(HT1-1) Specific Heat of Solids

Aim of experiment

Determination of the specific heat of a metal block

Apparatus

Large Mass of Metal A, Beaker B, Copper Calorimeter C in Insulating Jacket D, Water- Copper Stirrer E, Thermometer.

Theory of experiment

Materials differ from one another in the quantity of heat required to produce a given elevation of temperature in a given mass. The quantity of heat added to a given mass of a substance in order to increase its temperature is given by

$$Q = m\, C\Delta T$$

Where, C is a constant which depends on the material type and is called *specific heat. It is defined as the amount of energy required to increase the temperature of 1Kg of a substance by one degree.*
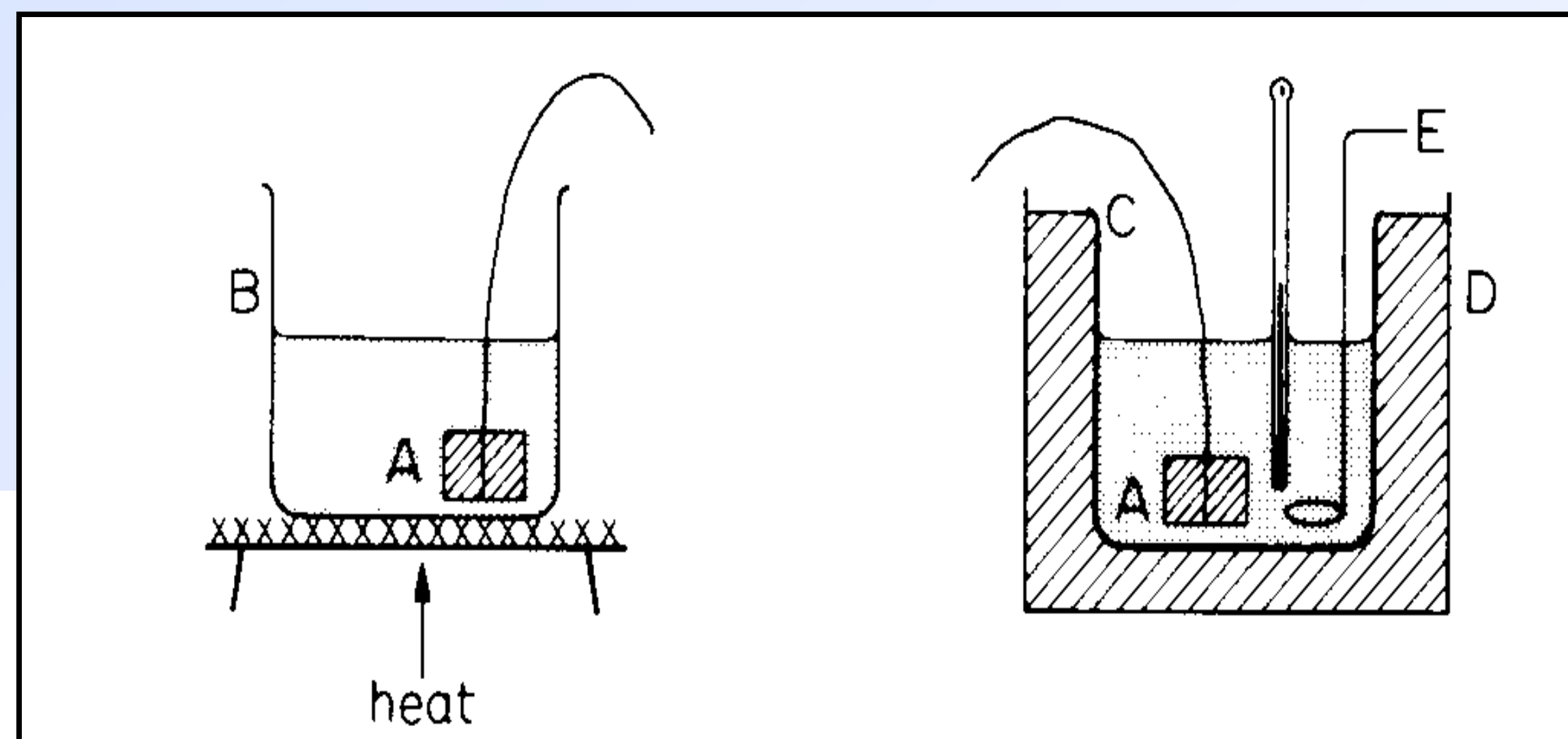
Figure 1. A schematic diagram for specific heat capacity measurement

Now consider a hot metal block with mass m_s and temperature T_s is placed in a calorimeter, *figure 1*, with mass m_c which contains water with mass m_w both of them at temperature T_i.
According to the conservation law of energy:

Heat lost by metal = Heat gained by water and calorimeter

$$m_s\, C_s\, (T_s\text{-}T_f) = (m_w\, C_w + m_c\, C_c)(T_f - T_i)$$

Where, C_s is the specific heat capacity of the metal block, C_w $(=4200\ J\ kg^{-1}\ K^{-1})$ is the specific heat capacity of water, C_c is the specific heat capacity of calorimeter, and T_f is the temperature of the mixture.

Procedures

1. Fill the beaker B with some water and place the metal A inside it, and boil the water.
2. Meanwhile, weigh the calorimeter, fill it about one-half with water, and reweigh.
3. Record the initial temperature of water and the calorimeter, T_i.
4. Record the temperature of the boiling water and the block, T_s.
5. Quickly transfer block A to the water in the calorimeter C.
6. Observe the water temperature until it reaches a maximum and then let to drop several degrees below the maximum reached. Record the maximum temperature T_f.
7. Repeat steps 3 to 6 two more tes and measure T_i, T_f, and T_s in each case.
8. Calculate the average specific heat of the metal block.

Results

Mass of calorimeter m_c = ...kg
Mass of water m_w = ...kg
Mass of metal block m_s=...... kg
Specific Heat of calorimeter C_c=....kg^{-1} K^{-1}
Specific Heat of water C_w = …….. Jkg^{-1} K^{-1}

Trial	$T_s\ (^oC)$	$T_i\ (^oC)$	$T_f\ (^oC)$	$C_s\ (J.kg^{-1}.\ K^{-1})$
1				
2				
3				
				C_{sav}=