

**THERE'S BEEN A FIRE!**

**YOUR NAME HERE:**

**INTRODUCTION TO THE PROBLEM**

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**There's been a fire!** You're here to investigate. Take the role of a fire investigator to identify evidence left behind, so you can make a claim about the origin of the fire.

**YOUR ROLE:**

**YOUR RESPONSIBILITY:**

1. **Watch the introductory video.** Re-watch as necessary to provide details about what you notice and wonder from the kitchen fire scene.



<p><b>Notice</b>                      What did you notice in the kitchen scene?</p>	<p><b>Wonder</b>                      What are you wondering?                      What more would you need to know to make a claim about the origin of the fire?</p>	<p><b>Initial Thinking</b>                      What are your initial thoughts about how the fire started, or where is started?</p>

2. **Scroll down the website page.** More closely observe three possible pieces of evidence left by the fire. What do you notice about this possible evidence?
3. What are you wondering about char, blackened surfaces, and the burned versus unburned objects?



4. **Sensemaking:** What do you already know about fire? Develop an initial model of fire in the provided space. Include as many labels as possible.



**What is Fire Interactive**

Scroll to the interactive showing a sofa on fire. Use the information from the interactive to gather information about fire.

1. Record your understanding of how fire develops in the chart below.

<b>1</b>	<b>CLICK ON HOTSPOT 1</b>	List signs that the sofa is experiencing a chemical change:	
<b>2</b>	<b>CLICK ON HOTSPOT 2</b>	What evidence can you observe that the couch has experienced a chemical reaction?	
<b>3</b>	<b>CLICK ON HOTSPOT 3</b>	Describe how the white smoke is formed.	
		What state of matter is actually igniting and burning?	

2. What is something new you learned about fire from the interactive?



**Fire is a gas phase chemical reaction that releases heat and light.**

Scroll to the **red language accordion**.

3. Using information from the accordion, identify the best explanations for each term or core idea.

\_\_\_\_\_ Phases of Matter

a. interaction of matter and energy that results in new products

\_\_\_\_\_ Chemical Reaction

b. release of heat, light, change in color or odor

\_\_\_\_\_ Evidence of a Chemical Reaction

c. solid, liquid, gas, or plasma



### Real Lab Footage: Pyrolysis

Scroll to the video showing an infrared view of a lamp shade next to a fire. Watch the video and observe the lampshade as it pyrolyzes.
















4. What color does the lampshade first appear in the infrared camera?
5. What color does the lampshade appear once it pyrolyzes?
6. What explanation can you make for the change in the lampshade's color?
7. What can you observe about the gases emitted from the lamp shade during the video?
8. What explanation can you make for the change in gas emitted?



## What are the Components of Fire interactive

Scroll to the **next interactive showing a sofa on fire**. Change the settings to observe for what and how much of each component is needed to ignite and sustain a fire.

9. Record your observations about the components of fire in the chart.

Trial	Component(s) Color in the bar to show the settings you tested.	How much? (Ratio) Use ratios to describe the setting you selected for each component.	Observations & Explanation What did you observe and how can you explain it.
1	Heat -  +	2/2 or 2:2 or 2 out of 2	<b>Example:</b> <i>The fire did not light. There was no fuel, and fire needs fuel.</i>
	Oxygen -  +	1/2 or 1:2 or 1 out of 2	
	Fuel -  +	0/1 or 0:1 or 0 out of 1	
2	Heat -  +		
	Oxygen -  +		
	Fuel -  +		
3	Heat -  +		
	Oxygen -  +		
	Fuel -  +		
4	Heat -  +		
	Oxygen -  +		
	Fuel -  +		
5	Heat -  +		
	Oxygen -  +		
	Fuel -  +		

