Heat and temperature difference

ASSIGN BUSTER

Heat and Temperature Difference BY Babel 23 Name: Date: Student Exploration: Heat Transfer by Conduction Vocabulary: conduction, convection, insulate, radiation, thermal conductor, thermal energy, thermal insulator Prior Knowledge Questions (Do these BEFORE using the Gizmo.) Suppose two frying pans have been left on the stove with the burners on. One of the frying pans has a metal handle and the other has a wooden handle.

1 . Which handle do you think you could safely touch?

2. Why do you think one handle will be cooler than the other?

Gizmo Warm-up Heat, also called thermal energy, can be transmitted through space (radiation), by booing fluids (convection), or through direct contact. This final method, called conduction, is explored in the Heat Transfer by Conduction Gizmos. To begin, check that Aluminum is selected. Select the BAR CHART tab and turn on Show numerical values.

1. What is the initial temperature of each beaker? Beaker A 95 Beaker B 5

2. Click Play ([pick]) and observe. A. What happens to the temperature of Beaker A over time? Beaker a goes down over time. B. Want napes to ten temperature AT Beaker B over time? Beaker D goes up.

3. Why do you think the temperatures of Beaker A and Beaker B changed as they did? Because of conduction. I Activity A: [pick] I Get the Gizmo ready: I Click Reset ([pick]). I I Measuring heat transfer I Check that Aluminum is selected. Question: How does the temperature difference between two containers relate to the rate of temperature change?

1. Observe: Select the GRAPH tab and press Play. Wait until the temperatures of the two beakers are both close to 50 co, and use the zoom out button ([pick]) to see the whole graph. Sketch the graph in the space at right. What does the graph show about the rate of temperature change over time?

2. Form hypothesis: How do you think the temperature difference between the Akers relates to the rate of heat transfer?

3. Gather data: Select the TABLE tab. Click Reset, and then click Play. Click Pause ([pick]) every 100 seconds (does not have to be exact). Each time you click Pause, record the temperature of each beaker and their temperature difference in the table below. (To find the temperature difference, subtract the temperature of beaker B from that of beaker A.) I Lime (s) I Beaker A temp. I Beaker B temp. Difference (co) 1 asses I pops 1 asses 1 asses (Activity A continued on next page) Activity A (continued from previous page) Lempel.

4. Calculate: At each time, what is the sum of the temperatures in each beaker?

5. Apply: In this simulation, the beakers are perfectly insulated. This meaner that no thermal energy (heat) is lost to the outside environment. If the beakers were not perfectly insulated, how do you think the sum of their temperatures would change over time? Explain.

6. Compare: Compare the temperature changes in the 0-100 second interval to the 500-600 second interval. First, record the temperature difference at

the start of each interval. Then, calculate how much the temperature in each beaker changed during the interval. I Value 10-100 s interval 1500-600 s interval I enrapture Iterance at ten sat I interval Change in Beaker A temperature Change in Beaker B temperature ten time

7. Analyze: How does the rate of temperature change depend on the temperature difference between the two beakers?

8. Think and discuss: Why do you think the rate of temperature change does not stay constant over time? If possible, discuss your answer with your teacher and classmates. I Activity B: I I Conductors and insulators Select the TABLE tab. Introduction: Materials that allow heat to pass through easily are called thermal conductors.

Materials that resist the transfer of heat are called thermal insulators. Quietest: wanly materials are ten Test conductors? wanly are ten worst conductors?

1. Predict: In the Gizmo, you can use aluminum, copper, steel, or glass to connect the two insulated beakers. A. Which material do you think will be the best thermal conductor? B. Which material do you think will be the best thermal insulator?

2. Gather data: With Aluminum selected, click Play. Click Pause after about 200 simulated seconds. Record the temperature of each beaker at 200 seconds. Next, calculate the temperature change of Beaker A. Repeat with each material to complete the table. I Material I Beaker A temp. At Beaker A temp. Change (co) seconds (co)

3. Analyze: What does your data indicate? I Beaker B temp. At 1200 seconds (co) I Minimum I Copper I Glass 1200

4. Classify: Which materials would you classify as thermal conductors, and which would you classify as an insulator? Which material was the best thermal conductor? Thermal conductors: Thermal insulator: Best thermal conductor: Apply: A good Trying pan wall transfer neat quickly Trot ten stove Turner to ten food. Based on the results of the Gizmo, which material would be best for frying pans? Why?