3 The volume of 1.00 kg of water in the liquid state at 100 °C is 1.00×10^{-3} m^3. The volume of 1.00 kg of water vapour at 100 °C and atmospheric pressure 1.01×10^5 Pa is 1.69 m^3.

(a) Show that the work done against the atmosphere when 1.00 kg of liquid water becomes water vapour is 1.71×10^5 J.

[2]

(b) (i) The first law of thermodynamics may be given by the expression

$$\Delta U = + q + w$$

where ΔU is the increase in internal energy of the system.

State what is meant by

1. $+ q$,

..... [1]

2. $+ w$.

..... [1]

(ii) The specific latent heat of vaporisation of water at 100 °C is 2.26×10^6 J kg^{-1}.

A mass of 1.00 kg of liquid water becomes water vapour at 100 °C.

Determine, using your answer in **(a)**, the increase in internal energy of this mass of water during vaporisation.

increase in internal energy = ... J [2]