1. This question is about determining the specific latent heat of fusion of ice.

A student determines the specific latent heat of fusion of ice at home as follows. She takes some ice from the freezer, measures its mass and mixes it with a known mass of water in an insulating jug. She stirs until all the ice has melted and measures the final temperature of the mixture. She also measured the temperature in the freezer and the initial temperature of the water.

She records her measurements as follows:

Mass of ice used	m_i	0.12 kg
Initial temperature of ice	T_i	-12 °C
Initial mass of water	m_w	0.40 kg
Initial temperature of water	T_w	22 °C
Final temperature of mixture	T_f	15 °C

The heat capacities of water and ice are $c_w = 4.2$ kJ kg^{-1} °C^{-1} and $c_i = 2.1$ kJ kg^{-1} °C^{-1} respectively.

(a) Set up the appropriate equation, representing energy transfers during the process of coming to thermal equilibrium, that will enable them to solve for the specific latent heat L_i of ice. Insert values into the equation from the data above, **but do not solve the equation.** *[5]*

$(mc\Delta T)_{water} = (mc\Delta T)_{ice} + (mL)_{ice}$

$+ (mc\Delta T)_{water}$

$[m_w c_w (T_f - T_w)] = m_i c_i (0 - T_i) + m_i H_f + m_i c_w (T_f - 0)$

heat lost by water heat gained by ice

mp

(This question continues on the following page)

(Question B3 continued)

(b) Explain the physical meaning of each *energy transfer term* in your equation (but not each symbol). *[4]*

(Go over all 3 parts.)

(c) State an assumption you have made about the experiment, in setting up your equation in (a). *[1]*

No E losses to the environment

(d) Why should she take the temperature of the mixture *immediately* after all the ice has melted? *[1]*

- It will change

(e) Explain from the microscopic point of view, in terms of molecular behaviour, why the temperature of the ice does not increase while it is melting. *[4]*

Same temp ∴ No change in KE

Added energy increase PE as you change state