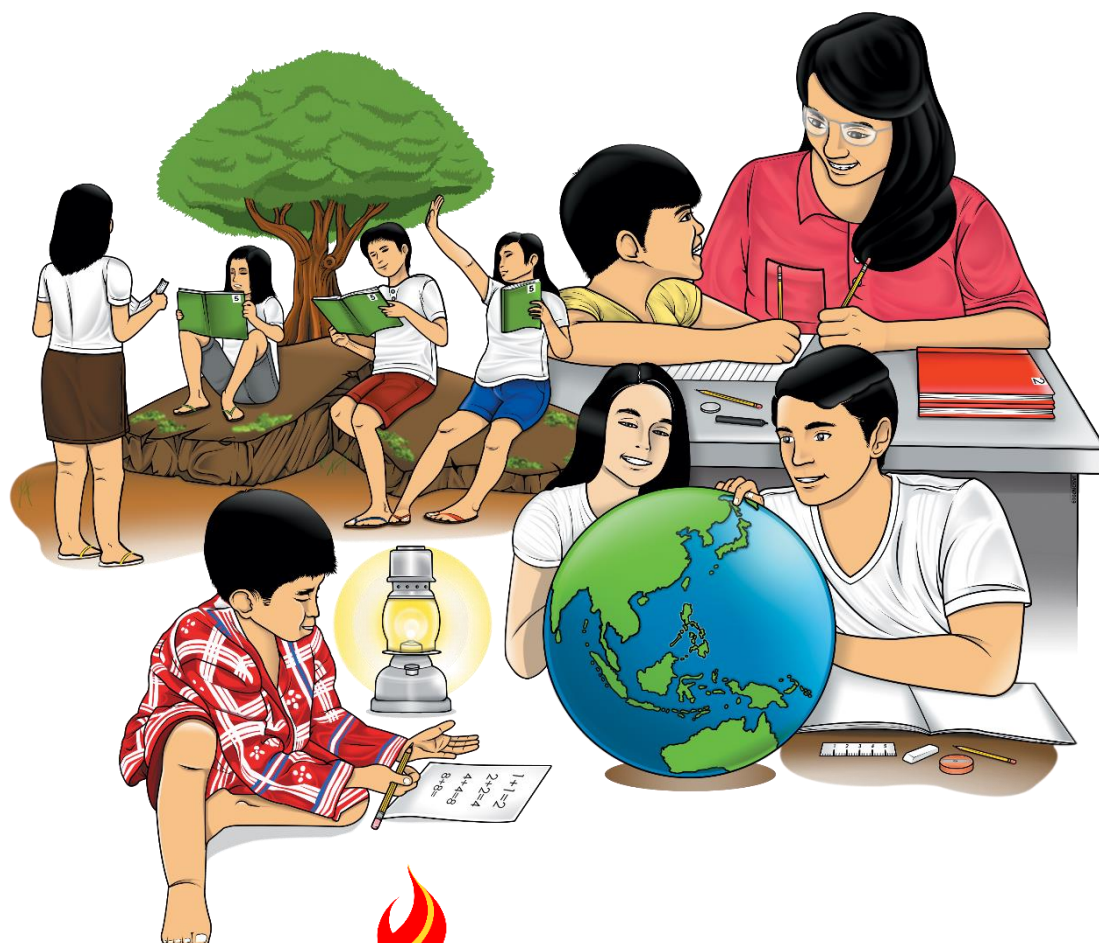


Disaster Readiness and Risk Reduction

Quarter 2 – Module 9

The Elements of Fire Triangle



Disaster Readiness and Risk Reduction
Alternative Delivery Mode
Quarter 2 – Module 9: The Elements of Fire Triangle
First Edition, 2021

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Development Team of the Module