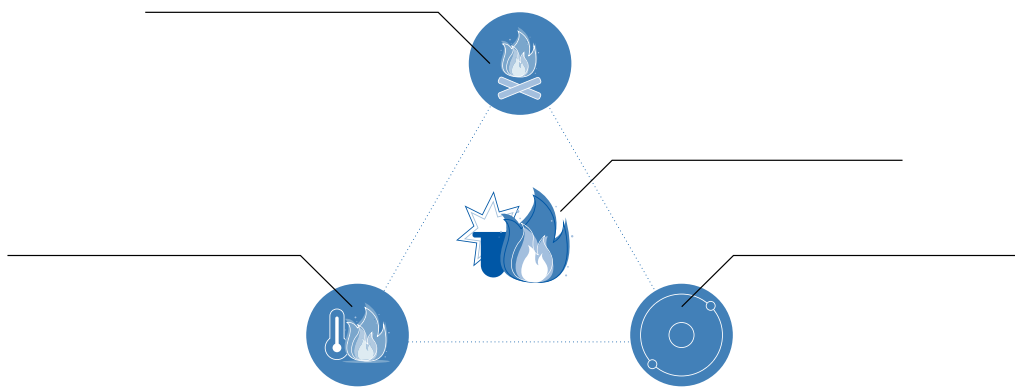
10. What is something new you learned about fire from this interactive?



## The Fire Triangle

Scroll to information about **The Fire Triangle**.

11. Use the information from the text and graphic to complete the statements. Fire professionals call the components of fire the \_\_\_\_\_ . Fire needs exact \_\_\_\_\_ of \_\_\_\_\_ , \_\_\_\_\_ , and \_\_\_\_\_ to ignite and burn. Another word for fire is \_\_\_\_\_. The \_\_\_\_\_ is the chemical reaction that includes all of the necessary amounts of fuel gases, oxygen, and heat.
12. Add labels identifying each component of the fire tetrahedron.



## Challenge – connecting your knowledge to fire investigation.

How does this knowledge connect to firefighters and investigators work?

13. Investigators closely observe a room to identify potential sources of heat, fuel and oxygen. What are potential sources of these components of the fire triangle in the kitchen scene? What are potential sources of these components of the fire triangle in the kitchen scene?
14. Recall the kitchen scene from the beginning of the pathway. Describe some evidence you saw before, but now have a better way to explain? What new evidence stands out as being important?



15. **Sensemaking:** Revisit your initial model of fire. Reflect on what you have learned. What can add to your model that reflects growth in your understanding of fire and its components? Use a different color to make your new thinking visible.



**How Does Fire Develop Interactive**

Scroll to the interactive where there is a **sofa on fire**. Use information from the interactive to gather information for how a fire develops.

1. Record your understanding of how fire develops in the chart below.

<b>1</b>	<b>CLICK ON HOTSPOT 1</b>	<b>IGNITION</b> When does fire ignite?	
<b>2</b>	<b>CLICK ON HOTSPOT 2</b>	<b>GROWTH</b> How can thermal energy transfer?	
+	<b>CLICK ON THE PLUS</b>	Describe how heat can flow around the sofa.	
<b>3</b>	<b>CLICK ON HOTSPOT 3</b>	<b>FULL DEVELOPMENT</b> What is occurring when a fire is fully developed?	
+	<b>CLICK ON THE PLUS</b>	Where was conduction evident? Where was convection evident?	
<b>4</b>	<b>CLICK ON HOTSPOT 4</b>	<b>DECAY</b> What evidence is left behind after a fire decays?	

2. What is something new you learned about fire from the interactive?

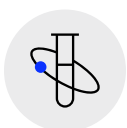


### Fire development can be divided into four stages.

Scroll to the **red language accordion** to better understand the stages of fire development.

3. Using information from the accordion, identify the best explanations for each term or core idea.

- \_\_\_\_\_ Ignition                                    a. longest stage of a fire
- \_\_\_\_\_ Growth                                    b. combination of heat, fuel, and oxygen that results in fire
- \_\_\_\_\_ Full Development                    c. continuation of a fire based on presence of heat, fuel, and oxygen
- \_\_\_\_\_ Decay                                      d. ignition of all combustible materials



### Classroom Investigation: Heat Transfer & Ignition

Observe the classroom investigation.

