

Name:

Date:

Class:

Heat Transfer Lab Sheet **Answer Key**

Introduction: This lab will explore the three kinds of heat transfer using stations, namely a conduction station, convection station and radiation station. The students will be exposed to the concept of solar drying used in the food industry citing both the natural or conventional process of sun drying and hybrid methods. Resource material will be provided to the students a few days before the lab to provide them with some information about heat transfer and solar dryers. The actual lab will be good for a 45-minute class and can be used for 8-12 grade physical science classes.

Student Objective: I will learn about the three kinds of heat transfer, give common examples and explain the three processes in terms of particle movements using the procedures and results in this lab.

Materials:

Station 1 – Conduction: hot plate, water, timer dropper or pipette, use cell phone for timer.

Station 2 – Convection: hair dryer, water, petri dish covered with aluminum foil or small ceramic or metal plate that can hold a drop of water, use cell phone for timer.

Station 3: Radiation: Heat Lamp (about 200 to 300 W), water, dropper or pipette, petri dish with aluminum foil, use cell phone for timer.

Procedures:

Station 1:

1. Plug the hot plate and adjust the temperature knob to high.
2. Using an IR thermometer from your teacher, measure the temperature of the hot plate.
3. Set your timer and place a drop of water using the dropper or pipette directly on the hot plate.
4. Measure the time until the drop of water is completely dried out.
5. Adjust the temperature knob of the hot plate to the maximum setting.
6. Repeat steps 2 and 3.
7. Record your data.

Station 2:

1. Plug the hair dryer.
2. Using an IR thermometer from your teacher, measure the temperature of the hot plate.
3. Set your timer and place a drop of water on the petri dish covered with aluminum foil.
4. Turn on the dryer and set it to maximum.
5. Point the dryer directly to the drop of water.
6. Measure the time until the water is completely dried out.
7. Record your data.

Station 3:

1. Plug and turn the heat lamp on.
2. Using an IR thermometer from your teacher, measure the temperature of the hot plate.
3. Set your timer and place a drop of water on the petri dish.
4. Point the heat lamp directly on the drop of water at a distance of about an inch away from the water.

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5. Measure the time until the drop of water is completely dried out.
6. Record your data.

Data:

Trial #	Conduction (time to dry) Temp: _____ (seconds)	Convection (time to dry) Temp _____ (seconds)	Radiation (time to dry) Temp _____ (seconds)
1			
2			
3			
Average			

Questions and Analysis:

1. Which heat transfer process took the least amount of time to dry out the drop of water? Explain why.

Conduction – because the water drops directly on the hot plate the temperature of the hot plate is hotter than the hair dryer and the heat lamp, the amount of heat supplied is more.

2. Which one took longer the longest time to dry out the water? Explain why.

Radiation – because the heat lamp has the lowest temperature of the three, the amount of heat supplied is least.

3. In summary, what factor in this lab affects the time for drying?

Temperature, the amount of heat

4. In a direct cabinet solar dryer (literature provided), what heat transfer processes are involved and cite specific examples.

Conduction – heat transfer between the trays and the food.

Convection – heat transfer by air flow by the fan in the heating chamber

Radiation – direct heat by the sun on the food and the trays.

5. Explain how the temperature inside the box is higher than the outside temperature.

It is called greenhouse effect. Electromagnetic waves with short wavelengths enter the box and some of its energy is absorbed by the box thereby it loses energy and cannot leave the box anymore.

6. How does this relate to greenhouse effect?

Electromagnetic waves with short wavelengths enter the box and some of its energy is absorbed by the box thereby it loses energy and cannot leave the box anymore.