Lab - Heat Mixes: Part II

Name: _____ Date: _____

Purpose
To predict the final temperature of water and nails when mixed.

Required Equipment/Supplies

balance	2 large insulated cups	thermometer (Celsius)
iron washers	hot and cold water	paper towels

Discussion
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 in temperature 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 depend on how much rock and how much water are present and how much energy is needed to change the temperature of water and rock by the same amount?
You are going to study what happens to the temperature of water when hot nails are added to it.

Before doing this activity, think about the following 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?
   (circle one) yes no

2. If you circled "yes," which one would warm more?
   (circle one) water iron

3. Again, suppose that equal masses of water and iron are at the same temperature. Suppose you then take the same amount of heat away from each of them. Would one cool more than the other?
   (circle one) yes no

4. If you circled "yes," which one would cool more?
   (circle one) water iron

Procedure

1. Place a large cup on each pan of the balance. Drop the bundle of nails into one of the cups. Add cold water to the other cup until it balances the cup of nails. When the two cups are balanced, the same mass is in each cup—a mass of nails in one, and an equal mass of water in the other.
2. Set the cup of cold water on your work table. Lift the bundle of nails out of its cup and place it beside the cup of cold water.
3. Fill the empty cup 3/4 full with hot water. Lower the bundle of nails into the hot water and leave it there for two minutes to allow the nails to come to the temperature of the hot water.
4. Measure and record the temperature of the cold water and the temperature of the hot water around the nails.
   Temperature of cold water = _____°C

   Temperature of hot water = _____°C
5. Is the temperature of the hot water equal to the temperature of the nails? Why do you think it is or is not? Can you think of a better way to heat the nails to a known temperature?
6. Predict what the temperature of the mixture will be when the hot nails are added to the cold water.
   Predicted temperature of mixture = _____°C

7. Lift the nails from the hot water and put them quickly into the cold water. When the temperature of the mixture stops rising, record it.

   Actual temperature of mixture = _____°C

8. How close is your prediction to the observed value?

9. Now you will repeat Steps 1 through 6 for hot water and cold nails. First, dry the bundle of nails with a paper towel. Then, balance a cup with the dry bundle of nails with a cup of hot water.

10. Remove the nails and fill the cup ¾ full with cold water. Record the temperature of the hot water in the first cup.

    Temperature of hot water = _____

11. Lower the bundle of nails into the cup of cold water, wait one minute (why?), and then record the temperature of the water around the nails.

    Temperature of cold water = _____°C

12. Predict what the temperature of the mixture will be when the cold nails are added to the hot water.

    Predicted temperature of mixture = _____

13. Lift the nails from the cold water and put them quickly into the hot water. When the temperature of the mixture stops changing, record it.

    Actual temperature of mixture = _____°C

14. How close is your prediction to the observed value?

Analysis

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

2. Suppose you have equal masses of water and nails 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?

   (circle one) yes no

3. If your answer to the question is "yes," which one would reach a higher temperature?

   (circle one) water nails

4. 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 nails at the same temperature as the water? Explain.

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