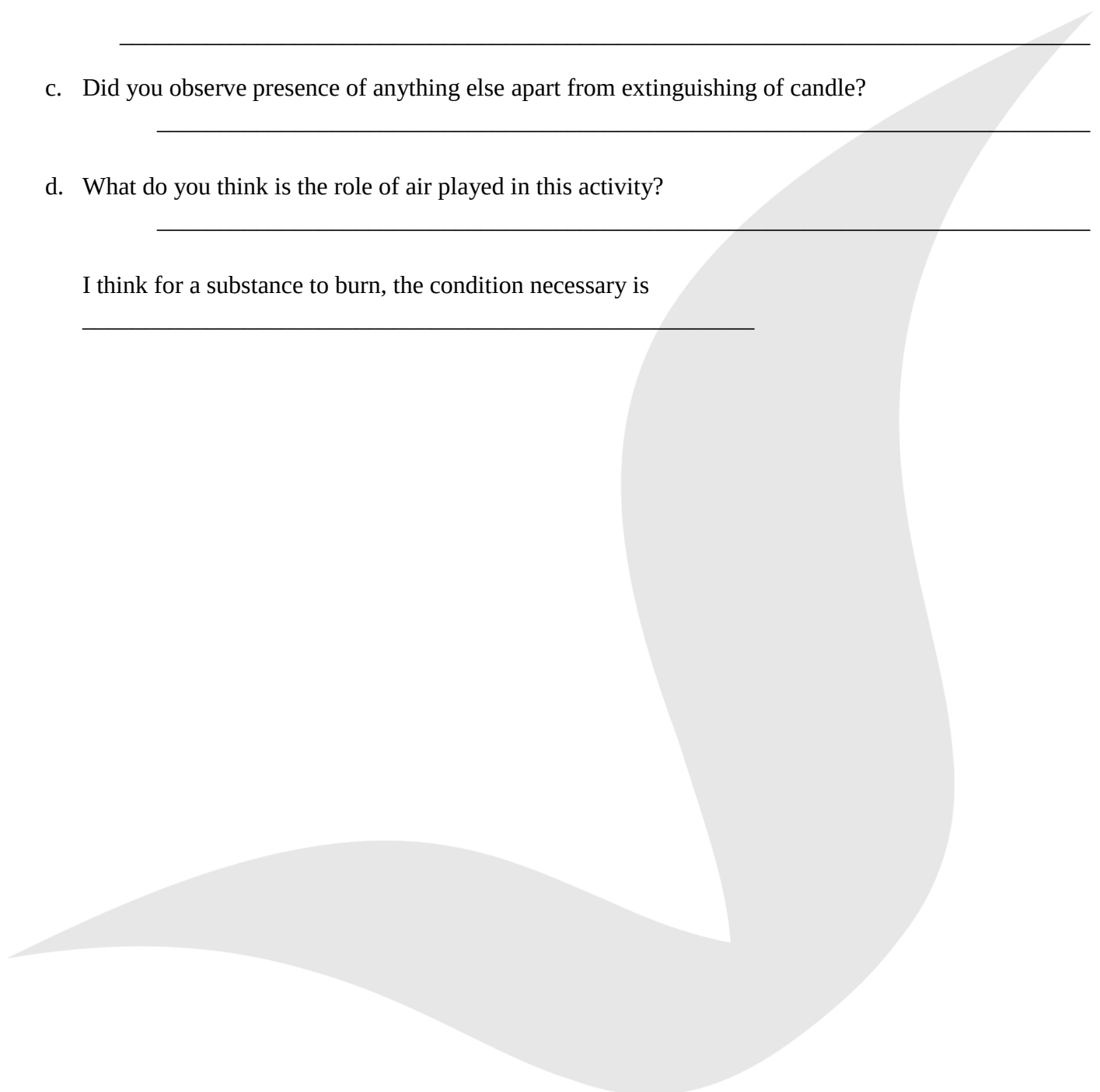
- a. What happened to the candle when the glass covers on it rested on the blocks? Did it get extinguished?

- b. What happened when you removed the blocks and then covered the candle?

- c. Did you observe presence of anything else apart from extinguishing of candle?

- d. What do you think is the role of air played in this activity?

I think for a substance to burn, the condition necessary is



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Period 2

Lesson Objectives

At the end of this lesson students will be able to:

- Hypothesize if substances can burn on their own or not and then explain the concept of ignition temperature.

Teaching Learning Materials required

- Board and markers
- Worksheet 2
- For every group: piece of coal, small piece of wood, paper, dry leaf, cotton ball, tongs, stop watch

Details of Teaching Learning Experience

Seating Arrangement: In groups of 4-5 each

Lesson Beginning <u>Time:</u> 10min <u>Purpose:</u> • Activate prior knowledge.	<u>Whole Class Discussion</u> • Ask the students to exchange their homework with each other. Let each group put forth their answer. Collate all the responses on the board. • Pose the question: 'If combustible substances need air to burn, why do they not burn spontaneously at room temperature? Do you think there may be some reason for this?' Inform the students that they will now find out through an experiment.
Lesson Middle <u>Time:</u> 20min. <u>Purpose:</u> • Develop conceptual understanding	<u>Experiment</u> • Distribute worksheet 2 to all the students and also distribute items for activity. • Let them follow the instructions and do the activity. • Ask them to record their observations. • They must now attempt the questions given in the annexure. • Let there be a whole class discussion in which the conclusions as well as the answers are discussed. • Arrive at a common consensus.

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Lesson End <u>Time:</u> 5min <u>Purpose:</u> • Finish Up • Homework Distribution	<u>Finish Up</u> • Wrap up the class by clearing any doubts. <u>Homework Assignment</u> • Write the following questions on board. Ask the students to write it in their notebook for homework. a) Why does a matchstick burn on rubbing? b) How do forest fires start? Find out.
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Worksheet 2**Skill: Observation and Investigation****Why do combustible substances not burn on their own at room temperature?**

Hypothesis:

I think substances do not burn on their own at room temperature because

Activity**Material:** piece of coal, small piece of wood, paper, dry leaf, cotton ball, tongs, stop watch**Instructions**

1. Burn each item and observe for 2 minutes. Hold coal, wood and paper with tongs while burning.
2. Let one of the students of the group measure time taken for the item to start burning, with a stop watch and record it.
3. Record the timings.

Item	Time taken to start burning
Coal	
Wood	
Paper	
Dry Leaf	
Cotton Ball	

The lowest called its

Based on questions.

1. Which

Informationtemperature at which a substance catches fire is **Ignition Temperature.****the information given above, answer the**

item has got the lowest ignition temperature?

2. Which item has got the highest ignition temperature? _____

3. Can you now predict why substances do not burn on their own?

4. Was your hypothesis correct or incorrect?

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Questions:

1. Why do you think different substances take different time to start burning?

2. Why is it easier and less dangerous to store wood than kerosene?

3. Which type of substances can prone to be fire hazards; those with low ignition temperature or those with high ignition temperature?

4. Substances which catch fire easily have _____ ignition temperature.



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Period 3

Lesson Objectives

At the end of this lesson students will be able to:

- Explain the conditions needed for fire to start, deduce how we can stop it and explain what inflammable substances are.

Teaching Learning Materials required

- Board and markers
- Worksheet 3
- Reference sheet1
- Materials for activity 2 paper cups, 2 candles or 2 Bunsen burner, water, cup holder [tongs or any other equipment to hold]

Details of Teaching Learning Experience

Seating Arrangement: - In groups of 4 or 5

Lesson Beginning <u>Time:</u> 5 min <u>Purpose:</u> Activate prior knowledge	<u>Class Discussion</u> • Ask each group to share their homework and recap the concept of ignition temperature. They can exchange information on how forest fires start abruptly and why match sticks need to be rubbed to ignite them. • Inform the students that now they will do an activity to find out more about substances which can combust. They will also deduce what keeps a fire burning.
Lesson Middle <u>Time:</u> 25 min. <u>Purpose:</u> • Develop conceptual understanding	<u>Activity</u> • Demonstrate the activity in front of the students. Instructions are given in the reference sheet 1. • Let them discuss the observation among themselves. • Distribute worksheet 3 to all students. • Let there now be a brainstorming session in which each answer is discussed. The whole class must arrive at a common consensus with respect to the answers. • Discuss the answers with reference to the information given in reference sheet 1.

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Lesson End <u>Time:</u> 5 min <u>Purpose:</u> • Finish Up	<u>Finish Up</u> • Wrap up the class by clearing doubts.
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Annexure: 3A

Skill: Drawing Inferences

WORKSHEET

I. Given below are a few things. Of these there are 3 things which are absolutely essential for fire to burn or continue burning. Select those and put them correctly in the empty boxes.

nitrogen water oxygen fuel minerals heat light sand carbon dioxide phosphorus candle



2. Based on the above, we can say that if any one of the three conditions is not fulfilled, the fire will stop burning. Fire brigade people try to cutoff one of these three things to stop a fire which may have broken out. Answer the questions now.

a. Why does fire brigade put water on the fire? How does it stop the fire from spreading?

b. You must have observed these fire pails at petrol pumps. Which condition do they cut off to stop the fire?



c. This fireman is showing what to do if your clothes or you catch fire.



How does rolling help in putting out fire?

III. Substances with low ignition temperature catch fire easily. These substances are called inflammable substances. Given below is a list of items. Tick those which have low ignition temperature and are inflammable in nature.

Petrol	Wool	Paper
Glass	LPG Gas	Stone
Kerosene	Water	Steel

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Reference sheet 1

Instructions for the activity:

1. Take two paper cups.
2. Heat one empty paper cup on the flame of burner and observe.
3. Fill the other paper cup one-third with water and heat it on the flame and observe.

Information

Fire needs 3 essential conditions to burn.

- Oxygen [Air]
- Fuel
- Heat

The heat keeps up the ignition temperature and sustains the fire.

If you wish to stop fire from burning further, you need to cutoff any one condition. For example, if you cover the fire, oxygen will be cutoff and the fire will stop. When you pour water on fire, it cuts off supply of oxygen and prevents fire from burning. Cooking gas, when turned off, stops burning immediately because you have cut off fuel supply.

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Period 4

Lesson Objectives

At the end of this lesson students will be able to:

- Categorize items according to their rate of combustion and then explain different types of combustion.

Teaching Learning Materials required

- Board and markers
- Worksheet 4

Details of Teaching Learning Experience

Seating Arrangement: - In groups of 4 or 5 in computer lab

Lesson Beginning <u>Time:</u> 5-7 min. <u>Purpose:</u> Recap the previous learning	<u>Whole Class Discussion</u> • Ask a few students to recap how fire can be started and put out. Ask a few students to define inflammable substances. • Collect responses and arrive at a common consensus. • Inform the students that they will now see if combustible/inflammable items burn in a particular pattern or they burn in different ways.
Lesson Middle <u>Time:</u> 30 min. <u>Purpose:</u> Develop conceptual understanding	<u>PowerPoint Presentation</u> • Distribute worksheet 4 to all students. • Let the students attempt Part A and categorise items as per instruction. • Discuss about the rapid combustion, spontaneous combustion and explosion. • Discuss the answers of part A and ask them to self- assess it. • Let the students now attempt questions in Part B. • Now there can be a whole class discussion in which the answers of both parts of Annexure 4A are discussed. Arrive at a common consensus.
Lesson End <u>Time:</u> 5 min <u>Purpose:</u>	<u>Finish Up</u> • Finish up the discussion by clarifying any doubts.

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• Finish Up	
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Worksheet 4

Skill: Analytical Thinking

PART A

1. Given below are three groups based on the rate of burning. Categorize the given items suitably.

Burn rapidly	Burn slowly	Burn extremely slowly

dry leaf wet coal petrol cotton cloth diesel glass wood
kerosene agarbatti candle paper cooking oil

PART B

1. Will you call burning of kerosene rapid combustion? Why?

2. Are the products of combustion of a candle and forest fire same?

3. Sometimes Phosphorus catches fire even at room temperature. What can you say about its ignition temperature? What kind of combustion that would be?

4. All substances which combust spontaneously have a _____ ignition temperature and they can be called as _____

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Period 5

Lesson Objectives

At the end of this lesson students will be able to:

- Explain flame and its characteristics.

Teaching Learning Materials required

- Board and markers
- Worksheet 5
- Activity 1: For every group: Candle, Camphor, Coal, matchstick and tongs

Details of Teaching Learning Experience

Seating Arrangement: - In groups of 4 or 5

Lesson Beginning <u>Time:</u> 5 min. <u>Purpose:</u> Generate interest.	<u>Whole Class Discussion</u> • Ask the students to recap different kinds of combustions that they have learnt. • Pose the following questions to the students: ○ List the common products which are given out during combustion. ○ You must have seen the flame of a gas stove. How is it different from flame of a candle? • Now inform the students that they will learn more about flame in this class.
Lesson Middle <u>Time:</u> 25 min. <u>Purpose:</u> Develop conceptual understanding	<u>Activity</u> • Distribute worksheet 5 to all the students. • Ask them to do the activity and record observation. • Discuss about the flame and its zone with the help of fig 6.13 of NCERT book. • Let the students attempt questions based on the discussion given in part-2. • Now there can be a whole class discussion in which all the answers of worksheet are discussed. Arrive at a common consensus.

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Lesson End <u>Time:</u> 5 min <u>Purpose:</u> • Finish Up	<u>Finish Up</u> • Finish up the discussion by clarifying any doubts. <u>Home Assignment</u> • Ask them to find the name of different fuels used for energy.
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Worksheet 5

Skill: Drawing Inferences

Activity 1

Material: Candle, Camphor, Coal, matchstick and tongs

Instruction

1. Burn all items one by one using the match stick.
2. Which item gives a very clear and defined flame?
3. Record your observation in the given table.

Item	Does not form defined flame	Forms a clear flame
Candle		
Coal		
Camphor		

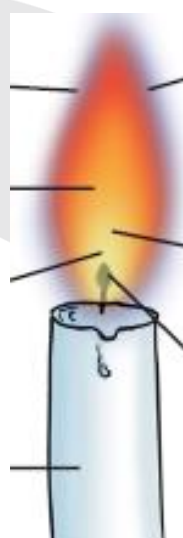
Part 2

1. How many zones are there in a flame?

2. Name the zones of the flame.

3. Which zone will have hottest temperature?

- Label the zones of the candle and then explain the characteristic of each zone.



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Period 6

Lesson Objectives

At the end of this lesson students will be able to:

- Analyze suitability of fuels based on the given information.

Teaching Learning Materials required

- Board and markers
- Worksheet 6
- Dictionary for each student

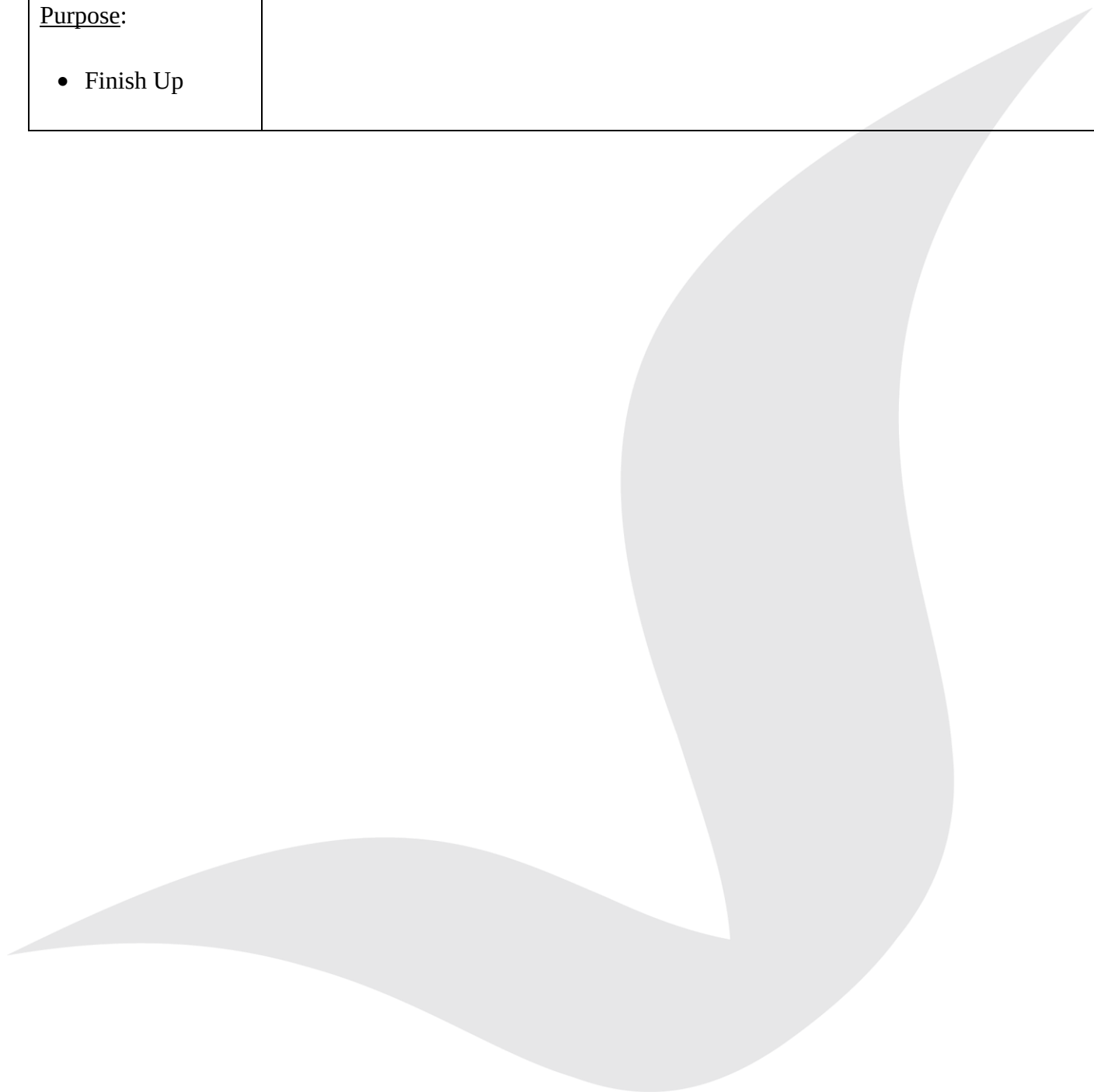
Details of Teaching Learning Experience

Seating Arrangement: - In groups of 4-5

Lesson Beginning <u>Time:</u> 5 min. <u>Purpose:</u> Recap the previous learning	<u>Class Discussion</u> - Pose following questions to start the discussion: - What are the conditions needed to begin a fire? - Why do forest fires spread rapidly? - How does a fire extinguisher help in arresting fire? - Now ask the students to find out the meaning of fuels from the dictionary. - Ask a few students to define fuels. Collate the response and write it on board. Arrive at a common consensus.
