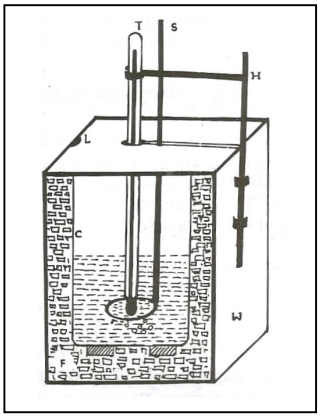
EXPERIMENT – 1

SPECIFIC HEAT OF SOLID



Aim : To find the specific heat of a given solid.

Required : Calorimeter, Laboratory thermometer, Water, Hot water, Solid shots (lead shots)

Description: Calorimeter consists of a thin cylindrical copper vessel. The copper vessel is placed in a wooden box. The gap between vessel and wooden box is filled with insulating material like wool / fur. The wooden box contains a wooden lid. The lid has a slot that a stirrer is to be immersed through it into the copper vessel. Also the lid has a hole to immerse laboratory thermometer. (It may also have an holder for thermometer at a side of wooden box.)

Formula : When two or more bodies at different temperatures are brought into thermal contact, then net heat lost by the hot bodies is equal to the net heat lost by the hot bodies until they attain the thermal equilibrium.

Net heat lost by the hot bodies = Net heat gain by the cold bodies

Procedure: (1) First we have to find the mass of the calorimeter (vessel) (m_1).

(2) Fill nearly half of the calorimeter with water and find the mass of calorimeter with water (m_2).

(3) Measure the initial temperature with laboratory thermometer ($T_1{}^oC$). This is the temperature of both water and also calorimeter.

(4) Take a few lead shots and place them in hot water. Heat them up to a temperature (nearly) 100^oC. So measure the temperature of lead shots ($T_2{}^oC$).

(5) Transfer the lead shots into calorimeter quickly with minimum loss of heat.

(6) Stir the mixture well.

(7) Note the final temperature ($T_3{}^oC$).

(8) Measure the final mass of calorimeter along with water and lead shots (m_3).

Heat (Q) = m.s.ΔT

According to the method of mixtures :

Heat lost by the solid = Heat gained by calorimeter + Heat gained by water

$(m_3-m_2).S_l.(T_2-T_3) = m_1.S_c.(T_3-T_1) + (m_2-m_1).S_w.(T_3-T_1)$

$$S_l = \frac{[m_1 S_c+(m_2-m_1)S_w][T_3-T_1]}{(m_3-m_2)(T_2-T_3)}$$

This way we can find the specific heat of a solid.

Take S_w = 1 cal/gm -^oC

S_c = 0.095 cal/gm -^oC

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Observation :

Mass of the calorimeter (copper vessel only) (m_1) = ... gm

Mass of the calorimeter with water (m_2) = ... gm

Mass of water $(m_2 - m_1)$ = ... gm

Temperature of water in calorimeter (T_1) = ... ^oC

Temperature of hot lead shots (T_2) = ... ^oC

Mass of the calorimeter with water and lead shots (m_3) = ... gm

Mass of lead shots $(m_3 - m_2)$ = ... gm

Final temperature of calorimeter with water and lead shots $(T_3 - T_2)$ = ...^oC

Specific heat of water (S_w) = 1 cal/gm-^oC

Specific heat of copper calorimeter (S_c) = 0.095 cal/gm-^oC

Specific heat of lead shots (S_l) = ?

Calculation :

$$S_l = \frac{[m_1\ S_c + (m_2 - m_1) S_w\ ][T_3 - T_1]}{(m_3 - m_2)(T_2 - T_3)}$$

$$S_l = \frac{[m_1\ (0.095) + (m_2 - m_1) 1\ ][T_3 - T_1]}{(m_3 - m_2)(T_2 - T_3)}$$

= .....

= .....

= .....

Precautions :

- Transfer solid shots from hot water to calorimeter vessel quickly and carefully with minimum loss of heat.

Result :

- The specific heat of given lead shots is ..... cal/gm-^oC.

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