U1, M1, L3 - The Fire Triangle (Part 2) - Oxygen - Key for Student Worksheet

Name: KEY	**Class/Period:**	**Date:**

Presentation: Complete this section of the worksheet as directed during the presentation.
Make a diagram of the fire triangle. Be sure to include labels.

Table 1: Physical & Chemical Changes

Change	Definition	Three examples
Physical	A **physical change** occurs when a specific molecule/substance/material undergoes a change or changes form without the molecule/substance/material having its unique chemical identity changing.	Ice melting, water freezing, water evaporating, water boiling, steam condensing, rain/snow being produced, rock crushed into a powder, etc.
Chemical	For a transformation to be a **chemical change**, the original unique chemical identity of a material/substance must change to a different chemical identity as a result of a chemical reaction.	Burning, rusting, cooking, digestion, photosynthesis, cellular respiration, etc.

Table 2: Balanced Chemical Equations for Photosynthesis and Cellular Respiration

Chemical Reaction	Balanced Chemical Equation
Photosynthesis	$6CO_2 + 6H_2O + \text{Sunlight} \rightarrow C_6H_{12}O_2 + 6O_2$
Cellular Respiration	$C_6H_{12}O_2 + 6O_2 \rightarrow 6CO_2 + 6H_2O + \text{Energy}$

State which scientific principle/law is demonstrated by a balanced chemical equation and then explain your response with complete sentences.

The Law of Conservation of Matter is demonstrated by a balanced chemical equation. Since, matter can be neither created nor destroyed, the atoms for each element must have the same amount on both sides of the reaction. The number of atoms for each element "before" the reaction or process resulting in change must equal the number of atoms for each element "after" the reaction or process resulting in change.

Describe in complete sentences how the chemical equation for cellular respiration could be modified to represent the combustion reaction?
To change the chemical equation for cellular respiration into one for combustion, "heat" must be present with the reactants, and the resulting release of energy should be described as "heat and light." Including heat with glucose and oxygen completes the fire triangle permitting combustion to begin.

Materials:

- Metal Tray
- 2 votive candles
- Plastic cup
- Stove lighter
- Fireplace matches (long)
- Spoon
- Small beaker (50 mL)
- Needle-nose pliers
- "White powder"
- "Clear liquid"

Procedure:

1. Read the prompts on page 3 to familiarize yourself with observations you should make during each trial. An area for taking notes is provided on page 4.
2. Place one votive candle on the metal tray and light it with the stove lighter. For the remainder of the activity, the fireplace matches will be lighted using this candle.
3. Place the second candle in the red plastic drinking glass.
4. Light a fireplace match from the burning candle on the metal tray and use it to light the candle in the container. This step proves that the candle in the red plastic glass can be lighted. If either candle is hard to light, you may need to scrape some wax from around the wick. Cut the blackened end of the fireplace match off with the needle-nose pliers so that it can be used again and again and again, etc.
5. Blow out the candle in the red plastic glass.
6. Carefully place 2 spoonfuls of the white powder around the base of the candle in the plastic glass.

7. Using a small beaker, pour 40 mL of the clear liquid onto the white powder (not on the candle!). Make every effort to keep the wick from getting "wet."
8. Relight a fireplace match from the candle on the metal tray, and use it to relight the candle in the plastic cup.
9. You may repeat the experiment and use different techniques to light the candle in the container.
10. After your group has completed all necessary trials and cleaned your group's laboratory station, respond to the prompts on page 3.

1) Describe what the group observed when the liquid was poured onto the powder. When the liquid and powder were mixed, bubbling occurred.
2) Did a chemical change occur when the liquid was poured onto the powder? Justify your answer. A chemical change took place when the liquid and powder were mixed. The bubbles that were observed indicated that a gas was produced by a chemical reaction, so the reactants combined to form a gas and, perhaps, some other new substances.
3) Describe what you observed when you were relighting the candle in the plastic glass. Unless a lot of time had passed, it was challenging to relight the candle in the plastic glass.
4) Describe the techniques you used to light the candle in the plastic glass. Explain how well each technique worked. Answers will vary. Possible responses might include: 1) Tilting the plastic cup. This method will have some success. 2) Fanning the plastic cup. This method will probably have more success than #1. 3) Waiting a few minutes. This method will have some success.
5) Use the Fire Triangle to explain your observations. Since heat and fuel were both available, a low concentration of oxygen was the reason for the difficulty relighting the candle in the plastic cup. A method in #4 may have allowed the concentration of oxygen to increase resulting in the group successfully relighting the candel in the plastic cup.
6) Using only the materials at your lab station, design a CO_2 fire extinguisher that will allow you to put out the votive candle in the metal tray. Test your fire extinguisher. Describe your fire extinguisher and its effectiveness. Include a diagram of your group's CO_2 fire extinguisher (on page 4 if there is not enough space in this box). Designs will vary. Possible designs might include: 1) Small beaker used to cover the candle on the metal tray.

2) Mixing “clear liquid” and “white powder” in the plastic cup and “pouring” the resulting gas onto the candle on the metal tray.

Diagrams should represent the written description.

Notes: