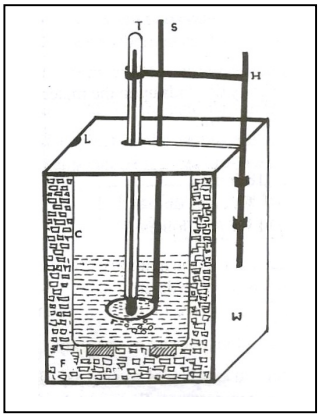
EXPERIMENT – 2

SPECIFIC HEAT OF LIQUID



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

Required : Calorimeter, Laboratory thermometer, given liquid, 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 given liquid and find the mass of calorimeter with the given liquid (m_2).

(3) Measure the initial temperature with laboratory thermometer ($T_1{}^oC$). This is the temperature of both given liquid 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 given liquid 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 given liquid

$$(m_3-m_2).S_L.(T_2-T_3) = m_1.S_c.(T_3-T_1) + (m_2-m_1).S_G.(T_3-T_1)$$

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

Take S_L = 0.031 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 given liquid (m_2) = ... gm

Mass of given liquid $(m_2 - m_1)$ = ... gm

Temperature of given liquid in calorimeter (T_1) = ... ^oC

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

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

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

Final temperature of

calorimeter with liquid and lead shots $(T_3 - T_2)$ = ...^oC

Specific heat of Lead shots (S_L) = 0.031 cal/gm-^oC

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

Specific heat of given liquid (S_G) = ?

Calculation :

$(m_3-m_2).S_L.(T_2-T_3) = m_1.S_c.(T_3-T_1) + (m_2-m_1).S_G.(T_3-T_1)$

$(m_3-m_2).(0.031).(T_2-T_3) = m_1.(0.095).(T_3-T_1) + (m_2-m_1).S_G.(T_3-T_1)$

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Precautions :

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

Result :

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

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