

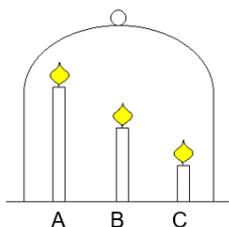
**S4 Chemistry**  
**Chapter 2 – The atmosphere**  
**Worksheet**

Name: \_\_\_\_\_ ( )      Class: 4 \_\_\_\_\_      Date: \_\_\_\_\_

**Part 1 – The experiment of three burning candles**

1. What are the THREE essential conditions for burning?  
\_\_\_\_\_, \_\_\_\_\_ and \_\_\_\_\_
2. Complete the word equation for complete combustion (burning).  
fuel + oxygen → \_\_\_\_\_ + \_\_\_\_\_

Refer to the experiment of three burning candles below and predict which candle(s) will go off first.



3. Which candle(s) will go off first?
- A. Candle A  
B. Candle B  
C. Candle C  
D. The three candles go out at the same time

4. Explain your answer to question 3.
- \_\_\_\_\_
- \_\_\_\_\_

Now, your teacher will show you a video of the experiment of three burning candles.

5. In the video, which candle(s) went off first? How much time did it take for it/them to go off?
- \_\_\_\_\_

Does the experimental result agree with your prediction in questions 3 and 4?

Part 2 – Learning Stations

Each of the four students of the group will go to the four learning stations as assigned. Follow the steps and complete the tasks in the following parts of the worksheet. You will have 15 minutes for the tasks. When the time is up, return to your original group and present the new information you have obtained at the learning station to your group members.

Learning Station A

You will watch a video of an experiment of three burning candles inside an inverted jar. The three candles have the same initial length but are placed on wooden blocks so as to vary the positions of the flame.

1. Complete the variable table below for the experiment in the video:

Independent variable (the only variable that is changed before the experiment begins)	Dependent variable (the variable to be measured)	Controlled variables (variables that are kept the same)
_____ of _____	_____ of _____	_____ of _____ _____ of _____ _____ of _____

2. In the box below, draw the experimental set-up (with labelling) as seen in the video.

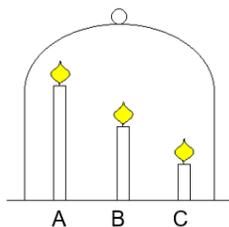
3. In the video, which candle(s) went off first? How much time did it take for it/them to go off?

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4. What conclusion can you draw from the video?

The \_\_\_\_\_ (higher / lower) the candles are placed, the \_\_\_\_\_ (faster / slower) the candle light goes off.

5. Consider again the experiment of three burning candles.



(a) How does the experimental set-up at Learning Station A differ from this experiment?

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(b) Do the two experiments have the same results?

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(c) What can you conclude from (a) and (b)?

The \_\_\_\_\_  
 does not affect the burning time of the three candles.

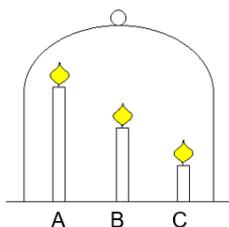
**S4 Chemistry**  
**Chapter 2 – The atmosphere**  
**Experiment Worksheet**

Name: \_\_\_\_\_ ( )      Class: 4 \_\_\_\_\_      Date: \_\_\_\_\_

**Part 1 – The experiment of three burning candles**

1. What are the THREE essential conditions for burning?  
\_\_\_\_\_, \_\_\_\_\_ and \_\_\_\_\_
2. Complete the word equation for complete combustion (burning).  
fuel + oxygen → \_\_\_\_\_ + \_\_\_\_\_

Refer to the experiment of three burning candles below and predict which candle(s) will go off first.



3. Which candle(s) will go off first?   
A. Candle A  
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D. The three candles go out at the same time

4. Explain your answer to question 3.  
\_\_\_\_\_  
\_\_\_\_\_

Now, your teacher will show you a video of the experiment of three burning candles.

5. In the video, which candle(s) went off first? How much time did it take for it/them to go off?  
\_\_\_\_\_

Does the experimental result agree with your prediction in questions 3 and 4?

## Part 2 – Learning Stations

Each of the four students of the group will go to the four learning stations as assigned. Follow the steps and complete the tasks in the following parts of the worksheet. You will have 15 minutes for the tasks. When the time is up, return to your original group and present the new information you have obtained at the learning station to your group members.

### Learning Station B

You are going to investigate the relationship of the initial length of candles and the amount of burning time of the candles.

#### Procedure:

1. Your group will be given three sets of candles different initial lengths. Record the initial length of each of the candles in the table below.
2. Light one candle and measure the amount of burning time. Record the results in the table.
3. Repeat steps 1 and 2. You can use a new candle if the candle has become significantly shorter after trial 1.
4. Calculate the average burning time and complete the table.

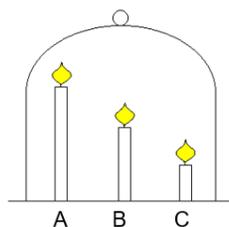
#### Precaution:

Do not touch the inverted beakers with bare hands as the beakers can become very hot. Before moving the hot beaker, wrap it with a towel.

#### Results:

Initial length of candle (cm)	Burning time of candle (s)			
	Trial 1	Trial 2	Trial 3	Average

Question: Consider again the experiment of three burning candles.



- (a) How does the experimental set-up at Learning Station B differ from this experiment?

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- (b) How does the experimental results at Learning Station B differ from the results of this experiment?

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- (c) What can you conclude from (a) and (b)?

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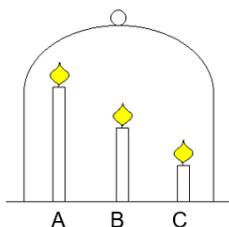
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Name: \_\_\_\_\_ ( )      Class: 4 \_\_\_\_\_      Date: \_\_\_\_\_

**Part 1 – The experiment of three burning candles**

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5. In the video, which candle(s) went off first? How much time did it take for it/them to go off?  
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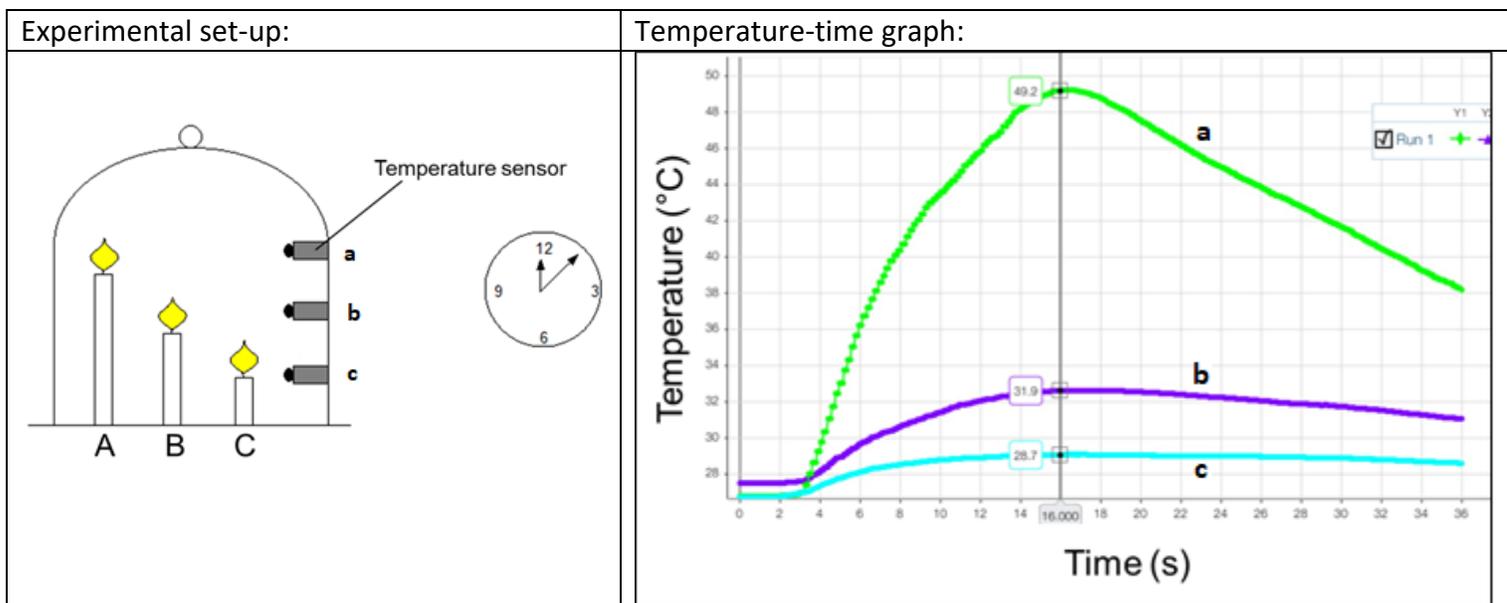
Does the experimental result agree with your prediction in questions 3 and 4?

## Part 2 – Learning Stations

Each of the four students of the group will go to the four learning stations as assigned. Follow the steps and complete the tasks in the following parts of the worksheet. You will have 15 minutes for the tasks. When the time is up, return to your original group and present the new information you have obtained at the learning station to your group members.

