## More Latent Heat Questions – Answers

Summary Questions:

1 a) Energy is needed to break the bonds which hold the molecules in place (potential energy).

b) The internal energy is the sum of the kinetic and potential energies of the molecules in the beaker. (At constant temperature, the KE does not change, but) the PE component needs to reduce, and so the internal energy must be reduced.

2 $Q = m\ l$ $P \times t = m\ l$ $3000 \times 120 = m \times 2.25 \times 10^6$

$m = 0.16$ kg

3 $\Delta Q / \Delta t = m\ c\ \Delta\theta / \Delta t = 0.080 \times 4200 \times (15 - 0) / 1200 = 4.2$ W

$Q = m\ l = 0.080 \times 3.4 \times 10^5 = 27200$ J

$P = Q / t$ $t = Q / P = 27200 / 4.2 = 6500$ s

4 a) $\Delta Q / \Delta t = m\ c\ \Delta\theta / \Delta t = 0.12 \times 1200 \times (78 - 60) / 120 = 22$ W

b) Latent heat $= 22 \times 300 = 6.5$ kJ

10.40 The idea here is to calculate how much ice melts!

Energy lost by glass + contents = Energy gained by ice melting

$C\ \Delta\theta = m\ l$ $600 \times (15 - 0) = m \times 3.4 \times 10^5$ $m = 0.026$ kg

Therefore 14g remains (3 s.f. value for $l_v = 3.34 \times 10^5$ gives 13g)

10.41 $\Delta Q / \Delta t = (\Delta m / \Delta t) \times l = (0.0463 / 600) \times 1.99 \times 10^5 = 15.4$ W

The beaker stays at the boiling point of liquid nitrogen (77K), so $\Delta\theta$ is zero. Hence no energy is transferred to / from the beaker.

10.42 Energy from steam condensing + Heat lost by condensed steam = Heat to warm coffee

$m_s\ l$ + $m_s\ c_w\ \Delta\theta$ = $m_c\ c_c\ \Delta\theta$

$m_s\ (2.25 \times 10^6 + 4200 \times (100 - 85)) = 0.18 \times 4200 \times (85 - 14)$

which gives $m_s = 0.023$ kg or 23 g

Note it is quite common to ignore the heat lost by the condensed steam cooling to the final equilibrium temperature, in which case you get 24 g.