

LAB: No pots? No pans? No problem.

Name: _____

Pre-Activity Questions (to be discussed/completed together before the activity)

1. What are the three ways that heat is transferred from one material (or place) to another?
2. Before trade relationships with Europeans resulted in ownership of metal goods, Plains Indian Tribes did not have metal pots and pans, yet they did boil water to cook certain foods. What did they use for containers?
3. What are some ways you might bring the water in such a container to a boil?
4. In this activity you will put a fire-heated stone into some water. Then you will determine how much heat has been transferred to water by the stone. What measurements will you need to make?
5. The specific heat of water is 1 calorie/gram x °C. What does this mean?
6. The unit that will be used to express your answer is “calories.” What is a calorie?

Procedures

1. Put your goggles on now and keep them on until you have completed the activity.
2. Add 200 ml of room temperature water to the cup. Insert a thermometer and set it aside for now.
3. Obtain a stone (quartzite is the type of rock used in this activity).
4. Check the temperature of the water now. Record the temperature (°C) on the data table. Remove the thermometer and set it aside for now.
5. Light your Bunsen burner. Using tongs (and wearing goggles!), hold the stone above the tip of the flame for three minutes.
6. Use tongs to gently set the hot stone into the cup of water (don't splash!). Put the tongs aside and do not touch them. The end of the tongs that held the stone will remain hot for several minutes.
7. Put the thermometer back into the cup of water so that it is **not touching the stone**. Watch what happens to the temperature of the water. When the temperature stops rising, record it on the data table.
8. Use your data and the formula to determine how many calories of heat were transferred from the stone to the water.

Data Table

C . . . Specific Heat of water is 1 calorie/gram x °C

m . . . Mass of water: 200 g

Temperature of water before: _____ °C

Highest temperature of water after the hot stone was added: _____ °C

ΔT . . . Change in Temperature of water: _____ °C

Formula

C x m x ΔT = calories of heat transferred to the water

How much heat was transferred from the stone to the water? _____ calories

How many “food Calories” (kilocalories) would this be? _____ kilocalories

Follow-Up Questions

1. How would the final temperature of your water have been different if the cup contained 100 ml of water instead of 200 ml? Explain your reasoning.
2. How would the final temperature have been different if the rock that you placed into the 200 ml of water was twice as massive? (Assume that the larger rock was the same temperature as your rock.) Explain your reasoning.
3. How much heat (calories) would it take to raise the temperature of a liter of water from room temperature (20° C) to 80° C? Use the formula above, that thing between your ears, and a calculator to figure it out. Show your work in the space below.
_____ calories
4. How was most of the heat transferred from the fire-heated stone to the water? (conduction, convection, or radiation)

Not all of the heat in the stone ended up in the water. Fill in the blanks with the appropriate term (conduction, convection, or radiation).

5. _____: As the rock was being moved from the flame to the cup, the rock gave off infrared waves, transferring heat to its surroundings.
6. _____: As the rock was being moved, heat was transferred to air molecules that collided with the rock.
7. _____: As the hot rock sat in the cup, both the rock and the water transferred heat to the cup.
8. _____: As the hot water warmed the air above it, this air began to rise, taking heat toward the ceiling.
9. _____: If you dropped the fire-heated stone and then picked it up with your fingers, heat from the stone would have caused major discomfort to your fingers.
10. _____: A heat lamp shines down on food at a restaurant buffet, keeping the food warm for customers.
11. _____: The Sun transfers heat to the Earth.
12. _____: Unfortunately much of the heat produced by burning wood in a fireplace goes up the chimney.
13. _____: You feel warmth as you put your hand near someone's face.
14. _____: This is why people sometimes say, "heat rises." (a statement that isn't always true)
15. _____: This is the reason your house loses heat every time you open a door to let the dog out (or in).
16. In the days before they were able to trade for pots and pans, American Indians must have done a lot of experimentation as they sought ways to boil water more efficiently. List 5 things (materials, methods, etc.) they may have experimented with. (5 points)
 - a.
 - b.
 - c.
 - d.
 - e.