Writers:	Rodgem A. Barairo
Editors:	Anne Marielle R. Del Mundo
Reviewers:	Yumi Angela S. Valderama; Jomar D. Flores; Delle Celeste M. Sepagan; Romalyn D. Rana
Illustrator:	Yonel Cadapan
Layout Artist:	Ma. Elinor F. Hemedes
	Ren Mac Mac G. Motas
Management Team:	Francis Cesar B. Bringas
	Job S. Zape Jr.
	Eugenio S. Adrao
	Elaine T. Balaogan
	Fe M. Ong-ongowan
	Susan DL Oribiana
	Jaypee E. Lopo
	Dolorosa S. De Castro
	Cristeta M. Arcos

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Department of Education – Region IV-A CALABARZON

Office Address: Gate 2 Karangalan Village, Barangay San Isidro
Cainta, Rizal 1800
Telefax: 02-8682-5773/8684-4914/8647-7487
E-mail Address: region4a@deped.gov.ph

Disaster Readiness and Risk Reduction

Quarter 2 – Module 9: The Elements of Fire Triangle

Introductory Message

This Self-Learning Module (SLM) is prepared so that you, our dear learners, can continue your studies and learn while at home. Activities, questions, directions, exercises, and discussions are carefully stated for you to understand each lesson.

Each SLM is composed of different parts. Each part shall guide you step-by-step as you discover and understand the lesson prepared for you.

Pre-tests are provided to measure your prior knowledge on lessons in each SLM. This will tell you if you need to proceed on completing this module or if you need to ask your facilitator or your teacher's assistance for better understanding of the lesson. At the end of each module, you need to answer the post-test to self-check your learning. Answer keys are provided for each activity and test. We trust that you will be honest in using these.

In addition to the material in the main text, Notes to the Teacher are also provided to our facilitators and parents for strategies and reminders on how they can best help you on your home-based learning.

Please use this module with care. Do not put unnecessary marks on any part of this SLM. Use a separate sheet of paper in answering the exercises and tests. And read the instructions carefully before performing each task.

If you have any questions in using this SLM or any difficulty in answering the tasks in this module, do not hesitate to consult your teacher or facilitator.

Thank you.



What I Need to Know

Among types of disasters, perhaps fire is one of the most-feared way of dying. This is so due to the common belief that people who get killed in fire incidents die of getting burned, which is not actually the case because the usual cause of death is of suffocation or oxygen deprivation.

If you happen to be in a situation where fire suddenly break-out, calmness as well as having the knowledge on what to do, is key to putting-out the fire. This module is designed to explain what the ingredients of fire are. By eliminating at least one ingredient in the equation, fire will be extinguished. In addition, knowing how fire progresses from one stage to another will also be important in combatting fire-related incidents.

So, keep the flame of love for learning burning as this can save not only your life, but others' lives too!

The Module is intended to equip you with knowledge concerning “Elements of Fire Triangle”.

After going through this module, you are expected to:

1. define fire;
2. enumerate the elements of the fire triangle;
3. create a meme (a humorous or informative illustration) that involves one or more elements of the fire triangle; and
4. relate fire triangle principles in everyday experiences.



What I Know

Multiple Choice. Choose the letter of the best answer. Write the chosen letter on a separate sheet of paper.

1. Which of the following is **NOT** an element of the fire triangle?
 - A. fuel
 - B. heat
 - C. hydrogen
 - D. oxygen
2. Which of the following statements is **TRUE** about the elements of the fire triangle?
 - A. Whenever these three ingredients are present there will be fire.
 - B. There is no exact mixture of the three ingredients to produce fire.
 - C. Fire can be prevented or extinguished by removing any one of the ingredients.
 - D. All of the given options.
3. The following are human-induced causes of fire, which of these is **NOT** a product of human error?
 - A. gas leaks
 - B. faulty electrical wirings
 - C. unattended ignition sources
 - D. low condition motor vehicles
4. In cooking adobo, Ric lighted the firewood using matchsticks and kerosene. He made sure that the fire will not die by fanning it. In this case, which serves as the fuel?
 - A. adobo
 - B. lighting matchsticks
 - C. firewood and kerosene
 - D. fanning to provide wind
5. From situation in item 4, which serves as the ignition?
 - A. adobo
 - B. lighting matchsticks
 - C. firewood and kerosene
 - D. fanning to provide wind
6. How does fanning help to support continuous combustion in question item 4?
 - A. adding fuel
 - B. providing oxygen
 - C. lowering temperature
 - D. increasing temperature

