Energy Transfer - Convection, Conduction, and Radiation

Day 1 - Introduction

Guiding question: *When it's cold outside you may build a fire. Where would you want to sit and why?*

Directions: Students will travel through activities and make observations on how energy moves.
Station 1: Make hot coco *(cup is thin and allows heat to move through the cup - conduction)*
Station 2: Roast a marshmallow with a tea light *(use a toothpick to roast a marshmallow with a tealight radiation)*
Station 3: Make bean soup *(beans in a 500ml beaker on a hotplate - convection)*
Station 4: Vocabulary
Worksheet - Energy Transformation Worksheet

Energy Transfer

S8P2. Obtain and communicate information about heat transfer. (i.e. conduction, radiation, and convection.)

INQUIRY

Stations	Observation	How is heat moving?	Illustration
Station 1 Soup			
Station 2 Marshmallow			
Station 3 Hot chocolate			

Day 2 - Engage

Engage - Do you sleep with your bedroom door open or closed? Why?
Allow students to turn and talk with elbow partners.
Share with class.

Guiding Question - How do you think a closed bedroom door would affect a fire from spreading

1. Make a prediction.
2. Watch video - Close before you doze - engagement
    a. Make observations
    b. What questions do you have?

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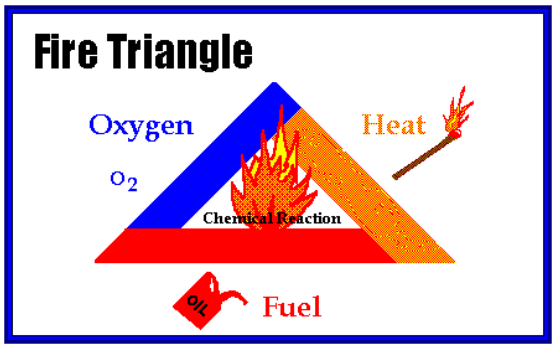
ENGAGE

Question: How do you think a closed bedroom door would affect a fire?	
Make a prediction	
Make observation	
Write at least 2 questions	

Day 2 / 3- Explore / Explain

Investigate - What does fire need to burn?

1. Review fire triangle - make connections for chemical change



Guiding Question - Why is sleeping with the door closed safer than sleeping with the door open?

1. Students begin completing a jigsaw activity using the documents from the textbook as well as real world examples of how heat transfer affect firefighters . ***Included Resource: How Does Fire Spread - Con, Cd, Rad.docx***
2. They will work in pairs to obtain information on their topic, either convection, conduction, or radiation.
3. After they have their topic well explained on their graphic organizer, they will rotate to teach their topic to another student.
4. Students will continue to rotate until they have completed their graphic organizers.

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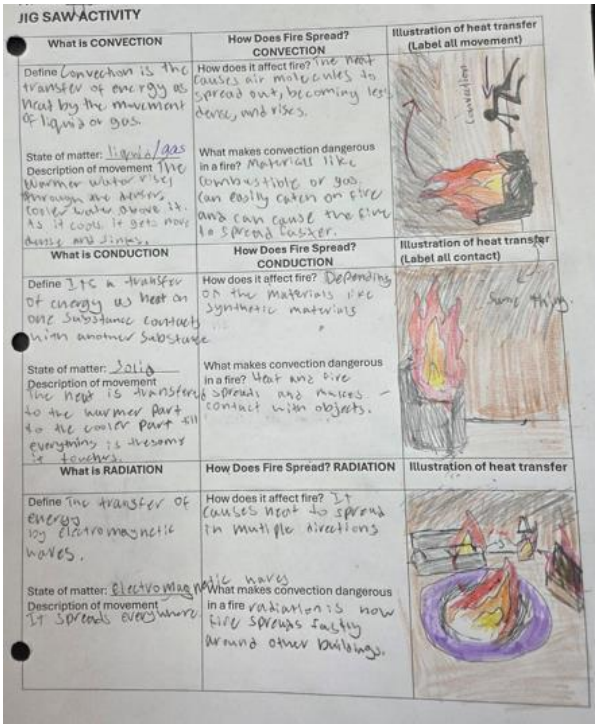
JIG SAW ACTIVITY

