GSC International
Phone: 417.374.7431
Fax: 417.374.7442
Toll Free: 888.756.4592
service@gosciencecrazy.com
2076 James River Court
Nixa, Missouri 65714

Heat Transfer Apparatus
#HEATRAN01

Warning:

- **Not a toy; use only in a laboratory or educational setting.**
- **California Proposition 65 Warning: This product can expose you to chemicals including styrene, lead, and acrylonitrile, which are known to the State of California to cause cancer, birth defects, or other reproductive harm. For more information go to www.P65Warnings.ca.gov.**

Introduction

Though they are used interchangeably in every day speech, temperature and heat are not quite the same thing. **Temperature** measures the kinetic energy of the molecules in an object or system, while **heat**, on the other hand, is the transfer of thermal energy from a hot region to a cold one. Heat uses three processes to transfer energy: radiation, convection, and conduction. Unlike conduction and convection, however, **radiation** does not require any contact between the objects undergoing a heat transfer. Radiation can occur in a vacuum. **Convection** can be described as the flow of thermal energy within a liquid or gas, while **conduction** can be described as the transfer of thermal energy between two objects that are in direct physical contact with each other.

This experiment hinges on the principle of conduction between two calorimeters, which are each made up of a plastic cup inside an insulating foam exterior to minimize external heat loss through the sides of the cup. One cup will be filled with warm water and the other will be filled with room temperature water. Thermal energy in the cup filled with warm water travels via conduction through the aluminum transfer bar into the cup containing the room temperature water. The heat in the warm cup will continue traveling into the room temperature cup until the system reaches thermal equilibrium. The directions on the following page will assist you in using this apparatus to explore this flow of heat.

Experiments

Preparation for Each Experiment

1. Boil a pot of water.
2. Place a cup into its insulated sleeve. Do the same for your other cup and sleeve. The reservoirs of you calorimeters are now assembled.
3. Place a rubberband around each leg of the aluminum transfer bar. They should be on the same plane as each other and a half-inch down from the bend in each leg.
4. Assemble the other half of your calorimeters separately from the reservoirs. Insert a thermometer into the round hole of each lid, and then insert a leg of the aluminum transfer bar into the rectangular slit on each lid. Keep the lids off of your calorimeters until you have poured your water.
5. Secure the lids onto your calorimeters immediately after filling them with water to minimize heat loss. The lids to your calorimeters should nest evenly in your the reservoirs

Equal Amounts in Each Cup

1. Fill one calorimeter with 150ml of room temperature water, and fill the other with 150ml of boiling water.
2. Secure the lids onto the calorimeters and immediately record the temperatures for both.
3. Record the temperature in each calorimeter every two minutes for a period of forty minutes.
4. Graph this data using the empty graphs on the following page.

Different Amounts in Each Cup

1. Predict the results of this experiment using the equations to the right. We will be using 100ml of room temperature water and 200ml of boiling water, giving you a total of 300ml of water.
2. Fill one calorimeter with 100ml of room temperature water, and fill the other with 200ml of boiling water.
3. Secure the lids onto the calorimeters and immediately record the temperatures for both.
4. Record the temperature in each calorimeter every two minutes for a period of forty minutes.

$$x = \Delta \frac{C}{T}$$

$$y = \Delta \frac{W}{T}$$

- **x = Temperature Decrease of Warm Liquid (°C)**
- **y = Temperature Increase of Cold Liquid (°C)**
- **Δ = Total Difference in Starting Temperatures (°C)**
- **C = Amount of Cool Liquid (ml)**
- **W = Amount of Warm Liquid (ml)**
- **T = Total Amount of Liquid (ml)**

5. Graph this data using the empty graphs on the following page. Check to see how close your results match with your predictions.

