Name _____ Date _____

SI Physics Lab #28 (75 pts)

Period _____ Mrs. Nadworny

Partners: Due Date: _____

Specific Heat of a Metal

NO Lab Write-Up Required

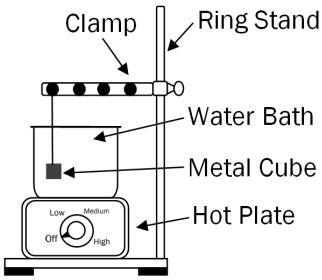
Purpose

To determine the specific heat of a metal cube using the conservation of energy principle

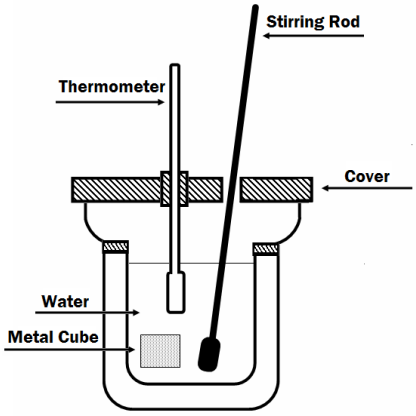
Materials

- Metal cube
- Pot
- Ruler
- Burner
- Thermometer
- Ring Stand
- Aluminum Calorimeter
- Pendulum Clamp

Procedure



1. Fill the metal pot to the top with water from the faucet. Place the filled pot on the burner which should be set to high. Allow to boil.
2. Select a metal cube and tie a piece of string to the hook. Make some visual observations about the metal cube and record above the data table.
3. Measure and record the mass of the cube and the dimensions of the cube. From this information, calculate the volume and density of the metal cube.
4. Measure and record the mass of your dry, **empty** calorimeter (outer and inner cups).
5. Fill the inside of your calorimeter (inner cup) approximately half-way with room temperature water, then measure and record the mass of the calorimeter (outer and inner cups) with the water in it.
6. Using the values from steps 4 and 5, calculate the mass of the water in the cup.
7. Wait for the pot of water to boil, and then hang your metal cube underneath the surface of the water from the metal bar overhanging it. Be sure that the cube does not touch the sides or bottom of the pot. [See top right picture.] Leave it submerged for approximately five minutes to give it a chance to get to the same temperature as the boiling water. **This temperature will be recorded as the initial temperature of the metal cube.**
8. Measure and record the temperature of the water in the calorimeter cup just before you put the cube in it. **This temperature will be recorded as the initial temperature of the water and cup.**
9. Remove the cube from the boiling water and place it quickly in the calorimeter cup and cover it immediately. [See picture.]
10. Stir gently with the stirring rod until the temperature stabilizes. Measure and record this final temperature.



Data Collection: (10 pts)

Visual observations of metal cube (e.g. color, luster, malleability, etc.):

Mass of cube	Dimensions of cube [L, W, H]	Mass of empty calorimeter cup	Mass of calorimeter and water	Initial temperature of cube (^{0}C)	Initial temperature of water in calorimeter (^{0}C)	Final temperature (^{0}C)
± _____	± _____	± _____	± _____		± _____	± _____
(g)	(cm)	(g)	(g)			
(kg)	(m)	(kg)	(kg)			

Data Analysis: (50 pts)

Calculate the following values. Show all of your work using the GUESS method. Record the values in the data table.

Volume of cube (m^3)	Density of cube (kg/m^3)	Mass of water in calorimeter cup (kg)	Temperature change of water and cup (^{0}C)	Temperature change of cube (^{0}C)

Volume of cube	Density of cube
Temperature change of water and cup	Temperature change of cube

Calculate the following values. Show all of your work using the GUESS method. Record the values in the data table.

Heat gained by the water (kJ)	Heat gained by the cup (kJ)	Heat lost by the cube (kJ)	Specific Heat of Metal (kJ/kg•^{0}C)

Heat gained by water (Q_w)

Heat gained by cup (Q_c)

Heat lost by metal cube (Q_m)

Specific Heat Capacity of metal cube (c_m)

Post-Lab Questions (15 pts)

Directions: Answer the following questions using full complete sentences. If you need more space, use a separate piece of paper to answer.

1. Identify the type of metal that the cube is made of using a combination of your visual observations, your calculated **density** and your calculated **specific heat**. Explain how you arrived at your conclusion. On the lab website there is a chart listing common materials and their values. (3 pts)

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2. Explain how the conservation of energy principle applies to the gain and loss of heat occurring in the calorimeter during this experiment. (3 pts)

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3. What type(s) of heat transfer were used as the cube gave up its heat to the water? Explain. (2 pts)

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4. One source of error is that we assumed that all of the heat lost by the metal was gained by the water and cup. In reality, this is not true. Explain where else the heat went. State whether this would give a calculated specific heat value that is lower or higher than the actual value and explain why. (3 pts)

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5. Describe a second source of error (unrelated to the first). Explain how it happened. Explain how it affected your data (mass, temperature). Explain how it affected your results (heat, specific heat). (4 pts)

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