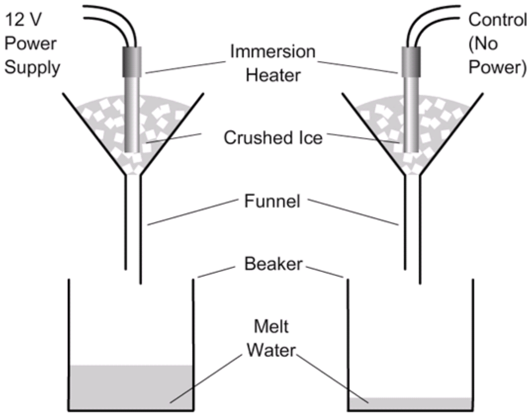
Edexcel Physics A Level

Core Practical 13

Determine the Specific Latent Heat of a Phase Change

Method 1: Determine the Specific Latent Heat of a Solid



- Set up apparatus as shown in diagram
- Weigh each of the beakers and record their initial mass
- Crush the ice and put it into the funnel, packed closely
- Fully submerge the immersion heater into the funnels of ice; one of the heaters are switched on while the other is not as a control, start the stopwatch
- Record the voltage and current across the heater
- After 5 minutes, switch off the heater and record the final mass of water in each of the beakers
- Calculate the total mass of water melted in the given time of 5 minutes, by finding the difference between the initial and final mass in each of the beakers
- Mass of ice melted by heater (Δm) = Total mass melted – Mass melted due to heat from surroundings
  - Therefore, Δm = Mass melted in beaker – Mass melted in control
- Find the s:

$$L_f = \frac{VIt}{\Delta m}$$

Where t = 300s, L_f is specific latent heat of fusion, v is voltage and I is current.

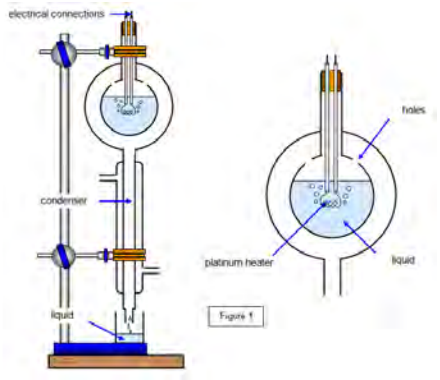
Safety

- Melted ice may drip onto the floor creating a slipping hazard, ensure that there is a beaker to catch the melted ice

Evaluation

- Uncertainty is ±1°c (uncertainty in each temperature measurement is ±0.5°c but the measurements are both used to calculate the change in temperature)
- The ice must be melting so that it is at 0°C, as the method does not account for heating the ice up to 0°C
- Ice must be crushed so that it cools the water down quickly, meaning less heat is absorbed from the room as the mixture is below room temperature - insulate the container
- If heat from the room enters, L is too small as temperature doesn't get as low as it should be

Method 2: Determine the Specific Latent Heat of a Liquid



- Set up the double-walled glass vessel and other apparatus, as shown above
- Measure initial mass, m_i, of the beaker
- Switch on immersion heater and start the stopwatch
- Record V, voltage, and I, current
- The liquid situated in the inner section of the tube will come to a boil and the vapour passes through the small holes, into the outer tube
- As the vapour passes through the condenser it becomes liquid again and collects in the beaker
- After 5 minutes, switch off heater, measure the final mass, m_f, of the beaker filled with water
- Find the mass of liquid which evaporates in 5 minutes, m_1, as $m_1 = m_f - m_i$
- Repeat procedure at least 3 times and find mean m_1
- Find m_2, the mass evaporated in a different time interval (e.g. 3 minutes), using the same procedure as above
- Considering the masses:
  - m_1 = mass evaporated by heater in 5 minutes + mass evaporated due to heat from surroundings (Q)
  - m_2 = mass evaporated by heater in 3 minutes + Q

  Subtracting the two equations:

$$m_1 - m_2 = mass\ evaporated\ in\ 2\ mins$$
$$L_v = \frac{VI \cdot (t_1 - t_2)}{m_1 - m_2}$$

Where L_v is the specific latent heat of vaporisation, t_1 is the time taken for m_1 and t_2 is the time taken for m_2.

Safety

- Risk of scalding from the vapour

Evaluation

- A clean beaker should be placed under the tube when the liquid drips at a constant rate
- If a joulemeter is connected, the energy input can be found directly