7. Amor rolled over the floor in order to put off the fire that caught her clothes. Which principle explains this?
- A. fuel is removed in such case
 - B. temperature is increased by her action
 - C. rolling over the floor reduces the amount of oxygen that will support fire
 - D. rolling over the floor lowers the temperature through an extinguishing agent
8. A fire can be caused by the following combustibles- burning paper, wood and gasoline. These combustibles serve as the _____.
- A. fuel
 - B. heat
 - C. oxidation
 - D. extinguishing agent
9. Which of the following is required to start a fire?
- A. fuel
 - B. ignition
 - C. oxidation
 - D. extinguishing agent
10. Sand can be added to fire in order to extinguish the latter by
- A. removal of fuel
 - B. removal of heat
 - C. removal of oxygen
 - D. inhibiting extinguishing agents
11. It is the lowest temperature to which a substance must be heated to release vapors that can cause a substance to burn when exposed to a flame or ignition source.
- A. accelerant
 - B. fire
 - C. fire triangle
 - D. flash point
12. Substances such as paint thinner, gasoline and alcohol which can speed up the burning process are called
- A. accelerants
 - B. explosives
 - C. extinguisher
 - D. flash point

13. Water, sand, foams are examples of _____.
A. fuel
B. ignition
C. oxidation
D. extinguishing agent
14. Fuels may be found in three states of matter. What are these?
A. oil, wood, paper
B. solid, liquid, gas
C. paper, gasoline, vapors
D. vapors, hydrocarbons, plastic
15. The element of the fire triangle often eliminated in wildfires:
A. fuel
B. heat
C. oxidation
D. extinguishing agent

Lesson

1

The Elements of Fire Triangle

Fire is considerably a friend but once fire is not controlled it could be one of our greatest enemies. Irresponsibility may lead to disaster and everything may change as fast as a split of a second. Based on the Bureau of Fire Protection (BFP), an average of 42 fire incidents were recorded from year 2013 to 2017. You probably have heard of a fire that broke out at Kentex Manufacturing, a factory of slippers and shoes in Valenzuela, Metro Manila on May 13, 2015. It is considered as the third worst fire incident in our country killing 74 people trapped inside the said factory, next to the 1996 Ozone Disco Club fire and the 2001 Manor Hotel fire that led to the death of 162 and 75 people, respectively.

In all fire cases, loss of lives, jobs, investments and properties can literally go up in smoke just in a matter of hours. Knowledge on the behavior, causes, effects and safety tips can help save lives and properties.



What's In

With your knowledge on disasters and its types, you are about to embark on another learning journey that will familiarize you with another disastrous event-FIRE. Your prior knowledge from Quarter 1 on how to get acquainted with the nature of a disaster, its types, its causes and effects will help you appreciate the beauty of knowing different disaster types and mitigation.

In this module, you are encouraged to learn concepts while having fun with your creative side. Some activities may require you to draw, interpret visuals, or express your thought through an essay.

Direction: Try to answer the following questions to help you establish prior knowledge and link it to the new lesson.

1. What are the 2 main different types of disaster?

2. For you, to which type does fire belong?

3. Give five common causes of a fire incident?

4. How will you compare a fire's extent of damage to that of other types of disasters?

5. List 5 important safety tips that you know about fire prevention.



Notes to the Teacher

This module tries to bring out the “creative” side of your learners as they learn basic knowledge on fire. The teacher is encouraged to acknowledge the other side and intelligence type of the learners in order to make self-learning experience fun, rather than a burden for them.



What's New

TRUE LIES

There are many misconceptions regarding fire. A person has to equip himself with factual information to guarantee safety. Not all shared information is true. So, can you spot them?

