Name _____ Section _____ Date _____

**CONCEPTUAL PHYSICS** | **Experiment**

**Heat, Temperature, and Expansion: Specific Heat** **Water's Heat Capacity**

# Temperature Mix

## Purpose

To predict the final temperature of a mixture of cups of water at different temperatures

## Apparatus

3 Styrofoam cups
liter container with a wide mouth
thermometer (Celsius)
pail of cold water
pail of hot water

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## Discussion

If you mix a pail of cold water with a pail of hot water, the final temperature of the mixture will be between the two initial temperatures. What information would you need to predict the final temperature? You'll begin with the simplest case of mixing ***equal*** masses of hot and cold water.

## Procedure

**Step 1:** Begin by marking your three Styrofoam cups equally at about the three-quarter mark. You can do this by pouring water from one container to the next and mark the levels along the inside of each cup.

**Step 2:** Fill the first cup to the mark with hot water from the pail, and fill the second cup with cold water to the same level. Measure and record the temperature of both cups of water.

**Temperature of cold water =** _____

**Temperature of warm water =** _____

**Step 3:** Predict the temperature of the water when the two cups are combined. Then pour the two cups of water into the liter container, stir the mixture slightly, and record its temperature.

**Predicted temperature =** _____

**Actual temperature of water =** _____

If there was a difference between your prediction and your observation, what may have caused it?

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Pour the mixture into the sink or waste pail. (Don't be a klutz and pour it back into either of the pails of cold or hot water!) Now you'll investigate what happens when ***unequal*** amounts of hot and cold water are combined.

**Step 4:** Fill one cup to its mark with cold water from the pail. Fill the other two cups to their marks with hot water from the other pail. Measure and record their temperatures. Predict the temperature of the water when the three cups are combined. Then pour the three cups of water into the liter container, stir the mixture slightly, and record its temperature.

**Predicted temperature =** _____

**Actual temperature of water =** _____

Pour the mixture into the sink or waste pail. Again, do ***not*** pour it back into either of the pails of cold or hot water!

a. How did your observation compare with your prediction?

_____

b. Which of the water samples (cold or hot) changed more when it became part of the mixture? In terms of energy conservation, suggest a reason for why this happened.

_____

**Step 5:** Fill two cups to their marks with cold water from the pail. Fill the third cup to its marks with hot water from the other pail. Measure and record their temperatures. Predict the temperature of the water when the three cups are combined. Then pour the three cups of water into the liter container, stir the mixture slightly, and record the temperature.

**Predicted temperature =** _____

**Actual temperature of water =** _____

Pour the mixture into the sink or waste pail. (By now, you and your lab partners won't alter the source temperatures by pouring waste water back into either of the pails of cold or hot water.)

a. How did your observation compare with your prediction?

_____

b. Which of the water samples (cold or hot) changed more when it became part of the mixture? Suggest a reason for why this happened.

_____

_____

## Summing Up

1. What determines whether the equilibrium temperature of a mixture of two amounts of water will be closer to the initially cooler or warmer water?

_____

2. How does the formula $Q = mc\Delta T$ apply here?

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