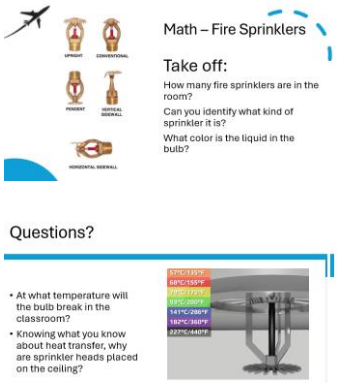
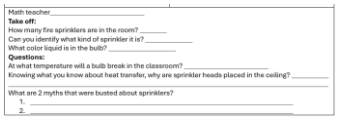
What is CONVECTION	How Does Fire Spread? CONVECTION	Illustration of heat transfer (Label all movement)
Define State of matter: _____ Description of movement	How does it affect fire? What makes convection dangerous in a fire?	
What is CONDUCTION	**How Does Fire Spread? CONDUCTION**	**Illustration of heat transfer (Label all contact)**
Define State of matter: _____ Description of movement	How does it affect fire? What makes conduction dangerous in a fire?	
What is RADIATION	**How Does Fire Spread? RADIATION**	**Illustration of heat transfer**
Define State of matter: _____ Description of movement	How does it affect fire? What makes radiation dangerous in a fire	



Day 5 - Extension for Fire Safety Month

This was an interdisciplinary activity that can be used within the science classroom or as interdisciplinary instruction. During this learning cycle, the extension activity was planned to corresponds within the learning of energy transfer in the science classrooms.

Included Resource: ***Graphic Organizer – Interdis. Fire Safety Graphic Organizer; Power Point – Interdisciplinary Fire Safety.pptx***

Content	Slides snips	Worksheet portion	Xplore Lab Links
Math - *investigate how firesprinklers work*			Fire Sprinkler Interactive

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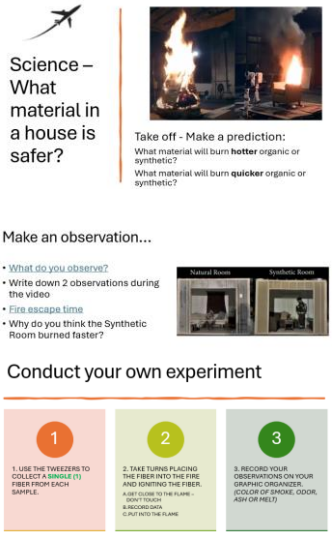
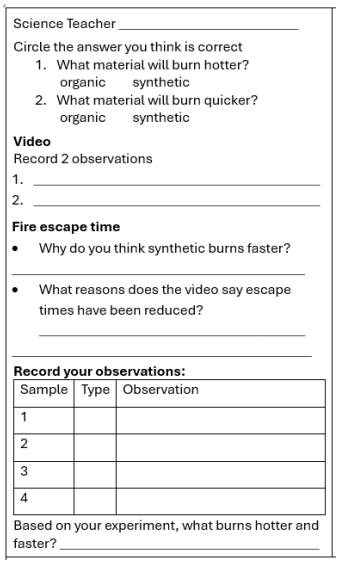
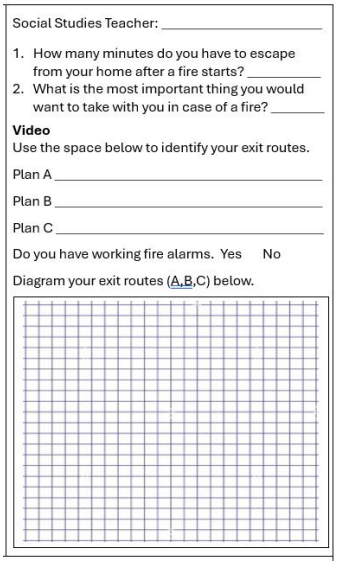
Science - *investigate how different materials burn*			Synthetic vs. Organic Materials Fire Escape Time
Social Studies - *create fire escape plan*			Fire Escape Plans

Day 6 - Evaluate, Plan and carry out an investigation.