Direction: Below are statements about basic information on fire. On your answer sheet, write **TRUE** if the statement expresses a correct idea, otherwise write **LIE**.

1. When a combustible material is heated, it burns.
2. A small fire inside a glass container dies down when it is tightly covered.
3. In photosynthesis, sunlight and heat make chemical energy (in the form of wood or fossil fuel); fire uses chemical energy to produce light and heat.
4. Fire is a thing, not an event.
5. Assuming stable fuel, heat, and oxygen levels, a typical house fire is constant in size every minute until the fire dies down.
6. Earth is the only known planet where fire can burn.
7. Water can be produced by fire.
8. Using concentrated sunlight, ancient Greeks were able to start fire. A parabolic mirror that focuses solar rays is still used to ignite the Olympic torch.
9. Among the stages of fire, the last stage which is the “decay stage” takes the longest time to finish.
10. All fire extinguishers are multipurpose, meaning each one can put out all types of fire caused by any material.



What is It

Ancient Greeks considered fire as one of their major elements like water, earth and air. Unlike water, earth and air, fire is known to be just an event that happened when matter changes from one form to another.

Fire is the rapid oxidation of a material in the exothermal chemical process of combustion, releasing heat, light, and various reaction products. This diagram below demonstrates the fire triangle.

The Fire Triangle

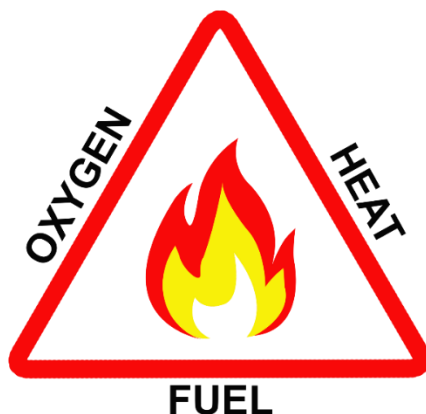


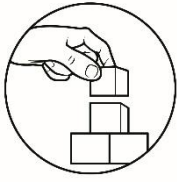
Figure 1. Fire Triangle is an illustration to help us understand the three important elements needed to start and sustain fire. Right amount of these elements will let fire occur naturally.

1. **Fuel** is any material that can be burned such as solid, liquid, or gas. Combustion takes place when fuel is converted into gaseous state as moisture is removed. This happens when vapor is escaping from any combustible material.
2. **Heat** is an energy that flows through object. Enough amount of heat would free the vapor from solid and liquid forms of fuel. The lowest temperature needed to form an ignitable mixture in air near the surface of the liquid is called the **flash point**. The higher the flashpoint, the more difficult it is to ignite the material. The ignition of fire to solid and liquid fuels varies. Most solid combustible materials ignite immediately. Other solid combustible materials take time to ignite due to its density.

- 3. Oxygen** is an element, estimated 21% of it can be found in the air. During combustion process chemical reaction takes place. Oxygen is released and serves as an oxidizing agent for combustible materials. Without an oxidizing agent like oxygen there will be no fire even if heat and fuel are present.

The theory of fire extinguishment is based on removing any of the elements in the fire triangle to suppress the fire.

1. **REMOVING THE HEAT.** The goal here is to lower the temperature which is usually accomplished by adding water as an extinguishing agent. Other extinguishing agents include chemical and mechanical foams.
2. **REMOVING THE FUEL.** In most cases, removing the fuel from the fire is not a practical way of extinguishing fire except when dealing with flammable liquid fires, valves can be shut off and storage vessels pumped to safe areas to help eliminate the supply of fuel to the fire.
3. **REMOVE THE OXYGEN.** Air is mainly 21% oxygen and this is sufficient to support combustion in most fire situations. Removal of the air or oxygen can be accomplished by separating it from the fuel source or by displacing it with other gases like carbon dioxide, nitrogen and steam. Examples of separation would be foam on a flammable liquid fire, a wet blanket on a trash fire, or a tight-fitting lid on a skillet fire. Foam does not only lower temperature but also remove oxygen.