Lesson Middle <u>Time:</u> 25 min. <u>Purpose:</u> Develop conceptual understanding	<u>Analysis of case studies</u> - Distribute worksheet 6 to all the students. - Ask them to gather examples of fuels that they must have found out as part of their homework. - Ask the students to fill in the annexure accordingly. - Now ask the students to categorize these fuels into solid/liquid/gases fuels. - They may then attempt the case studies and decide which kind of fuel is most appropriate for different usages. - Based on information of calorific value of fuel given in worksheet, let the students find out which fuel is most effective. - Let there now be a whole class discussion on the observations and analysis and ensure that all the students arrive at a common consensus.

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Lesson End <u>Time:</u> 5 min <u>Purpose:</u> Finish Up	<u>Finish Up</u> Clear any doubts that the students may have regarding the topic.



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Worksheet 6

Skill: Comprehension

I. List as many examples of fuels that you have found out as part of your homework.

2. Categorize the above fuels into 3 categories: solid, liquid and gases

Solid	Liquid	Gases

3. Anil has gone for a camp. He has to boil water for 10 people. He has been given a choice of 3 fuels: Coal, wood and LPG Gas.

- Which fuel will he use?

- Do you think all the fuels of same quantity give same amount of heat?

4. Why is it important to select an appropriate fuel for a particular use? For instance, why does LPG gas not be replaced by petrol for cooking purpose at home?

5. The amount of heat energy produced on complete combustion of 1 kg of fuel is called its calorific value. The unit of calorific value is kilojoule per kg [kJ/kg].

Given below is calorific value of different fuels.

Calorific Values of Different Fuels

Fuel Calorific Value (kJ/kg)

