Oxford Cambridge and RSA

# GCSE Physics B (Twenty First Century Science)

**J259/02** Depth in physics (Foundation Tier)

## Question Set 9

**1** Sarah carries out an experiment to measure the specific latent heat of vaporisation of water. She does this by finding the energy needed to evaporate a known mass of water.

The apparatus she uses is shown in **Fig. 1.1**.

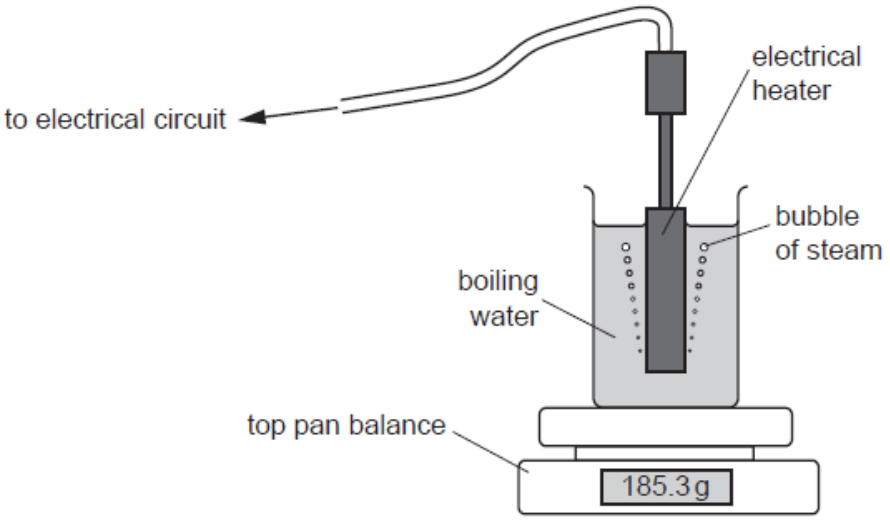


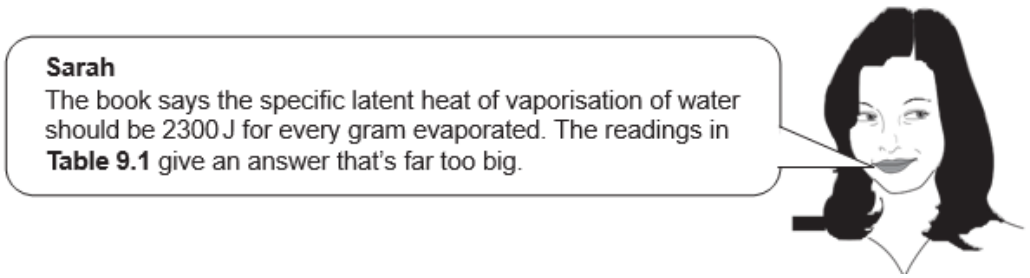

**Fig. 1.1**

Using this apparatus, Sarah takes these readings.

| | **Measured value** |
|---|---|
| current | 3.0 A |
| potential difference | 12 V |
| time | 150 s |
| balance reading at start | 185.3 g |
| balance reading at the end | 184.3 g |

**Table 1.1**

**(a)*** Sarah is not happy with her results.



Is Sarah right?

What could Sarah do to get an accurate value of the specific latent heat of vaporisation of water from her experiment? **[6]**

$P = IV = 3 \times 12 = 36\,W$

$E = Pt = 36 \times 150 = 5400\,J$

$\Delta m = 185.3 - 184.3 = 1\,g$

$E = \Delta m L$

$\frac{E}{\Delta m} = L \Rightarrow L = \frac{5400}{1} = 5400\,J/g$

$5400\,J/g > 2,300\,J/g$

- heat losses constitute the most significant shortcomings
- not all of heater in the water
- thermal energy will dissipate through sides & bottom of beaker
- thermal energy will dissipate from the water surface
- relatively low mass of water evaporated

development
- ensure water level is above top of heater
- surround beaker sides and bottom with insulating material
- cover top of beaker to limit convection losses
- use higher powered heater to evaporate more water in the same time

**(b)** Sarah's book has this information about vaporisation of two liquids.

| Liquid | Specific latent heat of vaporisation (J per gram) |
|---|---|
| water | 2300 |
| alcohol | 950 |

Suggest why it takes more energy to evaporate 1 gram of water than it does to evaporate 1 gram of alcohol. **[3]**

Force between particles in water are stronger than those in alcohol. Water is denser than alcohol so more intermolecular bonds need to be broken.

**Total Marks for Question Set 9: 9**

# Resource Materials

## Equations in Physics

change in internal energy = mass × specific heat capacity × change in temperature

energy to cause a change in state = mass × specific latent heat

for gases: pressure × volume = constant
(for a given mass of gas and at a constant temperature)

$(\text{final speed})^2 - (\text{initial speed})^2 = 2 \times \text{acceleration} \times \text{distance}$

energy stored in a stretched spring = ½ × spring constant × $(\text{extension})^2$

potential difference across primary coil × current in primary coil =
potential difference across secondary coil × current in secondary coil

**Higher tier only –**

**pressure due to a column of liquid = height of column × density of liquid × g**

**force = magnetic flux density × current × length of conductor**

**potential difference across primary coil ÷ potential difference across secondary coil = number of turns in primary coil ÷ number of turns in secondary coil**

**change in momentum = resultant force × time for which it acts**