What's More

Activity 1.1 FIRE STARTERS

Direction: Below is a word hunt activity where in you should search for any word that can serve as FUEL to ignite a fire and a question to answer. Write your answer on a separate sheet of paper.

A	D	R	L	U	M	B	E	R	A	D	F	H	X	S	A
S	P	T	D	T	J	A	D	A	D	Y	E	C	A	T	D
G	O	C	D	K	A	T	Y	K	S	I	H	W	C	Y	X
A	I	U	C	H	E	O	A	G	F	H	T	S	Z	I	J
S	U	N	L	H	M	R	H	D	H	S	H	T	H	R	T
O	L	M	K	E	S	S	O	I	I	I	U	D	Y	U	D
L	K	M	G	T	C	I	T	S	A	L	P	H	D	B	K
I	I	B	H	A	B	D	K	O	E	O	Y	T	J	B	H
N	K	E	R	F	P	F	L	P	D	N	S	R	U	E	I
E	H	D	E	L	J	L	T	L	G	D	E	A	D	R	Y
D	G	A	S	O	O	G	I	G	E	F	H	S	I	O	F
D	E	S	T	H	T	S	O	H	W	A	S	F	O	P	V
S	E	O	O	T	E	H	S	A	P	A	P	E	R	S	K
G	F	C	E	E	R	J	G	G	Q	F	H	D	Q	F	A
H	L	T	D	R	R	K	C	I	E	J	O	S	S	H	H
A	D	R	L	I	O	G	N	I	K	O	O	C	O	O	T

Question: How can you describe the items that you have found? How will you compare these items? Do these items differ from each other in terms of fire rate? How?

Activity 1.2 MY FIRE SAFETY MEME

Many people are so fond of “memes”. A meme is a piece of image or illustration, usually for humorous intent. It can also be used to simply spread or share an information or message.

Your task is to create your own meme about this lesson. It could be informative, funny or entertaining, or simply sharing safety tips or advice in case of fire. Make sure that your meme serves its intended purpose, is visually-appealing and has a good content.

Below is a sample of a funny meme about fire.



Figure 3. A witty meme on fire safety

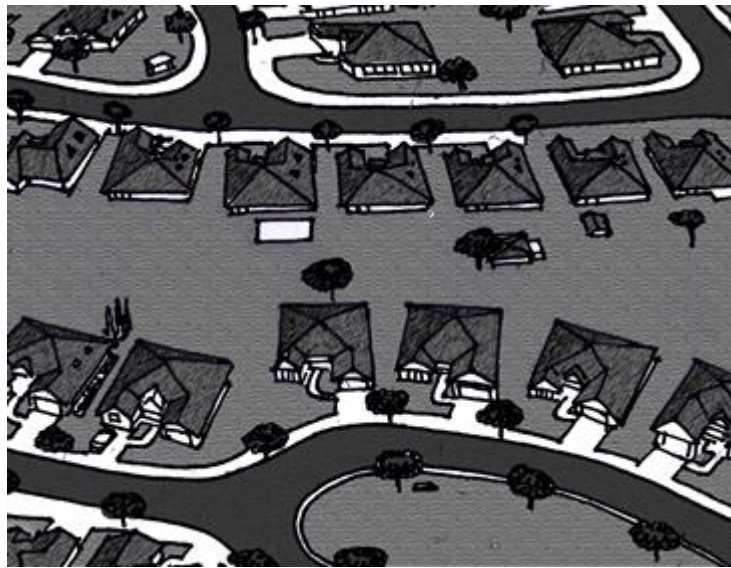
Activity 1.3 FIRE-PRONE AREAS

Direction: Write an essay that compares the two given areas in the pictures below with respect to:

- a. Presence of ingredients of fire
- b. Ability to give-off more fire
- c. Progression of fire through different stages in both residential areas
- d. Easy access for responding fire fighters

A rubric is provided to serve as your guide and your teacher's basis for scoring your work.

