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Hot Washer Lab

If you throw a hot rock into a pail of cool water, you know that the temperature of the rock will go down. You also know that the temperature of the water will go up- but will its rise be more than, less, than, or the same as the temperature drop of the rock? Will the temperature of the water go up as much as the temperature of the rock goes down? Will the changes of temperature instead depend on how much rock and how much water are present and how much energy is needed to change the temperature of the water and rock?

Purpose: To study what happens to temperature when cold or hot washers are added to water.

Materials: 2 beaker, graduated cylinder, washers, scale, clock(on the wall), pencils, string

Pre-Lab Questions:

1. Suppose that equal masses of water and iron are at the same temperature. Suppose you then add the same amount of heat to each of them. Would one change temperature more than the other? If so, which one? **Explain your answer!**

2. Again, suppose that equal masses of water and iron are the same temperature. Suppose you then take the same amount of heat away from each of them. Would one cool more than the other? If so, which one? **Explain your answer!**

Procedure:

STEP 1: Find the mass of 30 washers using the digital scale. Tie them to a string. Knowing what you know about density, figure out how many milliliters (mL) of cold water you will need to equal the mass of the washers (Hint: **IT'S THE SAME NUMBER!**).

STEP 2: Pour the appropriate amount of ice-cold water you determined in STEP 1 into a 150mL beaker.

STEP 3: Boil water on your bunsen burner using your larger beaker approximately 3/4th full of water. Once the water is boiling, place your washers into the water for 2-3 minutes to allow them to heat up.

Is the temperature of the hot water going to be equal to the temperature of the washers? Why do you think it is or is not? Can you think of a better way to heat the washers to a known temperature?

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STEP 4: Just before you are ready to mix the washers with the ice-cold water, measure and record the temperature of the hot water **around** the washers, and the temperature of your cold water.

Temperature of cold water = _______________ °C

Temperature of hot water = _______________ °C

STEP 5: Predict what the temperature of the mixture will be when the hot washers are added to the cold water.

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STEP 6: Lift the washers out of the hot water and put them into the cold water. Every 30 seconds, take the temperature of the mixture (not too near the washers!) until the temperature appears to level off. You may or may not fill out the entire table.

Time:	:30	1:00	1:30	2:00	2:30	3:00	3:30	4:00	4: 30	5:00	5:30
Temp:											

STEP 7: When it is clear that the temperature on the graph has leveled off, record the value of that final temperature.

Actual temperature of mixture = ____________________ °C

How close was the actual temperature of your mixture to your prediction?

Now you will repeat steps 1 through 7 for hot water and cold washers. (This means you will now be placing your washers into COLD water, and measuring out the same amount of water you used for part one and boil it to make HOT water.) You will be putting COLD washers into HOT water, and making the same measurements! Before you add your washers to your water, take the temperature of the cold water surrounding the washers, and the hot water:

Temperature of cold water = _______________ °C

Temperature of hot water = _______________ °C

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Prediction of final temperature of mixture: ___________

Take data the same way you did for part 1! When the temperature begins to level off, stop taking measurements.

Time:	:30	1:00	1:30	2:00	2:30	3:00	3:30	4:00	4: 30	5:00	5:30
Temp:											

Actual temperature of mixture = ____________________°C

How close were you to your prediction?

Analysis

Discuss your observations with the rest of your team, and write an explanation for what happened.

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Suppose that you have equal masses of water and washers at the same temperature. Suppose you then light similar candles and place a candle under each of the masses, letting the candles burn for equal times. Would one of the materials change temperature more than the other?

YES NO

If you circled "yes," which one would reach a higher temperature?

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Suppose you have cold feet when you go to bed, and you want something to warm your feet. Would you prefer to have a hot-water bottle filled with hot water, or one filled with an equal mass of washers at the same temperature as the water? Explain.

Why does the climate of a mid-ocean island stay nearly constant, getting neither very hot nor very cold?