Included Resource: Plan and carry out investigation popcorn.docx

Students participate in a lab activity where they collect data and explain how the transfer of energy pops popcorn.

Students decide how they are going to collect data. They can choose from how long it takes to pop or the amount of kernels are left after the popcorn is done popping. The data they collect allows the for consistent quantitative data but students determine how they will use the data.

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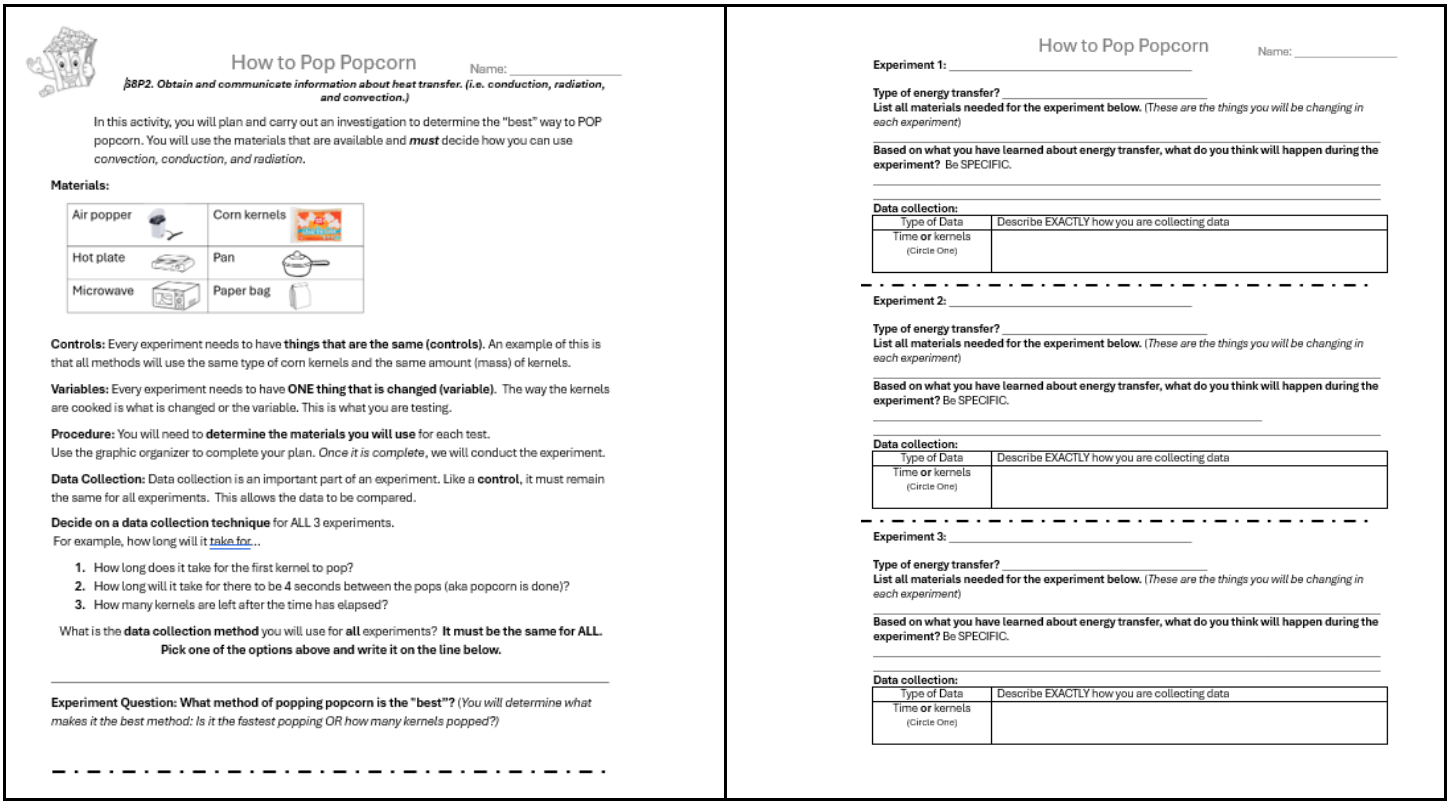

How to Pop Popcorn Name: _____

(8P2. Obtain and communicate information about heat transfer. (i.e. conduction, radiation, and convection.)