Picture A



Picture B



Learners will be graded with the following criteria:

	4	3	2	1
Content	Has main idea that stands out supported by very detailed information	Has main idea that stands out but supporting information is not specific	Main idea is somewhat clear but lacking in supporting information	Main idea is not clear and no valid supporting information
Grammar and usage	Virtually no errors in grammar and punctuations	Few errors in grammar and punctuations	A number of errors in grammar and punctuations	Has many errors in grammar and punctuations



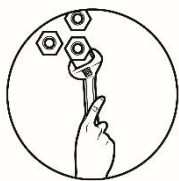
What I Have Learned

Direction: Supply the term/s needed to generalize your takeaways from this lesson.

_____ is the rapid oxidation of a material in the exothermal chemical process of combustion, releasing heat, light, and various reaction products.

Fire has three elements or ingredients namely _____, _____ and _____. All the three elements/ingredients of fire must come in _____ amount to cause fire and _____ of at least one element can put out the fire.

While not everything is known about the combustion process, it is generally accepted that fire is a _____ reaction. This reaction is dependent upon a material rapidly undergoing _____ process- a process that involves loss of electrons, or uniting with oxygen so rapidly that it produces heat and flame.



What I Can Do

Direction: Make a booklet that contains the following about fire. Give your booklet a catchy title.

- 5 misconceptions
- 5 quotations or sayings
- 5 original catch lines or “hugot” lines (brief phrases or statements derived from deeply rooted emotion)

	4	3	2	1
Content	Booklet includes information relevant to the topic, is educational, is organized and is appropriate for age selected. Shows high quality.	Booklet includes all relevant information; is educational, shows some organization and is generally appropriate for age selected. Shows quality work.	Information may lack relevance. There is not enough information presented. Information is presented in an unorganized fashion and may be hard to understand.	The booklet is missing vital information. There are many gaps in information presented. Organization and/or information is confusing.
Creativity	Appealing design Artwork is colorful and interesting & neatly done. Variety adds interest Text is high quality	Appealing design Demonstrates some variety in presentation, including use of artwork. Work is neatly presented. Text is clear and easy to read.	Some areas of visual interest and appeal. Some attempt to include artwork/color. Text is easily legible.	Lacking in visual interest and appeal

Source: “Booklet Rubric”, RCampus iRubric, accessed June 7, 2020,
<https://www.rcampus.com/rubricshowc.cfm?sp=yes&code=VX85C39&>



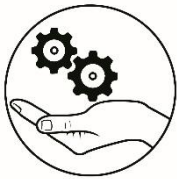
Assessment

Choose the letter of the best answer. Write the chosen letter on a separate sheet of paper.

1. This determines how easily a fuel will burn.
 - A. color of fuel
 - B. mass of fuel
 - C. melting point
 - D. moisture content
2. Fuels may be found in three states of matter. What are these?
 - A. oil, wood, paper
 - B. solid, liquid, gas
 - C. paper, gasoline, vapors
 - D. vapors, hydrocarbons, plastic
3. Which of the following is **NOT** an element of the fire triangle?
 - A. fuel
 - B. heat
 - C. hydrogen
 - D. oxygen
4. Which of the following statements is **TRUE** about the elements of the fire triangle?
 - A. Whenever these three ingredients are present there will be fire.
 - B. There is no exact mixture of the three ingredients to produce fire.
 - C. Fire can be prevented or extinguished by removing any one of the ingredients.
 - D. All of the given options.
5. The following are human-induced causes of fire, which of these is **NOT** a product of human error?
 - A. gas leaks
 - B. faulty electrical wirings
 - C. low condition motor vehicles
 - D. unattended ignition sources

