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HEAT TRANSFER LAB – CONDUCTION

Insulators and Conductors

Materials that conduct, or transfer, heat well are called **thermal conductors**. A thermal conductor transfers heat well because of the way its particles are arranged. Particles in thermal conductors allow heat to flow in and out of the material quickly.

Many metals are thermal conductors. One of the most widely-used conductors is copper. It is used as piping in homes for this very reason. It is an excellent conductor of heat. You may have also heard the term conductor use to refer to the property of a substance to conduct electricity. Copper wiring is used in electronics, power lines, telephone lines, appliances, and many types of motors for this property too.

Other materials do not transfer heat well. These materials are called **thermal insulators**. Thermal insulators do not allow heat to flow easily in and out of the material. Some examples of materials that are insulators include glass, plastic, rubber, wood, wool or the Styrofoam cups you will be using in lab.

Introduction

Areas that have heat energy are called *heat sources.* Areas that have little or less heat energy are called *heat sinks.* In this lab activity, you will determine in which direction energy flows between our heat source and heat sink, the Styrofoam cups. You will need to record temperature changes as the heat energy proceeds along its path.

Problems to consider

In which direction does heat energy flow: *source to sink*, or *sink to source*?

What is happening to the temperature of the hot and cold water connected to the aluminum bar?

What factors are influencing the flow of energy from one cup to the other?

Hypothesis

If a container of hot water (heat source) is connected to a container of cold water (heat sink) with an aluminum bar, the heat will transfer from the **heat source (or) heat sink** (circle one)

and then, next to the **heat source (or) heat sink** (circle one).

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Materials

Goggles <- wear them

2 Styrofoam cups

Warm water

2 thermometers

Color pencils

Timers – use clock, wrist watch or stop watch provided

Safety

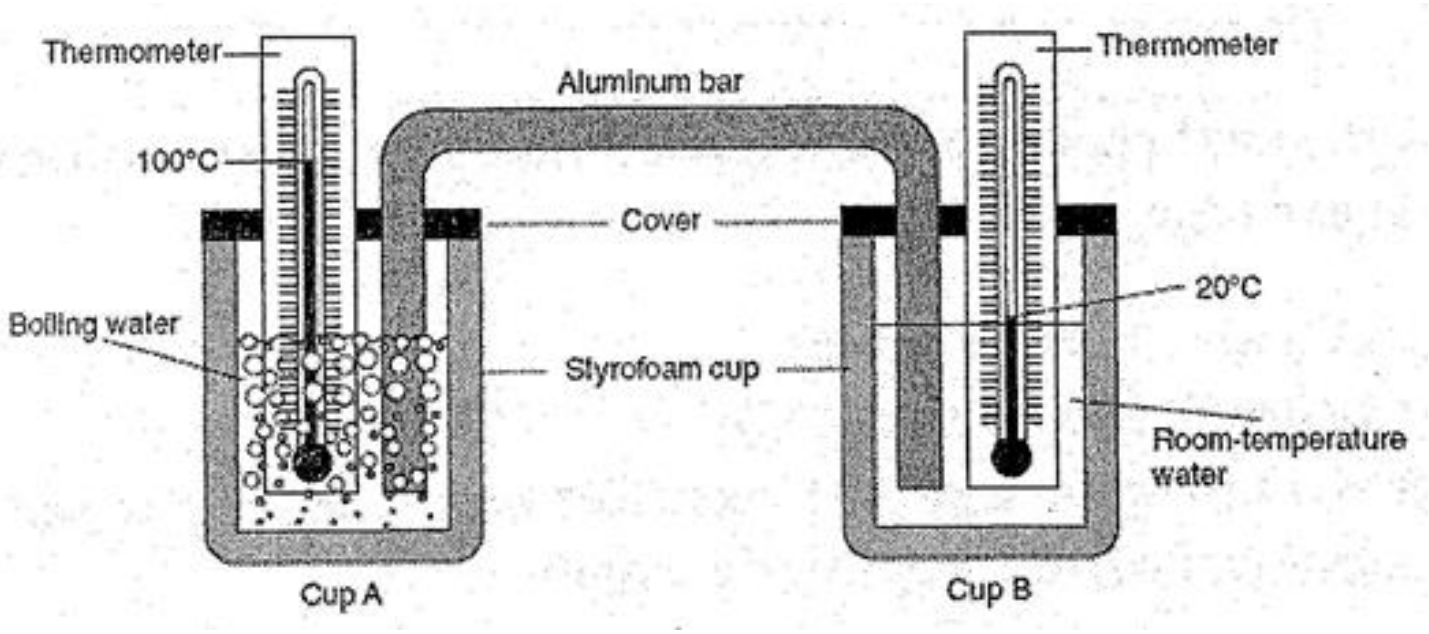
Use caution when handling hot water. The Styrofoam cups can and will tip over. Your lab data will be ruined and wore yet someone could get burned!

Diagram

NOTE: Thermometers do not touch the bottom of the cups or the aluminum bar.

The aluminum bars are not in contact with the bottom of the cup.

There is an air gap between the surface of the water and the covers (cup lid).



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Procedures

CHECK OFF EACH BOX AS YOU PROCEED THROUGH THE STEPS

- ☐ Set up the heat transfer kit as seen in the diagram above.
- ☐ Measure 150ml of cold water and add it to one insulated cup. Use the tap, don't make a mess.
- ☐ One individual needs to put on gloves. Wait for me to bring hot water so you can measure and then pour it into the second cup the hot water.
- ☐ Gently place on the lids, do not submerge them.
- ☐ Get your thermometers set and timer ready.
- ☐ Record the initial temperatures of both thermometers at time 0 and then begin recording data every minute for at least the next 20 minutes.

DATA TABLE

Time (minutes)	Temperature °C Hot water cup	Temperature °C Cold water cup
0		

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1a. Which container is the heat source _____? 1b. Which container is the heat sink _____?

2. How did energy move during the experiment? Be specific.

3. Recall that energy is neither created nor destroyed. Explain where the energy went in this experiment in detail.

4. What method of thermal energy transfer was studied in this experiment? Use the word **aluminum** in the sentence.

5. What can you now *infer* having conducted the experiment about the properties of aluminum?

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6. How does the graph of the hot water cup compare to the graph of the cold water cup?

7. What can you now infer would eventually happen based on the graph's trends to the temperature of both cups?

8. Were other forms of heat energy exhibited in this experiment?

9. Hopefully you responded yes to the last question, now describe with complete sentences (minimum 2) both of the other heat energy types and where they were observed by chance during the experiment. Write about the setting, the scene, what you saw. Use the words insulator, conductor, heat energy and of course radiant and convection.

Bonus: What might your graphing data be useful for? What purpose or contribution can this type of data be used for?

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Graph the data here, to show the relationship between time (minutes) and the temperature (^{0}C) in each cup. Label the X-axis. Label the Y-axis. Compose a title. Connect the data points using different colors and write in the key, labeling which is which.

Title:_____

Key
Warm water line:
Cold water line: