

SPECIFIC HEAT AND MELTING

Fusion welding involves raising the temperature of the pieces to be welded to their melting point. The amount of heat needed to raise the temperature of one gram of a material 1°C is called the specific heat of that material. Materials that require a lot of heat to raise their temperature have a high specific heat. Specific heat varies by type of material. Do you think specific heat varies within material type? For example, do you think all metals have the same specific heat?

EVIDENCE & PROOF

Materials:

- 3 samples of equal mass of aluminum, steel, copper;
- 1 small beaker; 3 styrofoam cups;
- burner (or alcohol burner) and stand;
- 3 Celsius thermometers; water heated to boiling point;
- safety glasses; heat protective gloves; container of water

Process: Follow these steps. Compare your results with your predicted answers to the questions.



Caution: Tie back long hair; wear safety glasses. Keep a container of water nearby. Know the location of the fire extinguisher. Hot wax can burn, wear heat protective gloves.

1. Set up the materials as shown in Fig. 1 below. Read and record the temperature of the water in beakers:
 A _____ B _____ C _____
2. Equal masses of aluminum, copper and steel are heated to the boiling point of water, then the metals are put into separate containers holding equal amounts of water at the same starting temperature. The metal that heats the water to the highest temperature has the lowest specific heat. Why?
3. Try it out. Put on safety glasses and gloves. Put the metal pieces or bundles into a beaker on the alcohol burner stand. (See Fig. 1) Add enough hot water to completely cover all of the metal. Light the burner and bring the water just to a boil. Blow out the burner.

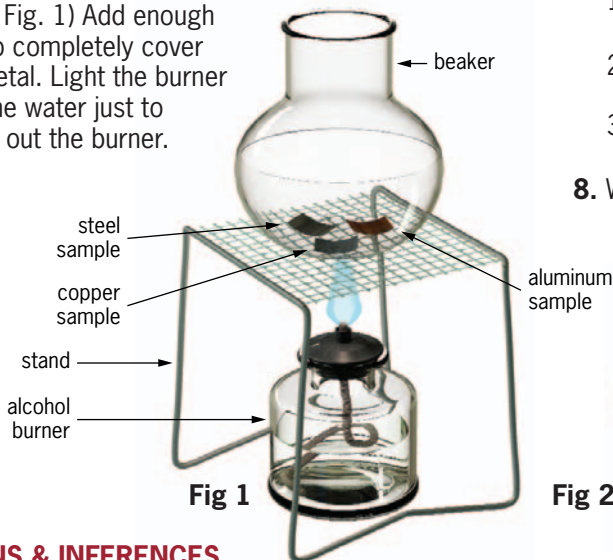
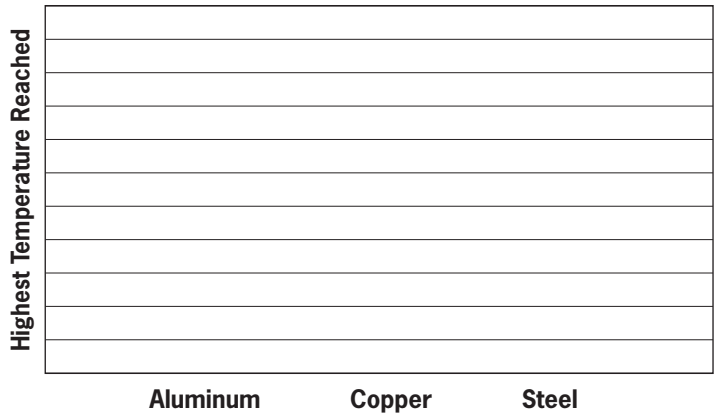


Fig 1

Questions & Predictions Predict and record answers to these questions. Observe and measure for Evidence & Proof below.

1. Do you think aluminum, copper and steel have the same or different specific heats? Why?
2. If you think the specific heats differ, rank them from highest specific heat to lowest.
4. Using the tongs, carefully remove the metal samples one at a time, and place each into one of the styrofoam cups of room temperature water. (See Fig. 2)
5. Read and record the temperature of the water in the beakers after 10 seconds, after 20 seconds and after 30 seconds. Be sure to stir the water in the beaker with the thermometer.
6. Complete the graph to illustrate your data. Use the highest temperature reached for each metal.



7. Rank the metals from (1) highest specific heat to (3) lowest
 1. _____
 2. _____
 3. _____
8. Were your predictions correct? Why?

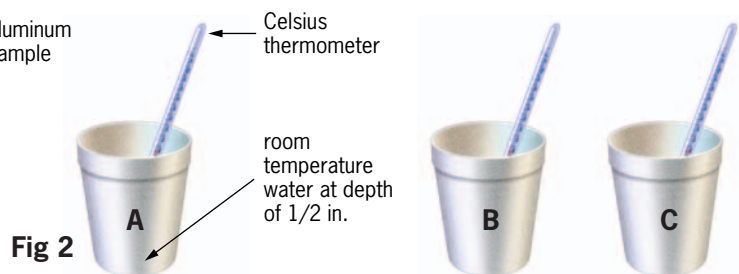


Fig 2

CONCLUSIONS & INFERENCE

Once heated, which would take the longest to cool; an aluminum pan, a steel pan or a copper pan? Why?

What proof of your answer does the experiment you just did provide?