



# Explorations of Heat Transfer

## NS 696 V: Weather and Climate for Educators

### Objective:

Students will identify the three types of heat transfer (conduction, convection, and radiation).

Students will be able to give examples of the three types of heat transfer

Students will be able to analyze an example of heat transfer and explain which of the three types of heat transfer the example best fits.

### Language Objective:

The student will be able to pronounce and say the following vocabulary correctly in a sentence: conduction, convection, and radiation.

### Materials:

Engage: Popcorn example

- Microwave
- Bagged popcorn
- Burner
- Jiffy pop (popcorn that pops when on stove burner)
- Air popper
- Popcorn kernels

Explore: Stations 1–3

- Ceramic reptile heater
- Metal lamp stand
- Blindfolds (1 for each member of the group)

- Insulated gloves
- Burner
- Frying pan
- Egg
- Spatula
- Butter or cooking spray
- Trash bin
- Hot plate
- One round metal fry pan/cake pan/ or fry daddy
- Silicon oil
- Aluminum powder
- Rubber spatula

Steps and Procedures (5 E Model):

Engage:

Start by preparing popcorn in 3 different ways. Microwave a bag of popcorn, use a burner to pop popcorn, and have an air popper popping kernels.

–Have students write down what they observe is happening. How is the preparation of the popcorn different? What is the commonality between all methods of popcorn preparation?

–As a group go over students responses. Try to guide the discussion into heat as the commonality between all types of popping. For differences we should see direct contact, warming air around, and waves from the microwave.

Explore:

Students will be split into groups and rotate between 3 stations. This will work best if you have two of each station so that groups can be smaller.

Station 1: Radiation

1. Have all students but one cover their eyes with the blindfolds and hold their hands in front of them.

2. The student not blindfolded should put on the gloves and move the ceramic heater (turned on) near the students.
3. Have the students move their hands to see if they can tell where the heater is.
4. Each students should write an explanation of what they observed and how the heat was transferred. Could you see the heat? If not, how did you know it was there?

#### Station 2: Conduction

1. Put the frying pan on the burner. What happened to the pan once it touched the burner?
2. Add a small amount of butter to the pan and observe. What happened to the butter after it was put into the pan?
3. Crack an egg and put it into the pan. What happens to the egg when it touches the pan? Would this same reaction happen if the egg was not touching the pan? Explain.
4. What had to happen in this demonstration in order for heat to be transferred from one object to the next?
5. Clean up all materials, clean out pan and spatula, and turn burner to low.

#### Station 3: Convection (Demonstration with teacher)

1. Teacher will turn a hot plate on low
2. Mix the aluminum powder into the silicon oil and pour it in the pan
3. Place the pan on the warm hot plate
4. Have students make a written observation of what is happening and why they think it is happening. Why might there be a dark spot in the middle of each cell?

### **Explain**

Come back as a class and discuss how heat was transferred in each situation. Present Heat transfer power point and allow students to take notes emphasizing key vocabulary.

### **Evaluate**

As an exit ticket or homework assignment, have the students come up with their own examples of conduction, convection, and radiation.

## **Extend**

As an extension activity students could create their own stations to teach conduction, convection, and radiation.

Students could research how these types of heat transfer are present when discussing weather and climate and do a presentation including visuals.

*Lesson generated by Amy Vashak*