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EXPERIMENT-6

OBJECT: To determine the specific heat capacity of the material of the given calorimeter

APPARATUS: A calorimeter of known mass lagged in a wooden case, thermometer, measuring cylinder, a glass rod to be used as a stirrer, tap water and boiling water.

THEORY: If hot water is mixed with cold water taken in a calorimeter, the hot water loses heat while the calorimeter and the cold water gains heat. If there is no heat loss. Heat lost by the hot water = Heat gained by the calorimeter + Heat gained by the cold water. Let mass of calorimeter be m_c and it contains V_1 cm^3 of cold water at t_1 °C. When V_2 cm^3 of hot water at t_2 °C is mixed with it, the final steady

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Temperature of mixture becomes t_3 °C. Then
Heat lost by the hot water $= V_2 \times 1 \times (t_2 - t_3)$ cal
Heat gained by the calorimeter $= m \times s \times (t_3 - t_1)$ cal
Heat gained by the cold water $= V_1 \times 1 \times (t_3 - t_1)$ cal
Here, we have assumed that density of water is $1 g cm^{-3}$ and specific heat capacity of water is $1 cal\ g^{-1} °C^{-1}$. When there is no loss of heat.

$$V_2 (t_2 - t_3) = ms (t_3 - t_1) + V_1 (t_3 - t_1)$$

$$\therefore s = \left(\frac{V_2 (t_2 - t_3) - V_1}{m (t_3 - t_1)} \right) \frac{m}{} \text{ cal } g^{-1} °C^{-1}$$

METHOD

1. Record the mass m of the given calorimeter.
2. Measure $V_1 = 50 cm^3$ of tap water by a measuring cylinder and pour it into the calorimeter lagged in a wooden cas. Note its temperature t_1 °C with the thermometer.
3. Note the temperature t_2 °C of the boiling water. Then measure $V_2 = 50 cm^3$ of boiling water by a measuring cylinder and pour it into the calorimeter. Take care that no water

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Splashes out

4. Stir well the contents of calorimeter with a glass rod and note the final steady temperature t_3 °C.

OBSERVATION:

1. Mass of calorimeter, m = 49.40 g
2. Volume of tap water, V_1 = 50 cm^3
3. Temperature of tap water t_1 = 27 °C
4. Temperature of boiling water, t_2 = 50 °C
5. Volume of boiling water, V_2 = 49 cm^3
6. Final steady temperature of mixture, t_3 = 0.63°C

CALCULATIONS: Calculate the specific heat capacity of material of calorimeter using the following relation

$$S = \frac{V_2(t_2 - t_3)}{m(t_3 - t_1)} - \frac{V_1}{m} = 2 \quad cal\,g^{-1}\,°C^{-1}$$

RESULT: The specific heat capacity of the material of calorimeter is $cal\,g^{-1}\,°C^{-1}$

PRECAUTIONS:

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1. The Temperature should be noted each time when it becomes steady.
2. While adding the boiling water into the beaker, care should be taken that water does not splash out.
3. The boiling water must be added quickly into the beaker so that there may be any loss of heat in air.

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