In this activity, you will plan and carry out an investigation to determine the "best" way to POP popcorn. You will use the materials that are available and ***must*** decide how you can use *convection, conduction, and radiation.*

Materials:

Air popper		Corn kernels	
Hot plate		Pan	
Microwave		Paper bag	

Controls: Every experiment needs to have **things that are the same (controls).** An example of this is that all methods will use the same type of corn kernels and the same amount (mass) of kernels.

Variables: Every experiment needs to have **ONE thing that is changed (variable).** The way the kernels are cooked is what is changed or the variable. This is what you are testing.

Procedure: You will need to **determine the materials you will use** for each test.
Use the graphic organizer to complete your plan. *Once it is complete*, we will conduct the experiment.

Data Collection: Data collection is an important part of an experiment. Like a **control**, it must remain the same for all experiments. This allows the data to be compared.

Decide on a data collection technique for ALL 3 experiments.
For example, how long will it take for...

1. How long does it take for the first kernel to pop?
2. How long will it take for there to be 4 seconds between the pops (aka popcorn is done)?
3. How many kernels are left after the time has elapsed?

What is the **data collection method** you will use for **all** experiments? **It must be the same for ALL. Pick one of the options above and write it on the line below.**

_____

Experiment Question: What method of popping popcorn is the "best"? *(You will determine what makes it the best method: Is it the fastest popping OR how many kernels popped?)*

How to Pop Popcorn Name: _____

Experiment 1: _____

Type of energy transfer? _____
List all materials needed for the experiment below. (*These are the things you will be changing in each experiment*)

_____

Based on what you have learned about energy transfer, what do you think will happen during the experiment? Be SPECIFIC.

_____

_____

Data collection:

Type of Data	Describe EXACTLY how you are collecting data
Time **or** kernels (Circle One)	

Experiment 2: _____

Type of energy transfer? _____
List all materials needed for the experiment below. (*These are the things you will be changing in each experiment*)

_____

Based on what you have learned about energy transfer, what do you think will happen during the experiment? Be SPECIFIC.

_____

_____

Data collection:

Type of Data	Describe EXACTLY how you are collecting data
Time **or** kernels (Circle One)	

Experiment 3: _____

Type of energy transfer? _____
List all materials needed for the experiment below. (*These are the things you will be changing in each experiment*)

_____

Based on what you have learned about energy transfer, what do you think will happen during the experiment? Be SPECIFIC.

_____

_____

Data collection:

Type of Data	Describe EXACTLY how you are collecting data
Time **or** kernels (Circle One)	

Day 7 - Evaluate, Communicate information about heat transfer

Included Resource - Plan and carry out an investigation CER

Students will use the data they collected to explain and communicate which popping method worked the best. They will complete the CER form to communicate their understanding of how energy is transferred and how the energy transfer affects the effectiveness of popping popcorn.

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How to Pop Popcorn Data Collection

Name: _____

How are you collecting data:

Step 1: _____

Step 2: _____

Step 3: _____

Data:

	Time	Kernels
Experiment 1: _____		
Experiment 2: _____		
Experiment 3: _____		

What can you determine from your data?

(Example: What method popped the best? What data supports your claim?)

_____

_____

Lab Write Up

Use what you have learned about heat transfer and the ways heat is transferred (conduction, convection, and radiation) to answer the question in CERS format. Be sure to do the following. Check off when done.

□ **Claim:** Restate and answer the question of what method popped the best popcorn.

□ **Evidence:** Describe the data from all 3 experiments with NUMBERS.

□ **Reasoning:** How does energy transfer (conduction, convection, or radiation) affect the way the kernels pop? Describe how the energy moves.

□ **Summary:** Summarize your findings and how it relates to the claim. (Don't forget transition words…)

Question: How does the method of popping popcorn affect the way the kernels are popped?

_____

_____

_____

_____

_____