### Learning Station C

Your group will study the temperature-time graph obtained from an experiment with temperature sensors fixed at three different heights inside an inverted jar with three burning candles.



Answer the following questions.

- At  $t = 16$  s, at which position (a, b or c) is the highest temperature recorded?

At position \_\_\_\_\_.

- Suggest a reason why the temperature is the highest at the position mentioned in Question 1.

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- Study the three curves in the graph. It can be seen that the temperature at all three positions a, b and c goes down after  $t = 16$  s. Suggest a reason for this.

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(Hint: Read question 5 on page 1 again.)

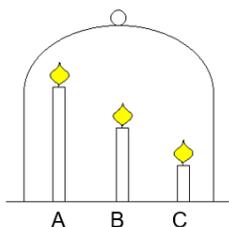
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- \_\_\_\_\_

Now, your teacher will show you a video of the experiment of three burning candles.

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Does the experimental result agree with your prediction in questions 3 and 4?

## Part 2 – Learning Stations

Each of the four students of the group will go to the four learning stations as assigned. Follow the steps and complete the tasks in the following parts of the worksheet. You will have 15 minutes for the tasks. When the time is up, return to your original group and present the new information you have obtained at the learning station to your group members.

### Learning Station D

Students will add different amounts of sodium carbonate solution to vinegar, and pass the gas produced through hydrogencarbonate indicator.

Students will watch a video of three burning candles inside an inverted jar with hydrogencarbonate indicator fixed at three different heights inside the jar.

#### Part 2.1

Carbon dioxide is produced when the sodium hydrogencarbonate in baking soda reacts with the ethanoic acid in vinegar.



Procedure:

1. Record the initial colour of hydrogencarbonate indicator.
2. Add 5 g of baking soda to vinegar in a side-arm boiling tube and stopper the side-arm boiling tube immediately to pass the gas produced through hydrogencarbonate indicator in another boiling tube. Record the final colour of the indicator in the table below.
3. Repeat step 1, using different amounts of baking soda.

Results:

Initial colour of hydrogencarbonate indicator: \_\_\_\_\_

Mass of baking soda added (g)	Final colour of hydrogencarbonate indicator

How does the amount of carbon dioxide change the colour of the hydrogencarbonate indicator?

\_\_\_\_\_

#### Part 2.2

Watch the video of the experiment of three burning candles inside an inverted jar with hydrogencarbonate indicator fixed at three different heights inside the jar. Then, answer the questions below.

1. Refer to your findings in Part 2.1. In the video, at which positions (A, B or C) is the amount of carbon dioxide the largest? At position \_\_\_\_\_.
2. Suggest a reason for your answer in Question 1.

\_\_\_\_\_  
\_\_\_\_\_

Part 3 – Presenting new information and Completing the Evidence Card

Now you are at your original group. Each of you will have 2 minutes to present to your group members the new information you obtained from each of the four learning stations.

Learning Stations (with student's name)	Findings / New information from the Learning Stations
A (_____)	
B (_____)	
C (_____)	
D (_____)	

Evidence Card

Independent variable is the factor that is set to be different before the experiment starts.  (Given)		Controlled variables are factors that are kept the same in the experiment.  (Given)
Fire triangle: Oxygen, fuel, high temperature  (Given)	Carbon dioxide puts out fire.  (Given)	Air contains 21% of oxygen.  (Given)

Now, you will watch again the video of the experiment of three burning candles.

With the help of the completed Evidence Card, explain why Candle A went off first in the experiment.

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Evidence card:

(Learning Station D)	(Learning Station C)	(Learning Station C)
Independent variable is the factor that is set to be different before the experiment starts.  (Given)	(Learning Station D)	Controlled variables are factors that are kept the same in the experiment.  (Given)
Fire triangle: Oxygen, fuel, high temperature (Given)	Carbon dioxide puts out fire.  (Given)	Air contains 21% of oxygen.  (Given)

Evidence card – suggested answers:

<p>The higher the position, the larger amount of carbon dioxide accumulates. (Learning Station D)</p>	<p>Hotter gases rise up. (Learning Station C)</p>	<p>Carbon dioxide has a higher density in air and sinks. (Learning Station C)</p>
<p>Independent variable is the factor that is set to be different before the experiment starts. (Given)</p>	<p>Carbon dioxide changes the colour of hydrgencarboante indicator from red to yellow. (Learning Station D)</p>	<p>Controlled variables are factors that are kept the same in the experiment. (Given)</p>
<p>Fire triangle: Oxygen, fuel, high temperature (Given)</p>	<p>Carbon dioxide puts out fire. (Given)</p>	<p>Air contains 21% of oxygen. (Given)</p>