6. Amor rolled over the floor in order to put off the fire that caught her clothes. Which principle explains this?
- A. fuel is removed in such case
 - B. temperature is increased by her action
 - C. Rolling over the floor reduces the amount of oxygen that will support fire.
 - D. Rolling over the floor lowers the temperature through an extinguishing agent.
7. Joey is frying tocino when he decides to watch his favorite TV series “Ang Probinsyano”. When he comes back to check, the pan is already on fire. What must he do?
- A. pray
 - B. call the fire station
 - C. Try to cover the frying pan with wet towel.
 - D. Throw water to the fire or fan the fire as much as he could.
8. In cooking adobo, Ric lighted the firewood using matchsticks and kerosene. He made sure that the fire will not die by fanning it. In this case, which serves as the fuel?
- A. adobo
 - B. lighting matchsticks
 - C. firewood and kerosene
 - D. fanning to provide wind
9. From question item 8, which serves as the ignition?
- A. adobo
 - B. lighting matchsticks
 - C. firewood and kerosene
 - D. fanning to provide wind
10. How does fanning help to support continuous combustion in question item 8?
- A. adding fuel
 - B. providing oxygen
 - C. lowering temperature
 - D. increasing temperature
11. It is the lowest temperature to which a substance must be heated to release vapors that can cause a substance to burn when exposed to a flame or ignition source?
- A. accelerant
 - B. fire
 - C. fire triangle
 - D. flash point

12. Substances such as paint thinner, gasoline and alcohol which can speed up the burning process are called
- A. accelerants
 - B. explosives
 - C. extinguisher
 - D. flash point
13. The significance of the fire triangle lies in the fact that
- A. At least two elements can start a fire.
 - B. Fire can be extinguished by accelerants.
 - C. If you add hydrogen, you can generate nuclear power.
 - D. If you take away one of the elements, you can put out fire.
14. Sand can be added to fire in order to extinguish the latter by
- A. removal of fuel
 - B. removal of heat
 - C. removal of oxygen
 - D. inhibiting extinguishing agents
15. The element of the fire triangle often eliminated in wildfires:
- A. fuel
 - B. heat
 - C. oxidation
 - D. extinguishing agent



Additional Activities

“What Made The Lovely Flames Die?”

“*Smoke Gets In Your Eyes*” is a song by The Platters released on November 1958.

Direction: Write your interpretation of the song with emphasis on lines which are printed in bold and italicized. Try to relate these lines as to how fire can be extinguished when one element of the fire triangle is lost.

Smoke Gets In Your Eyes

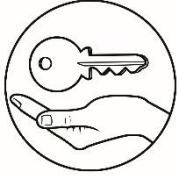
They asked me how I knew
My true love was true
I of course replied, something here inside
Cannot be denied

They said someday you'll find
All who love are blind
When your heart's on fire, you must realize
Smoke gets in your eyes

So I chaffed them and I gaily laughed
To think they could doubt my love
Yet today my love has flown away
I am without my love
(Without my love)

Now laughing friends deride
Tears I cannot hide, hide
So I smile and say, ***when a lovely flame dies***
Smoke gets in your eyes

(Source: Jerome Kern and Otto Harbach. *Smoke Gets In Your Eyes*. Retrieved from:
<https://www.musixmatch.com/lyrics/The-Platters/Smoke-Gets-in-Your-Eyes>)



Answer Key

Assessment	What's More	What I Know
1. D	1. Lie	1. C
2. B	2. True	2. C
3. C	3. True	3. D
4. C	4. Lie	4. C
5. C	5. Lie	5. B
6. C	6. True	6. B
7. C	7. True	7. C
8. C	8. True	8. A
9. B	9. True	9. B
10. B	10. Lie	10. C
11. D		11. D
12. A		12. A
13. D		13. D
14. C		14. B
15. B		15. B

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For inquiries or feedback, please write or call:

Department of Education - Bureau of Learning Resources (DepEd-BLR)

Ground Floor, Bonifacio Bldg., DepEd Complex
Meralco Avenue, Pasig City, Philippines 1600

Telefax: (632) 8634-1072; 8634-1054; 8631-4985

Email Address: blr.lrqad@deped.gov.ph * blr.lrpd@deped.gov.ph