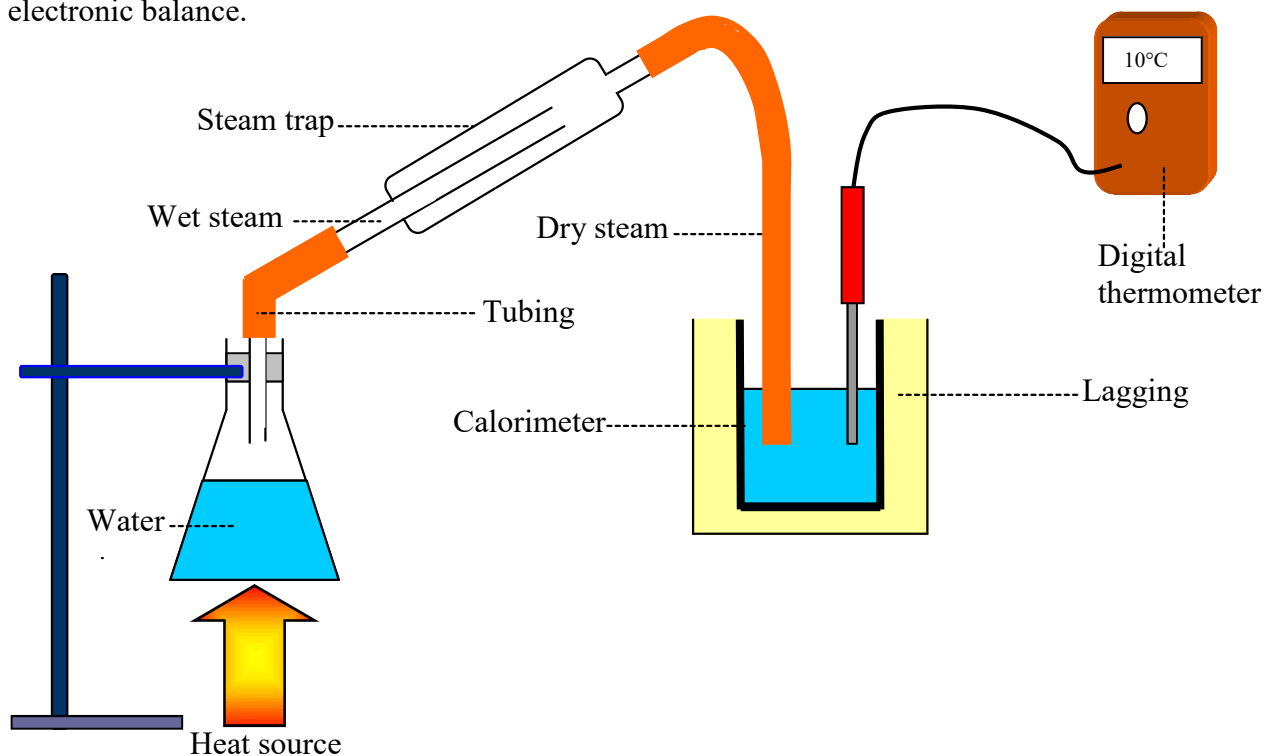


MEASUREMENT OF THE SPECIFIC LATENT HEAT OF VAPORISATION OF WATER

Apparatus

Calorimeter, lagging, beaker, conical flask fitted with stopper and delivery tube or steam generator, steam trap, retort stand, heat source, thermometer accurate to 0.1 °C and electronic balance.



Procedure

1. Half fill the conical flask or steam generator with water and fit with the delivery tube.
2. Heat until steam issues freely.
3. Find the mass of the calorimeter m_{cal} .
4. Half fill the calorimeter with water cooled to approximately 10 °C below room temperature.
5. Find the mass m_1 of the water plus calorimeter.
6. The mass of the cooled water m_w is $m_1 - m_{cal}$.
7. Record the temperature of the calorimeter plus water θ_1 .
8. Allow dry steam to pass into the water in the calorimeter until the temperature has risen by about 20 °C.
9. Remove the steam delivery tube from the water, taking care not to remove any water from the calorimeter in the process.
10. Record the final temperature θ_2 of the calorimeter plus water plus condensed steam. The fall in temperature of the steam $\Delta\theta_1$ is $100\text{ °C} - \theta_2$.
11. The rise in the temperature of the calorimeter plus water $\Delta\theta_2$ is $\theta_2 - \theta_1$.
12. Find the mass of the calorimeter plus water plus condensed steam m_2 . Hence the mass of the condensed steam m_s is $m_2 - m_1$.

Results

Mass of the calorimeter	$m_{\text{cal}} =$
Mass of the water plus calorimeter	$m_1 =$
Mass of the cooled water	$m_w = m_1 - m_{\text{cal}} =$
Temperature of the calorimeter plus water	$\theta_1 =$
Final temperature of the calorimeter plus water plus condensed steam	$\theta_2 =$
Fall in temperature of the steam	$\Delta\theta_1 = 100\text{ }^\circ\text{C} - \theta_2 =$
Rise in the temperature of the calorimeter plus water	$= \theta_2 - \theta_1 =$
	$\Delta\theta_2$
Mass of the calorimeter plus water plus condensed steam	$m_2 =$
Mass of the condensed steam	$m_s = m_2 - m_1 =$

Calculations

Assume heat losses to the surroundings cancel heat gains from the surroundings. Given that the specific heat capacity of water c_w and the specific heat capacity of copper c_c are already known, the specific latent heat of vaporisation of water l may be calculated from the following equation:

Energy lost by steam = energy gained by calorimeter + energy gained by the water

$$m_s l + m_s c_w \Delta\theta_1 = m_{\text{cal}} c_c \Delta\theta_2 + m_w c_w \Delta\theta_2.$$

Notes

If a polystyrene container is used in place of the copper calorimeter, then the energy lost by the steam is equal to the energy gained by the water.

The energy equation now reads: $m_s l + m_s c_w \Delta\theta_1 = m_w c_w \Delta\theta_2.$

Use a tilted insulated tube as an alternative delivery pipe for dry steam. This does away with the need to use a steam trap.

If the water in the calorimeter is initially cooled to $10\text{ }^\circ\text{C}$ below room temperature and then heated to $10\text{ }^\circ\text{C}$ above room temperature the heat gains and heat losses approximately cancel each other out.