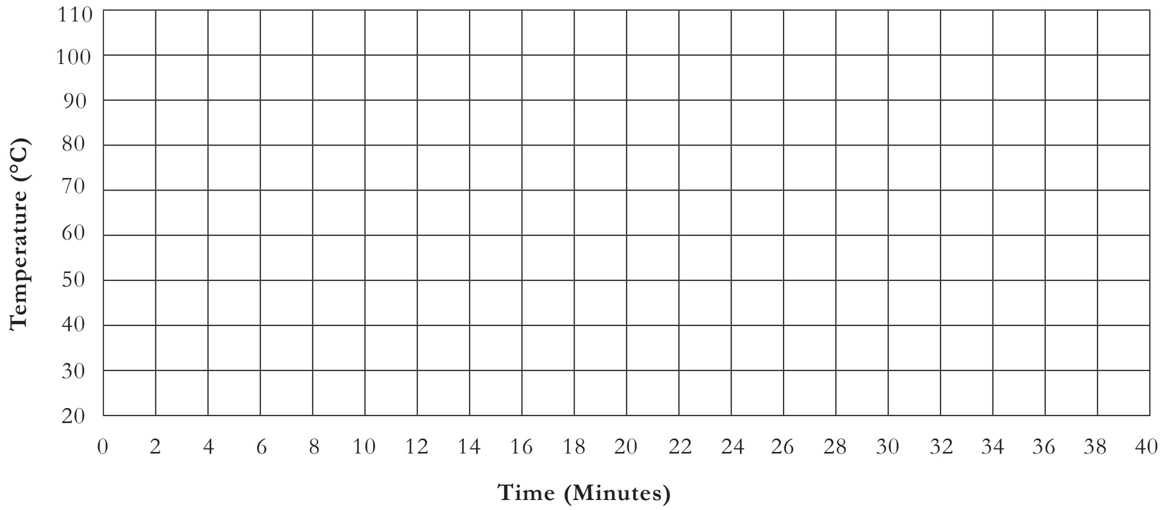
(Note: You can repeat this experiment with any quantities ranging from 100ml to 225ml.**)**

Equal Amounts of Different Liquids in Each Cup

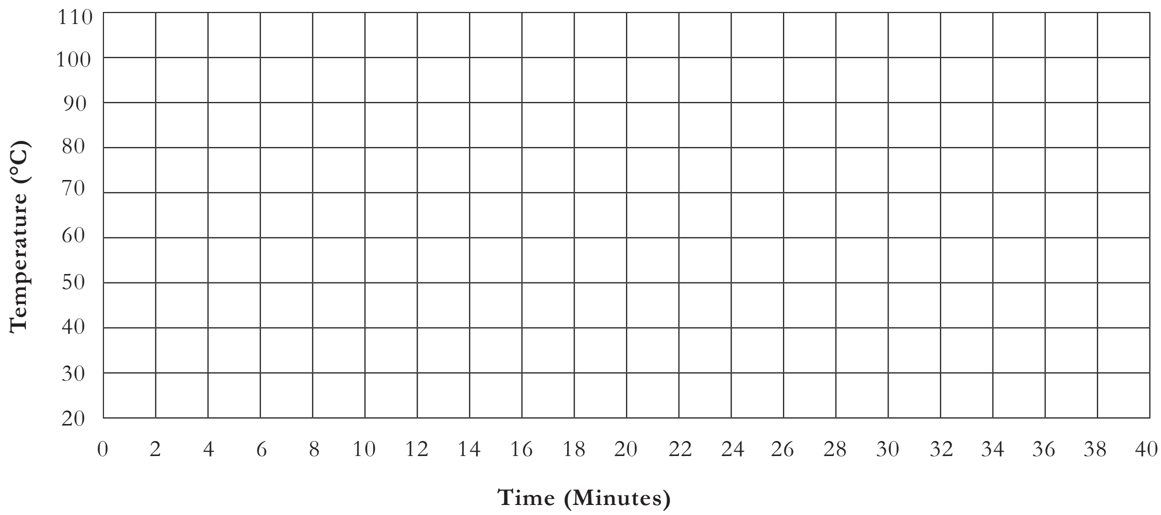
1. Fill one calorimeter with 150ml of room temperature isopropyl rubbing alcohol, and fill the other with 150ml of boiling water.
2. Secure the lids onto the calorimeters and immediately record the temperatures for both.
3. Record the temperature in each calorimeter every two minutes for a period of forty minutes.
4. Graph this data using the empty graphs on the following page.

Graphs for Recording Observations

Heat Transfer Observations



Heat Transfer Observations



Heat Transfer Observations