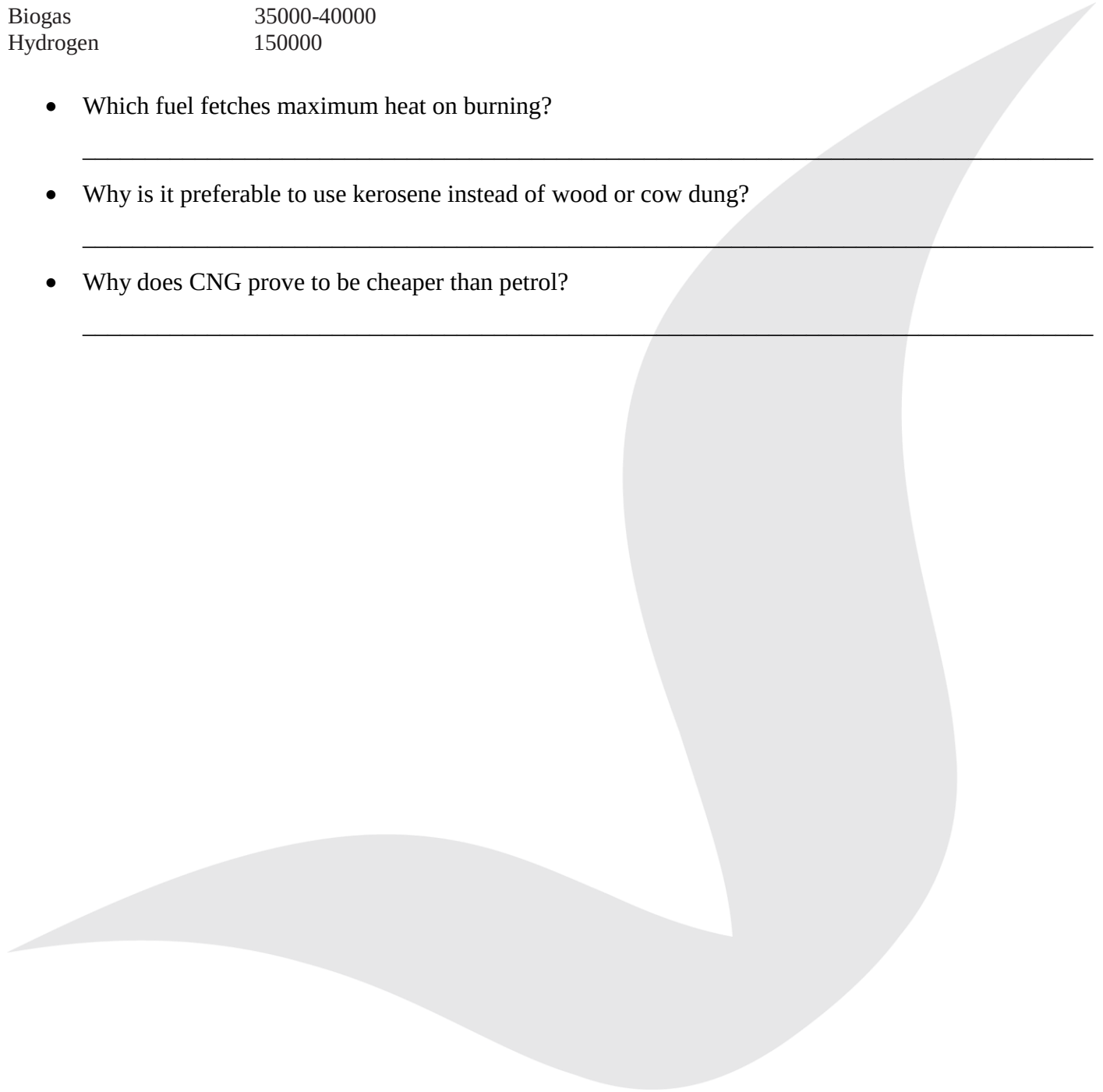
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Cow dung cake	6000-8000
Wood	17000-22000
Coal	25000-33000
Petrol	45000
Kerosene	45000
Diesel	45000
CNG	50000
LPG	55000
Biogas	35000-40000
Hydrogen	150000

- Which fuel fetches maximum heat on burning?

- Why is it preferable to use kerosene instead of wood or cow dung?

- Why does CNG prove to be cheaper than petrol?



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Period 7

Lesson Objectives

At the end of this lesson students will be able to:

- List the characteristics of fuel and brainstorm on how burning of fuel impacts the environment.

Teaching Learning Materials required

- Board and markers
- Reference sheet 2
- Chart paper, colours for each group

Details of Teaching Learning Experience

Seating Arrangement: - In groups of 4-5

Lesson Beginning <u>Time:</u> 5 min. <u>Purpose:</u> Recap the previous learning	<u>Mind Map</u> - Ask the students to recap the meaning of fuel. Ask some students to define the meaning of calorific value of fuel. - Now ask the students to gather together and have a group discussion on what characteristics they would ideally want in a fuel. Give an example such as: Fuel must be easily available. - Now pose questions such as - Why are certain fuels preferred over other to check pollution? - We are often told not to burn leaves. Why do you think it is so? - Why should we be careful about the effect it has on environment while burning anything? - Collect the answers to be on the same page. - Now inform the students that they have to find out how burning fuel impacts the environment.
Lesson Middle <u>Time:</u> 25 min. <u>Purpose:</u> Develop conceptual understanding	- Display reference sheet 2 to all the students. - Inform the students that they have to discuss among themselves and write about the harmful effects of burning of fuels. Instruct them that they may showcase their work on a chart- the students may draw, stick pictures, write captions and make their work creative

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Lesson End <u>Time:</u> 5 min <u>Purpose:</u> • Finish Up	<u>Finish Up</u> • Clear any doubts that the students may have.
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Reference sheet 2