4. How did the students demonstrate different methods of thermal energy transfer?

Method of Thermal Energy Transfer	How did the students investigate?	What were the outcomes?
Conduction		
Convection		
Radiation		



5. How might you plan an investigation to understand how different materials transfer thermal energy and ignite? Sketch or write your investigation ideas:



### Challenge – connecting your knowledge to fire investigation.

How does this knowledge connect to firefighters and investigators work?

6. Investigators use their knowledge of how thermal energy transfers to trace back to the potential origin of the fire. What might an investigator observe to determine if an object was damaged by conduction, convection or radiation?
7. Recall the kitchen scene from the beginning of the pathway. Describe some evidence you saw before, but now have a better way to explain? What new evidence stands out as being important?



8. **Sensemaking:** Revisit your initial model. Reflect on what you have learned. What can you add to your model that reflects growth in your understanding of fire development? Use a different color to make your new thinking visible.



**How Does Fire Behave Interactive**

Scroll to the interactive where there is a **bed on fire**. Gather and communicate information from the interactive about how a fire behaves and interacts with matter.

1. Record your understanding of how fire behaves in the chart below.

<b>1</b>	<b>CLICK ON HOTSPOT 1</b>	What causes particles to move?	
<b>2</b>	<b>CLICK ON HOTSPOT 2</b>	How does a change in temperature affect other properties of matter?	
<b>3</b>	<b>CLICK ON HOTSPOT 3</b>	How does density affect the motion of gases in the room?	
<b>4</b>	<b>CLICK ON HOTSPOT 4</b>	What happened to the smoke once it reached the wall?	
<b>5</b>	<b>CLICK ON HOTSPOT 5</b>	What occurred once the oxygen in the room was used by the fire?	
<b>6</b>	<b>CLICK ON HOTSPOT 6</b>	How did the fire eventually extinguish?	

2. What is something new you learned about fire from the interactive?



**During a fire, changes in temperature affect the pressure and volume of gases in the room. These changes cause fire to behave in predictable ways.**

Scroll to the **red language accordion** to better understand the stages of fire development.

3. Using information from the accordion, identify the best explanations for each term or core idea.

\_\_\_\_\_ Temperature  
\_\_\_\_\_ Pressure  
\_\_\_\_\_ Volume

- a. force exerted on walls of a container
- b. amount of space consumed by an object
- c. measurement of total kinetic energy of an object



## How Does Ventilation Affect Fire Interactive

Scroll to the interactive where a **bed is on fire**. Gather and communicate information from the interactive about how ventilation affects fire interactions with matter.

4. Record your understanding of how ventilation affects fire in the chart below.

1	<b>CLICK ON HOTSPOT 1</b>	Make a prediction. How do you think the fire would behave if the window was open? Would it go out, or would it grow bigger?	
2	<b>CLICK ON HOTSPOT 2</b>	How did the open window first affect the fire?	
		How does the interactive represent hot smoke and cooler air?	
3	<b>CLICK ON HOTSPOT 3</b>	After some time passes, how does the open window continue to affect the fire?	

5. What is something new you learned about fire from the interactive?



## Ventilation is the exchange of hot, oxygen-depleted gases, with cool, oxygen-rich air.

Scroll to the **red language accordion** to better understand the stages of fire development.

6. Using information from the accordion, identify the best explanations for each term or core idea.

\_\_\_\_\_ Exchange

a. fills lower pressure area

\_\_\_\_\_ Hot, oxygen depleted gas

b. unequal pressure of inside hot air and outside cold air that creates a circulation of air

\_\_\_\_\_ Cool, oxygen rich gas

c. flows outside the room



### Real Lab Footage: Fuels

Scroll to the real lab footage of **organic versus synthetic fuels**. Gather information as you observe the video.

