3 **(a)** State the first law of thermodynamics in terms of the increase in internal energy ΔU, the heating q of the system and the work w done on the system.

.....

..... [1]

(b) The volume occupied by 1.00 mol of liquid water at 100 °C is 1.87×10^{-5} m^3. When the water is vaporised at an atmospheric pressure of 1.03×10^5 Pa, the water vapour has a volume of 2.96×10^{-2} m^3.
The latent heat required to vaporise 1.00 mol of water at 100 °C and 1.03×10^5 Pa is 4.05×10^4 J.
Determine, for this change of state,

(i) the work w done on the system,

w = ... J [2]

(ii) the heating q of the system,

q = ... J [1]

(iii) the increase in internal energy ΔU of the system.

ΔU = ... J [1]

(c) Using your answer to **(b)(iii)**, estimate the binding energy per molecule in liquid water.

energy = ... J [2]

[Turn over