7. In the space below, record your observations about organic and synthetic fuels.

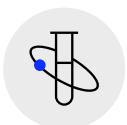
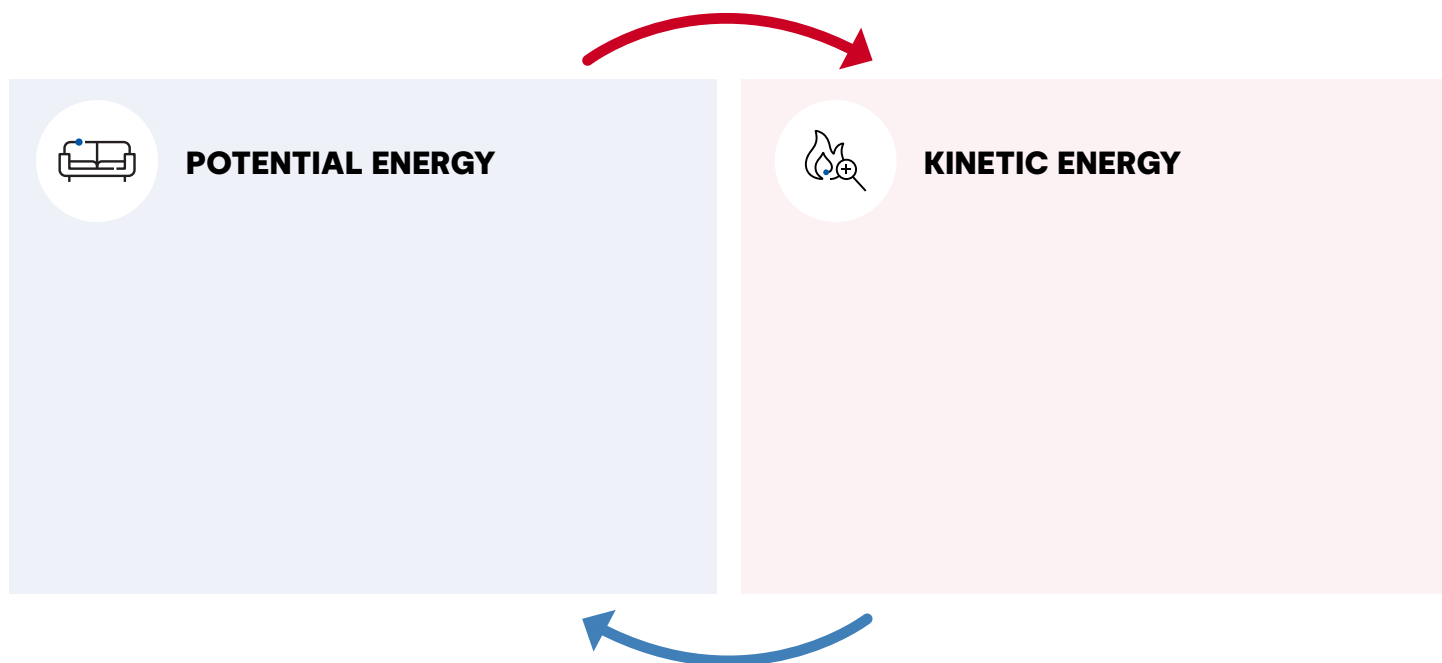
ORGANIC FUELS	SYNTHETIC FUELS



### Fire is an example of matter and energy transformations.

Scroll to the **red language accordion** to better understand these transformations.

8. Using information from the accordion, review each form of energy and its examples. In the chart below, provide examples of how the different forms of energy may be observed during a fire.



### Classroom Investigation: Energy & Combustion

Observe the classroom investigation.

9. Add new information you gathered about the energy in different fuels to your organizer for question 8.



## Challenge – connecting your knowledge to fire investigation.

How does this knowledge connect to firefighters and investigators work?

10. Investigators identify smoke patterns such as lines demarcation. What can these patterns tell us about where a fire originated?
11. Recall the kitchen scene from the beginning of the pathway. Describe some evidence you saw before, but now have a better way to explain? What new evidence stands out as being important?



12. **Sensemaking:** Revisit your initial model. Reflect on what you have learned. What can you add to your model that reflects growth in your understanding of fire behavior. Use a different color to make your new thinking visible.